ECONOMIC AND SECTOR WORK REPORT NO. 100066-MM

MYANMAR: ANALYSIS OF FARM PRODUCTION ECONOMICS

FEBRUARY 26, 2016

Funded by

Livelihoods and Food Security Trust Fund

LIFT

UKaid from the British people

European Union

Australian Aid

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ACRONYMS & ABBREVIATIONS

AEZ	Agro-ecological zone
ASEAN	Association of Southeast Asian Nations
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FOB	Free on board
GDP	Gross domestic product
Ha	Hectares
HH	Household
K	Potassium
LIFT	Livelihoods and Food Security Multi-Donor Trust Fund
MMK	Myanmar Kyat
MADB	Myanma Agricultural Development Bank
MOAI	Ministry of Agriculture and Irrigation
N	Nitrogen
P	Phosphorus
Tons	Metric ton
USDA	U.S. Department of Agriculture
$	US dollar

EXECUTIVE SUMMARY

1 **This report was prepared by the World Bank in partnership with the Livelihoods and Food Security Multi-Donor Trust Fund (LIFT).** Both the World Bank and the LIFT are actively involved in supporting Myanmar's agriculture sector given its significance in poverty reduction and food security, and they both consider the lack of reliable farm data to be a significant constraint to designing effective programs and policies. This report fills some of the data gaps. The presented results are based on a 2013/14 Myanmar agricultural survey of 1,728 farm households in four regions (Ayeyarwady, Bago, Sagaing, and Shan State[1]) of Myanmar that covered major crops grown in the surveyed regions during the monsoon and dry seasons. These crops include beans and pulses, oil seeds, and maize.

2 **In addition to presenting the collected data, the report offers the first analysis of these data.** It focuses on the assessment of the extent of crop diversification and an analysis of farm production economics, in particular (partial factor) productivity of agricultural land and labor and crop profitability. Future analyses can include more elaborate assessments of farm production function, total factor productivity, and efficiency. They can also include the analysis of value chain constraints of the major agricultural commodities, including institutional factors affecting production decisions and profitability outcomes.

3 **The survey is not nationally representative and its results need to be interpreted in that context.** It focused on farm households residing in main village tracts, which usually have better access to market, finance, and public services. The results therefore tell a story about farms with better opportunities and most likely better farming outcomes. This focus was chosen to study Myanmar's commercial production areas and to facilitate international comparisons, as most international studies follow a similar approach, focusing on advanced farmers in commercial production areas.

4 **The four main findings of the report are as follows:**

a. Myanmar's farming systems are diversified more than commonly thought. While during the monsoon season most farms produce paddy, during the cool and dry seasons most farms produce crops other than paddy, mainly beans and pulses, oilseeds, and maize.

b. The analysis reconfirmed that agricultural productivity in Myanmar is low, irrespective of what indicators are used, limiting the sector's contribution to poverty reduction and shared prosperity.

c. Low productivity is a result of multiple factors, many of them associated with the undersupply of quality public services such as research, extension, and rural infrastructure, in delivery of which the government has a key role to play.

d. Going forward and given that paddy is less profitable and more costly to produce than other crops in most agro-ecological zones, especially during the cool and dry seasons, it is desirable to redesign public programs from exclusive support of paddy production to support for broad-based agricultural development.

5 **These findings are substantiated with evidence from the agricultural survey.** They are also supported by cross-country comparisons for rice production and profitability.

[1] Unless otherwise noted, the terms "Ayeyarwady, Bago, Sagaing, and Shan State" refer to the respective administrative regions rather than to towns, rivers, or other places with the same name (i.e., the word "Region" is implied but does not follow each instance of the region's name).

Finding No. 1: Farming systems are diversified in Myanmar

6 **Most farms produce paddy during the monsoon season, mainly due to excessively high humidity, which makes it difficult to produce other crops.** Monsoon paddy is the main crop for both small and large farms and across all ecoregions. Out of 1,728 surveyed households, 1,373 (80 percent) reported producing monsoon paddy.

7 **Yet very few surveyed farmers practiced rice monoculture during the year.** Most produce two crops per year. Farming systems are well diversified, with paddy production prevailing during the monsoon while other crops are produced during the cool and dry seasons. Only 336 farmers produced paddy during the dry season, while most of the rest produced beans and pulses.

8 **The most widely planted beans and pulses in Myanmar are chickpeas, black gram, and green gram.** During the dry season, their production was observed in seven ecoregions, while during the monsoon season beans and pulses were produced only in the dryland and river areas of Sagaing. A large number of farmers (787 out of 1,728) were producing one of these three types of pulses, depicting the importance of this category of crops in Myanmar agriculture. Myanmar is the world's second largest exporter of beans and pulses after Canada, and the customers include India, United Arab Emirates, Thailand, Bangladesh, and China. In 2014, the export value of beans and pulses was $835 million, larger than the export value of rice, estimated at roughly $630 million.

9 **A variety of other crops were grown during the cool and dry seasons.** Sagaing was the main location for oilseeds production – i.e., sesame, groundnuts, and sunflower seeds. In Shan State, maize is an important crop. In addition, one out of ten farmers in the northern and southern interior ecoregions of Shan State grew culinary crops (mainly chilies, onion, garlic, and potatoes).

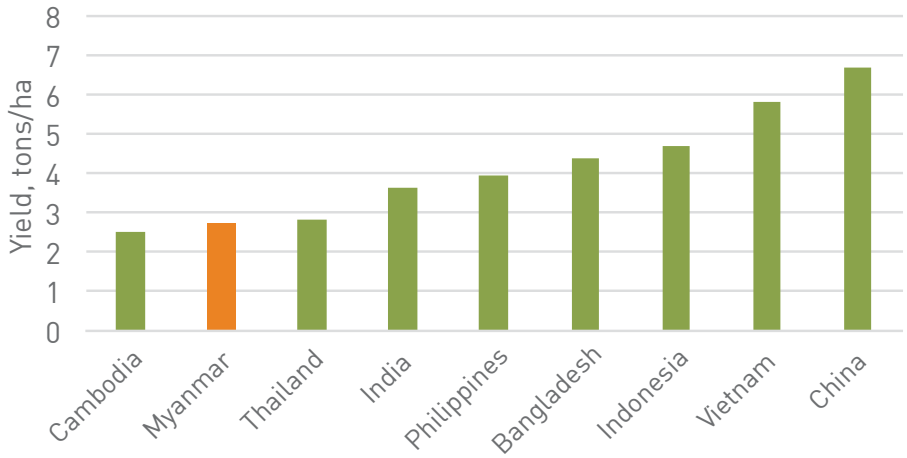
Finding No. 2: Agricultural productivity in Myanmar is low, limiting the sector's contribution to poverty reduction and shared prosperity

10 **Irrespective of what indicators are used, agricultural productivity in the surveyed commercial production areas of Myanmar was found to be very low.** Let's start with paddy. Paddy yields (or land productivity), labor productivity, and profitability in Myanmar are all low compared to performance in key production areas of Asia's other rice bowls. Within Myanmar, paddy productivity and profitability are lowest in Ayeyarwady and Sagaing and highest in Shan State. The survey found average paddy yield in 2013/14 to be 2.7 tons/hectare (ha) dry paddy equivalent or 3.5 tons/ha wet paddy equivalent. This is identical to the average yield reported by the U.S. Department of Agriculture. The official statistics report 3.8 tons/ha. It is not clear whether this is wet or dry paddy equivalent, but in either case it is above the yield found in the survey. This firmly puts Myanmar on the lower end of the Asian rice productivity spectrum (Figure 1ES). Note that the yields of most other crops included in the survey were also consistently lower than those officially reported.

11 **Labor productivity was also found to be low, reflecting low yields and high labor intensity of agricultural production.** The example of monsoon rice shows that one day of work generates only 23 kg of paddy in Myanmar, compared to 62 kg in Cambodia, 429 kg in Vietnam, and 547 kg in Thailand (Figure 2ES). Myanmar's labor productivity in rice production is higher during the dry season but is still very low in international comparison.

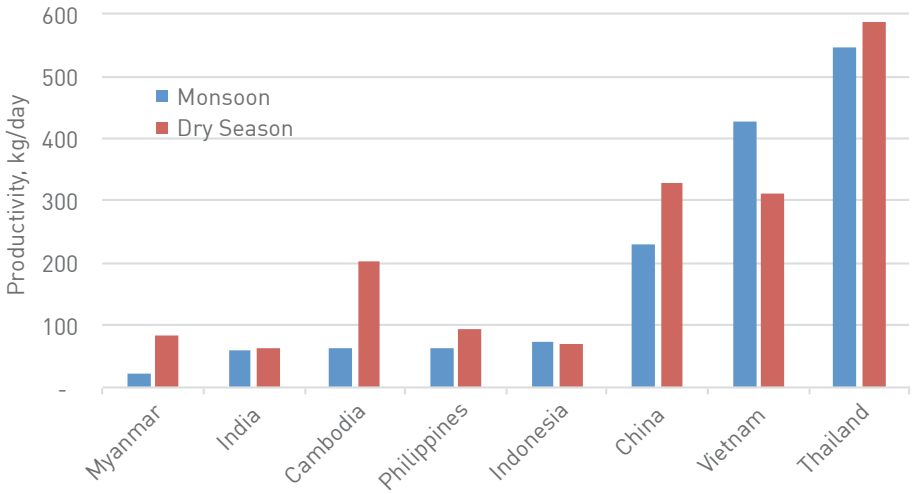
12 **Farm practices are still largely labor-intensive.** Farming in Myanmar looks today as it did in Thailand and Vietnam 15-20 years ago. In Ayeyarwady, farmers spend more than 100 days per hectare of monsoon paddy compared to 52 days in Cambodia, 22 days in Vietnam, and 11 days in Thailand (Figure 3ES).

FIGURE 1ES: MYANMAR YIELDS ARE AMONG LOWEST IN ASIA



Source: 2013/14 Myanmar agricultural survey and USDA.

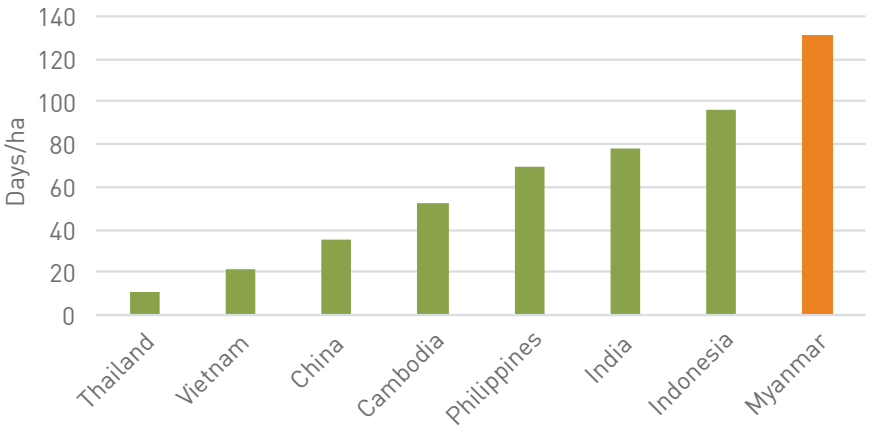
FIGURE 2ES: LOW YIELDS AND HIGH LABOR USE KEEP MYANMAR'S LABOR PRODUCTIVITY LOW



Note: Data for Myanmar are for Ayeyarwady. Data for other countries refer only to one key rice-growing area.

Source: 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 and 2015 for all other countries.

FIGURE 3ES: MYANMAR'S MONSOON PADDY PRODUCTION IS MOST LABOR INTENSIVE



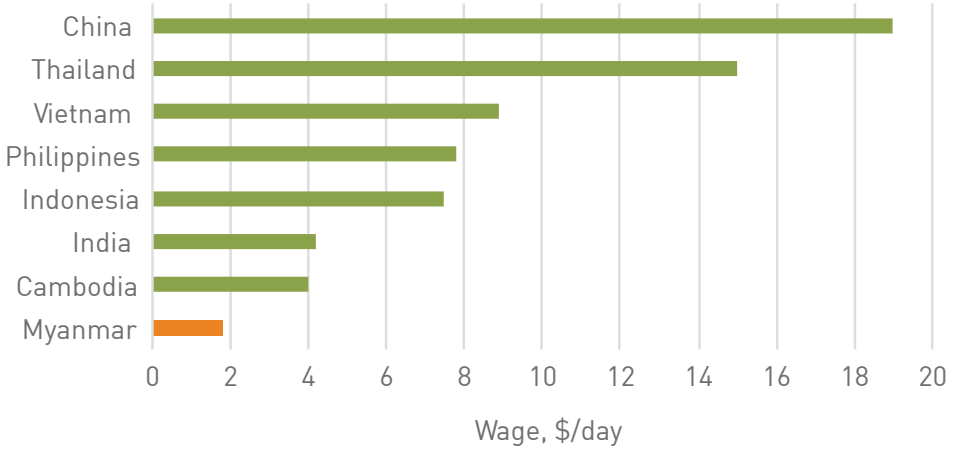
Note: Data for Myanmar are for Ayeyarwady. Data for other countries refer only to one key rice-growing area.

Source: 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 and 2015 for all other countries.

13 **Low labor productivity reflects the low wages and the low use of capital.** During the 2013 monsoon season, the daily wage was $2.0 in the Delta and Dry Zones. Although the wage rose to $3.0-3.4/day during the dry season, it remained low in international comparison (Figure 4ES). Capital in Myanmar is, on the other hand, expensive and in short supply. Except in Shan State, the rental machinery market is essentially nonexistent. Some mechanized services are available, as the survey shows, but they are of low diversity and poor quality. Many farmers use draught oxen instead as an intermediate means of mechanization, and only a few own power tillers and small tractors. As the labor market tightens in the future, the rental machinery market will become vitally important for small farms, for whom ownership of expensive farm equipment is unaffordable.

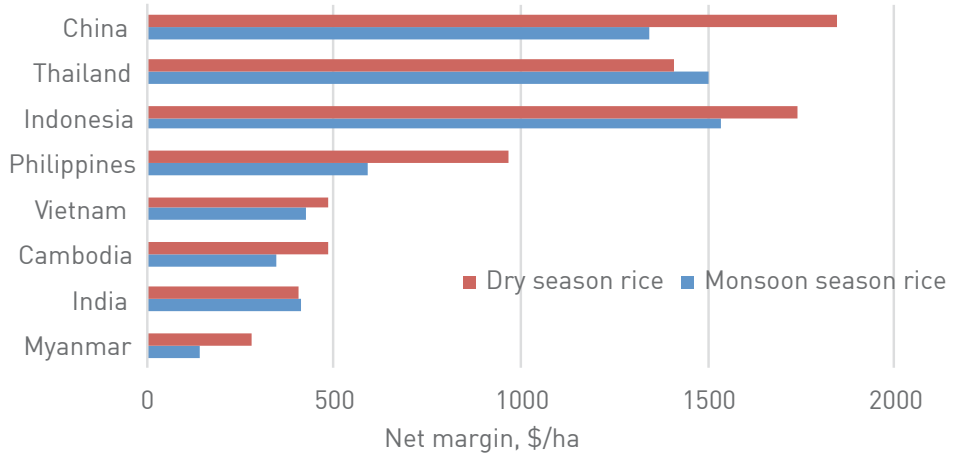
14 **Low productivity of land and labor results in low profits from producing paddy in Myanmar.** In 2013/14, the net margin/profit from producing monsoon paddy averaged $114/ha, ranging from $88/ha in Ayeyarwady to $337/ha in Shan State. The higher profit in Shan State is explained by its proximity to China, which resulted in higher farm-gate prices and lower input prices compared to other parts of Myanmar. The profitability of dry season paddy was higher, ranging from $170/ha in Sagaing and $279/ha in Ayeyarwady to $427/ha in Shan State. Yet these profits are still low compared to those achieved by farmers in Asia's other key rice bowls (Figure 5ES).

FIGURE 4ES: MYANMAR'S WAGES ARE STILL VERY LOW



Source: 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 and 2015 for all other countries.

FIGURE 5ES: MYANMAR HAS THE LOWEST PROFITS FROM RICE PRODUCTION



Note: Data for Myanmar are for Ayeyarwady. Data for other countries refer only to one key rice-growing area.
Source: 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 and 2015 for all other countries.

15 **Profits from producing paddy in Myanmar vary significantly, making it difficult to use averages.** Profits tend to increase along with increased farm size. Small farms had higher yields but failed to translate higher yields into higher profits. Economies of scale allowed large farms to adopt more modern technologies and save on costs. Male-headed households, the vast majority in this survey, managed to achieve higher profits than female-headed households. The situation varies by crop and by ecoregion, with the differences sometimes insignificant, but male-headed households earned higher incomes for many crops. Profits were also influenced by ecoregions' natural conditions, seeding techniques, fertilizer use, and other factors.

16 **Although higher than for paddy, the profits from producing other crops included in the survey are low on average.** Data for cross-country comparisons/benchmarking for non-rice crops are not available to support this point, but the survey shows that at the current level of profitability, agricultural income alone is insufficient for poverty reduction in most cases. Farmers with one hectare of farmland and producing two crops a year cannot rely on agricultural income to pull all members of their households out of poverty. Most crop combinations[2] grown by the surveyed households did not raise their per capita agricultural income[3] above the regional rural poverty line (Table 1ES).

TABLE 1ES: AGRICULTURAL INCOME IS INSUFFICIENT TO PULL SMALL FARMS OUT OF POVERTY

	Monsoon paddy (MP) only	MP + Dry season paddy	MP + Black gram	MP + Green gram	MP + Chickpeas	MP + Sesame	MP + Maize
Ayeyarwady: Rural poverty line: $364							
Brackish water	106		258	416			
Freshwater	74		185				
Saltwater	67	266					
Bago: Rural poverty line: $354							
East alluvial	101		198	200			
West alluvial	71		172				
River area	33		160				
Sagaing: Rural poverty line: $354							
Dryland	16	53			52		
Irrigated tract	1	78		181	82		
River area	7			250	28	65	
Shan State: Rural poverty line: $405							
Border area	64	169					292
Northern interior	82						369
Southern interior	141						

Source: 2013/14 Myanmar agricultural survey.

[2] The only crop combination that generated per capita income higher than the poverty line was monsoon rice and dry season's green gram in Ayeyarwady.
[3] Agricultural income is the gross margin calculated as revenues less all costs excluding family labor.

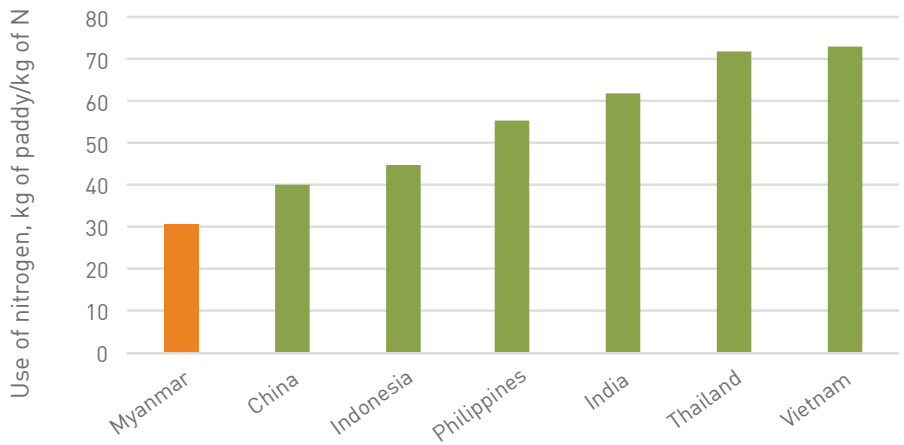
Finding No. 3: Low agricultural productivity is the result of multiple factors, many of which are associated with the undersupply of quality agricultural public goods

17 **Agricultural productivity is affected by many factors.** Some of them are beyond the immediate influence of agricultural policy makers. A decrease in labor availability can be driven by rising wages outside of agriculture. Changes in the cost of working capital (interest rate) largely reflect macroeconomic developments rather than agriculture sector performance. Land prices can increase or decrease responding to the changes in demand from industry or urban development. Yet many factors affecting farm production can be influenced by the government through service delivery and an enabling policy environment. The survey found many examples of public services that even when delivered to farmers did not have any visible impact.

18 **Take the case of seeds.** The supply of certified paddy seeds is estimated to meet not more than 1 percent of the potential demand. Locally produced good seeds are unavailable even to farmers residing in the main village tracts. For comparison, the supply of good rice seeds is estimated to satisfy 10 percent of demand in Cambodia, while farmers in Thailand and Vietnam do not have any problem with seed availability. The situation for other crops in Myanmar is even worse than for paddy: the public system does not produce enough good seeds and the enabling environment for the private sector is not conducive enough to stimulate seed imports or production and multiplication of seeds in the country. It is not a surprise that most Myanmar farmers use their own saved seeds, a practice that keeps yields low.

19 **Another example of a problem resulting from the undersupply of public goods such as agricultural research and extension is farmers' poor knowledge about fertilizer use.** Myanmar farmers widely use urea and compound fertilizers for paddy production in both monsoon and dry seasons, but often at inefficient application rates and inappropriate nutrient composition. During the monsoon season, farmers apply only half of the nitrogen (N) and phosphorus (P) rates applied in other Asian countries, while during the dry season the application of these fertilizers was above the levels observed in other countries. In addition, Myanmar farmers overuse N and P at the expense of potassium (K), resulting in relatively low partial factor productivity of N. One kilogram of N in Myanmar's dry season generated only 30 kg of paddy compared to 72 kg in Thailand and Vietnam (Figure 6ES). Despite the higher yields triggered by this higher use of fertilizers, high fertilizer users obtained profits below those of low fertilizer users.

FIGURE 6ES: MYANMAR HAS THE LOWEST PARTIAL FACTOR PRODUCTIVITY OF NITROGEN



Note: Data for Myanmar are for Ayeyarwady. Data for other countries refer only to one key rice-growing area.
Source: 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 and 2015 for all other countries.

20 **A final example of the undersupply of high quality public programs is Myanmar's poor record on irrigation.** Irrigation coverage in Myanmar is relatively low: in 2014-2015, only about 3 million ha of agricultural land were part of public irrigation systems, which constituted 15 percent of crop area. This is much lower coverage than in Indonesia and Thailand (about 30 percent), China (about 50 percent), and Vietnam (70 percent).

Finding No. 4: Given that in many agro-ecological zones paddy is less profitable than other crops, the government needs to gradually shift its focus from paddy production to broad-based agricultural support to better leverage agriculture for poverty reduction

21 **The survey confirmed that paddy is the major crop grown in Myanmar during the monsoon season but other crops are much more important during the dry season.** The survey also found paddy not to be the most profitable crop. Except for chickpea and sesame, all other crops generated higher profits (Table 2ES). Most profitable was green gram, widely produced in the Dry Zone and the Delta. Chickpea and sesame were less profitable than paddy but were less costly to produce. In particular, labor use was lower, making these crops more attractive in areas with a high labor deficit during peak harvest times.

22 **The situation is more nuanced by ecoregion because not all crops are equally suitable.** For the brackish water area in Ayeyarwady and the irrigated tract area in Sagaing, growing green gram was most profitable (Table 3ES). In the east alluvial ecoregion of Bago, however, the labor productivity for rice and green gram was similar, while variable costs and water requirements were different: both were highest for paddy. Farmers with access to irrigation and working capital/loans can make good money producing dry season paddy. But those in drier places without access to working capital have to pick more economically suitable crops, usually pulses and oilseeds.

23 **Shifting the public policy focus from paddy production to broad-based agricultural development and profitability of overall farming systems offers high rates of return.** Producing more and getting higher paddy yields does not automatically lead to higher farm incomes. The freedom of selection of least costly and most profitable crops and high attention to efficiency and profitability of production (i.e., producing more by using less inputs or using inputs better instead of using more to achieve higher yields) are the keys to ensuring high returns to land and labor in Myanmar agriculture.

TABLE 2ES: IN MYANMAR, LAND AND LABOR PROFITS FOR PULSES AND OILSEEDS ARE IN GENERAL HIGHER THAN FOR PADDY

	Net margin, $/ha	Labor productivity, $/day	Production costs, $/ha	Labor use, days/ha
Monsoon paddy	114	4.75	510	103
Dry season paddy	246	9.20	626	63
Black gram	267	9.29	237	45
Green gram	581	15.92	355	51
Chickpeas	141	6.85	266	42
Groundnuts	324	8.32	421	65
Sesame	202	8.54	217	44
Sunflower seeds	377	15.68	121	30

Source: 2013/14 Myanmar agricultural survey.

TABLE 3ES: DRY SEASON PADDY CAN COMPETE WITH OTHER CROPS ONLY IN SOME ECOREGIONS

	Net margin, $/ha	Labor productivity, $/day	Production costs, $/ha	Labor use, days/ha
Brackish water, Ayeyarwady				
Paddy	279	10.16	517	51
Black gram	241	7.40	287	57
Green gram	643	13.39	346	66
East alluvial, Bago				
Paddy	279	10.16	517	51
Black gram	255	8.52	256	49
Green gram	335	9.80	337	52
Irrigated tract, Sagaing				
Paddy	288	9.64	533	60
Green gram	787	16.06	459	84
Chickpeas	181	8.73	282	35

Source: 2013/14 Myanmar agricultural survey.

24 More attention to profitability would favor crop diversification but to meaningfully support this, agricultural programs need to broaden their scope and coverage well beyond rice. The public seed production system, for example, which currently focuses almost exclusively on hybrid rice varieties, needs to broaden its scope to include planting materials for a diverse range of paddy and other crops, building on Myanmar's rich agro-diversity and farmers' economic considerations. Agricultural extension services would need to increase outreach to farmers and crop coverage to accelerate adoption of modern farm technologies. Irrigation systems need to be more flexible and provide demand-driven irrigation services to enable farmers to pursue the best crop mix/rotation patterns in different areas and in response to market opportunities.

အစီရင်ခံစာ အနှစ်ချုပ်

၁ **ဤအစီရင်ခံစာအား ကမ္ဘာ့ဘဏ်နှင့် The Livelihoods and Food Security Multi-Donor Trust Fund (LIFT) အဖွဲ့အစည်းတို့ အတူပူးတွဲ၍ပြုစုခဲ့ပါသည်။** မြန်မာနိုင်ငံ၏ စိုက်ပျိုးရေး ကဏ္ဍသည် နွမ်းပါးမှု လျော့ချရေးနှင့် စားနပ်ရိက္ခာ လုံခြုံရေး တို့အတွက် များစွာအရေးပါသည့်အပြင် စိုက်ပျိုးရေးကဏ္ဍအတွက် ထိရောက်သောအစီအစဉ်မူဝါဒများ ရေးဆွဲရာတွင် အားထားနိုင်သော အထောက်အထား အချက်အလက်များ မရှိခြင်းသည်လည်း သိသာကြီးမားသည့် အခက်အခဲတစ်ခုအဖြစ်ယူဆခြင်းကြောင့် ကမ္ဘာ့ဘဏ်နှင့် LIFT တို့သည် မြန်မာ့စိုက်ပျိုးရေးကဏ္ဍ ပံ့ပိုးကူညီရေးတွင် တက်ကြွစွာဆောင်ရွက်လျက်ရှိသည်။ ဖော်ပြပါရလဒ်များမှာ မြန်မာနိုင်ငံ၏ဒေသကြီး (၄)ခုရှိ (ဧရာဝတီ၊ ပဲခူး၊ စစ်ကိုင်းနှင့် ရှမ်းပြည်နယ်)[1] မိုးရာသီနှင့် ခြောက်သွေ့ရာသီ များအတောအတွင်း အဓိကကောက်ပဲသီးနှံများ စိုက်ပျိုးသည့် လယ်လုပ်ငန်းလုပ်ကိုင်သောမိသားစု (၁၇၂၈) စုအား စိုက်ပျိုးရေးဆိုင်ရာ ဆန်းစစ်လေ့လာမှု (၂၀၁၃/၁၄) အပေါ် အခြေခံပါသည်။ အဆိုပါကောက်ပဲသီးနှံများတွင် ပဲအမျိုးမျိုး၊ ဆီထွက်သီးနှံနှင့် ပြောင်းအစရှိသည်တို့ ပါဝင်သည်။

၂ **ဤအစီရင်ခံစာအနေဖြင့် စုဆောင်းရရှိသည့်အချက်အလက်များအပြင် ၄င်းအချက်အလက်များအပေါ် ပထမဆုံးအကြိမ်ဆန်းစစ်လေ့လာမှုများကို ဖော်ပြထားပါသည်။** ဤအစီရင်ခံစာတွင် သီးနှံများအမျိုးမျိုး ပြောင်းလဲ ထုတ်လုပ်မှုအတိုင်းအတာအချက်အလက်နှင့် လယ်ယာကုန်ထုတ်လုပ်မှုစီးပွားရေးကဏ္ဍ - အထူးသဖြင့် (တစိတ် တဒေသအားဖြင့်) စိုက်ပျိုးမြေဖြစ်ထွန်းမှု၊ လယ်ယာလုပ်သားနှင့် သီးနှံအမြတ်အစွန်းဖြစ်ထွန်းမှု စသည်တို့နှင့် ပတ်သက်၍ ဆန်းစစ်လေ့လာမှုများကို အဓိကထားတင်ပြထားပါသည်။ အနာဂါတ်ဆန်းစစ် လေ့လာမှုများတွင် လယ်ယာကုန်ထုတ်လုပ်မှုလုပ်ငန်းစဉ်၊ ဖြစ်ထွန်းမှုဆိုင်ရာ ပေါင်းစည်းအချက်အလက်/အရင်းခံများ၊ လုပ်ငန်း ထိရောက်မှုစသည်တို့နှင့် ပတ်သက်၍ ပိုမိုကျယ်ပြန့်ပြည့်စုံသော အကဲဖြတ်မှုများပါဝင်ပါမည်။ ၄င်းတွင် ကုန်ထုတ် လုပ်မှုဆိုင်ရာ ဆုံးဖြတ်ချက်များနှင့် အကျိုးဖြစ်ထွန်းမှု ရလဒ်များအပေါ် သက်ရောက်သည့် အဖွဲ့အစည်းဆိုင်ရာ အချက်အလက်များအပါအဝင် အဓိကစိုက်ပျိုးရေး ထွက်ကုန်ပစ္စည်းများ၏တန်ဖိုးဖြစ်ထွန်းမှုဖြစ်စဉ်အဆင့်ဆင့် (Value Chain)ဆိုင်ရာ အကန့်အသတ်များအပေါ် ဆန်းစစ်လေ့လာမှုလည်း ပါဝင်နိုင်ပါသည်။

၃ **ဤဆန်းစစ်လေ့လာမှုသည်နိုင်ငံအဆင့်ကိုယ်စားပြုနိုင်ခြင်းမရှိသလို ၄င်းရလဒ်များအနေဖြင့်လည်း အဆိုပါ အခြေအနေအားဖြင့် ဆက်လက်ဆန်းစစ်လေ့လာရန်လိုအပ်ပါသည်။** ဆန်းစစ်လေ့လာမှုအနေဖြင့် စျေးကွက်၊ ဘဏ္ဍာရေး၊ အများပြည်သူဝန်ဆောင်မှုများနှင့် ပတ်သက်၍ ကောင်းမွန်သော အခြေအနေရှိသည့် အဓိကကျေးရွာအုပ်စုများတွင် နေထိုင်သော လယ်ယာလုပ်ငန်းလုပ်ကိုင်သည့် မိသားစုများအား အဓိကထားတင်ပြထားပါသည်။ ထို့ကြောင့် ရလဒ်များအနေဖြင့် ပိုမိုကောင်းမွန်သော လယ်ယာလုပ်ငန်း ရလဒ်များဖြစ်နိုင်ဖွယ် အရှိဆုံးနှင့် အခွင့်အလမ်းကောင်းများရှိသည့်လယ်ယာများနှင့်ပတ်သက်သော အကြောင်းအရာများပါဝင်ပါသည်။ ယင်းသို့အဓိကထား လေ့လာရခြင်းမှာ မြန်မာနိုင်ငံ၏စီးပွားဖြစ် စိုက်ပျိုးထုတ်လုပ်သည့် ဧရိယာများကို လေ့လာနိုင် ရန်နှင့် စီးပွားဖြစ် စိုက်ပျိုးထုတ်လုပ်သော ဧရိယာများရှိ အဆင့်မြင့်တောင်သူများအပေါ် အဓိကထားလေ့လာသည့် နိုင်ငံတကာလေ့လာမှုနည်းလမ်းများနှင့် အနီးစပ်ဆုံးဖြစ်စေခြင်းဖြင့် နိုင်ငံတကာဆိုင်ရာ နှိုင်းယှဉ်လေ့လာမှုများ ဆောင်ရွက်နိုင်စေရန်ဖြစ်သည်။

၄ **အစီရင်ခံစာ၏ အဓိကတွေ့ရှိချက် (၄)ခုမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်။**

(က) မြန်မာနိုင်ငံ၏လယ်ယာလုပ်ငန်းစနစ်များမှာ ယေဘူယျထင်မြင်ယူဆထားသည်ထက် အမျိုးမျိုးအထွေထွေ ကွဲပြားထုတ်လုပ်မှု ပိုမိုများပြားပါသည်။ မုတ်သုန်ရာသီ အတောအတွင်းတွင် လယ်ယာအများစုမှာ စပါး စိုက်ပျိုးထုတ်လုပ်ကြပြီး အေးမြ၊ ခြောက်သွေ့သောရာသီများတွင် စပါးမဟုတ်သောအခြားသီးနှံများ - အဓိကအားဖြင့် ပဲအမျိုးမျိုး၊ ဆီထွက်သီးနှံနှင့် ပြောင်းစသည့်သီးနှံများကို အများစု စိုက်ပျိုးထုတ်လုပ် ကြပါသည်။

(ခ) ဤဆန်းစစ်လေ့လာမှုအရ မည်သည့်အညွှန်းကိန်းများကို အသုံးပြုသည်ဖြစ်စေ၊ မြန်မာနိုင်ငံရှိ လယ်ယာကုန်ထုတ်လုပ်မှုမှာ နည်းပါး၍ နွမ်းပါးမှုလျော့ချရေးနှင့် ဥစ္စာဓနမျှဝေပိုင်ဆိုင်မှုရှိရေးကိစ္စရပ်များတွင် ၄င်းကဏ္ဍ၏ အရေးပါမှုအပေါ် အကန့်အသတ်ရှိနေကြောင်း ထပ်မံအတည်ပြုခဲ့ပါသည်။

(ဂ) ကုန်ထုတ်လုပ်မှု နည်းပါးရသည့်အခြေခံအကြောင်းရင်းများစွာရှိပြီး အများစုမှာ အစိုးရအနေဖြင့် အဓိကအခန်းကဏ္ဍမှ ပါဝင်သည့် အရည်အသွေးရှိသောအများပြည်သူဆိုင်ရာဝန်ဆောင်မှုများဖြစ်သည့် သုတေသန၊ တိုးချဲ့ဆောင်ရွက်မှု၊ ကျေးလက်အခြေခံအဆောက်အအုံ စသည်တို့နှင့်ပတ်သက်၍ ဖြည့်ဆည်းနိုင်မှု လျော့နည်း/မလုံလောက်ခြင်းနှင့် များစွာဆက်စပ်နေပါသည်။

(ဃ) စိုက်ပျိုး - ဈေးစနစ်ဆိုင်ရာ ဇုန်အများစုတွင် စပါးသည် အခြားသီးနှံများထက် စိုက်ပျိုးထုတ်လုပ်ရာတွင် အမြတ်အစွန်းနည်းပါး၍ ထုတ်လုပ်မှုစရိတ်ကြီးမားခြင်းကြောင့် အနာဂတ်တွင် - အထူးသဖြင့် အေးမြ ခြောက်သွေ့သည့် ရာသီများတွင် - စပါးထုတ်လုပ်မှုအတွက်သာ သီးသန့်ပံ့ပိုးမှုအစား ပိုမိုကျယ်ပြန့်သော အခြေခံအားဖြင့် စိုက်ပျိုးရေးဖွံ့ဖြိုးတိုးတက်မှုအတွက် ပံ့ပိုးနိုင်ရန် အများပြည်သူဆိုင်ရာ အစီအစဉ်များကို ပုံစံ ပြောင်းလဲဆောင်ရွက်စေလိုပါသည်။

၅ ဤလေ့လာတွေ့ရှိချက်များသည် စိုက်ပျိုးရေးဆိုင်ရာ လေ့လာဆန်းစစ်မှုရရှိလာသည့် အထောက်အထားများကို အခြေခံပါသည်။ ထို့ပြင် ၄င်းတို့အား ဆန်စပါးထုတ်လုပ်ခြင်းနှင့် အကျိုးအမြတ် ဖြစ်ထွန်းမှုများအတွက် နိုင်ငံများအကြား နှိုင်းယှဉ်လေ့လာမှုများဖြင့်လည်း ပံ့ပိုးထားပါသည်။

[1] အကယ်၍ အခြားဖော်ပြချက် မရှိပါက "ဧရာဝတီ၊ ပဲခူး၊ စစ်ကိုင်းနှင့် ရှမ်းပြည်နယ်" စသည်တို့သည် မြို့၊ မြစ် နှင့် အခြားနေရာဒေသများ၏ အမည်နာမ မဟုတ်ပဲ သက်ဆိုင်ရာ စီမံခန့်ခွဲရေးတိုင်းဒေသကြီးများကို ရည်ညွှန်းသည်။

လေ့လာတွေ့ရှိချက်(၁) မြန်မာနိုင်ငံရှိ လယ်ယာစိုက်ပျိုးရေးစနစ်များမှာအမျိုးမျိုးအထွေထွေကွဲပြားဆောင်ရွက်မှုရှိသည်။

၆ မုတ်သုန်ရာသီကာလတွင် ရာသီဥတုစိုထိုင်းဆမြင့်မားခြင်းကြောင့် လယ်ယာအများစုမှာ စပါးစိုက်ပျိုး ထုတ်လုပ်ကြခြင်းကြောင့် အခြားသီးနှံများ စိုက်ပျိုးထုတ်လုပ်ရန် အခက်အခဲရှိပါသည်။ ဂေဟဆိုင်ရာဒေသများအားလုံး အနှံ့နှင့် အငယ်စား၊ အကြီးစား လယ်ယာများအားလုံးအတွက် အဓိကစိုက်ပျိုးသီးနှံမှာ မိုးစပါးဖြစ်ပါသည်။ လေ့လာခဲ့သော အိမ်ထောင်စုပေါင်း ၁၇၂၈ ခုအနက် ၁၃၇၃ ခု (၈၀%)ခန့်မှာ မိုးစပါးစိုက်ပျိုးထုတ်လုပ်ကြကြောင်း သိရှိရသည်။

၇ သို့သော် လေ့လာတွေ့ရှိချက်အရ တနှစ်တာကာလအတွင်း ဆန်စပါးတမျိုးတည်းသာ စိုက်ပျိုးသည့် တောင်သူအနည်းငယ်သာရှိသည်။ အများစုမှာ တနှစ်လျှင် သီးနှံ (၂)မျိုးခန့်စိုက်ပျိုးကြသည်။ လယ်ယာလုပ်ငန်းစနစ်များမှာ အမျိုးမျိုးကွဲပြားကြပြီး မိုးရာသီတွင် ဆန်စပါးကို အနှံ့အပြား စိုက်ပျိုးကြ၍ အခြားသီးနှံများကို အေးမြ၊ ခြောက်သွေ့ရာသီများတွင် စိုက်ပျိုးကြသည်။ လေ့လာခဲ့သည့်တောင်သူများအနက် (၃၃၆) ဦးသာ ခြောက်သွေ့ရာသီတွင် စပါး (နွေစပါး)စိုက်ပျိုးကြပြီး ကျန်သည့် တောင်သူအများစုမှာ ၎င်းကာလတွင် ပဲအမျိုးမျိုးစိုက်ပျိုးကြသည်။

၈ မြန်မာနိုင်ငံတွင် အများဆုံးစိုက်ပျိုးသည့် ပဲအမျိုးမျိုးအုပ်စုဝင်သီးနှံများမှာ ပဲဝါကလေး၊ မတ်ပဲ နှင့် ပဲတီစိမ်း တို့ဖြစ်သည်။ ခြောက်သွေ့ရာသီတွင် အဆိုပါ သီးနှံစိုက်ပျိုးမှုများကို ဂေဟဒေသ (၂) ခုတွင်တွေ့ရှိရပြီး မိုးရာသီတွင် ပဲအမျိုးမျိုးကို ခြောက်သွေ့ဒေသနှင့် စစ်ကိုင်းတိုင်းရှိမြစ်ကြောင်းဧရိယာများတွင်သာ စိုက်ပျိုးကြပါသည်။ တောင်သူအများစု (၁၇၂၈) အိမ်ထောင်စုအနက် (၇၈၇)အိမ်ထောင်စုမှာ ဖော်ပြပါပဲအမျိုးအစား (၃)မျိုးအနက် တစ်မျိုးမျိုးကို စိုက်ပျိုးကြပြီး မြန်မာ့စိုက်ပျိုးရေးတွင် အဆိုပါသီးနှံအုပ်စုအမျိုးအစား၏ အရေးပါမှုကို ညွှန်ပြနေပါသည်။ မြန်မာနိုင်ငံသည် ကနေဒါနိုင်ငံပြီးလျှင် ဒုတိယအကြီးမားဆုံး ပဲအမျိုးမျိုးတင်ပို့သည့်နိုင်ငံဖြစ်ပြီး အဓိကဝယ်ယူ သည့် နိုင်ငံများမှာ အိန္ဒိယ၊ UAE၊ ထိုင်းနိုင်ငံ၊ ဘင်္ဂလားဒေ့ရှ်နှင့် တရုတ်နိုင်ငံတို့ဖြစ်သည်။ ၂၀၁၄ ခုနှစ်တွင် ပဲအမျိုးမျိုးနိုင်ငံခြားတင်ပို့မှုတန်ဖိုးမှာ အမေရိကန်ဒေါ်လာ ၈၃၅သန်းခန့်ရှိပြီး ခန့်မှန်းခြေ တန်ဖိုးဒေါ်လာ (၆၃၀)သန်းရှိ သည့် ဆန်စပါးတင်ပို့သည့် တန်ဖိုးထက် ပိုမိုများပြားသည်။

၉ အမျိုးမျိုးသော အခြားသီးနှံများကိုအေးမြ၍ ခြောက်သွေ့သော ရာသီများတွင် စိုက်ပျိုးကြသည်။ စစ်ကိုင်းတိုင်းသည် ဆီထွက်သီးနှံ (နှမ်း၊ မြေပဲ၊ နေကြာ) အဓိကစိုက်ပျိုးသည့်တည်နေရာဖြစ်သည်။ ရှမ်းပြည်နယ်တွင်မူ ပြောင်းမှာအဓိက သီးနှံအမျိုးအစားဖြစ်သည်။ ထို့ပြင် ရှမ်းပြည်နယ်၏မြောက်ပိုင်းနှင့် တောင်ပိုင်းဒေသအတွင်းပိုင်းရှိ ဂေဟဒေသများတွင်ရှိသော တောင်သူ (၁၀)ဦးလျှင် တစ်ဦးနှုန်းမှာ ဟင်းစားသီးနှံများ (အဓိကအားဖြင့် ငရုတ်၊ ကြက်သွန်နီ/ဖြူ၊ အာလူး)ကို စိုက်ပျိုးကြသည်။

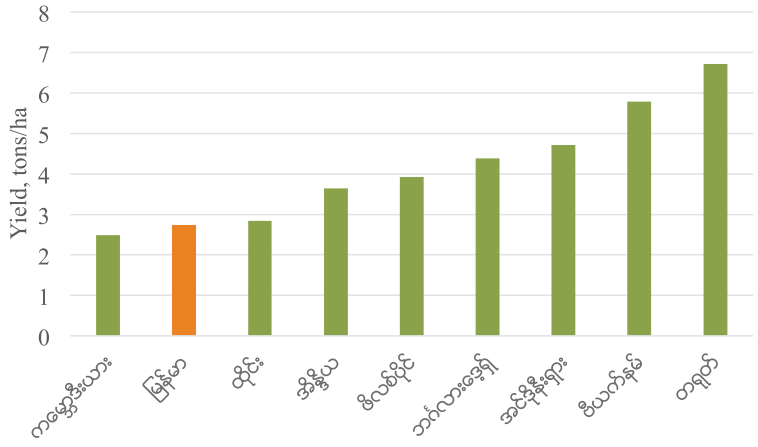
လေ့လာတွေ့ရှိချက် (၂) မြန်မာနိုင်ငံ၏ လယ်ယာကုန်ထုတ်လုပ်မှုမှာ ပမာဏနည်းပါး၍ နွမ်းပါးမှုလျော့ချရေးနှင့် ဥစ္စာဓနမျှဝေပိုင်ဆိုင်မှုရှိရေး ကိစ္စရပ်များအပေါ် ၎င်းကဏ္ဍ၏ အရေးပါမှုအား ကန့်သတ်မှုဖြစ်စေသည်။

၁၀ မည်သည့်အညွှန်းကိန်းကို အသုံးပြုသည်ဖြစ်စေ၊ မြန်မာနိုင်ငံ၏လေ့လာတိုင်းတာခဲ့သော စီးပွားဖြစ်စိုက်ပျိုးထုတ်လုပ်သည့်ဧရိယာများရှိ စိုက်ပျိုးရေးကုန်ထုတ်လုပ်မှုအခြေအနေမှာလွန်စွာနည်းပါးကြောင်းတွေ့ရသည်။ ဆန်စပါး စိုက်ပျိုးထုတ်လုပ်မှုအခြေအနေနှင့်ပတ်သက်၍ မြန်မာနိုင်ငံရှိ ဆန်စပါးထွက်နှုန်း (သို့) လယ်ယာမြေထွက်နှုန်း၊ လယ်လုပ်သားများ၏ကုန်ထုတ်စွမ်းရည်၊ အကျိုးအမြတ်ဖြစ်ထွန်းမှုစသည့် အချက်များမှာ အာရှတိုက်၏အခြားဆန်စပါး စိုက်ပျိုးထုတ်လုပ်သောနိုင်ငံများ၏ အရေးပါသည့် စိုက်ပျိုးဧရိယာများရှိ ဆောင်ရွက်ချက်နှင့် နှိုင်းယှဉ်ပါကနည်းပါးလျက်ရှိပါသည်။ မြန်မာနိုင်ငံအတွင်းတွင် ဧရာဝတီတိုင်းနှင့် စစ်ကိုင်းတိုင်းများမှာ ဆန်စပါးထုတ်လုပ်မှုနှင့် အကျိုးအမြတ်ဖြစ်ထွန်းမှုများတွင် အနည်းဆုံးဖြစ်၍ ရှမ်းပြည်နယ်မှာ အများဆုံးဖြစ်ပါသည်။ လေ့လာတိုင်းတာချက်အရ ၂၀၁၃-၁၄ စပါးထွက်နှုန်းနှင့်ပတ်သက်၍ နွေစပါးမှာ ၂. ၇တန်။ ဟက်တာ (ha) ပမာဏရှိ၍ မိုးစပါးမှာ ၃. ၅တန်/ ha ပမာဏ ရှိပါသည်။ ၎င်းသည် အမေရိကန်နိုင်ငံ စိုက်ပျိုးရေးဌာနမှ ထုတ်ပြန်သည့် ပျမ်းမျှထွက်နှုန်းနှင့်အတူတူပင်ဖြစ်သည်။ တရား၀င် စာရင်းဇယားအစီရင်ခံစာအရ ၃. ၈တန်/ha ရှိသည်ဟု သိရပါသည်။ သို့သော် ၎င်းပမာဏမှာ နွေစပါးပမာဏ (သို့) မိုးစပါးပမာဏဖြစ်သည် စသည်ဖြင့် ရှင်းလင်းမှုမရှိသော်လည်း မည်သို့ပင်ဖြစ်စေ တမျိုးချင်းစီ၏ ပမာဏအနေဖြင့် လေ့လာတိုင်းတာချက်အရ တွေ့ရှိရသည့် ပမာဏထက်မြင့်မားနေပါသည်။ ယင်းအချက်မှာ အာရှ ဆန်စပါး စိုက်ပျိုးထုတ်လုပ်မှုဇယား၏ အောက်ပိုင်းအဆင့်တွင်ရှိနေသည်။ မြန်မာနိုင်ငံ၏ အနေအထားကို ထင်ဟပ်စေပါသည် (ပုံ - 1ES)။ လေ့လာမှုတွင် ပါဝင်သည့် အခြားသီးနှံအများစု၏ထွက်နှုန်းမှာလည်း တရား၀င် အစီရင်ခံ ထုတ်ပြန်ချက်ပမာဏများထက် လျော့နည်းနေပါသည်။

၁၁ လယ်လုပ်သားများ၏ ကုန်ထုတ်စွမ်းရည်မှာလည်း နည်းပါးကြောင်းတွေ့ရှိရပြီး ၎င်းအချက်မှာသီးနှံထွက်နှုန်း နည်းပါးခြင်းနှင့် စိုက်ပျိုးထုတ်လုပ်မှုကဏ္ဍ လုပ်သားအသုံးပြုရမှုမြင့်မားခြင်း စသည့် အချက်များကို ထင်ဟပ်စေပါသည်။ ဥပမာအနေဖြင့်မိုးစပါးစိုက်ပျိုးထုတ်လုပ်မှုတွင် မြန်မာနိုင်ငံ၌ တနေ့တာလုပ်အားအနေဖြင့် စပါး ၂၃ကီလိုဂရမ် သာထုတ်လုပ်နိုင်ကြောင်း တွေ့ရှိရပြီး ကမ္ဘောဒီးယားနိုင်ငံတွင် ၆၂ ကီလိုဂရမ် ၊ ဗီယက်နမ်နိုင်ငံတွင် ၄၂၉ ကီလိုဂရမ် နှင့် ထိုင်းနိုင်ငံ တွင် ၅၄၇ ကီလိုဂရမ် အသီးသီးရှိကြပါသည် (ပုံ - 2ES)။ မြန်မာနိုင်ငံ၏ ဆန်စပါး စိုက်ပျိုးထုတ်လုပ်ရေးတွင် လုပ်သားများ၏ ကုန်ထုတ်စွမ်းရည်မှာ ခြောက်သွေ့ ရာသီများတွင် ပိုမိုမြင့်မားသော်လည်း နိုင်ငံတကာနှိုင်းယှဉ်လေ့လာမှုအရ လွန်စွာနည်းပါးနေပါသည်။

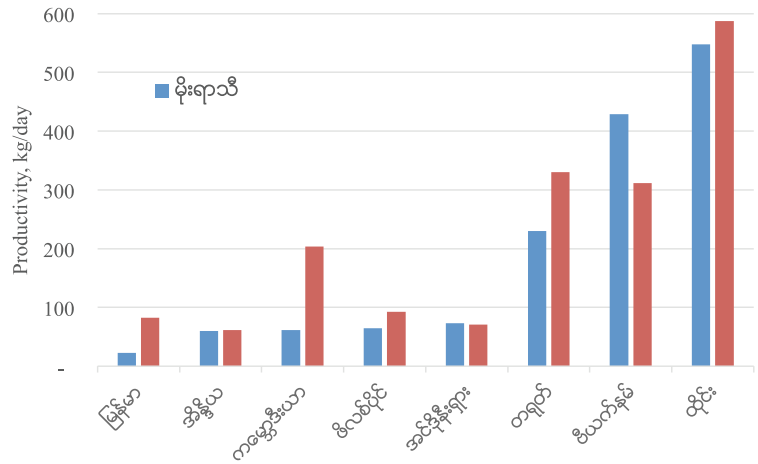
၁၂ လယ်ယာလုပ်ငန်းစနစ်များအရဖြင့် လယ်လုပ်သား အသုံးပြုရမှု ကြီးမားများပြားလျက်ပင် ရှိနေပါသေးသည်။ ယနေ့ခေတ် မြန်မာနိုင်ငံ၏ လယ်ယာလုပ်ငန်းအခြေအနေများမှာ လွန်ခဲ့သော ၁၅-၂၀နှစ်ခန့်က ထိုင်း၊ ဗီယက်နမ်နိုင်ငံများ၏ အခြေအနေနှင့် ဆင်တူနေပါသည်။ ဧရာဝတီတိုင်းတွင် တောင်သူများမှာ မိုးစပါးစိုက်ပျိုးကာလများတွင် လယ်ယာမြေ ၁ ha လျှင် ရက်ပေါင်း (၁၀၀)ကျော် အချိန်ပေးရပြီး အခြားနိုင်ငံများနှင့် နှိုင်းယှဉ်လေ့လာပါက ကမ္ဘောဒီးယားတွင် (၅၂)ရက်၊ ဗီယက်နမ်တွင် (၂၂)ရက်နှင့် ထိုင်းနိုင်ငံတွင် (၁၁)ရက်ခန့်သာ အသီးသီးရှိကြပါသည်။ (ပုံ-3ES)

ပုံ 1ES: အာရှနိုင်ငံများတွင် မြန်မာသီးနှံထွက်နှုန်းမှာ အနည်းဆုံးအခြေအနေတွင် ရှိနေပါသည်။



သတင်းအရင်းအမြစ် - မြန်မာ့စိုက်ပျိုးရေးလေ့လာဆန်းစစ်ချက်နှင့် USDA

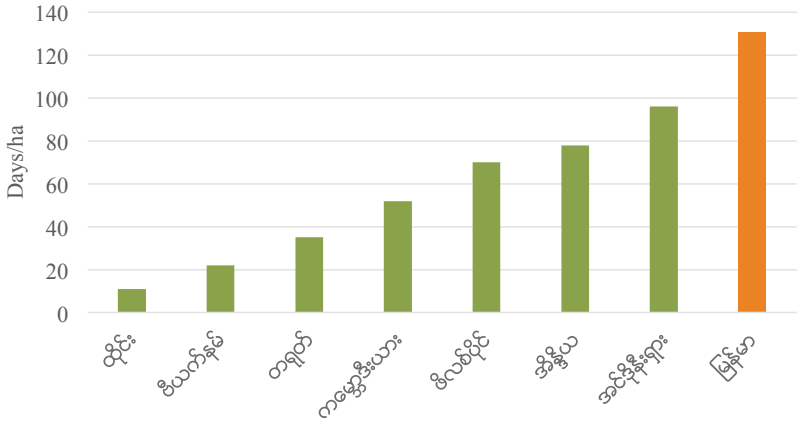
ပုံ 2ES: သီးနှံထွက်နှုန်းနည်းပါးခြင်း၊ လုပ်သားအသုံးပြုမှုမြင့်မားခြင်းများဖြင့် မြန်မာနိုင်ငံ၏ လယ်လုပ်သားများ၏ ကုန်ထုတ်စွမ်းရည်နည်းပါးမှု



မှတ်ချက် - မြန်မာနိုင်ငံ၏အချက်အလက်များမှာ ဧရာဝတီတိုင်းအတွက် ရည်ညွှန်းဖြစ်ပြီး အခြားနိုင်ငံများ၏ အချက်အလက်များမှာ အရေးပါသည့် ဆန်စပါးစိုက်ပျိုးဧရိယာတခုအတွက်သာ ရည်ညွှန်းပါသည်။

သတင်းအရင်းအမြစ် - မြန်မာနိုင်ငံအချက်အလက်များအတွက် မြန်မာစိုက်ပျိုးရေး ဆန်းစစ်လေ့လာချက်မှဖြစ်ပြီး ကမ္ဘောဒီးယားအတွက် ကမ္ဘာ့ဘဏ် 2015a နှင့် အခြားနိုင်ငံ များအတွက် Bordey et al. 2014 နှင့် 2015 တို့မှဖြစ်သည်။

ပုံ 3ES: မြန်မာနိုင်ငံ၏ မိုးစပါးစိုက်ပျိုးထုတ်လုပ်မှုကာလမှာ လုပ်သားအသုံးပြုမှု အမြင့်မားဆုံးဖြစ်သည်။



မှတ်ချက် - မြန်မာနိုင်ငံ၏အချက်အလက်များမှာ ဧရာဝတီတိုင်းအတွက် ရည်ညွှန်းဖြစ်ပြီး အခြားနိုင်ငံများ၏ အချက်အလက်များမှာ အရေးပါသည့် ဆန်စပါးစိုက်ပျိုးဧရိယာတခုအတွက်သာ ရည်ညွှန်းပါသည်။

သတင်းအရင်းအမြစ် - မြန်မာနိုင်ငံအချက်အလက်များအတွက် မြန်မာစိုက်ပျိုးရေး ဆန်းစစ်လေ့လာချက်မှဖြစ်ပြီး ကမ္ဘောဒီးယားအတွက် ကမ္ဘာ့ဘဏ် 2015a နှင့် အခြားနိုင်ငံ များအတွက် Bordey et al. 2014 နှင့် 2015 တို့မှဖြစ်သည်။

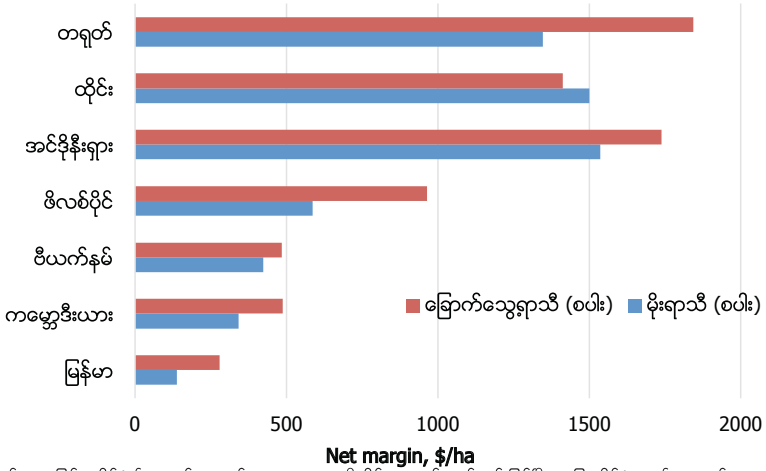
၁၃ **လုပ်သားများ၏ ကုန်ထုတ်စွမ်းရည်နည်းပါးခြင်းကြောင့် လုပ်အားခနည်းပါးခြင်းနှင့် မတည်ငွေ/အရင်းအနှီး အသုံးပြုမှုနည်းပါးခြင်းများကို ထင်ဟပ်စေပါသည်။** ၂၀၁၃ ခုနှစ် မိုးရာသီကာလအတွင်း မြစ်ဝကျွန်းပေါ်နှင့် အပူပိုင်းခြောက်သွေ့ဒေသများတွင် နေ့စဉ် နေ့တွက်/လုပ်အားခမှာ အမေရိကန်ဒေါ်လာ (၂)ဒေါ်လာသာရှိပါသည်။ ခြောက်သွေ့ရာသီကာလအတွင်း နေ့တွက်/လုပ်အားခမှာ (၃)ဒေါ်လာသို့ မြင့်တက်လာသော်လည်း နိုင်ငံတကာ နှိုင်းယှဉ်လေ့လာမှုအရ နည်းပါးနေဆဲ ဖြစ်ပါသည်။ (ပုံ - 4ES)။ မြန်မာနိုင်ငံတွင် မတည်ငွေ/အရင်းအနှီးနှင့် ပတ်သက်၍ စျေးကြီးပြီး၊ ဖြည့်ဆည်းမှုလုံလောက်ခြင်းမရှိပါ။ ရှမ်းပြည်နယ်မှလွဲ၍ စက်ယန္တယား ငှားရမ်းမှုစျေးကွက်မှာ မရှိမဖြစ်အဖြစ် တည်ရှိခြင်းမျိုးမရှိပါ။ အချို့သော စက်မှုဝန်ဆောင်မှုများရှိသော်လည်း (ဆန်းစစ်လေ့လာချက်အရ) ၎င်းတို့မှာ အမျိုးအစားအမျိုးမျိုးကွဲပြားမှုနည်းပါးပြီး အရည်အသွေးကောင်းမွန်ခြင်းမရှိပါ။ တောင်သူအများစုမှာ ကွဲ/နွားများကိုသာ အသုံးပြု၍ အလယ်အလတ်အဆင့် စက်မှုလယ်ယာဆောင်ရွက်မှုအခြေအနေသာရှိပြီး တောင်သူ အနည်းငယ်သာလျှင် တက်မကျင် (power tiller) နှင့် ထွန်စက်အသေးစားများ ပိုင်ဆိုင်ကြသည်။ အနာဂတ်တွင် အလုပ်သမားစျေးကွက်ကြပ်တည်းလာမှုနှင့်အတူ စက်ယန္တယားငှားရမ်းမှုစျေးကွက်သည် အသေးစားတောင်သူများအတွက် မရှိမဖြစ်အရေးပါလာမှာဖြစ်ပြီး ၎င်းတို့အနေဖြင့်လည်း တန်ဘိုးကြီးမားသည့် လယ်ယာသုံးစက်ကရိယာများကို ပိုင်ဆိုင်ရန် ငွေကြေးတတ်နိုင်ကြမည်မဟုတ်ပါ။

၁၄ **လယ်ယာမြေနှင့် အလုပ်သမားများ၏ ကုန်ထုတ်လုပ်မှုနည်းပါးခြင်းကြောင့် မြန်မာနိုင်ငံတွင် ဆန်စပါး စိုက်ပျိုးထုတ်လုပ်ခြင်းမှ အကျိုးအမြတ်ရလဒ်နည်းပါးခြင်းကို ဖြစ်စေပါသည်။** ၂၀၁၃-၁၄ခုနှစ်များတွင် မိုးစပါးစိုက်ပျိုးထုတ်လုပ်ခြင်းမှ အသားတင်အမြတ်အစွန်းမှာ ပျမ်းမျှအားဖြင့် အမေရိကန်ဒေါ်လာ ၁၁၄ ဒေါ်လာ/ဟက်တာ ရှိပြီး ကွဲပြားသည့် တန်ဘိုးများအနေဖြင့် ဧရာဝတီတိုင်းတွင် ၈၈ ဒေါ်လာ/ဟက်တာ ရှိ၍ ရှမ်းပြည်နယ်တွင် ၃၃၇ဒေါ်လာ/ ဟက်တာ တို့ဖြစ်သည်။ ရှမ်းပြည်နယ်တွင် အမြတ်အစွန်းပိုမိုမြင့်မားရခြင်းမှာ တရုတ်နိုင်ငံနှင့် နီးကပ်စွာတည်ရှိသည့် နေရာဖြစ်၍ မြန်မာနိုင်ငံ၏ အခြားအစိတ်အပိုင်းများနှင့်နှိုင်းယှဉ်ပါက တောင်သူများတိုက်ရိုက်ရောင်းချသော စျေးနှုန်းမြင့်မားပြီး သွင်းအားစု စျေးနှုန်းလျော့နည်းသည့်ရလဒ်များကြောင့် ဖြစ်ပါသည်။ နွေစပါးအတွက် အမြတ်အစွန်းမှာ ပိုမိုမြင့်မားပြီး အမျိုးမျိုးသောတန်ဘိုးများ အနေဖြင့် စစ်ကိုင်းတိုင်းတွင် ၁၇၀ဒေါ်လာ/ဟက်တာ၊ ဧရာဝတီတိုင်းတွင် ၂၇၉ဒေါ်လာ/ ဟက်တာ နှင့် ရှမ်းပြည်နယ်တွင် ၄၂၇ ဒေါ်လာ/ ဟက်တာ တို့ အသီးသီးရှိကြပါသည်။ သို့ရာတွင် အဆိုပါ အမြတ်အစွန်းများမှာ အာရှဒေသရှိ အရေးပါသော ဆန်စပါးထုတ်လုပ်သည့်နိုင်ငံများမှ တောင်သူများရရှိမှုနှင့် နှိုင်းယှဉ်လျှင် နည်းပါးလျက်ပင်ရှိပါသည်။ (ပုံ - 5ES)

ပုံ 4ES: မြန်မာနိုင်ငံရှိ လုပ်အားခများမှာ နည်းပါးလျက်ပင် ရှိပါသည်။

သတင်းအရင်းအမြစ် - မြန်မာနိုင်ငံအချက်အလက်များအတွက် ၂၀၁၃-၁၄ မြန်မာ့စိုက်ပျိုးရေးဆန်းစစ် လေ့လာချက်၊ ကမ္ဘောဒီးယားနိုင်ငံအတွက် ကမ္ဘာ့ဘဏ် 2015a နှင့် အခြားနိုင်ငံများအတွက် Bordey et al. 2014 နှင့် 2015 တို့မှဖြစ်သည်။

ပုံ 5ES: မြန်မာနိုင်ငံအနေဖြင့် ဆန်စပါးစိုက်ပျိုးထုတ်လုပ်ခြင်းကဏ္ဍမှ အနည်းဆုံးအကျိုးအမြတ်သာ ရရှိနေသည်။



မှတ်ချက် - မြန်မာနိုင်ငံ၏အချက်အလက်များမှာ ဧရာဝတီတိုင်းအတွက် ရည်ညွှန်းဖြစ်ပြီး အခြားနိုင်ငံများ၏ အချက်အလက်များမှာ အရေးပါသည့် ဆန်စပါးစိုက်ပျိုးဧရိယာတခုအတွက်သာ ရည်ညွှန်းပါသည်။

သတင်းအရင်းအမြစ် - မြန်မာနိုင်ငံအချက်အလက်များအတွက် မြန်မာစိုက်ပျိုးရေး ဆန်းစစ်လေ့လာချက်မှဖြစ်ပြီး ကမ္ဘောဒီးယားအတွက် ကမ္ဘာ့ဘဏ် 2015a နှင့် အခြားနိုင်ငံ များအတွက် Bordey et al. 2014 နှင့် 2015 တို့မှဖြစ်သည်။

၁၅ မြန်မာနိုင်ငံရှိ ဆန်စပါးစိုက်ပျိုးထုတ်လုပ်ခြင်းမှရရှိသည့် အကျိုးအမြတ်များသည် သိသာစွာအမျိုးမျိုးကွဲပြားလျက်ရှိပြီး ပျမ်းမျှအနေဖြင့်တွက်ချက်ဖော်ပြရန် ခဲယဉ်းပါသည်။ အမြတ်အစွန်းအနေဖြင့် လယ်ယာမြေအရွယ်အစား ကြီးမားသည်နှင့်အမျှ အမြတ်အစွန်းပိုမိုကြီးမားလာသည့် အခြေအနေရှိပါသည်။ အသေးစားလယ်ယာများအနေဖြင့် သီးနှံထွက်နှုန်းမြင့်မားသော်လည်း မြင့်မားသည့်သီးနှံထွက်နှုန်းမှ ပိုမိုမြင့်မားသည့်အမြတ်အစွန်းအဖြစ်သို့ ပြောင်းလဲ ဆောင်ရွက်နိုင်ခြင်း မရှိကြပါ။ အမြောက်အများထုတ်လုပ်ခြင်းဖြင့် စရိတ်စက သက်သာစေသည့် သဘောအရ အကြီးစားလယ်ယာများသည် ခေတ်မှီနည်းပညာများကို ပိုမို အသုံးပြုနိုင်ကြပြီး စရိတ်စကလျော့နည်း သက်သာကြပါသည်။ ဤဆန်းစစ်လေ့လာမှုတွင် အများစုအဖြစ်ပါဝင်သော အမျိုးသားဦးဆောင်သည့် အိမ်ထောင်စုများသည် အမျိုးသမီးဦးဆောင်သော အိမ်ထောင်စုများထက် အမြတ်အစွန်းပိုမိုရရှိရန် ဆောင်ရွက်နိုင်ကြပါသည်။ အဆိုပါ အခြေအနေသည် သီးနှံအမျိုးအစားအားဖြင့်သော် လည်းကောင်း၊ ဧဝဒေသအားဖြင့် သော်လည်းကောင်း ကွဲပြားမှုရှိသော်လည်း(ကွဲပြားမှုများမှာ ရုံဖန်ရုံခါ မသိသာပါ) အမျိုးသားဦးဆောင်သည် အိမ်ထောင်စုများသည် သီးနှံ အများအပြားအတွက် ပိုမိုမြင့်မားသည့်ဝင်ငွေရရှိကြသည်။ ထို့ပြင် ဧဝဒေသများ၏သဘာဝအခြေအနေများ၊ မျိုးစေ့နည်းပညာများ၊ မြေဩဇာ အသုံးပြုမှုနှင့် အခြားအချက်အလက်များမှာ အမြတ်အစွန်းအပေါ် သက်ရောက်မှု ရှိပါသည်။

၁၆ ဆန်စပါးထက်စာလျှင် ပိုမိုမြင့်မားသော်လည်း ဆန်းစစ်လေ့လာချက်တွင် ပါဝင်သည့် အခြားသီးနှံများ စိုက်ပျိုးထုတ်လုပ်မှုမှရရှိသည့် အမြတ်အစွန်းများသည် ပျမ်းမျှအနေဖြင့်မူ နည်းပါးပါသည်။ ၄င်းအချက်ကိုပံ့ပိုးရန် ဆန်စပါး မဟုတ်သော သီးနှံများနှင့်ပတ်သက်၍ နိုင်ငံများအကြားနိုင်းယှဉ်လေ့လာချက်/စံသတ်မှတ်ချက်အတွက် အချက်အလက်များ မရရှိနိုင်သော်လည်း၊ ဆန်းစစ်လေ့လာချက်အရလက်ရှိအမြတ်အစွန်းရရှိမှုပမာဏအားဖြင့် အခြေအနေ အများစုတွင် စိုက်ပျိုးရေးလုပ်ငန်းဝင်ငွေတခုတည်းဖြင့် နွမ်းပါးမှုလျော့ချနိုင်ရန် လုံလောက်ခြင်းမရှိပါ။ လယ်ယာမြေ (၁) ဟက်တာ ရှိ၍ တနှစ်လျှင် သီးနှံ (၂)မျိုး စိုက်ပျိုးသည့်တောင်သူများအနေဖြင့် ၄င်းတို့၏ အိမ်ထောင်စုဝင်ငွေများ နွမ်းပါးမှုမှလွတ်မြောက်စေရေးအတွက် စိုက်ပျိုးရေးမှ ရရှိသည့်ဝင်ငွေအပေါ် မှီခိုအားထားရန် မဖြစ်နိုင်ပါ။ ဆန်းစစ် လေ့လာခဲ့သည့် အိမ်ထောင်စုများမှ သီးနှံတွဲဖက်စိုက်ပျိုးသူအများစုမှာ[၂] ၄င်းတို့၏ စိုက်ပျိုး ရေးမှရရှိသည့် တဦးချင်း ဝင်ငွေပမာဏအားဖြင့်[၃] ဒေသဆိုင်ရာကျေးလက်ချို့တဲ့နွမ်းပါးမှုအဆင့် သတ်မှတ်ချက်အထက်သို့ရောက်ရှိရန် ဆောင်ရွက်နိုင်ခြင်းမရှိကြပါ။ (ဇယား - 1ES)

ဇယား 1ES: စိုက်ပျိုးရေးရရှိသည့်ဝင်ငွေသည် အသေးစားတောင်သူများအတွက် နွမ်းပါးမှုမှ လွတ်မြောက်နိုင်ရန် လုံလောက်မှု မရှိပါ။

	r;pyg;	r;pyg; + aEpyg;	r;pyg; + rwy	r;pyg; + ywpr;	r;pyg; + u v m;y	r;pyg; + Er;	r;pyg; + ajym i;
{&m0w - au;;v uEr;yg;r owrwr:0; - 364 a':v m							
q m;"mwygaomaom&	106		258	416			
a&c:l	74		185				
q m;iea&	67	266					
yc; - au;;v uEr;yg;r owrwr:0; - 354 a':v m							
t a&lEe;ajr	101		198	200			
t aemuEe;ajr	71		172				
jrp{& , m	33		160				
ppu i;- au;;v uEr;yg;r owrwr:0; - 354 a':v m							
ajcmuaolajr	16	53			52		
q na&aomu typ	1	78		181	82		
jrp{& , m	7			250	28	65	
&r;jyne , - au;;v uEr;yg;r owrwr:0; - 405 a':v m							
e , pya'o	64	169					292
ajrmuzu t wi;yi;	82						369
awmizu t wi;yi;	141						

သတင်းအရင်းအမြစ် - ၂၀၁၃-၁၄ မြန်မာ့စိုက်ပျိုးရေးဆန်းစစ်လေ့လာချက်

[၂] ရောဝတီတွင် နွမ်းပါးမှု အခြေခံမျဉ်းထက် မြင့်မားသည့် တဦးချင်းဝင်ငွေရရှိနိုင်သည့် ပေါင်းစပ်သီးနှံမှာ မိုးစပါးနှင့် ခြောက်သွေ့ရာသီ ပဲတီစိမ်း ဖြစ်သည်။

[၃] စိုက်ပျိုးရေးဝင်ငွေသည် မိသားစုလုပ်အားကို ချန်လှပ်၍ ကုန်ကျစရိတ်နည်းဝင်ငွေအဖြစ် တွက်ချက်ထားသော စုစုပေါင်း အမြတ်အစွန်းကို ဆိုလိုသည်။

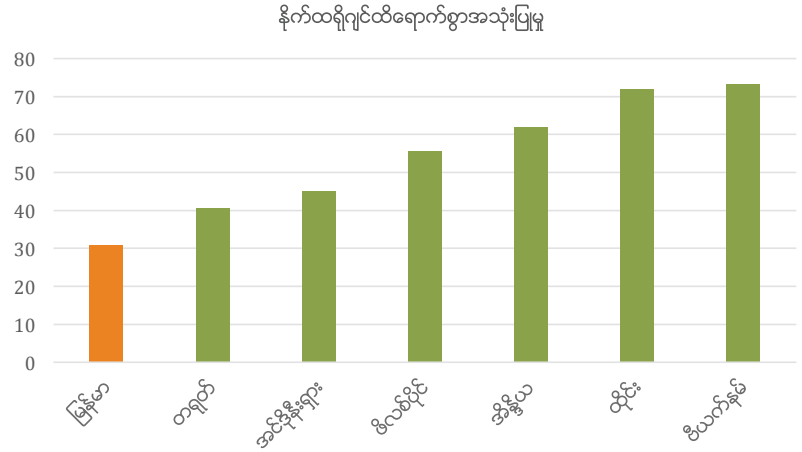
လေ့လာတွေ့ရှိချက် (၃) - စိုက်ပျိုးရေးကုန်ထုတ်လုပ်မှုပမာဏ နည်းပါးသောအကြောင်းရင်းအချက်အလက်အမျိုးမျိုး ရှိပြီး အများစုမှာ အရည်အသွေးရှိသောစိုက်ပျိုးရေးကဏ္ဍအများပြည်သူဆိုင်ရာပစ္စည်း အင်္ဂါရုပ်များ ဖြည့်ဆည်းမှုလုံလောက်မှုမရှိခြင်းနှင့် ဆက်နွယ်မှုရှိပါသည်။

၁၇ **စိုက်ပျိုးရေးကုန်ထုတ်လုပ်မှုအပေါ် သက်ရောက်မှုရှိသော အချက်အလက်များရှိပါသည်။** ၄င်းအချက်အလက်များအနက် အချို့မှာ စိုက်ပျိုးရေးမူဝါဒရေးဆွဲသူများ၏ တိုက်ရိုက်ဩဇာလွှမ်းမိုးမှုပြင်ပတွင်ရှိနေပါသည်။ စိုက်ပျိုးရေး ကဏ္ဍပြင်ပရှိ လုပ်အားခများတိုးမြှင့်လာခြင်းသည်လည်း လယ်ယာလုပ်သားလျော့နည်းမှုအပေါ် သက်ရောက်မှုရှိပါသည်။ လုပ်ငန်းမတည်ငွေ ကုန်ကျစရိတ်အပြောင်းအလဲများ (အတိုးနှုန်း) သည်လည်း စိုက်ပျိုးရေးကဏ္ဍဆောင်ရွက်မှု များထက်စာလျှင် အကြီးစားစီးပွားရေးဖွံ့ဖြိုးမှုများကို ထင်ဟပ်စေသည်။ မြေယာစျေးနှုန်း အတက်အကျများမှာလည်း စက်မှု(သို့) မြို့ပြဖွံ့ဖြိုးမှု၏ လိုအပ်ချက်အပြောင်းအလဲများအပေါ် မူတည်လျက်ရှိသည်။ သို့ရာတွင် လယ်ယာကုန်ထုတ်လုပ်မှုအပေါ် သက်ရောက်သည့်အချက်အလက်များနှင့်စပ်လျဉ်း၍ အစိုးရ၏ဝန်ဆောင်မှုဖြန့်ဖြူးခြင်း၊ အထောက်အကူပြုမူဝါဒဝန်းကျင်ကောင်းများ စသည်အားဖြင့် လွှမ်းမိုး ထိန်းချုပ် နိုင်ပါသည်။ ဆန်းစစ်လေ့လာချက်အရ အများပြည်သူဆိုင်ရာဝန်ဆောင်မှုများကို တောင်သူများထံသို့ဖြန့်ဖြူးရာတွင်ပင် သိသာမြင်သာသည့် အကျိုးသက်ရောက်မှုတစ်စုံတစ်ရာမတွေ့ရှိရခြင်းမျိုး လေ့လာသိရှိရပါသည်။

၁၈ **မျိုးစေ့ဆိုင်ရာကိစ္စရပ်များ - တရားဝင်အသိအမှတ်ပြုထားသောစပါးမျိုးစေ့များဖြည့်ဆည်းခြင်းသည် လိုအပ်ချက်အလားအလာ၏ ၁%ထက်မပိုသော ပမာဏကိုသာဖြည့်ဆည်းနိုင်သည်ဟု ခန့်မှန်းရသည်။** ဒေသတွင်း ထုတ်လုပ်သောမျိုးကောင်း၊ မျိုးစေ့များကို အဓိကကျေးရွာအုပ်စုများတွင်နေထိုင်သည့် တောင်သူများပင်ရရှိခြင်းမရှိ ကြောင်းသိရှိရသည်။ နှိုင်းယှဉ်လေ့လာမှုအရ ကမ္ဘောဒီးယားနိုင်ငံတွင် စပါးမျိုးကောင်းမျိုးစေ့များဖြည့်ဆည်းမှုသည် ခန့်မှန်းခြေ၊ လိုအပ်ချက်၏ ၁၀% ကိုလိုအပ်ကြောင်း သိရှိရပြီး ထိုင်းနှင့် ဗီယက်နမ်နိုင်ငံ၏တောင်သူများအနေဖြင့် မျိုးစေ့ရရှိနိုင်မှုနှင့်ပတ်သက်၍ ပြဿနာတစ်စုံတစ်ရာမရှိကြောင်း သိရှိရသည်။ မြန်မာနိုင်ငံရှိ အခြားသီးနှံများ၏ အခြေအနေမှာ ဆန်စပါးထက်ပိုမိုဆိုးရွားပါသည်။ အများပြည်သူဆိုင်ရာစနစ်များမှ လုံလောက်ကောင်းမွန်သော မျိုးစေ့များ ထုတ်လုပ်ခြင်းမရှိသလို ပုဂ္ဂလိကကဏ္ဍအတွက် အထောက်အကူပြုဝန်းကျင်ကောင်းများအနေဖြင့်လည်း မျိုးစေ့တင်ပို့ ခြင်း(သို့)ထုတ်လုပ်ခြင်းနှင့် နိုင်ငံအတွင်းမျိုးစေ့ပွားမှု ဆောင်ရွက်ခြင်း စသည့် အချက်များကို စေ့စေ့ပေးနိုင်ရန်လုံလောက်အောင် ဆောင်ရွက်နိုင်ခြင်းမရှိပါ။ သို့ဖြင့် မြန်မာတောင်သူများအများစုမှာ ၄င်းတို့ကိုယ်ပိုင်စု ဆောင်းထားသည့် မျိုးစေ့များနှင့် ထွက်နှုန်းနည်းပါးသည့် လုပ်နည်းလုပ်ဟန်များကိုသာ အသုံးပြုနေကြပါသည်။

၁၉ **စိုက်ပျိုးရေးဆိုင်ရာသုတေသနနှင့် တောင်သူပညာပေးလုပ်ငန်းစသည့် အများပြည်သူဆိုင်ရာ ပစ္စည်းအင်္ဂါရုပ်များဖြည့်ဆည်းမှုမလုံလောက်ခြင်းကြောင့် ဖြစ်ပေါ်လာသည့်နောက်ထပ်ပြဿနာတစ်ခုမှာ ဓါတ်မြေဩဇာအသုံးပြုခြင်းနှင့်ပတ်သက်၍ တောင်သူများအနေဖြင့် အသိပညာဗဟုသုတနည်းပါးခြင်းဆိုသည့်အချက်ဖြစ်သည်။** မြန်မာနိုင်ငံရှိ တောင်သူများသည် မိုးစပါးနှင့် နွေစပါးနှစ်မျိုးလုံအတွက် ယူရီးယားနှင့် ကွန်ပေါင်းမြေဩဇာများကို ကျယ်ပြန့်စွာ အသုံးပြုသော်လည်း အသုံးပြုနှုန်းထားများနှင့် ဩဇာဓါတ်ရောစပ်ပါဝင်မှုများအနေဖြင့် ထိရောက်ဆီလျော်မှုမရှိကြောင်းတွေ့ရသည်။ မိုးရာသီကာလတွင် တောင်သူများသည် အခြားအာရှနိုင်ငံများတွင် အသုံးပြုသည့် နှုန်းထား၏ ထက်ဝက်ခန့်ပမာဏရှိနိုက်ထရိုဂျင် (N) နှင့် ဖော့စဖရက် (P)တို့ကိုအသုံးပြုပြီး ခြောက်သွေ့ရာသီတွင် ၄င်းမြေဩဇာများကို အခြားနိုင်ငံများအသုံးပြုသည့်ပမာဏထက် ပိုမိုအသုံးပြုကြပါသည်။ ထို့ပြင် မြန်မာတောင်သူများသည် ပိုတက်စီယမ် (၂) ထိခိုက်ခံ၍ N နှင့် P အလွန်အကျွံအသုံးပြုခြင်းမျိုးရှိပြီး N ၏ PFP (စိုက်ပျိုးစွမ်းဆောင်ရည်) နည်းပါးမှုရလဒ်များကို ဖြစ်ပေါ်စေပါသည်။ မြန်မာနိုင်ငံ၏ ခြောက်သွေ့ရာသီအတွင်း N (၁)ကီလို ဂရမ်သည် စပါး (၃၀)ကီလိုဂရမ်ကိုသာ ထုတ်လုပ်နိုင်ပြီး နှိုင်းယှဉ်လေ့လာချက်အရ ထိုင်းနှင့် ဗီယက်နမ်နိုင်ငံ များတွင် (၇၂)ကီလိုဂရမ် အထိ ထုတ်လုပ်နိုင်ကြသည် (ပုံ - 6ES) ။ ယင်းသို့ မြေဩဇာအသုံးပြုမှုမြင့်မားခြင်းကြောင့် ထွက်နှုန်းတိုးနိုင်သော်လည်း မြေဩဇာ အများအပြား အသုံးပြုသူများအနေဖြင့်မူ အနည်းငယ်သာ အသုံးပြုသူများထက် အမြတ်အစွန်းရရှိမှု လျော့နည်းပါသည်။

ပုံ 6ES: မြန်မာနိုင်ငံသည် နိုက်ထရိုဂျင် (N) Partial factor productivity အနည်းဆုံးဖြစ်သည်။



မှတ်ချက် - မြန်မာနိုင်ငံ၏အချက်အလက်များမှာ ဧရာဝတီတိုင်းအတွက် ရည်ညွှန်းဖြစ်ပြီး အခြားနိုင်ငံများ၏ အချက်အလက်များမှာ အရေးပါသည့် ဆန်စပါးစိုက်ပျိုးဧရိယာတခုအတွက်သာ ရည်ညွှန်းပါသည်။

သတင်းအရင်းအမြစ် - မြန်မာနိုင်ငံအချက်အလက်များအတွက် မြန်မာစိုက်ပျိုးရေး ဆန်းစစ်လေ့လာချက်မှဖြစ်ပြီး ကမ္ဘောဒီးယားအတွက် ကမ္ဘာ့ဘဏ် 2015a နှင့် အခြားနိုင်ငံ များအတွက် Bordey et al. 2014 နှင့် 2015 တို့မှဖြစ်သည်။

၂၀ **အရည်အသွေးမြင့်မားသည့် အများပြည်သူဆိုင်ရာအစီအစဉ်များဖြည့်ဆည်းမှုမလုံလောက်ခြင်းနှင့်ပတ်သက်၍ ဥပမာတခုဖြစ်သည့် မြန်မာနိုင်ငံ၏ ဆည်မြောင်းများနှင့်ပတ်သက်သည့် မှတ်တမ်းမှတ်ရာအချက်အလက်များ အားနည်းခြင်း၊ မြန်မာနိုင်ငံရှိ ဆည်မြောင်းလုပ်ငန်းများ လွှမ်းခြုံပမာဏမှာ နည်းပါးပါသည်။** ၂၀၁၄-၁၅ ခုနှစ်တွင် အများပြည်သူဆိုင်ရာ ဆည်မြောင်းစနစ်များ၏ အစိတ်အပိုင်းအဖြစ် လယ်ယာ (ha) ၃သန်းခန့်သာရှိပြီး ၎င်းတွင် သီးနှံဧရိယာ ၁၅%သာ ပါဝင်ပါသည်။ ၎င်းသည် အခြားနိုင်ငံများနှင့် နှိုင်းယှဉ်လျှင် များစွာနည်းပါးပါသည်။ ဥပမာ- အင်ဒိုနီးရှားနှင့် ထိုင်း (၃၀%)ခန့်၊ တရုတ်နိုင်ငံ (၅၀%)၊ ဗီယက်နမ်နိုင်ငံ (၇၀%)။

လေ့လာတွေ့ရှိချက် (၄)- စိုက်ပျိုးရေး-ဂေဟဇုန်အများအပြားတွင် ဆန်စပါးသည် အခြားသီးနှံများ ထက်အမြတ်အစွန်းနည်းပါးသောကြောင့် အစိုးရအနေဖြင့် နွမ်းပါးမှုလျော့ချရေး ပိုမိုကောင်းမွန်သော လယ်ယာ စိုက်ပျိုး ရေးကဏ္ဍအရှိန်မြှင့်ဆောင်ရွက်နိုင်ရန် ဆန်စပါးထုတ်လုပ်ရေးအပေါ် အလေးထားဆောင်ရွက်မှုမှ ပိုမိုကျယ်ပြန့်သောစိုက်ပျိုးရေးပံ့ပိုးမှုများအဖြစ် တဖြည်းဖြည်း ခြင်းပြောင်းလဲလုပ်ဆောင်ရန် လိုအပ်ပါသည်။

၂၁ **ဆန်းစစ်လေ့လာချက်အရ မှတ်သုန်ရာသီကာလများတွင် မြန်မာနိုင်ငံ၌ ဆန်စပါးသည် အဓိကစိုက်ပျိုးသီးနှံ ဖြစ်သော်လည်း ခြောက်သွေ့ရာသီများတွင် အခြားသီးနှံများမှာ ပိုမိုအရေးကြီးကြောင်းသတ်မှတ်နိုင်ပါသည်။** ထို့ပြင် ဆန်စပါးသည် အမြတ်အစွန်းအများဆုံးရရှိသောသီးနှံမဟုတ်ကြောင်းလည်း တွေ့ရှိရပါသည်။ ကုလားပဲနှင့် နှမ်းမှလွဲ၍ အခြားသီးနှံအားလုံးမှာ အမြတ်အစွန်းပိုမိုမြင့်မားပါသည်။ (ဇယား- 2ES)။ အမြတ်အစွန်းအများဆုံးမှာ ပဲတီစိမ်း ဖြစ်ပြီး အပူပိုင်းဒေသနှင့် မြစ်ဝကျွန်းပေဒေသများတွင် ကျယ်ကျယ်ပြန့်ပြန့်စိုက်ပျိုးကြသည်။ ကုလားပဲနှင့်နှမ်းတို့သည် ဆန်စပါးထက်အမြတ်အစွန်းလျော့နည်းသော်လည်း ထုတ်လုပ်ရန် ကုန်ကျစရိတ်မှာ ပိုမိုသက်သာပါသည်။ အထူးသဖြင့် အလုပ်သမားအသုံးပြုရမှုနည်းပါးခြင်းကြောင့် အလုပ်များသည့် ရိတ်သိမ်းရာသီကာလများတွင် အလုပ်သမား မလုံလောက်မှုမြင့်မားသည့်ဧရိယာများအတွက် ၎င်းသီးနှံများမှာ အထူးသင့်တော်ပါသည်။

၂၂ **သီးနှံအမျိုးအစားအားလုံးတူညီစွာကောင်းမွန်သင့်တော်ခြင်းမျိုး မရှိဘဲ ဂေဟဒေသများအပေါ် မူတည်၍ အခြေအနေမသိမသာ ကွဲပြားခြင်းမျိုးရှိပါသည်။** ဧရာဝတီဒေသရှိ အနည်းငယ်ငန်သည့် ရေဧရိယာဒေသများနှင့် စစ်ကိုင်းတိုင်းဒေသကြီးရှိ ဆည်ရေသောက်ဧရိယာများအတွက် ပဲတီစိမ်းစိုက်ပျိုးခြင်းသည် အမြတ်အစွန်းအများဆုံးဖြစ်နိုင်ပါသည်။(ဇယား - 3ES)ပဲခူးအရှေ့ပိုင်း နုန်းဆန်သောဂေဟဒေသများတွင်မူ ဆန်စပါးနှင့် ပဲတီစိမ်း တို့အတွက် အလုပ်သမားများ၏ ကုန်ထုတ်လုပ်မှုမှာ နီးစပ်တူညီသော်လည်း ပုံသေမဟုတ်သော ကုန်ကျစရိတ်များ နှင့် လိုအပ်ချက်များမှာမူ ကွဲပြားပါသည်။ ၎င်းအချက်များနှင့်ပတ်သက်၍ ဆန်စပါးမှာ အမြင့်မားဆုံးဖြစ်ပါသည်။ ဆည်မြောင်းရေရရှိ ပြီး လုပ်ငန်းဆောင်ရွက်ရန် မတည်/ချေးငွေအသုံးပြုနိုင်သော တောင်သူများအနေဖြင့် နွေစပါး စိုက်ပျိုးခြင်းဖြင့် အကျိုးအမြတ်ကောင်းစွာရရှိနိုင်ပါသည်။ သို့သော် ပိုမိုပူးပြင်းခြောက်သွေ့ပြီး လုပ်ငန်းဆောင်ရွက်ရန် မတည်/ချေးငွေ မရရှိနိုင်သည့်တောင်သူများအနေဖြင့်မူ ပဲနှင့်ဆီထွက်သီးနှံစသည့် စီးပွားရေးအရ ပိုမိုသင့်တော်သောသီးနှံများကို ရွေးချယ်ရပါသည်။

ဇယား 2ES: မြန်မာနိုင်ငံတွင် ယေဘူယျအားဖြင့် ပဲနှင့် ဆီထွက်သီးနှံများအတွက် မြေယာနှင့် အလုပ်သမား အကျိုးအမြတ်များမှာ ဆန်စပါးထက် ပိုမိုမြင့်မားပါသည်။

	t om;wi t u;zpxe;r a':vm^[uwm	vyom;uexw pr;&n a':vm^&u	uexwp&w a':vm^[uwm	vyom; t o;yr &u^[uwm
r;py;	114	4.75	510	103
aEpy;	246	9.20	626	63
rwy	267	9.29	237	45
ywpr;	581	15.92	355	51
u vm;y	141	6.85	266	42
ary	324	8.32	421	65
Er;	202	8.54	217	44
aeumap	377	15.68	121	30

owi; t&i; tjrp - 2013-14 jrermpuy;a&;qe;ppav vmcu

ဇယား 3ES: အချို့သော ဂေဟဒေသများတွင်သာ နွေစပါးမှာ အခြားသီးနှံများနှင့် ယှဉ်ပြိုင်နိုင်ပါသည်။

	အသားတင်အကျိုးဖြစ်ထွန်းမှု ဒေါ်လာ/ဟက်တာ	လုပ်သားကုန်ထုတ် စွမ်းရည် ဒေါ်လာ/ရက်	ကုန်ထုတ်စရိတ် ဒေါ်လာ/ဟက်တာ	လုပ်သား အသုံးပြုမှု ရက်/ဟက်တာ
ဆားဓါတ်ပါသောရေ- ဧရာဝတီ				
စပါး	၂၇၉	၁၀.၁၆	၅၁၇	၅၁
မတ်ပဲ	၂၄၁	၇.၄၀	၂၈၇	၅၇
ပဲတီစိမ်း	၆၄၃	၁၃.၃၉	၃၄၆	၆၆
အရွေနုန်းမြေ- ပဲခူး				
စပါး	၂၇၉	၁၀.၁၆	၅၁၇	၅၁
မတ်ပဲ	၂၅၅	၈.၅၂	၂၅၆	၄၉
ပဲတီစိမ်း	၃၃၅	၉.၈၀	၃၃၇	၅၂
ဆည်ရေသောက်အုပ်စု- စစ်ကိုင်း				
စပါး	၂၈၈	၉.၆၄	၅၃၃	၆၀
မတ်ပဲ	၇၈၇	၁၆.၀၆	၄၅၉	၈၄
ပဲတီစိမ်း	၁၈၁	၈.၇၃	၂၈၂	၃၅

သတင်းအရင်းအမြစ် - ၂၀၁၃-၁၄ မြန်မာ့စိုက်ပျိုးရေးဆန်းစစ်လေ့လာချက်

ပြည်သူ့ရေးရာစိုက်ပျိုးရေးမူဝါဒနှင့်ပတ်သက်၍ ဆန်စပါးစိုက်ပျိုးထုတ်လုပ်မှုအပေါ် အလေးထား ဆောင်ရွက်နေခြင်းမှ ပိုမိုကျယ်ပြန့်သောစိုက်ပျိုးရေးဖွံ့ဖြိုးတိုးတက်မှုနှင့် ယေဘူယျစိုက်ပျိုးရေးစနစ်များ၏ အကျိုးအမြတ်ဖြစ်ထွန်းမှုများအပေါ် ပြောင်းလဲဆောင်ရွက်ခြင်းဖြင့် အကျိုးအမြတ်ပြန်လည်ရရှိဖြစ်ထွန်းမှုမြင့်မားနိုင်ပါသည်။ ဆန်စပါးစိုက်ပျိုး ထုတ်လုပ်မှု ပိုမိုများပြားစွာနှင့် ထွက်နှုန်းမြင့်မားစေရန် ဆောင်ရွက်ခြင်းများ အနေဖြင့် စိုက်ပျိုးရေးဝင်ငွေအလိုလျောက် မြင့်မားလာစေမည်မဟုတ်ပါ။ မြန်မာ့စိုက်ပျိုးရေးကဏ္ဍအတွက် မြေယာနှင့် လုပ်သားရင်းနှီးလုပ်ကိုင်မှုအပေါ် အကျိုးအမြတ်ဖြစ်ထွန်းမှု ပိုမိုမြင့်မားလာစေရန်အတွက် ကုန်ကျစရိတ် အနည်းဆုံးနှင့် အမြတ်အစွန်းအများဆုံးသီးနှံများကို လွတ်လပ်စွာ ရွေးချယ်နိုင်ခြင်းနှင့် စိုက်ပျိုးထုတ်လုပ်မှု ထိရောက်မှန်ကန်ရေးနှင့် အကျိုးအမြတ်ဖြစ်ထွန်းမှုများအပေါ် အဓိကထားဆောင်ရွက်ခြင်း (ဥပမာ-ထည့်ဝင်ရမှုလျော့နည်းပြီး၊ များများထုတ်လုပ်နိုင်ခြင်း (သို့) ထည့်ဝင်ရမှု (input) များများ အသုံးပြုခြင်းထက် ပိုမိုကောင်းမွန်စွာအသုံးပြုခြင်းဖြင့် ထွက်နှုန်းမြင့်မားစေခြင်း)စသည့်အချက်များမှာ အရေးပါပါသည်။

အကျိုးအမြတ်ဖြစ်ထွန်းမှုအပေါ် ပိုမိုအဓိကထား ဆောင်ရွက်ခြင်းသည် သီးနှံအမျိုးမျိုးကွဲပြားစွာ စိုက်ပျိုးထုတ်လုပ်မှုအတွက်အထောက်အကူဖြစ်စေသလို၊ စိုက်ပျိုးရေးအစီအစဉ်များအနေ ဖြင့် ဆန်စပါးထက်ကျော်လွန်၍ ၎င်းတို့၏အတိုင်းအတာ၊ အကြိုးဝင်မှုကို ပိုမိုကျယ်ပြန့်စွာ ဆောင်ရွက်ရန်လိုအပ်ခြင်း ဆိုသည့်အချက်အပေါ် တွင်လည်း အပြည့်အဝပံ့ပိုးပေးနိုင်မည်ဖြစ်သည်။ ဥပမာ- အများပြည်သူဆိုင်ရာမြို့စေ့ထုတ်လုပ်မှုစနစ် (လတ်တလောတွင် စပ်မြို့စပါးအမျိုးမျိုးအတွက်သာသီးသန့်အလေးထားဆောင်ရွက်လျက်ရှိ)အနေဖြင့် အတိုင်းအတာပိုမို ကျယ်ပြန့်စွာ ဆောင်ရွက်ရန်လိုအပ်ပြီး မြန်မာနိုင်ငံ၏ ကြွယ်ဝသောဇီဝမျိုးကွဲမျိုးစုံနှင့် တောင်သူများ၏ စီးပွားရေးရာထည့်သွင်း စဉ်းစားရမှုများအပေါ် အခြေခံ၍ အမျိုးမျိုးသော စပါးအမျိုးအစာများနှင့် အခြားသီးနှံများအတွက်ပါ စိုက်ပျိုးပစ္စည်းများ (မျိုးစေ့၊ သစ်သီး စသည်)များပါဝင်လာစေရန် ဆောင်ရွက်သင့်ပါသည်။ စိုက်ပျိုးရေး ပညာပေးဝန်ဆောင်မှုများအနေဖြင့်လည်း တောင်သူများဆီ ပိုမိုရောက်ရှိစေရန်နှင့် ခေတ်မှီစိုက်ပျိုးရေးနည်းပညာ အသုံးပြုမှုများ အရှိန် မြင့်လာစေရန် တိုးချဲ့ဆောင်ရွက်သင့်ပါသည်။ ဆည်မြောင်းစနစ်များအနေဖြင့်လည်း တောင်သူများအတွက် ဧရိယာ အမျိုးမျိုးတွင် အကောင်းဆုံး Crop Mix/ rotation ပုံစံများဆောင်ရွက်နိုင်ရန်နှင့် စျေးကွက်အခွင့်အလမ်းများအတွက် ပိုမိုပျော့ပြောင်းညင်သာ၍ လိုအပ်ချက်အလိုက် ဆည်မြောင်းဝန်ဆောင်မှုများ ဖြည့်ဆည်းပေးနိုင်စေရန် ဆောင်ရွက်သင့်ပါသည်။

CHAPTER 1: INTRODUCTION

1 **This report is about the economics of farm production in selected regions of Myanmar.** It provides baseline information on prevailing farm practices, technologies, productivity, and economic outcomes of farming across a wide range of agro-ecological zones in four regions of Myanmar: Ayeyarwady, Bago, Sagaing, and Shan State.[4] The survey included the 2013 monsoon season and the 2014 off-season (cool and dry season). It covered 1,728 farmers in main village tracts; i.e., farmers with better access to market, finance, and public services, thereby telling a story about farms with better opportunities and most likely better farming results. Comparisons in productivity and profitability are made across seasons (monsoon and cool and dry), farms of different sizes, and those featuring different patterns of land use, crop rotations, and farming practices based on an analysis of representative farm enterprise models. Most data are disaggregated by gender. Where possible, Myanmar is benchmarked with its peers: Cambodia, Thailand, Vietnam, and other Asian countries. Altogether, this report is among the first in the country to build on accurate primary data and to cover a wide range of details pertaining to farm production economics.[5]

2 **The report's specific value added is in closing knowledge gaps on the basic facts about farming systems, and farm productivity and profitability.** It is known that many farms produce variety of crops in Myanmar but the full extent/magnitude of diversification of farming systems across the seasons is not well known. In addition, information on input use, production costs, and profits is not accurate or largely nonexistent in Myanmar. While several studies recently estimated the costs of rice production, they did not contain some pieces of crucial information at a sufficient level of representation to help inform policy decisions.[6] For example, while many agree that the level of fertilizer use is suboptimal, the level of fertilizer use per hectare of land is not clear. Furthermore, it is not clear how it varies by region, crop (off-season paddy, monsoon paddy, other crops), or ecosystem (dry land or irrigated tract). Knowing the level of use and how it varies across regions and production environments is essential for understanding the possible production impact of alleviating credit constraints. More importantly, such knowledge could also provide rough estimates of how much farmers' income would rise if fertilizer use increased. This knowledge in turn could help prioritize investments and policy interventions. Fertilizer use provides just one example

3 **The extent of mechanization for different farm operations (including availability of mechanization services), the importance of farm saved seed versus seed bought in the market, and the relative importance of family versus hired labor are other key data that provide evidence on which to rank different types of interventions.** For example, there is a need for better understanding of dynamics in labor availability and cost of hired labor, draught power availability, the cost and availability of farm equipment and services, and costs of mechanized farming systems vis-à-vis those of labor-intensive practices. Such analysis can help determine the scale of production where economic and technical factors seem to lead to either more productive use of farm mechanization or where productivity improvements are possible through adoption of more labor-intensive methods.

[4] Unless otherwise noted, the terms "Ayeyarwady, Bago, Sagaing, and Shan State" refer to the respective administrative regions rather than to towns, rivers, or other places with the same name (i.e., the word "Region" is implied but does not follow each instance of the region's name).
[5] Note that the survey does not include livestock and fisheries due to the need for different approaches in data collection compared to crops.
[6] They also did not have information on crops other than rice.

4 **A distinction is made between land and labor productivity.** While both assets are important, an increase in land productivity (i.e., crop yield) may not necessarily lead to an increase in labor productivity (i.e., income), which is critical for poverty reduction. Using better seeds, applying more fertilizers, and putting more machines on farm fields are necessary but insufficient actions to increase the returns to labor. Low income per hectare may actually generate more income per capita depending on the number of farm laborers employed or total days spent in the field. These nuances need to be much better understood in Myanmar and the discussion shifted in the direction of farm incomes rather than strictly on production and yields.

5 **Why is the above information important?** Because agriculture is a large and important sector in Myanmar. Although the agriculture share in gross domestic product (GDP) has fallen in recent years, it is still close to a third (MOAI 2015a). Agriculture makes up around one quarter of Myanmar's total merchandize exports and employs more than half of the workforce (World Bank 2015a). Crops account for three quarters of agriculture GDP. Although rice is the largest in terms of output, beans and pulses account for half of value added in crops. Therefore policies targeted at increasing productivity of these crops could have important macroeconomic and poverty alleviation implications. The latter ranged between 26-37 percent in 2010 depending on the methodology used. Many rural people, including farmers, are poor: rural areas account for 76 percent of all the poor in the country.

6 **The role of agriculture in reducing poverty is well recognized in the country.** Leveraging agriculture for reducing rural poverty is a key government priority. The 2014/15 Systematic Country Diagnostic of the World Bank Group stressed the importance of raising returns to agricultural land and labor to end poverty in Myanmar. Along with other reports, it identifies low agricultural productivity as a central reason for high rural poverty. It acknowledges that with the slow creation of nonfarm jobs, agriculture will continue to employ many people for years to come and affect job creation beyond primary production, e.g., in agroprocessing and food distribution services.

7 **This report provides details that can be used for designing effective programs and policies to leverage agriculture's role in poverty reduction.** It starts with a presentation of the survey methodology, the survey tools, and the framework for analyzing farm profitability (Chapter 2). Chapter 3 presents the factors of agricultural production – land, labor, and capital – of the surveyed farms. Chapter 4 describes the prevailing production choices/mixes in the monsoon and off-seasons. Chapter 5 analyzes the economics of monsoon rice production and profitability. Chapter 6 presents an analysis of production and profitability for off-season rice. Chapters 7, 8, and 9 analyze the non-rice crop production and profitability for beans and pulses, maize, and oilseeds, respectively. Chapter 10 summarizes the key findings. Eleven annexes include all details and results of the 2013/14 Myanmar agricultural survey, including elaborative farm budgets for each crop.

CHAPTER 2: METHODOLOGY AND SURVEY TOOLS[7]

8 **Ayeyarwady, Bago, Sagaing, and Shan State were selected as target areas for data collection.** They represent a rich variety of agro-ecological zones/ecoregions and farming systems in Myanmar. The Myanmar Marketing Research and Development Organization designed the survey and collected the data, with technical support from the International Rice Research Institute, the Philippine Rice Research Institute, and the United Nations Food and Agriculture Organization (FAO). Data were collected for the 2013/14 agricultural season, through two survey rounds. The targeted crops were paddy, pulses and beans, oilseeds, and maize. The survey does not cover areas specialized in horticultural or industrial crops.

9 **The first round of the survey was conducted from November to December 2013.** In each of the four selected regions/states, three representative ecosystems were chosen (see below). Within each of the 12 region-specific ecosystems, two townships were randomly selected using probability proportional to size based on the net sown acres of each township. Within each of these 24 townships, four village tracts (an administrative unit composed of groups of villages) were chosen by simple random sampling. In Shan State, with the exception of Taunggyi Township, village tracts were not selected at random but chosen in consultation with Township Agricultural Officers, who could advise on village tracts with a satisfactory security situation. Within each village tract, the main village was selected to minimize the survey team's transport costs. If the selected main village turned out to have less than half of its area planted to the target crops, another randomly selected main village elsewhere in the township was chosen as a substitute.

10 **Within each of these 96 main villages, all agricultural households were listed and organized under the categories of smallholder farmer (owns less than 5 acres), medium holder farmer (owns 5-10 acres) and large holder farmer (owns more than 10 acres).** Individual farmers who double-cropped (two target crops or one target crop and one nontarget crop) were then chosen from each of the three size categories according to simple random sampling, with the number of farmers in each category proportional to the number of each category of farms in that village. Main villages are likely to have better agricultural performers than more remote villages. They are likely to be the most economically active, receive more public services, have better access to markets, and represent long-established production areas with better soils and production environments.

11 **The decision to select farmers from main villages was driven by a number of considerations.** First, most studies with international comparisons use a similar approach by collecting data from more developed farming areas, often equipped with irrigation. To compare the Myanmar findings with those of its peers required a similar approach. Second, the limited budget available to the team required prioritization and clear focus on capturing the state of farm production economics in selected regions. Third, insecurity in some areas precluded the team from surveying more remote villages.

12 **It follows that the findings of this analysis should not be interpreted as Myanmar's averages.** They need to be seen as an insight into the production economics of better-performing farms mainly growing rice during the monsoon season and

[7] See Annex 1 for more details, including maps showing the survey areas. Annex 2 presents the conversion factors used in this report.

other crops during the off-season, including second season rice, in selected regions of Myanmar. The surveyed farmers are more receptive to adopting new and modern technologies. They represent the upper tier of farmers, those using higher application rates of fertilizers and better-quality seed, and likely having better access to services such as credit, equipment rental, and irrigation. Overall, the results illustrate the profitability of agricultural production when adequate level of inputs and more modern technologies are used.

13 **The survey collected information from 1,728 farmers during the first round.** In some cases, data on yield for plots observed during the first round were not available at the time of the survey, so the team collected the yield information during the second round. This was mostly the case for farmers in Labutta Township in Ayeyarwady due to flooding that caused delayed cropping. By region, the sample included 484 households in Ayeyarwady, 380 households in Bago, 501 households in Sagaing, and 363 households in Shan State. They represent 0.07 percent of all farms in those regions (Annex 1, Table 39A[8]).

14 **Respondents were farmers who met the following criteria:** (i) had resided in the village at least two years; (ii) expressed availability and willingness to participate fully in the survey; (iii) was actively cultivating land, whether as a landowner, land tenant, or landowner who rents additional land; and (iv) was the head of the household or a household member who led the farm work.

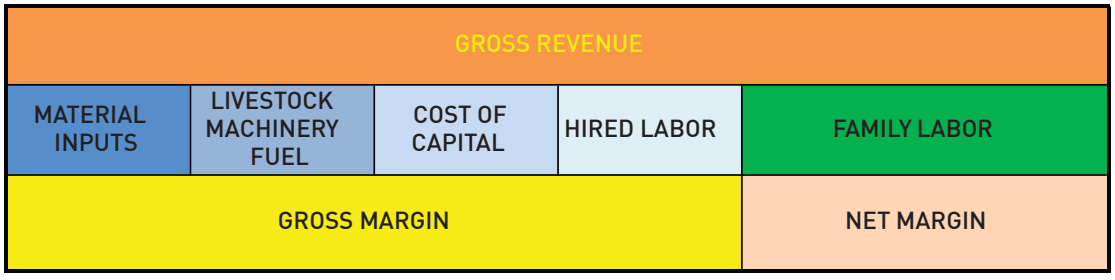
15 **The townships within each state or region were organized under three clusters defined by geographical area and zone-specific agro-ecological characteristics** (Table 40A, Table 41A, Figure 51A, Figure 52A, Figure 53A, Figure 54A, and Figure 55A in Annex 1). They are the following:

a. Ayeyarwady's ecoregions include the land under saltwater, brackish water, and freshwater. These areas are the part of the larger Delta Region agro-ecological zone (AEZ).
b. Bago's ecoregions are west alluvial, east alluvial, and east/west flooded lands. Together with Sagaing, they belong to the larger Dry Zone AEZ.
c. Also part of the larger Dry Zone AEZ, Sagaing's ecoregions include irrigated tract land, dryland, and riverbed areas.
d. Shan State's ecoregions include southern interior, northern interior, and border areas representing the Shan Plateau/ Mountainous Region AEZ.

16 **Data for the second round of the survey were collected during the months of March to May 2014.** The interviewers returned to the same households visited in 2013 and requested information on second season rice and other crops (maize, pulses and beans, oilseeds) for the summer crop. Out of the 1,728 initially selected farms, about 56 percent provided information on non-rice production, mainly pulses, and about 20.5 percent on rice production. The remaining households grew a nontarget crop (e.g., fruits, culinary crops) during the second season, and further data on those crops were not collected.

17 **The survey data is used to analyze farm profitability through construction of farm budgets.** Figure 1 presents the farm budget calculation framework.

FIGURE 1: FARM BUDGET CALCULATION FRAMEWORK



Source: Own presentation.

[8] See Annex 1 for more details, including maps showing the survey areas. Annex 2 presents the conversion factors used in this report.

18 **The farm budget components are calculated in the following manner:**

a. **Gross revenue** is calculated by multiplying yield (quantity produced as reported by farmers) with farm-gate prices. Yields and farm-gate prices for budget estimates are in wet paddy equivalent. In cases where farmers did not sell their production, prices were estimated using the median farm-gate prices at the ecoregion level, thus imputing a value of rice for own consumption.

b. **Total costs** are broken down into five subcategories: (i) material inputs, comprising seeds, fertilizers, manure, and chemicals; (ii) hired labor; (iii) costs of using livestock, machinery, and fuel; (iv) computed cost of working capital; and (v) imputed costs of family labor:

   i. *The cost of seeds* was computed using the quantity of seeds and the actual prices for farmers purchasing hybrid seeds, certified seeds, or noncertified seeds from different sources. For farmers using their own seeds, the median prices of dry paddy at the ecoregion level were used. In sum, seeds are monetized whether purchased or self-supplied.

   ii. Only the *costs of hired labor* are considered at this point. A value is imputed for family and permanent labor, but this is done at a later stage and is not included here.

   iii. Because not all farmers own livestock and machinery, they are often rented in, while other farmers use their own livestock and machinery. Thus two ways exist to calculate the cost of these services. One is to use the purchase price of livestock or machinery and annualize it using estimates of depreciation, salvage value, the opportunity cost of capital, and other parameters. The other is to use rental rates for these services. Given its relative simplicity, the latter approach was used. For the sake of consistency, average rental rates were calculated for the various services used by farmers who rent in these services; these numbers were then applied to all farmers, even those who owned their own livestock/machinery. This is essentially the opportunity cost of using their own equipment – if they did not use it on their own farm, they could rent it out to another farmer.

   iv. The *cost of working capital* is proxied by a sum of costs multiplied by an interest rate. The relevant costs are those for material inputs, livestock, machinery, and fuel plus hired labor, excluding labor costs related to harvest and post-harvest activities (because outputs can be sold once harvested, these labor costs do not need to be financed). If the sale of outputs is delayed, then any financing of harvest labor costs required is not a production cost but is more properly viewed as a cost of marketing. The interest rate is a weighted average of two interest rates, with the weights being the fractions of farmers who borrowed money and those who did not. For farmers who borrowed, the interest rate is the median interest rate for a six-month loan (the most common loan duration) within each ecoregion. For farmers who did not borrow money, the interest rate used is equal to half of that used for borrowers, as a proxy for the opportunity cost of own capital.

   v. The *own farm labor cost, including permanent labor living on the farm*, is imputed using person-hours of labor allocated to farm production multiplied by the average wage rate for hired labor for a similar task. Where the cost of hired labor is missing for a particular task, the average hourly rate for all tasks is used.

c. **The three profitability indicators used are – gross margin, net margin, and labor productivity:**

   i. **Gross margin** is gross revenue *less* costs excluding family labor. The gross margin is essentially the income accruing to a household that owns the land it tills: returns to family (and permanent) labor employed on

the farm, returns to land, and returns to management skills.

ii. **Net margin** is gross revenue *less* total costs or, equivalently, gross margin less the imputed value of family (and permanent) labor. It is essentially farm profit after assuring payment to own family labor at market wage rates, i.e., the returns to land and management skills.

iii. **Labor productivity** is computed by dividing gross revenue net of input costs by the number of days of labor spent on farm production regardless of the source (family, hired, or permanent). This indicator gives an idea of how productive farm labor is in growing a particular crop. Labor productivity tends to be high when large amounts of capital (e.g., machines) are used, when high-quality land is used, or when skillful farm managers are employed. Labor productivity is crucial for achieving high standards of living, and tends to be higher in rich countries relative to poor countries.

19 **Annex 8 presents detailed farm budgets for each ecoregion and farm size.** The latter allows some basic analysis of scale economies in Myanmar's agriculture sector. In addition, the farm budgets are constructed to compare profitability by: (i) type of crop establishment (transplanting versus direct seeding); (ii) adoption of different types of seeds; (iii) quantity of fertilizers used (low, medium, or high) and type of fertilizer used (none, urea, or urea and NPK); and (iv) gender of the household head.

20 **The results of the survey were compared with international data from the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT) and the U.S. Department of Agriculture (USDA).** In addition, rice data were benchmarked against selected countries in Asia, the data for which came from three studies carried out in 2014 and 2015. The first is a study on Cambodia carried out by the World Bank (2015a). It analyzes farm production economics in the major rice-producing areas (Takeo, Prey Veng, and Svay Rieng Provinces in South-East region and Battambang and Banteay Meanchey Provinces in North-West region) in 2013. The second study includes China, India, Indonesia, the Philippines, Thailand, and Vietnam. It was carried out by a joint team from the Philippine Rice Research Institute, International Rice Research Institute, Benguet State University, and Philippine Council for Agriculture and Fisheries (Bordey *et al.* 2014 and 2015). It covers a total of 603 farmers in intensively cultivated areas of Asian commercial production rice bowls during the January-June 2013 harvest (i.e., dry/off-season in Myanmar) and July-December 2013 harvest (i.e., monsoon season in Myanmar). The third study is still ongoing, but is already providing relevant information on rice value chains in the Greater Mekong Subregion, covering Cambodia, Lao PDR, Myanmar, Thailand, and Vietnam. It is being carried out by the World Bank (2015c) to deepen knowledge, foster cross-county experience sharing, and promote dialogue on how to better leverage rice sector development for poverty reduction.

21 **All three mentioned studies present data for 2013 that are comparable to the 2013/14 Myanmar survey.** Moreover, the farm budgets are calculated in the same way as in the Myanmar report and focus on the more productive farmers in the main rice-producing areas, as in this report. This makes the results of all three studies meaningfully comparable to the results of the Myanmar study herein.

CHAPTER 3: FACTORS OF AGRICULTURAL PRODUCTION

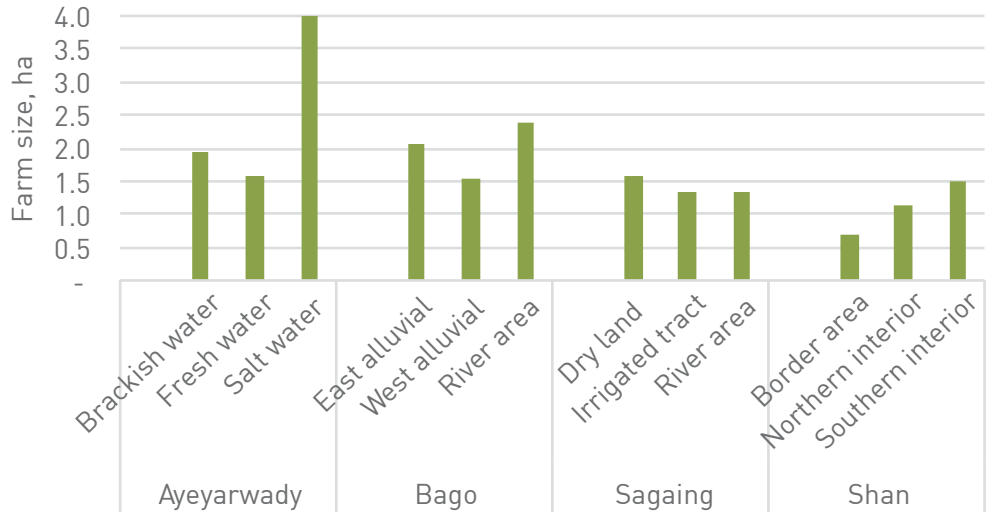
3.1 LAND

23 **Land is the important factor of production in agriculture.** The greater the land available, the more farm income can be derived from it. In the sample of 1,728 farm households, the average farm size was 8.26 acres or 3.34 hectares (ha)[9] (Table 49A). This average size is slightly higher than the average for Myanmar from the 2010 Agricultural Census (estimated at 6.34 acres) but is consistent with the average for the four regions included in the survey. The smallest farms are in Shan State and the largest in Ayeyarwady and Sagaing (Figure 2). The average farm size of male-headed households (3.37 ha) is only marginally larger than that of female-headed households (3.15 ha). .

24 **Small farms, defined in this report those having less than 2 ha, can be found in all regions.** But there are more of such farms in Sagaing (61 percent of all farms) and Shan State (69 percent) than in Ayeyarwady (33 percent) and Bago (46 percent). Significant disparities are also observed across ecoregions. The saltwater ecoregion in Ayeyarwady (districts of Labutta and Pyapon) is characterized by a high percentage of farms with more than 2 ha of land (83 percent of all households). In contrast, smallholders dominate in the districts of Kyaukme (66 percent) and Muse (85 percent) of Shan State.

25 **The size structure of farms in Myanmar is similar to that in most Asian countries.** Most farms are small in the broader international comparison and will remain small in the future. Even large farms with 5-10 ha in Myanmar, large in an Asian context, are small compared to farms in Australia, the United States, or even southern Europe. Land constraints play a role: even in the future (2050), Myanmar's agricultural land endowment per projected total population will be small compared to that of Australia and the United States, the global agricultural

FIGURE 2: FARM SIZE BY ECOREGION



Source: 2013/14 Myanmar agricultural survey.

[9] In the main text, land area is presented in "ha" for consistency with international comparisons. Tables in the annexes present land data in "acres," the more commonly used land metric in Myanmar.

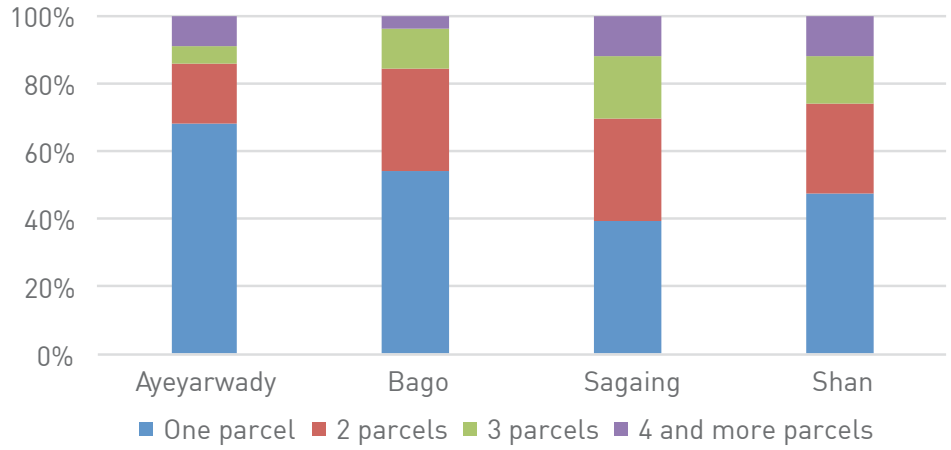
powerhouses. A large role is also played by Myanmar's high agricultural labor force, a factor that can be overcome in the future in contrast to the limited land availability. In Japan and South Korea, for example, low land availability is compensated for by small agricultural labor forces, 1.0 and 2.3 percent of total population, respectively, resulting in much larger average farm sizes than in Myanmar.

26 **Along with economic growth, agricultural employment in Myanmar will decline, which will automatically increase the average size of farms.** Agricultural land area can also expand but urbanization and stronger forest protection will be limiting factors for significant agricultural area expansion. The extent and speed of reduction in agricultural labor will depend on the ability of nonfarm sectors to create jobs and absorb today's farm labor, as well as migration opportunities. But even if the agricultural population shrinks to 5 percent of total population by 2050, agricultural land availability in Myanmar will still be only 4.3 ha per farmer, or 8.6 ha per household assuming two farmers per household. In other words, it will not be as large as in Australia, Europe, and the United States.

27 **Several policy implications emerge.** First, relying on large farm sizes alone to solve the farm income problem in Myanmar will work only for a tiny minority because the land resource is simply limited. Second, for farm households to keep up with their nonfarm counterparts, it will be essential for them to grow more profitable crops (primarily nonstaples) and diversify their incomes into nonfarm sectors (or leave farming entirely). Third, the productivity of land needs to be high to provide good farm incomes, putting a premium on sustainable land and water management. Fourth, with higher wages and a labor shortage, mechanization will eventually occur but will need to work at smaller field scales than in North America or Australia.[10] Most farms will have to mechanize through rental markets as farm sizes (i.e., a low land/labor ratio) will simply not be large enough to profitably work machinery full-time without renting out to other farmers.

28 **With regard to mechanization, the good news is that in some areas of Myanmar, most farms operate only one parcel of land.**[11] In Ayeyarwady, 68 percent of farms have only one parcel,[12] including 83 percent of farms in the saltwater ecoregion (Table 50A). Most parcels in Ayeyarwady are between 2.6-5.0 acres in size (Table 51A). In Sagaing, however, the proportion of farmers with one parcel declines to 40 percent. Overall, half of the surveyed farmers operate one land parcel; 26 percent have two parcels, 14 percent have three parcels, and only 10 percent have four or more parcels. Large land fragmentation is only observed in Sagaing and Shan State (Figure 3).

FIGURE 3: NUMBER OF PARCELS BY FARM BY REGION



Source: 2013/14 Myanmar agricultural survey.

[10] Higher wages and fewer laborers available, however, will not automatically trigger mechanization as the experience of Indonesia and the Philippines demonstrates. An enabling environment for a rental machinery market in terms of laws and regulations as well as farmers' access to working capital are also necessary to ensure rapid and efficient replacement of labor by machines. See more discussion in Chapter 3.3.

[11] This is the issue worth noting. For example, in Red River Delta the average farm holding is below 0.5 ha with this typically being divided into 3 to 7 parcels of different quality land, scattered throughout the village/commune.

[12] A parcel is defined as any piece of land entirely surrounded by other land, water, road, forest, etc., not forming part of the holding.

29 **The weak land rental market in Myanmar has prevented movement of land from less to more efficient farmers.** No farmer in the survey sample in Ayeyarwady reported renting land (Table 52A). The proportion of farmers reporting that they rented land was a mere 1 percent in Bago and Sagaing and 3 percent in Shan State, despite the relatively high rental payments. Rental payments averaged $830/ha in Bago and Shan State.

30 **Many reasons explain the inactive rental market in Myanmar.** One is the low land tax rates and the soft enforcement of tax payments; i.e., most landowners did not pay taxes at all in 2013/14 (Table 52A). Another reason is the uncertainty over future land reform. Almost 90 percent of households surveyed possessed documents proving their land ownership (Table 53A), including half of households with a land use right certificate. But they did not know the extent of security of those documents or what will happen to their land that is operated/leased by other farmers at the time of reform.

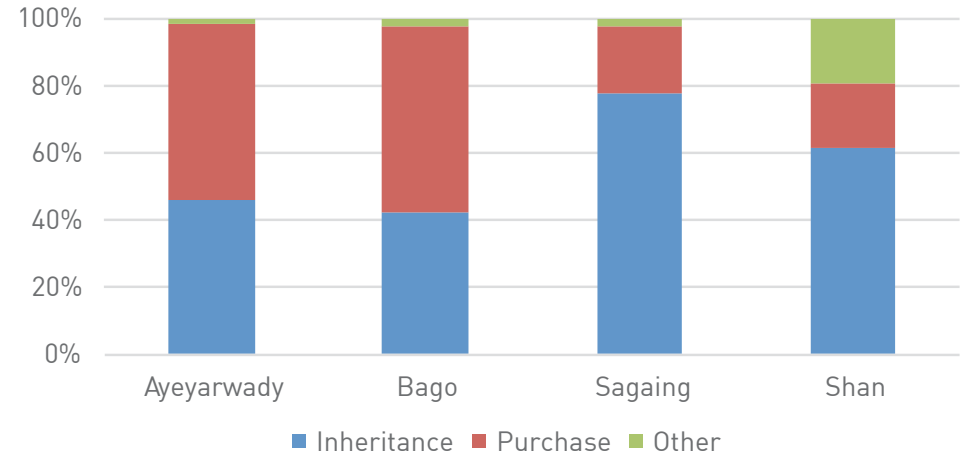
31 **As a result, most land operated by farmers is either inherited or purchased.** Between half and three-fourths of farmers acquired their land from inheritance, with the lowest proportion in Bago and the highest in Sagaing (Table 54A). The land market for purchase was more active in Ayeyarwady and Bago, with more than half of land obtained by purchase; transactions picked up slightly during 2005-2013 (Table 55A). Other modes of acquisition were quite important in Shan State (Figure 4), where farmers got land from the government and communities or through land clearing.

32 **Most landowners said they could use land as loan collateral but very few actually did so (Table 56A).** The supply of long-term credit requiring the use of land as collateral is very limited in Myanmar. Moreover, some land is in communal/customary ownership and cannot be used for collateral by individuals.

33 **With regard to soil types, most parcels in the survey sample were located in lowlands, except in Shan State.** Most land plots in Shan State and to a lesser extent in Sagaing were upland plots (Figure 5). Sagaing was also characterized by 5 percent of kayland (i.e., plots located along rivers). These are fertile lands made up by alluvial deposits left by river floods during the rainy season. Some land plots reportedly have high erosion, especially in hilly regions, as well as in the saltwater ecoregion of Ayeyarwady (Table 57A). Land texture determines the types of crops best suited for cultivation. For example, clay is the main type of soil for lowland plots, which are mostly suitable for rice production (Table 58A). Upland plots in Shan State were qualified as sandy by farmers.

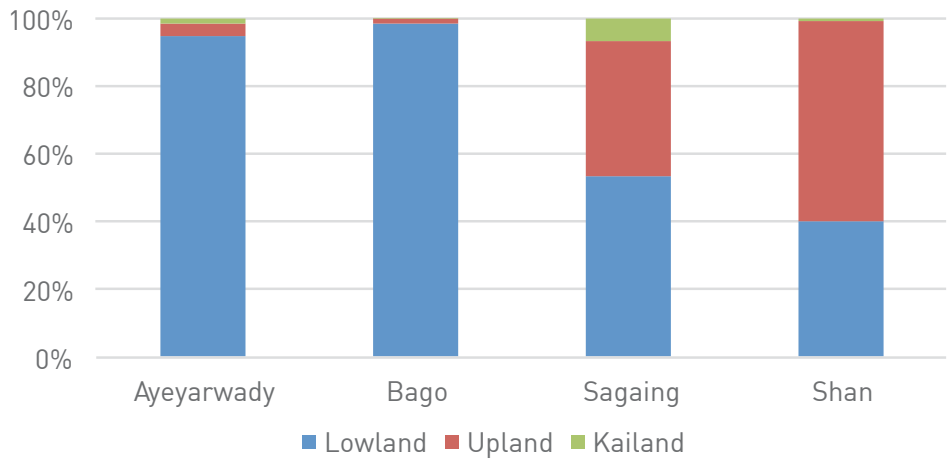
34 **The productivity, intensity of use, and value of land increase along with access to water.** With irrigation, farmers are willing to invest more in the use of modern inputs, labor, and services, taking into account the reduced climatic risks such as drought and flooding. Unfortunately, irrigation coverage in Myanmar is relatively low. In 2011/12, 2.12 million ha of agricultural land were part of public irrigation systems, according to MOAI (2013). This constituted 12 percent of crop area and was much smaller than in other Asian countries, except Cambodia (Table 1).

FIGURE 4: MODE OF LAND ACQUISITION BY REGION



Source: 2013/14 Myanmar agricultural survey.

FIGURE 5: GEOGRAPHICAL LOCATION AND SLOPE OF PARCELS



Source: 2013/14 Myanmar agricultural survey.

TABLE 1: IRRIGATION COVERAGE, SELECTED COUNTRIES

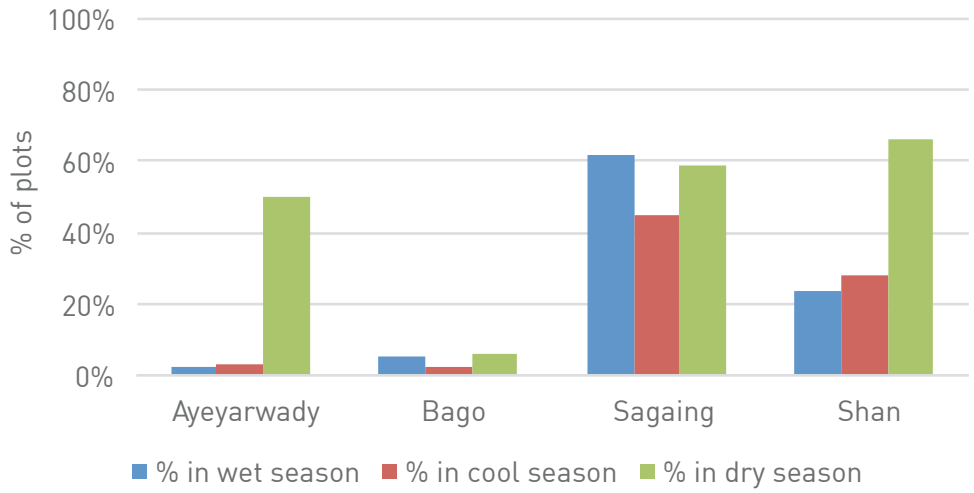
Country	Full control actual irrigated area (ha) 2011-2012	Arable land (ha) 2011	Share of irrigated areas in arable land (%)
Cambodia	317,225	4,000,000	7.9
China	54,218,976	111,598,500	48.6
Indonesia	6,722,299	23,500,000	28.6
Malaysia	340,717	1,800,000	18.9
Myanmar	**2,120,000**	**17,640,000**	**12.0**
Philippines	1,879,084	5,400,000	34.8
South Korea	880,400	1,492,000	59.0
Thailand	5,059,914	15,760,000	32.1
Vietnam	4,585,500	6,500,000	70.5

Source: FAO 2012 for irrigation statistics and the World Development Indicators for arable land.

35 **In the survey sample, the extent of irrigation significantly varied by region and season (Figure 6 and Table 59A).** On one hand, farmers in Ayeyarwady and Bago barely used irrigation in the wet season, as their fields received enough water from rains. In the dry season, 64 percent of plots in freshwater ecosystem of Ayeyarwady were irrigated, while other land areas remained unirrigated. On the other hand, most land in Sagaing was under irrigation in all seasons, with water coming from both public systems (canals and wells) and rivers (Figure 7 and Table 60A). In Shan State, the use of irrigation was highest in the dry season.

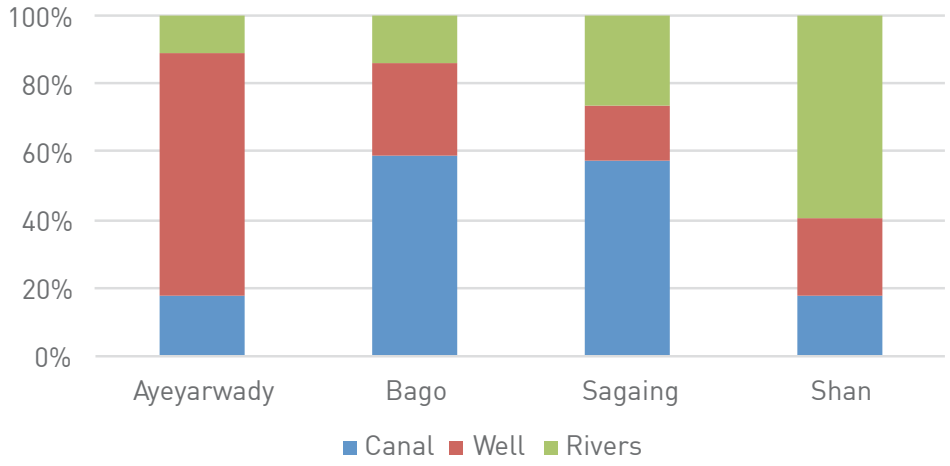
36 **Most farmers in Shan State used private solutions, pumping water from rivers (Table 61A).** Many farmers identified pumps as an efficient equipment to overcome the lack of hard irrigation infrastructure such as dams, and at the same time to reduce the likelihood of production loss due to droughts and floods. Pumps were also used to drain water from flooded fields when needed.

FIGURE 6: PROPORTION OF IRRIGATED PLOTS BY SEASON AND REGION



Source: 2013/14 Myanmar agricultural survey.

FIGURE 7: PRIMARY SOURCE OF WATER FOR IRRIGATION BY REGION



Source: 2013/14 Myanmar agricultural survey.

37 **The average cost of irrigation was about $49/ha, though it varied significantly by region and season.** The cost was mainly related to the use of labor for irrigation, diesel to pump water, rental of pumping equipment, and other expenses, but not actual payments for water. In the irrigated tract area of Sagaing, farmers spent $62/ha for irrigation in the wet season (Table 62A). In the cool season, this rate increased to $74/ha and in the dry season fell to $17/ha, probably due to either free provision of water in public canals or a limited supply of water in the dry season. In other regions, very few farmers reported paying for irrigation at all.

3.2 LABOR

38 **Rural labor is another important factor of agricultural production.** Agriculture is the primary source of livelihoods for most rural dwellers. Even for households owning land that complement total income by working off their farms, agricultural income was the main source of income (Table 63A). For landless households, working on farms is essentially a matter of survival; it is essential to make ends meet.

39 **More than half of the total labor force in Myanmar is estimated to work in agriculture (World Bank 2015b).** Prevailing farming practices are highly labor-intensive and agricultural wages are low. Farm wages in Myanmar in the 2013 monsoon season were only $1.8-2.5/day, the lowest in a sample of selected Asian countries (Table 2). In the 2014 dry season, wages grew to $3.0-3.5/day, showing rapid growth, but not sufficient to reach the levels observed in peer countries. As a result of low wages and the high cost of capital, rice production practices in Myanmar are labor-intensive: 131 days are spent per ha of paddy in Ayeyarwady, the main rice-producing area of the country, compared to 11 days in Thailand, 22 days in Vietnam, and 52 days in Cambodia, the countries competing with Myanmar on global rice markets. It appears that Myanmar currently has the highest labor intensity of wet paddy commercial production in Asia.

40 **High labor use in Myanmar, combined with low use of material inputs and capital, leads to low farm labor productivity.** People spend too much time on paddy and have less time for other crops, other jobs, and other activities. In many Asian countries, the high share of agricultural labor in the national accounts (Table 2, fourth column) distorts the true picture of labor productivity in rice production by pushing it downwards. It ignores the much lower labor input in terms of person-days (Table 2, third column). In contrast, Myanmar's high share of agricultural labor in total labor appears to reflect the actual situation of low labor productivity due to high labor inputs.

41 **In terms of labor intensity of rice production, Myanmar looks today as some of its neighbors did 10-15 years ago.** In the 1990s, from 60-170 days were spent per hectare of paddy land in the commercial major rice Asian bowls (Table 3). With the rise of wages and the development of private sector-driven rental machinery services, the labor intensity of rice production decreased significantly in most countries. Nowadays labor allocations there are 11-50 days (Table 2). In China, for example, the labor intensity of rice production declined from 80 days/ha in the 1990s to 35 days/ha in 2014.

TABLE 2: WAGES AND LABOR INTENSITY IN RICE SYSTEMS, INTERNATIONAL COMPARISON, 2013/14

Country	Average wage, $/day	Labor input, wet season rice, days/ha	Agricultural labor in total labor force, % (2015)
Cambodia	4.0	52	51
China	19.3	35	35
India	4.2	78	47
Indonesia	7.5	96	35
Myanmar	**1.8 (2.5)**	**131 (103)**	**63**
Thailand	10.0-16.5	11	40
Vietnam	8.9	22	47
Philippines	7.8	70	32

Note: Data for Myanmar are for Ayeyarwady; the average for the four regions is in parentheses. Data for other countries refer only to one key rice-growing area.
Source: Columns 1 and 2, 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 and 2015 for all other countries. Column 3, World Development Indicators.

TABLE 3: LABOR USE FOR RICE PRODUCTION IN MAJOR ASIAN RICE BOWLS, 1994-1999

Country	Region	Labor, days/ha
China	Zhejiang	80
India	Tamil Nadu	170
Indonesia	West Java	115
Philippines	Central Luzon	58
Thailand	Central Plains	18
Vietnam	Mekong Delta	83

Source: Moya et al. 2004.

42 **It is important to note, however, that higher wages alone are not sufficient to trigger the quick replacement of labor by machinery.** The examples are Indonesia and the Philippines. Labor use in rice production there declined over time but remains very high compared to China, Thailand, Vietnam, or even Cambodia. Many challenges face their rental machinery markets, ranging from private sector-unfriendly regulations to social resistance to replacing wage labor by machines. Myanmar can take note of this.

43 **Farm wages are determined by many factors, including the prevailing wages outside agriculture.** Wages are expected to increase as per capita income increases. Looking at daily average wages across Asia (Figure 8, left side), it becomes clear why agricultural wages in Myanmar are so low: they follow wages in other parts of the economy. Wages in Myanmar are among the lowest. Note that the average wages in developing countries of Asia are still very low compared to their more developed peers, with a large gap (Figure 8, right side). In Japan, for example, the minimum wage is $6/hour or $48/day (assuming an 8-hour work day). Wages received by most people are much higher than the minimum wage. Wages in Europe and the United States are even higher than in Japan, and much higher than in developing Asia.

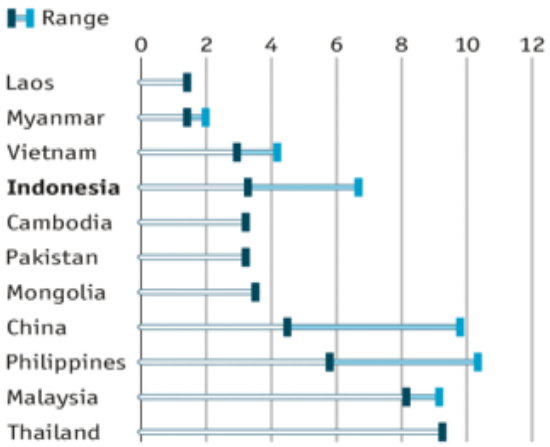
44 **Returning to the survey results, the average household size in Myanmar was 5.85, ranging from 5.22 in Ayeyarwady to 6.21 in Bago (Table 64A).** On average, households contain more women than men, with the exception of Bago, where the proportion of men is 0.52 (Table 65A). This difference is likely to be the effect of hired employees living at the household, of which 90 percent are men. In Bago, about 10 percent of the household members are hired individuals, while in other regions the proportion is about 1 percent.

45 **The presence of hired members in the household lowers the dependency ratio, resulting in more available labor for productive tasks.** The dependency ratio[13] ranged from 48 percent in Bago to 57 percent in Sagaing (Table 65A). The average age of hired household members was 30 years. In the district of Thayarwadi in the west alluvial ecoregion, the dependency ratio was 39 percent and the proportion of hired members was 17 percent. On the opposite end of the spectrum was Katha in the river area ecoregion, with a dependency ratio of 72 percent. The gender of the household head also affected the dependency ratio: it was higher for male-headed households (54 percent) than for female-headed households (50 percent).

[13] The dependency ratio is a measure showing the number of dependents (aged 0-14 and over the age of 65) to the total number of household members aged 15-64.The lower the ratio, the higher the number of active members taking care of non-active members.

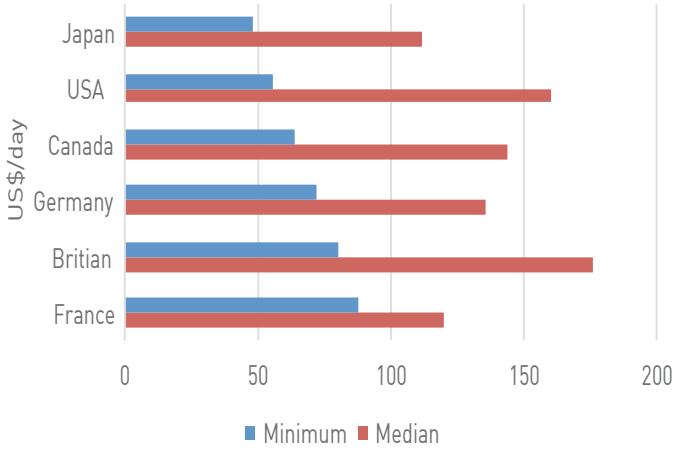
FIGURE 8: WAGES, INTERNATIONAL COMPARISON

Daily Minimum Wage, $, end Sept. 2014



Source: The Economist based on the Philippines National Wages and Productivity Commission.

Daily Wage, $, 2013



Source: 2013/14 Myanmar agricultural survey.

46 **The quality of human capital in Myanmar agriculture is very low. More than 70 percent of household heads did not attend school beyond the primary level (Figure 9).** The proportion of household heads with little or no education was very high, at more than 90 percent in Shan State, of which about 50 percent have no education (Table 67A). The situation was a bit better in Ayeyarwady (districts of Hinthada, Maubin, Labutta, and Pathein) and Bago (district of Thayarwadi), where more than one out of five heads of households finished secondary school and between 5-17 percent went through tertiary school and beyond. The policy implication is that extension services, on-farm training, and vocational skills improvement programs are absolutely necessary to uplift farm labor productivity in Myanmar.

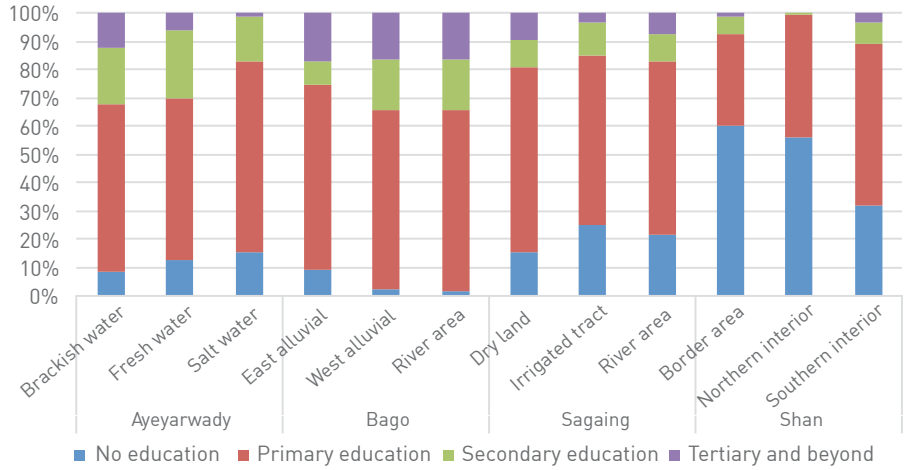
47 **Female heads of households were less educated than male household heads.** On average, 19 percent of men did not have any formal education compared to 30 percent of women (Table 67A). While 9 percent of men received tertiary and higher education, the share for women was only 4 percent.

48 **Many households in the survey sample possessed media equipment or cell phones.** TV possession was more common than radio possession, with more than half of the sampled households owning a TV in all regions, with the exception of farmers in Sagaing (44 percent) (Table 68A). At least one member in about 39 percent of the sampled households had a cell phone, with the lowest proportion in Sagaing (17 percent) and the highest in Shan State (56 percent).[14] Landline phones are extremely rare, with ownership at about 5 percent overall. The rate dropped to 1 percent in Shan State and 3 percent in Sagaing. In the saltwater ecoregion township of Labutta, however, the percent of farmers using a cell phone was just 6 percentage points above those using landline phones (25 percent versus 19 percent).

49 **With the development of mobile technologies, cell phones are expected to play an important role in terms of dissemination and access to information and improving farmers' skills and capacity.** For example, the use of text messages for dissemination of technical and price information is increasing due to its low cost. A slight bias toward male-headed households existed in terms of possession of media equipment: on average, lower proportions of female-headed households had a TV, radio, or cell phone.

[14] In 2014, the national average cell phone ownership was 33 percent, according to the 2014 Myanmar Population and Housing Census. Ownership of cell phones is increasing rapidly in the country, however.

FIGURE 9: EDUCATION OF HOUSEHOLD HEAD BY REGION



Source: 2013/14 Myanmar agricultural survey.

3.3 CAPITAL/PRODUCTIVE ASSETS

50 **Capital is usually required to raise labor productivity in agriculture.** The use of capital in crop production is associated with mechanization, which can have many advantages, including more timely completion of planting and harvesting, reduced post-harvest losses, and others. These factors certainly play a role in decisions to mechanize, but perhaps the two most important factors are the level of wages and the land/labor ratio: higher wages and land/labor ratios should lead to adoption of labor-saving technologies and greater use of machinery (Dawe 2015). Social factors also play a role in terms of accepting machinery to replace labor.

51 **The level of agricultural mechanization in Myanmar is still low in regional comparison.** The example is the percentage of farmers using combine harvesters or threshers (Table 4). It is not a surprise given the low wages in rural areas, the excess agricultural labor, and the still-lacking infrastructure and regulatory environment for machinery service providers. The small size of farms also matters but experience from other countries shows that this problem can be overcome through rental machinery services. The rental machinery market has been booming in other Asian countries. Many know about the advances made in China, Thailand, and Vietnam, especially in the core rice producing areas (Table 4). But even in Cambodia, another poor country with mostly small farms, mechanization has greatly advanced: in 2013, 73 percent of all land preparation was done by machinery (Chan 2014). The number of tractors increased 145 percent between 2004 and 2013, and the number of power tillers increased 648 percent. Machinery and equipment services are readily available. Even farmers are expanding into service provision, providing tillage and harvesting services for neighboring farmers (USAID 2015). Competition between tractor dealers is heated and has led to the introduction of leasing options, in addition to bank financing options.

52 **In Myanmar, according to the survey, the share of farms owning motorized agricultural equipment varied from 12 percent in Sagaing to 26 percent in Ayeyarwady (Figure 10), and the type of machinery owned differed by region.** Shan State is characterized by a high number of farmers with power tillers, reaching 45 percent of all farmers (Table 70A). The share is about 20 percent in Ayeyarwady and 10 percent in Bago and Sagaing. About one-fifth of farmers in Ayeyarwady own small tractors, and Bago has the highest percentage of farmers owning a medium-size tractor (15 percent). Except in Ayeyarwady, many farmers own several pieces of machinery and equipment (for example, a power tiller and small tractor). The age of this machinery is unknown, though most is likely very old.

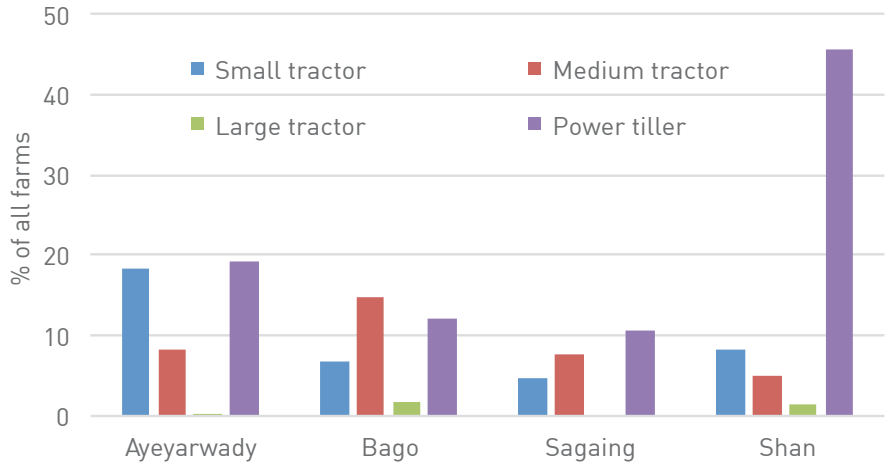
53 **Ownership of four-wheel tractors in the survey sample was much higher than the regional average ownership reported in the 2014 Myanmar Population and Household Census.** According to the Census, the national average ownership is only 2.5 percent. Shan State has the highest rate (6.9 percent); other regions are much lower, around 2 percent (Table 5). Ownership rates in the 2013/14 Myanmar agricultural survey were much higher, confirming that the 2013/14 Myanmar agricultural survey included mostly better-off and more productive farmers.

TABLE 4: PADDY AREA AND MECHANIZATION, INTERNATIONAL COMPARISON

	Average paddy area cultivated, ha	Farmers using combine harvesters/threshers, %
China	0.36	100
India	3.33	99
Indonesia	1.67	0
Myanmar	**2.14**	**1**
Philippines	2.06	3
Thailand	4.39	100
Vietnam	1.38	100

Source: 2013/14 Myanmar agricultural survey and Bordey et al. 2014 and 2015. Data for other countries refer only to one key rice-growing area.

FIGURE 10: POSSESSION OF AGRICULTURAL TRACTORS BY REGION



Source: 2013/14 Myanmar agricultural survey.

54 **Ownership of harvesting equipment was much lower than that of tractors.** For rice, only 0.5 percent of surveyed farmers had a combine harvester. These farms were located in Ayeyarwady and Shan State (Table 71A). However, a greater proportion of farmers owned a thresher for post-harvest tasks: 17 percent in Ayeyarwady and 5-6 percent in the other regions (Table 72A).

55 **Instead, most farmers in Ayeyarwady, Bago, and Sagaing owned and used draught oxen** (Figure 11). Oxen constitute an intermediate solution par excellence in developing countries, where most farmers face high initial costs of mechanization. Draught oxen provide power for agricultural production and transportation. Oxen have inherent risks related to their health and availability of feed, however.

56 **In areas with higher wages and good access to affordable machinery, such as in Shan State, ownership of draught oxen was low: about 79 percent of farms in Shan State did not own them** (Table 73A). On the other hand, the share of farms without draught oxen in Bago was only 22 percent. The average number of draught oxen per farm was 1.7. The mode was two draught oxen (38 percent of the cases); about 14 percent of farms owned three to four animals; and only 2 percent owned more than four animals.

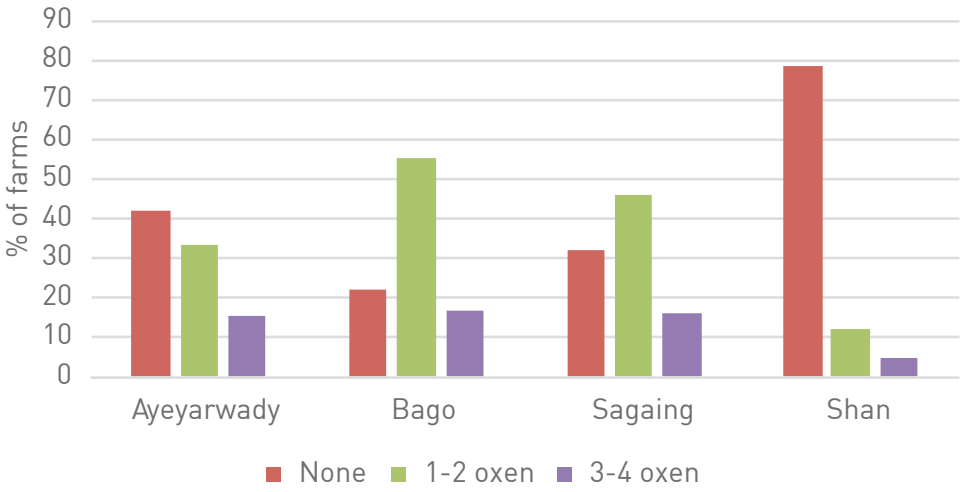
57 **As a result, Myanmar's rice production, a proxy for typical farming practices, has been less capital-intensive than that of most Asian countries.** The average labor cost/machine cost ratio in 2013/14 in Myanmar was 2.1 (Table 6), meaning that farmers spent twice as much on labor, hired and own, as on mechanized services. In Thailand this ratio was 0.9, in China 1.2, and in Vietnam 1.6. Myanmar fares similarly with India but more favorably than Cambodia, the Philippines, and Indonesia. In the latter two countries, very small farm sizes, policy barriers to rental machinery markets, and social resistance to mechanization explain the high labor/machinery ratios despite the relatively high wages (Dawe 2015).

TABLE 5: OWNERSHIP OF 4-WHEEL TRACTORS, PERCENT OF HOUSEHOLDS

Region	2013/14 Survey, %	2014 Population Census, %
Ayeyarwady	26	2.5
Bago	24	1.9
Sagaing	13	1.8
Shan State	14	6.9

Source: 2013/14 Myanmar agricultural survey and MIP 2015.

FIGURE 11: POSSESSION OF DRAUGHT OXEN BY REGION



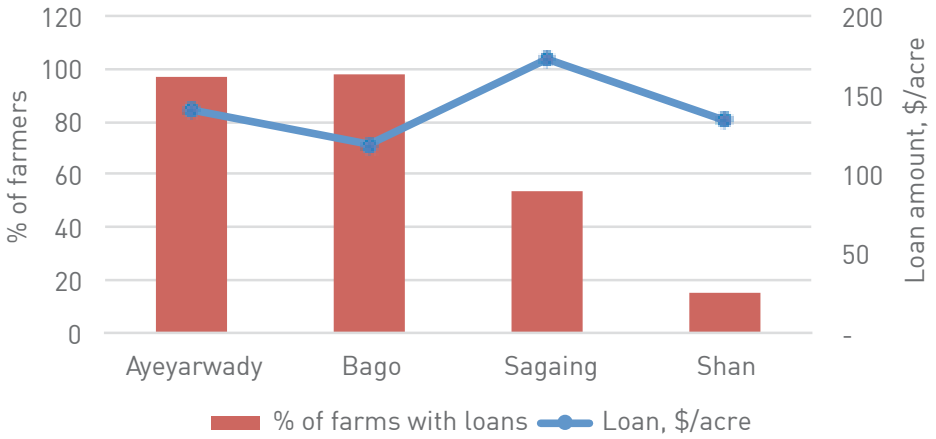
Source: 2013/14 Myanmar agricultural survey.

TABLE 6: AGRICULTURAL WAGES, LABOR INPUT, AND LABOR/CAPITAL RATIO, INTERNATIONAL COMPARISON, 2013/14

Country	Average wage, $/day	Labor input, wet season rice, days/ha	Labor/machine ratio, wet season rice
Cambodia	4.0	52	3.0
China	19.3	11	1.2
India	4.2	78	1.9
Indonesia	7.5	94	11.8
Myanmar*	**1.8 (2.5)**	**131 (103)**	**2.1 (2.0)**
Philippines	7.8	69	2.6
Thailand	10.0-16.5	10	0.9
Vietnam	8.9	23	1.6

Note: Data for Myanmar are for Ayeyarwady; the average for the four regions is in parentheses. Data for other countries refer only to one key rice-growing area.
Source: 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 and 2015 for all other countries.

FIGURE 12: FARMERS WITH LOANS AND LOAN AMOUNTS



Source: 2013/14 Myanmar agricultural survey.

58 **The use of mechanized services and inputs depends on access to working capital, among several other factors.** In Myanmar, farmers in general do not have the access to long-term capital, preventing investments in agricultural machinery and other productive assets at least for the large farms, for whom owning machinery can make economic sense (World Bank and LIFT 2014a). For farms with small land areas buying expensive agricultural machines is often unprofitable, and what they need is the access to short-term working capital to purchase mechanized services. In Myanmar, it is a common practice among farmers to get agricultural loans. In the survey, about two out of three farmers had ongoing loans in 2013. About 67 percent of these farms had one loan, about 30 percent had two different loans, and 3 percent had three loans.

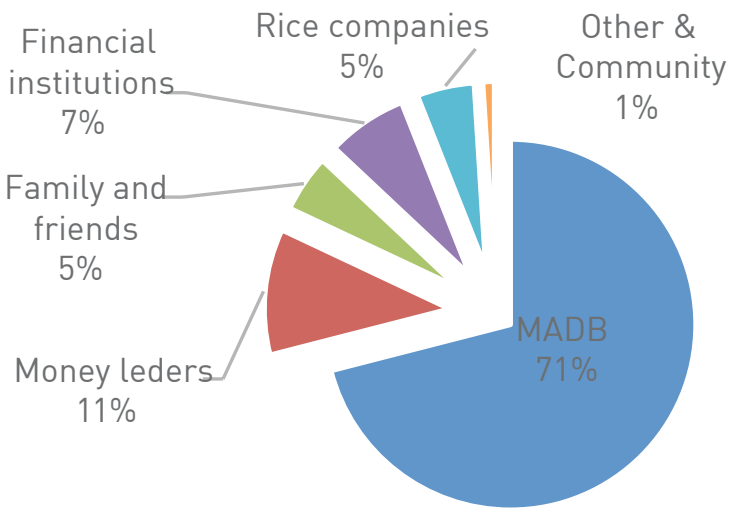
59 **The highest loan coverage was in Ayeyarwady and Bago.** Almost all farmers there reported having loans (97-98 percent of farmers), with an average loan amount of $125/acre (Figure 12).[15] In Sagaing, 54 percent of farmers had loans, with an average amount of $172/acre. The lowest proportion of farmers having loans was found in Shan State (less than 15 percent), where the loan amount averaged $125/acre. It could be that many farmers in Shan State have contract farming arrangements with Chinese traders, for example, where inputs are provided in advance, with payments made by outputs after the harvest. This reduces the need to obtain loans.

60 **For the monsoon season, the main source of loan was the Myanma Agricultural Development Bank (MADB).** About 71 percent of farmers received MADB loans (Figure 13). Money lenders constituted the second major source of capital, with 11 percent of farmers accessing funds from them. Other important sources were other financial institutions, family and friends, and rice companies.

61 **Most of the loans, about 65 percent, were for six months** (Figure 14). This is in line with MADB's lending policy. A small number of loans (10 percent) were for five months, and another 10 percent for seven to eight months. Very few loans lasted more than one year.

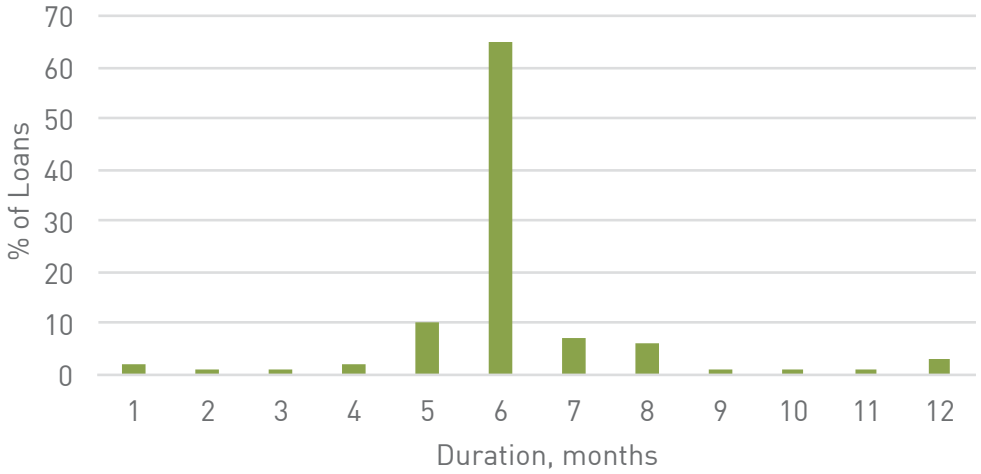
[15] An access to finance in more remote villages may be lower than reported in the surveyed main village tracts.

FIGURE 13: SOURCE OF AGRICULTURAL LOANS FOR FARMERS



Source: 2013/14 Myanmar agricultural survey.

FIGURE 14: DURATION OF LOANS IN MONTHS



Source: 2013/14 Myanmar agricultural survey.

TABLE 7: AVERAGE AND MEDIAN MONTHLY INTEREST RATE BY SOURCE

Source of Loan	N	Average monthly interest, %	Median monthly interest, %
MADB	1,124	0.80	0.80
Money lender	170	5.40	5.00
Family and friends	73	4.13	5.00
Microfinance institution	111	2.42	2.50
Rice company	87	1.11	1.00
Other	24	2.59	2.50
Total	**1,589**	**1.60**	**0.80**

Source: 2013/14 Myanmar agricultural survey.

CHAPTER 4: FARM CROPPING DECISIONS

63 **About 60 percent of Myanmar farmers are estimated to produce more than one crop in a calendar year, according to the 2015 household survey conducted by the World Bank for poverty assessment.** Our survey targeted such farmers, i.e. producing more than one crop, and their cropping decisions are presented below.

64 **Myanmar is well known for producing rice. Rice is the most cultivated crop** (Table 74A). It is produced in all ecoregions and AEZs, but mainly during the monsoon season. Beans and pulses are the second most grown crop in the country, most of which are produced during the cool and dry season. Other important crops include maize, groundnuts, sesame, sunflower, and culinary crops.

65 **Very few farmers from the survey practiced rice monoculture.** The exception was farmers in the saltwater ecoregion of Ayeyarwady, where 97 percent of farmers reported producing only rice (Table 8). In Myanmar, farming systems are diversified, with paddy production prevailing during the monsoon while other crops are produced during the cool and dry season (off-season) (Table 75A). For major crops such as rice, pulses, and maize, farmers do not mix different crops on the same plot. However, mixed cropping was more common for sesame (33 percent of parcels), sunflowers, and culinary crops. Only 3 percent of plots mixed pulses with other crops.

TABLE 8: CROPS GROWN ACROSS ALL SEASONS, % PRACTICING FARMERS

	Only rice	Only maize	Only oil seeds	Rice+ maize	Rice+ pulses	Rice+ oilseed	3 or more crops
Ayeyarwady							
Brackish water	9				88		3
Freshwater	38				41		11
Saltwater	97						
Bago							
East alluvial	2				97		2
West alluvial	10			1	87	1	1
River area	9				84	2	6
Sagaing							
Dryland	45		1	1	2	3	41
Irrigated tract	40		1		20	12	24
River area	2		2		1	49	32
Shan State							
Border area	58	2		33			
Northern interior	16	19		42			1
Southern interior	4	24		51			3

Source: 2013/14 Myanmar agricultural survey.

TABLE 9: PERCENTAGE OF FARMERS PRODUCING RICE BY SEASON AND REGION

	Monsoon	Off-season
Ayeyarwady		
Brackish water	100	
Freshwater	100	
Saltwater	100	**94**
Bago		
East alluvial	100	2
West alluvial	99	5
River area	100	15
Sagaing		
Dryland	65	29
Irrigated tract	96	48
River area	60	6
Shan State		
Border area	98	58
Northern interior	81	2
Southern interior	70	1

Source: 2013/14 Myanmar agricultural survey and MIP 2015.

66 **Yet rice is still the most cultivated crop.** In Ayeyarwady, Bago, the irrigated tract in Sagaing, and the border area of Shan State, essentially all farms grew rice during the monsoon season (Table 9 and Table 75A). The proportions were also high in other ecoregions, with the lowest figure being 60 percent in the river area of Sagaing.

67 **On the other hand, only a few ecoregions had rice growers during the off-season.** Some of the highest numbers were in the saltwater of Ayeyarwady (94 percent of farmers), and the irrigated tract (48 percent) and dryland areas (29 percent) of Sagaing. In two other ecoregions (river area of Bago and border area of Shan State), 15 percent and 58 percent of farmers grew rice in the off-season, respectively.

68 **The second most cultivated crop was pulses, a group that comprises black gram, green gram, chickpeas, pigeonpeas, and other grams.** India and China are the largest buyers of Myanmar beans and pulses. During the off-season, between 48 percent (dryland area) to 89 percent (brackish water area) of the surveyed farms grew at least one type of pulse. The exception was Shan State, where less than 2 percent of farmers were growing off-season pulses. In the northern and southern interior ecoregions in Shan State, maize constituted the second most cultivated crop during the monsoon and off-seasons. Sagaing had the most diversified mix of crops during both the monsoon and off-seasons.

69 **Sagaing was the main location of oilseeds production.** Sesame was produced in the dryland and river areas, mostly during the monsoon season. Groundnut production was concentrated in the river area, with 23 percent of farmers producing it during the monsoon season and 83 percent during the off-season. Mustard production was practiced by 10-20 percent of farmers in the irrigated tract and dryland areas, but only by a negligible percent of farmers in the river area.

70 **A variety of other crops were grown in other places.** About one out of ten farmers in the northern and southern interior ecoregions of Shan State grew culinary crops (mainly chilies, onion, garlic, and potatoes), especially during the off-season. The freshwater ecoregion was characterized by 20 percent and 7 percent of farmers cultivating tobacco (including betel) during the monsoon and off-seasons, respectively.

CHAPTER 5: MONSOON RICE PRODUCTION AND PROFITABILITY

71 **Chapter 5 presents the results of the survey on monsoon rice cultivation.** The number of observations is reduced to one main plot per household of those producing rice in the monsoon season with a nonmissing quantity produced, which represents about 80 percent of total farms (1,373 out of the total 1,728 observations). All statistics in this chapter relate to these 1,373 plots. As such, statistics for the northern and southern interior ecoregions in Shan State should be interpreted with care because of their relatively low number of sample plots (35 and 22, respectively) (Table 76A).

72 **In addition to the analysis by ecoregion, the data were analyzed by gender of the household head and farm size.** All 1,728 farmers were categorized into three groups of similar size, based on their total landholding. The first group had the smallest farm size, with an average landholding below 1.1 ha (Table 10). The second group had medium-size farms, with an average land size of 2.7 ha. The third group included large farms, with an average landholding of 6.4 ha. This type of analysis reveals information on the existence of scale economies in rice production in Myanmar and on the variability of labor productivity across farm sizes.

73 **The distributions of farms by size for rice cultivation varied by region.** Large and medium-size farms dominated rice production in Ayeyarwady and Bago: more than 75 percent of farms fell in this category. On the contrary, Sagaing and Shan State had smaller farms, constituting about one-third (Sagaing) to one-fifth (Shan State) of the sampled rice producers in these regions. A slight difference was found between male- and female-headed rice-producing households in term of farm size distribution (3.2 ha for men versus 2.6 ha for women).

TABLE 10: CLASSIFICATION OF FARMS BY SIZE

	Number of farms	Acres per farm, average	Ha per farm, average
Small farm [0.1-4.5 acres]	483	2.63	1.06
Medium farm [4.51-9.0 acres]	435	6.70	2.70
Large farm [↑9.0 acres]	455	15.70	6.35

Source: Own presentation.

5.1 YIELDS[16]

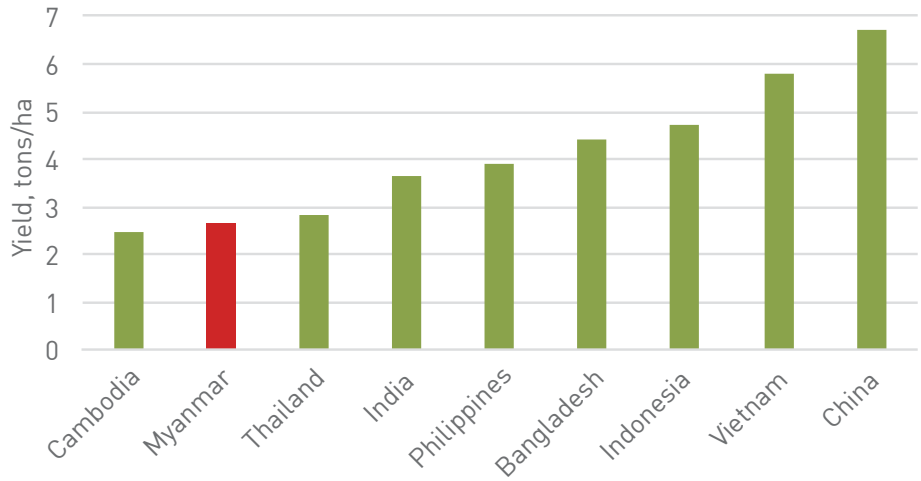
74 **Many discussions are held in Myanmar about paddy yields.** On one hand, the MOAI reported an average yield of 3.84 tons/ha in 2012/13 (MOAI 2015b). On the other, the USDA reported 2.7 tons/ha for Myanmar. The USDA records put Myanmar on the lower end of the Asian spectrum, the second lowest just above Cambodia (Figure 15), while official statistics put Myanmar solidly in the middle.

75 **The survey provides some empirical evidence in this regard.** But before yields from the survey are presented, it is important to note that USDA and most international statistical databases report yields in "dry paddy equivalents." Myanmar's paddy yields may be reported in "wet paddy equivalents," implying that they are inflated compared to dry paddy equivalents. The estimated conversion factor from wet to dry in Myanmar is 0.814, assuming 25 percent average moisture content in wet paddy, 14 percent average moisture content in dry paddy, and about 5 percent impurities in wet paddy. [17]

76 **The weighted average paddy yield in dry equivalent in the surveyed sample was 2.73 tons/ha.** The average was 2.56 tons/ha for the monsoon season and 3.41 tons/ha for the off-season (Table 11). Note that these data come from relatively more productive farms, and farms outside of this survey are likely to have lower yields. The survey results are much closer to the data from USDA than MOAI. Even the weighted average wet paddy yield was 3.35 tons/ha, implying that official yield data (3.8 tons/ha) are biased upward and that the actual yield gap of Myanmar compared to its peers is quite high. During the monsoon season, the lowest yields were found in Sagaing and the highest in Shan State, with Ayeyarwady and Bago in the middle (Table 77A). No significant gender disparities were found for monsoon rice yields.

77 **In Shan State, small farms had considerably higher yields than medium and large farms** (Figure 16). The yield difference reached 74 percent. In other regions, the inverse relationship between yield and farm size was not as strong as in Shan State, except in Sagaing and, to a lesser extent, Bago. In Ayeyarwady, the average yield for small farms was only 10 percent higher than for large farms (Table 77A).

FIGURE 15: PADDY YIELDS, 2013/14, INTERNATIONAL COMPARISON



Source: USDA.

[16] In the main text, yields are presented in "tons/ha" for consistency with international comparisons. Tables in the annexes present yield data in "kg/acre," the more common measurement in Myanmar.

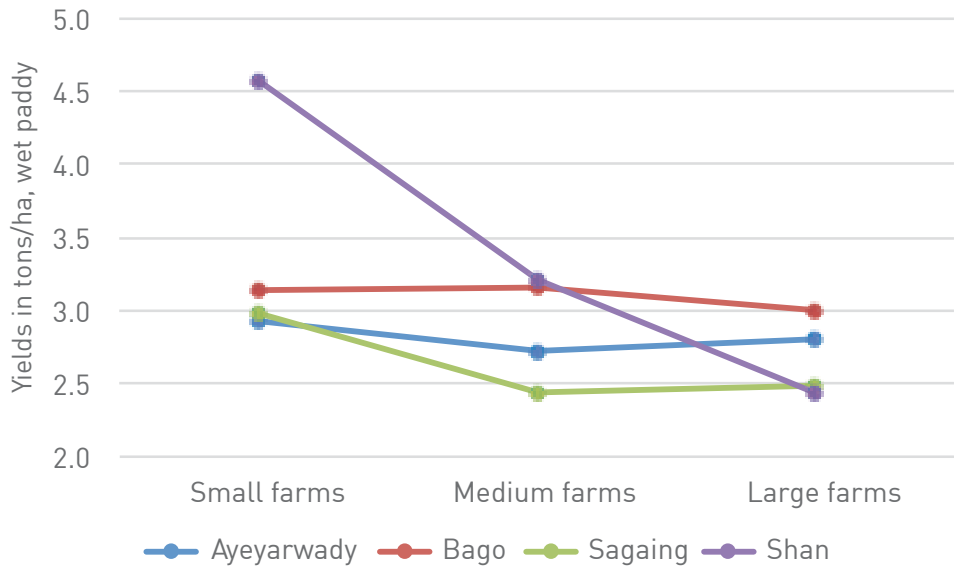
[17] The conversion factor is calculated as the ratio of dry yield to wet yield = (1-Moisture Content of Wet Paddy-Impurities)/(1- Moisture Content of Dry Paddy) = (1-0.25-0.05)/(0.86) = 0.814.

TABLE 11: PADDY YIELDS IN MYANMAR

Region	No. of farms	Kg/acre, wet paddy	Tons/ha, wet paddy	Tons/ha, dry paddy
Monsoon Season				
Ayeyarwady	474	1,261	3.12	2.54
Bago	380	1,234	3.05	2.48
Sagaing	345	1,111	2.75	2.23
Shan State	174	1,722	4.26	3.46
Weighted average*		**1,274**	**3.15**	**2.56**
Dry Season				
Ayeyarwady	151	1,746	4.31	3.51
Sagaing	150	1,426	3.52	2.87
Shan State	35	2,649	6.55	5.33
Weighted average*		**1,681**	**4.15**	**3.41**
Yield				
Simple average			3.65	2.97
Weighted average*			**3.35**	**2.73**

Note: *Weighted by number of farmers by region. ** Weighted by season, assuming that 80 percent of paddy is produced during the monsoon season and 20 percent during the dry season.
Source: 2013/14 Myanmar agricultural survey.

FIGURE 16: MONSOON RICE: AVERAGE YIELD BY FARM SIZE AND REGION



Source: 2013/14 Myanmar agricultural survey.

5.2 HARVEST

78 **About 56 percent of farmers harvested rice in November, 23 percent in October, and 18 percent in December/January** (Figure 17). This means that 99 percent of the fields were harvested between October and December (Table 78A). Farmers in Shan State harvested more in October (early) compared to farmers in Sagaing, who harvested rice mostly in December.

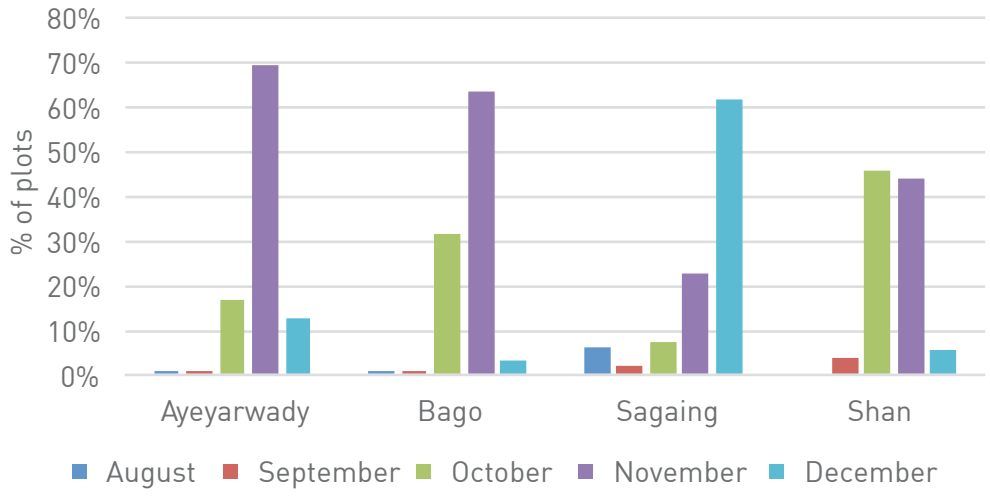
79 **The timing of the harvest appears to have an effect on yields.** For example, about 16 percent of plots were harvested in December and these plots in general show lower yields (530 kg/ha less) compared to those harvested in September. This is a large difference, and suggests that some research on the optimal time period for planting could be useful. Of course, farmers might not be able to follow the agronomically optimal time for planting due to various constraints, but it would still be useful to know the optimal period as a point of reference for decision making. Various weather shocks from year to year might also mean that the optimal period for planting ex-post is substantially different from the optimal period as determined ex-ante.

80 **The survey asked farmers about their perception of the likely impact of various shocks on their agricultural production, asset holding, and consumption.** The types of shocks included:

a. Social shocks such as death or sickness of a family member, or other social event affecting the family's capacity to conduct its agricultural production.
b. Income shocks such as reduced resources from wage or remittances, or business failure and bankruptcy.
c. Production shocks, especially natural shocks such as drought and flooding, but also crop failure, pest attacks, and other weather-related disasters.
d. Price shocks for both inputs and outputs.
e. Other shocks such as theft.

81 **On average, production shocks were the most frequent of all shocks.** Nearly one-sixth of all farmers (16 percent) mentioned production shocks, with farmers in the districts of Sagaing (44 percent), Taunggyi (30 percent), Katha (24 percent), and Monywa (23 percent) affected particularly often. Social shocks ranked second with a 12 percent response. Farmers in Katha, Sagaing, Taunggyi, and Kyaukme districts (Sagaing and Shan State) were concerned about income shocks, with 4 percent of farmers in each of these districts mentioning them. One farmer out of ten in Shan State reported that price shocks affected them.

FIGURE 17: MONTHS FOR HARVESTING MONSOON RICE BY REGION



Source: 2013/14 Myanmar agricultural survey.

5.3 SALES OF PADDY

82 **Rice market in Myanmar has been liberalized (World Bank and LIFT 2014a), similar to the market for other agricultural commodities.** Transactions are based on the market principles and there are no policy barriers for cross-regional movement of goods. Regional markets are well integrated. Differences in regional rice prices are determined by marketing unit costs, distances to major consumption centers and export markets (Yangon and the border with China), and rice variety and its quality. Most rice produced domestically (12.6 million tons in 2014/15) is also consumed domestically (10.6 million tons), according to the USDA. Export accounts for only 15 percent of production, but it has been rising over time. More than half of total export goes to China through cross-border trade. African countries are the most important buyers of formal exports, although Myanmar is also able to penetrate in higher value markets such as in the EU.

83 **Most surveyed farms sell most of their paddy.** About 85 percent of farmers said they sell all or portions of their paddy production (Table 79A). By region, 95 percent of farmers in Ayeyarwady and Bago were rice sellers. The proportions went down to 75 percent in Shan State and further to 64 percent in Sagaing. The percentage of sellers was as low as 27 percent in the district of Taungoo in Sagaing and as high as 100 percent in Pathein in Ayeyarwady and in Loilen, Taunggyi, and Kyaukme in Shan State.

84 **On average, 67 percent of total paddy production was being sold** (Table 80A). In Ayeyarwady most paddy was sold in the form of wet paddy and largely to traders who came to villages (Table 81A). In Bago and Sagaing, most paddy was also sold mainly to traders in the form of wet paddy, but the share of dried paddy was larger than in Ayeyarwady. In Shan State, on the other hand, most paddy was dried before sale and most farmers went to the nearest towns to sell their paddy at higher prices.

85 **Most sellers of rice in the sample were "net" sellers.**[18] In other words, they produced more than they consumed. The survey found that per capita annual consumption of milled rice ranged from 112 kg in Sagaing to 152 kg in Bago, while per capita production of paddy was 361 kg in Sagaing, 1,078 kg in Bago and 1,238 kg in Ayeyarwady. Production exceeded consumption in all regions (Table 12). In most instances, households sold about 90 percent of the available surplus, except in Sagaing where actual sales exceeded the derived surplus on average. This means that farmers in Sagaing sold rice after harvest and bought some amounts later to meet their own consumption requirements.

86 **The share of sales in production increased with farm size.** In Sagaing and Ayeyarwady, for example, small farms sold 93 percent and 51 percent of their production respectively, a lower percentage compared to 97 percent and 67 percent for medium-size farms and 100 percent and 75 percent for large farms (Table 79A). More than half of the medium-size and large farms were selling wet rice; i.e., just after the harvest. This could be the consequence of the lack of drying facilities, with large farms not having enough drying pavement to handle the larger production quantities. Often, prices are quite low during these periods. Only 12 percent of farmers reported having invested in drying pavement. This is especially a problem for farmers in Ayeyarwady, where there is usually more rain.

TABLE 12: PRODUCTION AND CONSUMPTION OF RICE BY REGION

	Production per capita	Consumption per capita*	Surplus per capita	Surplus per farm	Actual sale
Region	Kg of paddy	Kg of paddy	Kg of paddy	Kg of paddy	Kg of paddy
Ayeyarwady	1,238	237	1,001	5,206	4,499
Bago	1,078	253	825	5,114	4,352
Sagaing	361	187	174	1,063	1,434
Shan State	657	200	457	2,697	2,439

Note: *Milling ratio of paddy into rice is assumed to be 60 percent.
Source: 2013/14 Myanmar agricultural survey.

[18] This situation may not be a representative national picture.

TABLE 13: NET RICE SELLER POSITION BY FARM SIZE

	Net surplus per farm	Surplus as share of production	Sales as share of production
	Kg/paddy	%	%
Ayeyarwady			
Small farms	1,935	64	62
Medium farms	4,270	79	66
Large farms	8,263	86	71
Bago			
Small farms	1,731	55	50
Medium farms	4,882	78	61
Large farms	7,396	80	67
Sagaing			
Small farms	145	10	60
Medium farms	1,215	55	66
Large farms	2,129	67	66
Shan State			
Small farms	2,336	68	50
Medium farms	4,431	81	73
Large farms	4,422	80	76

Source: 2013/14 Myanmar agricultural survey.

87 **Interestingly, even small farms were net sellers of rice.** They produced more than the members of their households consumed (Table 13). Small farms sold almost all surplus available.

88 **Finally, it is important to mention that the per capita rice consumption levels found in the survey were lower than generally perceived in Myanmar.** According to the survey, average per capita rice consumption was 132 kg. In the National Rice Development Strategy, MOAI assumed per capita rice consumption of 175 kg (MOAI 2015b). The results of the survey are comparable with the results of the 2010 household survey used for poverty assessment (IHLCA). Its average consumption was found to be 145 kg per capita, including 117 kg in urban areas and 155 kg in rural areas. The implication of lower-than-perceived rice consumption is lower domestic utilization of rice and a larger surplus available for exports.

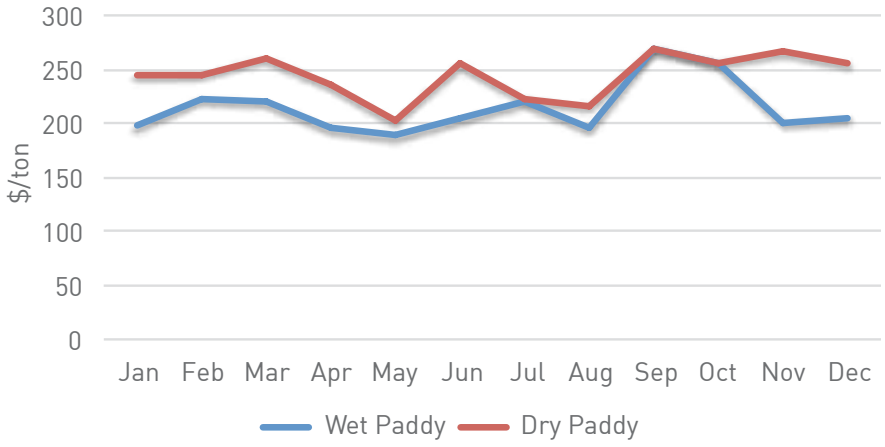
5.4 PADDY PRICES

89 **In the 2013 monsoon season, the average wet paddy price was MKK 210/kg or $214/ton.**[19] Prices of wet paddy were below the price of dry paddy except in the harvest months of September and October, when both prices were very similar (Figure 18). The average price of dry paddy was 14 percent above that of wet paddy ($244/ton versus $214/ton).

90 **Great variability existed across regions, however.** The average wet paddy price in Shan State was 68 percent higher than the price in Ayeyarwady ($340/ton versus $200/ton), and the price for dry paddy was 64 percent higher. In comparison, the wholesale price of Emata rice in Yangon was $390/ton in 2013 (FAO).

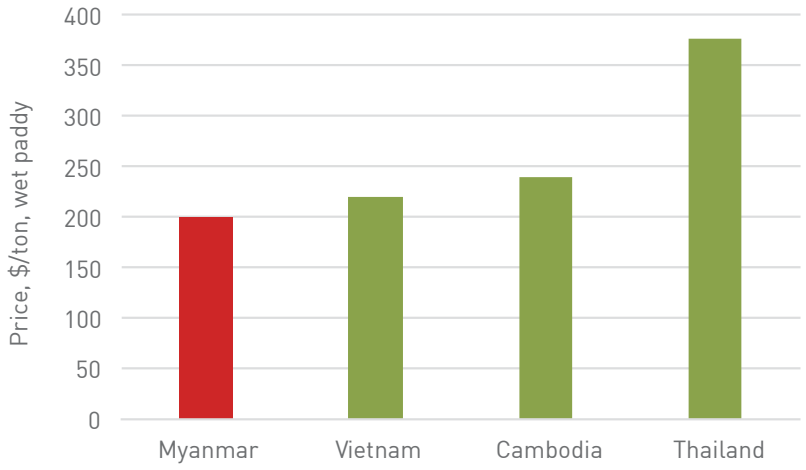
91 **In Ayeyarwady, the main rice-producing area in Myanmar, the average farm-gate price of wet paddy was $200/ton.** This price was the lowest amongst the peer countries, and closest to prices in Vietnam (Figure 19). It should be noted that Thai prices in 2013/14 were inflated due to its rice pledging scheme. With the scheme's closure, the prevailing farm-gate price in Thailand dropped to $240/ton in 2014/15.

FIGURE 18: AVERAGE PADDY PRICES, 2013



Source: 2013/14 Myanmar agricultural survey.

FIGURE 19: FARM-GATE PADDY PRICES, WET PADDY, INTERNATIONAL COMPARISON, 2013



Source: 2013/14 Myanmar agricultural survey and World Bank 2015c.

[19] The exchange rate used for conversions in this study is MKK 979 per 1 US$, the prevailing exchange rate in November-December 2013.

92 **The low farm-gate price in Myanmar is a result of many factors.** Some are related to the poor quality of harvest (high moisture, many impurities, etc.) and the multiple number of varieties used by farmers, which makes it difficult for rice mills to find large volumes of uniform variety. Others are related to the high costs in the downstream parts of the value chain, including high milling costs, high transport costs, and high export costs in the Port of Yangon (World Bank and LIFT 2014a and World Bank 2015c). All these costs reduce the share of wholesale and export prices received by producers (Table 14). Without reducing these downstream costs, farm-gate prices in Myanmar have little scope to increase, as they need to remain competitive with prices offered by competing exporters.

TABLE 14: FARM-GATE PRICES AS A PERCENTAGE OF WHOLESALE AND FOB PRICES, INTERNATIONAL COMPARISON, 2013

Countries	Paddy farm-gate price in wholesale rice price in country capital, %	Paddy farm-gate price in FOB rice price, %
Myanmar	**47**	**49**
Cambodia	53	48
Vietnam	64	63
Thailand	77	70

Note: In Vietnam, An Giang represents the wholesale market relevant to producers in Mekong Delta Region. The national capital Hanoi is supplied with rice mainly by Red River Delta farmers.
Source: World Bank 2015c.

5.5 SEEDS

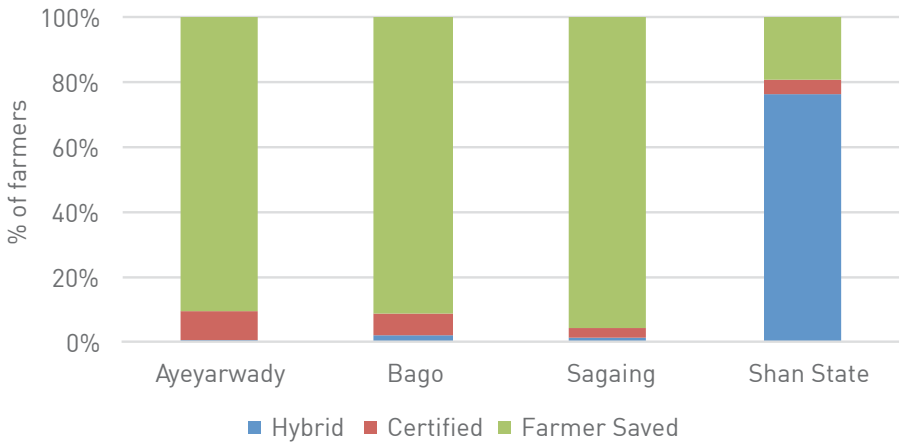
93 **According to the survey responses, most farmers used their own seeds saved from previous harvests.** The use of certified seeds was observed in all ecoregions but was at the low level (Figure 20). Less than 7 percent of farmers reported using certified seeds (Table 82A), and even this small figure is probably an overestimation given the low supply of paddy seeds in Myanmar (Table 15). Purchased seeds were likely assumed to be certified, yet this was not always true. The adoption of certified seeds did not differ much across farm size.

94 **In addition, some farmers used hybrid seeds, but this happened exclusively in Shan State.** About 66 percent of farmers in the southern interior ecoregion and 92 percent in the border area reported using hybrid seeds. Almost all small farms in Shan State used hybrid seeds. The percentage dropped to 52 percent for medium-size farms and 4.5 percent for large farms. Large farms with no access to low-interest credit appear to have difficulties procuring relatively large amounts of costly hybrid seeds.

95 **The low use of certified seeds was due to their low supply.** The current supply of certified rice seeds was estimated to satisfy less than 1 percent of potential demand (Table 15). For comparison, the supply/demand ratio was 10 percent in Cambodia, 117 percent in Thailand, and 100 percent in Vietnam. When MOAI reports that 1.5 percent of paddy area is under hybrid varieties, 55 percent under high-yielding varieties, 20 percent under high-quality varieties, and 23 percent under local varieties, there is no connection between this information and the actual use of new seeds by farmers. Table 15 implies that most farmers simply reuse old (farmer saved) seeds for many years.

96 Farmers' most common sources of seed procurement, outside the use of own production, were relatives, neighbors, and friends in Ayeyarwady, Bago, and Sagaing (Table 84A). The next most commonly used suppliers were input traders and markets at the village level. Cooperatives and government sources were barely used, except in the brackish (16 percent of farmers) and the freshwater

FIGURE 20: TYPES OF RICE SEED USED BY FARMERS BY REGION



Source: 2013/14 Myanmar agricultural survey.

TABLE 15: SUPPLY OF AND DEMAND FOR RICE SEED IN MYANMAR, 2013/14

	Supply	Demand
Breeder seeds, tons	2.96	
Foundation seeds, tons	3.80	
Registered seeds, tons	197.49	
Estimate of the supply of certified seeds, tons	**1,000***	
Paddy sown area, million ha		7.28
Per hectare seed use, kg		120
Demand for seed, tons		873,600
Adjusted demand for seed, tons**		**288,300**
Ratio of supply to demand, %	**0.35**	

Note: *Data on production of certified seeds are not available. A generous estimate is that it is five times the volume of registered seeds.
**Adjustment assumes that good seeds can be used over the course of three years, after which the farmer needs to buy new seeds.
Source: van den Broek et al. 2015 and own estimates.

(13 percent) ecoregions in Ayeyarwady and the river area in Bago (11 percent). For farmers in Shan State, the most used source was traders because of the high percentage of hybrid seed users. Hybrid seeds need to be renewed every year, or else a large drop-off in yield occurs.

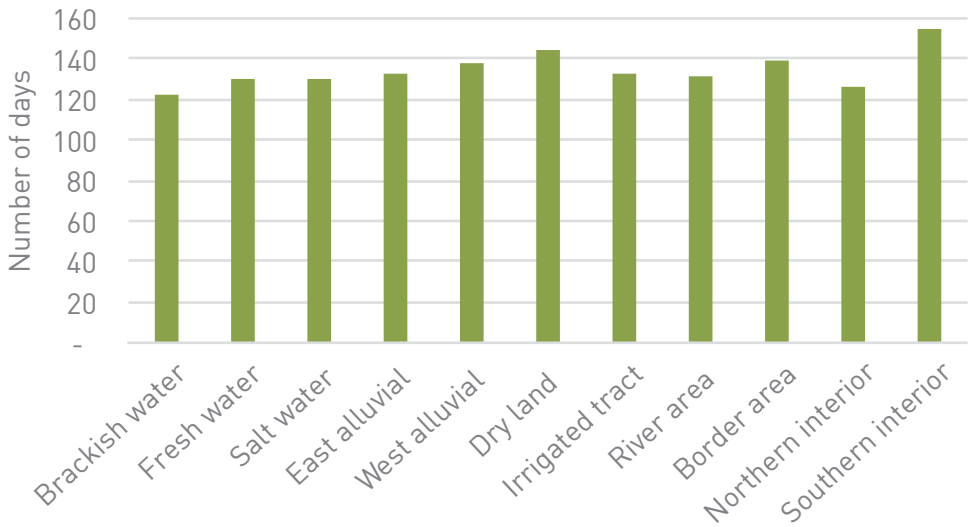
97 **For rice cultivar, the preference varied across regions.** Farmers in Ayeyarwady preferred varieties from the Letywezin group (73 percent of farmers). In Bago and Shan State, farmers mainly used varieties from the Emata group (77 percent and 86 percent, respectively) (Table 85A). And farmers in Sagaing used three types: Letywezin (35 percent), Emata (21 percent), and Meedon (31 percent). In Shan State, hybrid seed use was correlated with the choice of Emata variety. A fourth varietal group, Ngasein, was adopted by farmers in Sagaing (13 percent) and, at a lower magnitude by farmers in Bago and Ayeyarwady (4 percent each).

98 **The main months of sowing/transplanting spread from May to August.** A slight variation existed across regions: in Bago and Shan State, the

peak was in June; in Sagaing and Ayeyarwady, July was the peak (Figure 21 and Table 86A). The average age of a rice seedling was 30 days at the day of transplanting, with practically no difference across regions. The amounts of seeds used, however, varied from 59 kg/ha for transplanted plots in Shan State to 128 kg/ha for direct seeding in Ayeyarwady. With the System of Rice Intensification, the amount of seeds can be reduced to 25 kg/ha, and it is suggested that farmers transplant seedlings of less than 10 days of age. The System of Rice Intensification, however, requires well-controlled irrigation water, good leveling of the rice field, and labor-intensive transplanting as the method of crop establishment.

99 **Among surveyed farms that grew monsoon rice, 86 percent of households established the crop by transplanting.** This included almost all farmers in Shan State and Sagaing, 88 percent in Bago, and 71 percent in Ayeyarwady (Table 87A). Monsoon rice occupied farm land during 135 days.[20] The shortest growth duration was in the brackish water ecoregion in Ayeyarwady (123 days) and the longest in the dryland ecoregion in Sagaing (145 days),[21] which was 18 percent longer than the shortest cycle (Figure 20). These growth durations are much longer than those in most other ASEAN[22] countries, especially in the Mekong Delta of Vietnam, where many varieties used have a growth duration of approximately 90 days. The growth duration depends on several factors, mainly the rice variety. Having a short-cycle crop allows more flexibility in increasing cropping intensity. In addition, it can reduce the risks of being affected by drought and flooding. Short-duration varieties will not be a solution for all farmers, but developing some that are adapted to growing conditions in Myanmar should be a major priority of research and extension systems.

FIGURE 21: GROWTH DURATION OF MONSOON RICE PRODUCTION



Source: 2013/14 Myanmar agricultural survey.

[20] Average based on 752 plots (out of 1,373) that contained information on both the date of sowing and harvesting.
[21] Data from southern interior ecoregion show 154 days but this is based on only 3 observations.
[22] Association of Southeast Asian Nations.

5.6 FERTILIZERS

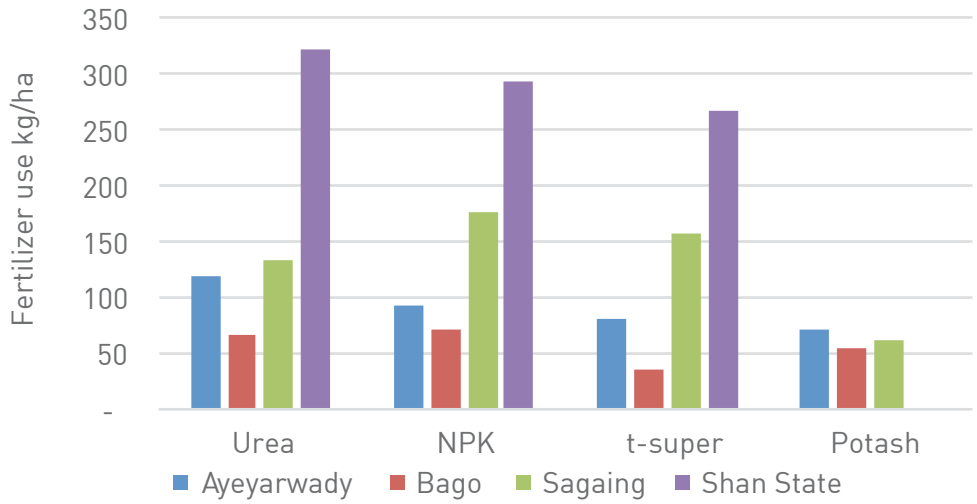
100 **According to a 1999 study of the Myanmar Agriculture Service, agricultural soil in the country lacks organic matter.** Many rice plots are characterized by phosphorus (P) deficiency, particularly in Bago, Ayeyarwady, and Sagaing. About one-third of the sampled soils are acid, which reduces the availability of phosphate to plants (Yu Lwin et al. 2013). Soils in Myanmar, therefore, require fertilization, but better soil knowledge is also required to ensure application of nutrients in the proper quantities.

101 **According to FAOSTAT, average consumption[23] of fertilizers in Myanmar is very low, at 10-12 kg/ha in 2012.** Yet the 2013/14 Myanmar agricultural survey shows that many farmers do use fertilizers, especially urea, and often apply them in large quantities. Urea is a nitrogen (N) fertilizer, and N is the most common macronutrient used in rice cultivation around the world, including Myanmar. In cases of intensive rice cropping (two to three times a year), the replenishment of P and potassium (K) nutrients is also required. But the application of these nutrients was found to be low, probably because of Myanmar's still low rice production intensity. The use of organic fertilizers in any form (compost, cow dung, farm residues, manure, etc.) was barely observed.

102 **About nine out of ten sampled farmers were using urea for their monsoon rice.** The proportion went down to 37 percent for NPK, 19 percent for T-super, and less than 2 percent for potash (Table 88A). No common trend was found across regions but generally the percentage of small farms using fertilizers was lower than that of large farms (e.g., T-super in Ayeyarwady, NPK in Bago and Sagaing, and urea in Sagaing). In Shan State, small farms were more likely to use NPK and T-super than large farms.

103 **The proportion of farmers using urea was quite high, above 80 percent in all ecoregions, with the exception of the river area (Sagaing) where the use rate was very low (13 percent).** The proportions came close to 100 percent in Shan State's ecoregions (Table 87A). The application rate of urea varied from relatively low (62 kg/ha in Bago) to quite high (297 kg/ha in Shan State) (Table 90A; note that the numbers in this table are in kg/acre, not kg/ha). In Sagaing, the average application rate among users was 144 kg/ha and in Ayeyarwady 124 kg/ha (Figure 22). An exceptionally high application rate of 347 kg/ha was observed in the border area, while in all other ecoregions it remained below 240 kg/ha. A substantial difference in application rate by farm size was only observed in Bago and Shan State: large farms applied less urea than small farms (236 kg/ha versus 322 kg/ha in Shan State, and 61 kg/ha versus 85 kg/ha in Bago).

FIGURE 22: APPLICATION RATES OF VARIOUS FERTILIZERS BY REGION



Source: 2013/14 Myanmar agricultural survey.

[23] The average consumption is the ratio of the quantity of fertilizers used over the total cultivated area, including non-users. The average application rate for any particular type of fertilizer is the total quantity of that fertilizer used divided by the total area receiving that particular type of fertilizer; i.e., for users only.

104 **NPK users were about one-fourth to one-third of the sampled farms in Ayeyarwady, Bago, and Shan State, but the proportion was relatively high in the dryland and the irrigated tract ecoregions in Sagaing.** In general, the percentage of users was lower compared to users of urea, and a large difference existed between small and medium-size/large farms. Table 87A shows the highest proportion of NPK users in the irrigated tract and dryland ecoregions. The proportion of users in the northern interior ecoregion was also quite high (60 percent). The lowest percentages were in the saltwater (Ayeyarwady) and river area (Sagaing) ecoregions, with less than 1 percent of farmers using NPK. The average application rate was 120 kg/ha, ranging from 77 kg/ha in Bago to 245 kg/ha in Shan State (Table 90A).

105 **The third mostly commonly used fertilizer was T-super, adopted by 28 percent of farmers in Ayeyarwady, 6-7 percent in Bago and Sagaing, and 49 percent in Shan State.** The average application rate was 133 kg/ha, with farmers in Shan State again applying the highest rate (239 kg/ha) and farmers in Bago putting the lowest amount (27 kg/ha) on their rice fields. Other fertilizers such as gypsum and potash were barely used, with adoption rates of less than 2 percent in each region (Figure 21).

106 **In international comparison, Myanmar farmers applied much less fertilizer and used much less of all nutrients than their peers.** In the main rice-producing areas of South and East Asia, the use of N is more than 100 kg per ha (Table 17). A commonly recommended application rate across Asia for monsoon rice is about 95 kg of N per ha, and for dry season rice 110 kg of N per ha. Actual use may differ from these blanket recommendations depending on agro-ecology and site-specific factors, but this general recommendation is a useful benchmark for Myanmar. In Myanmar's Ayeyarwady, the application of N among adopters was only 53 kg per ha. Farmers used small quantities of P and K nutrients (Table 91A), thereby depleting their soils and keeping productivity low.

107 **Several reasons explain the low application rates of fertilizer in Myanmar.** One of the most important is economic. In Ayeyarwady, for example, farm-gate prices for monsoon paddy are relatively low (Figure 18) while urea prices are relatively high in regional comparison. Therefore, the relative/effective fertilizer prices in Myanmar are much higher than in other countries (Table 16). In other words, fertilizers are simply too expensive relative to paddy prices in Myanmar, thereby making the marginal value of output less likely to pay for the increased use of inputs.

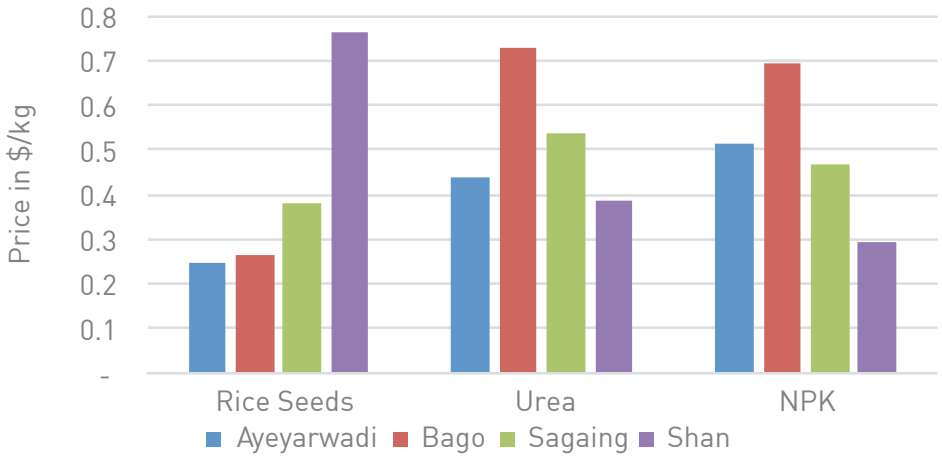
108 **Prices of inputs in Myanmar showed significant regional variation.** For seeds, prices paid by farmers were the lowest in Ayeyarwady ($0.25/kg) and the highest in Shan State ($0.77/kg), as most rice seeds there were more expensive hybrid seeds (Figure 23). For urea and NPK, prices were lowest in Ayeyarwady and Shan State due to their proximity to import sources, and highest in Bago.

TABLE 16: TERMS OF TRADE FOR MONSOON RICE, INTERNATIONAL COMPARISON, 2013

	Myanmar	Cambodia	Thailand	Vietnam
Paddy price, wet, $/ton	200	240	376	220
Urea price, $/ton	440	425	426	357
Urea to paddy price ratio	**2.20**	**1.77**	**1.13**	**1.62**

Source: 2013/14 Myanmar agricultural survey and World Bank 2015c.

FIGURE 23: PRICES OF KEY INPUTS BY REGION



Source: 2013/14 Myanmar agricultural survey.

TABLE 17: FERTILIZER USE BY MICRONUTRIENT, 2013 WET SEASON, INTERNATIONAL COMPARISON

Nutrients	China	India	Thailand	Vietnam	Myanmar*
Use, kg/ha					
Nitrogen (N)**	198	105	88	99	53
Phosphorus (P)	29	21	22	31	15
Potassium (K)	110	33	10	35	3
Share in total use, %					
Nitrogen (N)	59	66	65	60	75
Phosphorus (P)	9	13	16	19	21
Potassium (K)	33	21	19	21	4

Note: * For Myanmar, Ayeyarwady is used as the major rice-producing area. ** N is a component of chlorophyll (important in photosynthesis) and amino acids (building blocks of protein). P plays a major role in photosynthesis and is a source of nucleic acids for DNA and RNA. K improves overall plant health and helps fight disease (Source: cropnutrition.com).
Source: 2013/14 Myanmar agricultural survey for Myanmar data and Bordey et al. 2014 and 2015 for other countries.

5.7 CHEMICALS

110 **The types of pesticides surveyed in the study included insecticides, herbicides, fungicides, molluscicides, and rodenticides.** Only the first three types of pesticide were used by the sample farmers – no one reported the use of molluscicides or rodenticides. Since there are too many types and brand names of pesticides with different amounts of active ingredients, the analysis focused on the costs rather than the quantity applied per hectare.

111 **Insecticide use in monsoon rice production varied greatly across regions.** The proportion of users went from almost none in Bago to 12 percent in Ayeyarwady, 27 percent in Shan State, and 37 percent in Sagaing (Table 92A). The average expenditures also differed by region, from $0.2/ha in Bago to $9.3/ha in Sagaing, and by farm size, with small farms spending as much as $3.3/ha in Shan State and large farms spending from zero to $8.3/ha in Sagaing.

112 **Herbicides were used by 6.3 percent of farmers.** The adoption rates were relatively high in Ayeyarwady and Sagaing (near 10 percent) and very low (1-2 percent) in the two other regions. On average, each farmer spent less than a dollar per hectare ($0.7/ha) on herbicides. Large farms might be expected to use more herbicides, with small farms using labor to control weeds, but no evidence of such a trend was found in the survey data.

5.8 LABOR

113 **Labor is currently the most important factor of production in Myanmar's agriculture.** Data on labor use were collected for three types of labor – family, permanent, and hired– and for a variety of specific tasks. For rice production, agricultural tasks were divided into seven groups: (i) seedbed preparation; (ii) main plot preparation; (iii) crop establishment (i.e., transplanting or sowing); (iv) crop management; (v) irrigation and drainage; (vi) harvest; and (vii) post-harvest. The amount of labor allocated to each agricultural task for each type of labor was recorded in hours.

114 **On average for the sampled farms, rice production required 332 hours of total labor per acre, varying from 278 hours in Bago to 424 hours in Ayeyarwady** (Table 97A). This translates into 103 person-days (days)/ha on average, ranging from 86 days/ha in Bago to 131 days/ha in Ayeyarwady (Table 18).[25] Crop establishment accounts for the largest share of labor use, about 30-40 percent (Figure 24). Harvest and post-harvest was the second most important use, ranging from 21-30 percent across regions. Land preparation varied from 19-28 percent, while crop management accounted for the rest of the labor use, ranging between 12-19 percent.

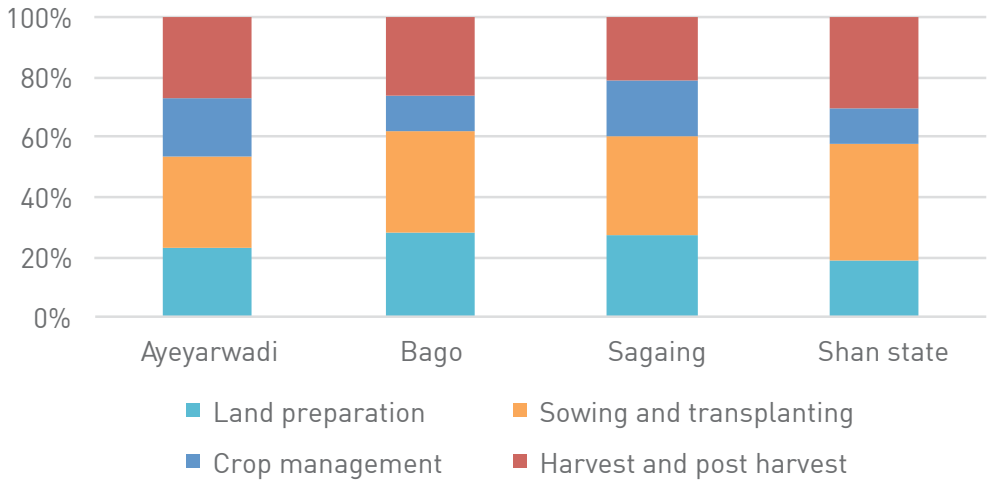
115 **In terms of regional variability, monsoon rice production was much more labor-intensive in Ayeyarwady than in the other three regions, with total labor use roughly 50 percent higher.** One key reason is that farm wages are much lower in Ayeyarwady ($1.84/day) than in the other regions, where they range from about $2.50/day in Bago and Sagaing to $4.17/day in Shan State (Table 18). Thus, labor use is higher in Ayeyarwady for each of the four key groups of activities: land preparation, crop establishment, crop management, and harvest/post-harvest.

TABLE 18: LABOR INPUT AND WAGES

	Labor input Days/ha	Cost of labor MKK/hour	Cost of labor $/day
Ayeyarwady	131	225	1.84
Bago	86	298	2.43
Sagaing	88	309	2.52
Shan State	88	511	4.17
Weighted average	**103**	**303**	**2.47**

Source: 2013/14 Myanmar agricultural survey.

FIGURE 24: DISTRIBUTION OF LABOR BY TASK FOR MONSOON RICE PRODUCTION



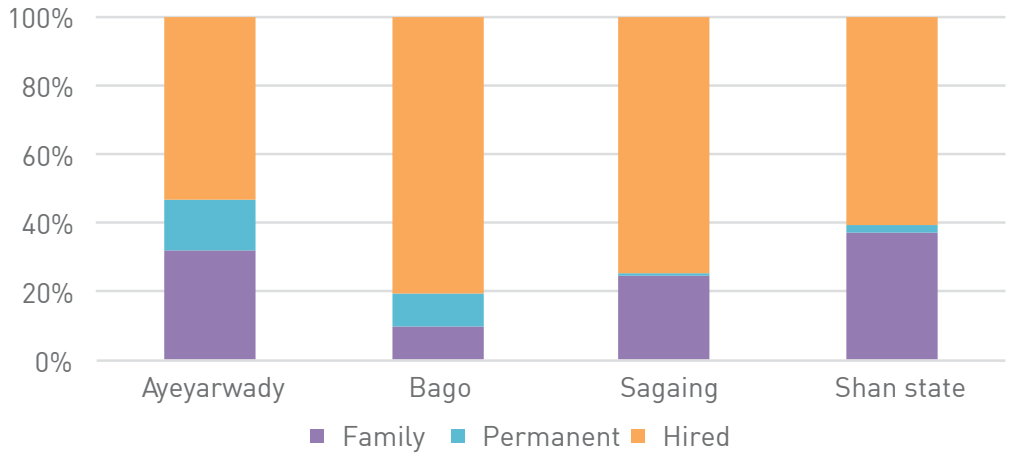
Source: 2013/14 Myanmar agricultural survey.

[25] This estimate assumes an 8-hour work day.

116 **Hired labor accounted for 54 percent of total labor use in Ayeyarwady, 61 percent in Shan State, 75 percent in Sagaing, and 81 percent in Bago** (Figure 25 and Table 97A). Bago and Ayeyarwady were also characterized by the relative importance of permanent labor, 14 percent and 9 percent of total use, respectively (Table 97A). Figure 25 provides a snapshot of the structure of labor by type across the four regions.

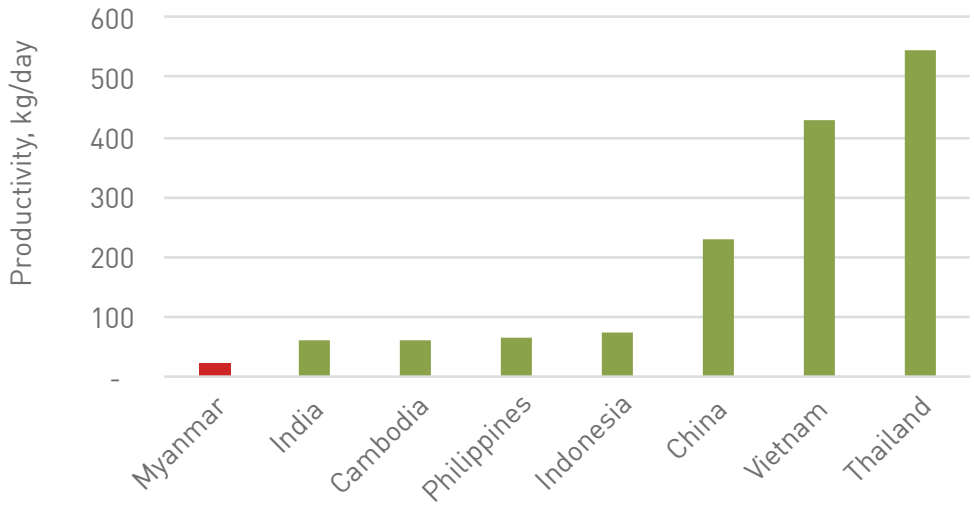
117 **A comparison of labor use and yields across countries shows low labor productivity in Myanmar.**[26] One day of labor generated only 23 kg of wet paddy, compared to 62 kg in Cambodia, 429 kg in Vietnam, and 547 kg in Thailand (Figure 26). Low labor productivity in Myanmar is a result of the country's relatively high labor use and low yields.

FIGURE 25: DISTRIBUTION OF LABOR BY TYPE FOR MONSOON RICE PRODUCTION



Source: 2013/14 Myanmar agricultural survey.

FIGURE 26: LABOR PRODUCTIVITY, 2013 MONSOON SEASON, INTERNATIONAL COMPARISON



Source: 2013/14 Myanmar agricultural survey.

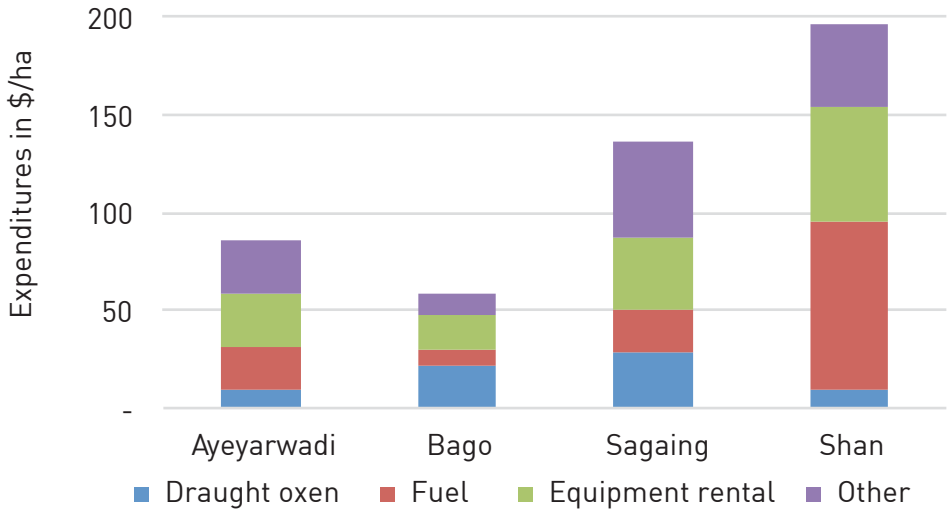
[26] Later in the report, the monetary expression of labor productivity is introduced, complementing this quantitative presentation of labor productivity.

5.9 LIVESTOCK, MACHINERY, AND FUEL

118 **Farmers in Myanmar have started to use services for rice production.** These services consist of renting tractors or draught oxen for land plowing, leveling, and transportation, and threshers for post-harvest. When machinery is involved, the rental rate depends on whether the machine owner provides the fuel or if the farmer contracting for the service must provide the fuel.

119 **Farmers in Shan State reported spending $203/ha on animals, machinery, and fuel, the highest among the four regions.** This is more than double the expenditures in Ayeyarwady ($89/ha) and more than three times the cost of livestock, machinery, and fuel in Bago ($59/ha). In Sagaing, expenditures on services amounted to $138/ha. The lowest expenditures were for farmers in Bago ($59/ha), out of which 37 percent was for hiring draught oxen. In spite of the high ownership of oxen, the hire of draught oxen was also important in Sagaing, accounting for 21 percent of total livestock, machinery, and fuel expenditures (Figure 27). For farmers in Shan State, where the rate of possession of a power tiller was quite high, expenditures on fuel reached 44 percent of service costs, but only 5 percent for hiring draught oxen. The highest use of draught oxen was observed in the west alluvial ecoregion, where it accounted for 45 percent of total service costs.

FIGURE 27: DISTRIBUTION OF EXPENDITURES OF LIVESTOCK, MACHINERY, AND FUEL BY REGION



Source: 2013/14 Myanmar agricultural survey.

5.10 PROFITABILITY

120 **The average gross margin for monsoon paddy, weighted by the number of farms in each ecoregion, was $204/ha, the net margin was $114/ha, and the labor productivity was $4.75/day** (Table 19). The variation (standard deviation) of gross and net margins was high, pointing to the divergent performance of farmers in Myanmar and suggesting that caution be taken when using average figures. Gross and net margins were highest in Shan State. Average margins for monsoon rice were very low in Sagaing in 2013/14. Farmers in Ayeyarwady achieved similar gross margins to those in Bago, but net margins were lower due to the higher use of labor. The high labor use in Ayeyarwady also led to low labor productivity. In Sagaing, in spite of the low margins, labor productivity was comparable to that in Ayeyarwady due to the lower amount of labor used there for paddy production.

TABLE 19: FARM BUDGETS FOR MONSOON RICE BY REGION

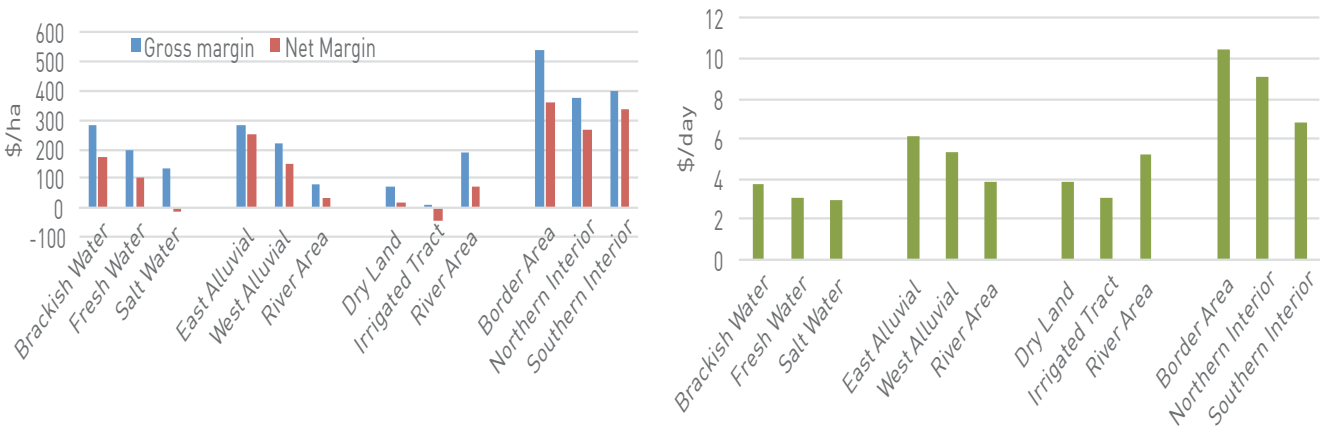
	Number of farms	Gross margin, $/ha	Net margin, $/ha	Labor productivity, $/day
Ayeyarwady	474	203	88	3.30
Bago	380	196	146	5.12
Sagaing	345	71	3	3.85
Shan State	174	490	337	9.67
Simple average		240	143	5.48
Weighted average		**204**	**114**	**4.75**
Standard deviation		87	74	1.11

Source: 2013/14 Myanmar agricultural survey.

121 **Monsoon rice production was quite profitable in four ecoregions (east alluvial in Bago, and border area, northern interior, and southern interior in Shan State), with higher net margins and labor productivity than in the other ecoregions** (Figure 28). Farmers in these ecoregions achieved net margins ranging from $251/ha to $358/ha, and labor productivity above $8.0/day. Another four ecoregions were moderately profitable, with net margins between $71/ha and $153/ha: river area in Sagaing, west alluvial in Bago, and brackish and freshwater in Ayeyarwady. Labor productivity in these four ecoregions ranged from $3.1/day to $5.2/day. The other four ecoregions (river area in Bago, dryland and irrigated tract in Sagaing, and saltwater in Ayeyarwady) were marginally profitable at best, with negative net margins in the latter two. Net margins ranged from negative to $30/ha and labor productivity from $3.0/day to $3.8/day.

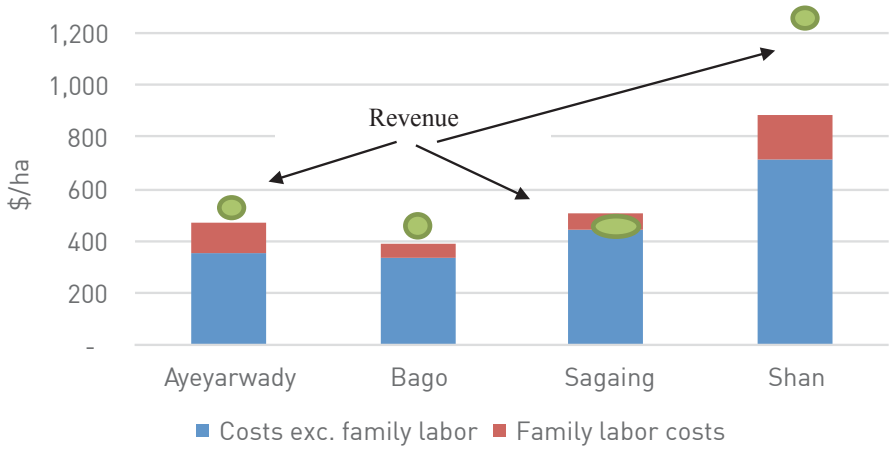
122 **The different profitability outcomes are explained by differences in revenues and costs. In Ayeyarwady, Bago, and Sagaing, the gross revenues were quite similar, in the range of $512/ha to $558/ha** (Figure 29). The gross revenues in Shan State were more than two times higher, at $1,220/ha on average, due to the considerably higher yields (Table 77A) and higher farm-gate prices than in Bago and Sagaing. Total costs in Shan State, however, were twice as high as in the other regions due to the application of larger amounts of fertilizers, the purchase of expensive hybrid seeds, and the highest wage rate in the country. Among the three remaining regions, total production costs were lowest in Bago ($391/ha) and highest in Sagaing ($509/ha).

FIGURE 28: FARM PROFITS AND LABOR PRODUCTIVITY BY ECOREGION



Source: 2013/14 Myanmar agricultural survey.

FIGURE 29: REVENUES AND PRODUCTION COSTS OF MONSOON RICE BY REGION

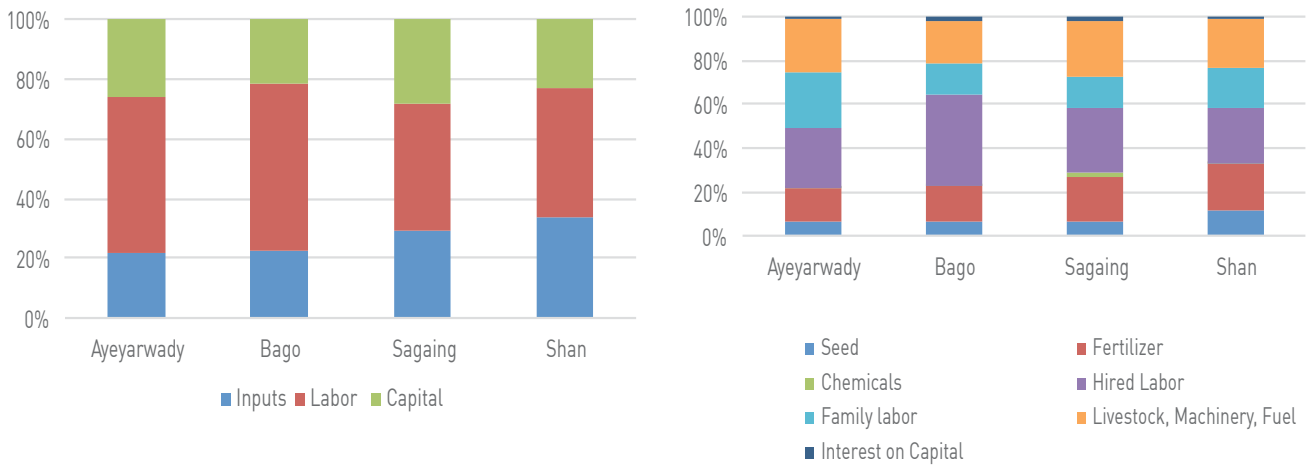


Source: 2013/14 Myanmar agricultural survey.

123 **The largest share of total costs belonged to labor.** Labor accounted for 42 percent of total costs in Sagaing and Shan State, 51 percent in Ayeyarwady, and 55 percent in Bago (Figure 30, left side). Among intermediate inputs, fertilizers accounted for the lion's share, while spending on seeds was modest, pointing to the low use of good-quality seeds (Figure 30, right side). Capital, including livestock, machinery, fuel and interest on working capital, accounted for 21-27 percent of total costs.

124 **The financial outcomes were affected by specific ecoregion characteristics.** In addition, they were determined by the type of crop establishment, types of seed used, application of fertilizers, farm size, and gender. These factors are analyzed in turn below.

FIGURE 30: BREAKDOWN OF PRODUCTION COSTS OF MONSOON RICE BY REGION



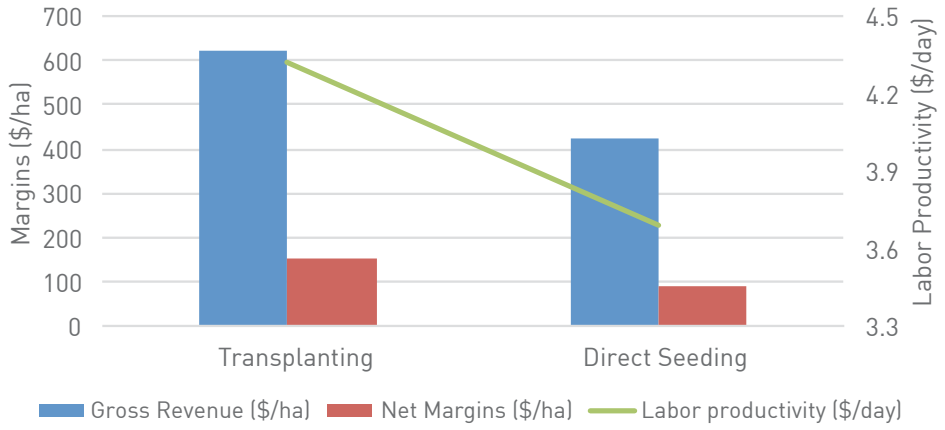
Source: 2013/14 Myanmar agricultural survey.

5.11 IMPACT OF CROP ESTABLISHMENT ON PROFITABILITY

125 **The most commonly used crop establishment method in the monsoon season was transplanting.** In the survey, 86 percent of households transplanted monsoon rice, with almost all farmers in Shan State and Sagaing, 88 percent in Bago, and 71 percent in Ayeyarwady using this method of crop establishment (Table 87A). Compared to farmers practicing direct seeding, farmers adopting transplanting gained 70 percent higher net margins ($153/ha versus $92/ha) and higher labor productivity ($4.32/day versus $3.69/day) (Figure 31).

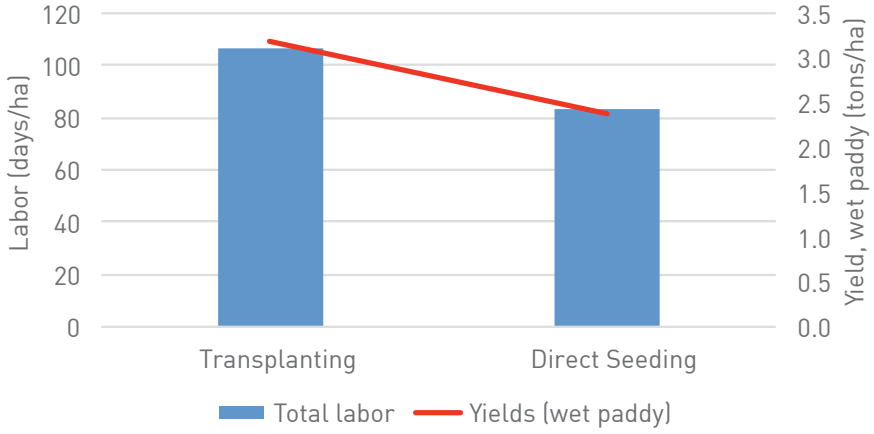
126 **Transplanting is often considered a better technology compared to direct seeding.** Because of more uniform plant spacing, it allows better control of weeds through the use of mechanized equipment and better development of rice plants, which in turn leads to higher yield. Indeed, in the sample farms, the average yield in dry paddy equivalent was 2.60 tons/ha for transplanting versus 1.94 tons/ha for direct seeding (Table 111A). Transplanting involves higher costs of production, however. In the sample, it used 29 percent more labor: 110 days/ha for transplanting versus 85 days/ha for direct seeding (Figure 32). All other costs were comparable.

FIGURE 31: MARGINS AND LABOR PRODUCTIVITY FOR MONSOON RICE BY CROP ESTABLISHMENT



Source: 2013/14 Myanmar agricultural survey.

FIGURE 32: YIELDS AND LABOR NEEDS FOR MONSOON RICE BY CROP ESTABLISHMENT



Source: 2013/14 Myanmar agricultural survey.

127 **Direct seeding was more common in Ayeyarwady (29 percent of parcels) compared to Sagaing (3 percent) and Bago (12 percent).** Availability of labor was reported as a constraint to transplanting. In such cases, farmers could potentially adopt improved direct seeding methods (i.e., mechanical seeders to facilitate crop management) and use herbicides to control weeds. But no farmers reported using mechanical transplanters in the current survey. Labor shortages will become more critical in Myanmar in the future if wages increase further.

128 **In countries where wages increased, mechanization advanced and the use of direct seeding, which is less labor-intensive, became more common.** Essentially all farmers in the main producing areas of China, Thailand, and Vietnam practice direct seeding (Table 20) and manage to produce good financial results, much better than farmers in Myanmar (see Chapter 6.8). As wages in Myanmar increase to the levels of Vietnam, Thailand, and China, direct seeding is certain to become more common. Forward-looking agronomic research should look into this coming transition in the country.

TABLE 20: CROP ESTABLISHMENT METHODS FOR MONSOON RICE, INTERNATIONAL COMPARISON

	Share of farmers transplanting	Share of farmers using direct seeding
Cambodia	60	40
China	0	100
India	99	1
Indonesia	100	0
Myanmar	**71 (86)**	**29 (14)**
Philippines	79	21
Thailand	0	100
Vietnam	0	100

Note: Data for Myanmar are for Ayeyarwady; the average for the four regions is in parentheses.
Source: 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 for all other countries. FAOSTAT for farm labor statistics.

5.12 IMPACT OF ADOPTION OF HYBRID SEEDS ON PROFITABILITY

129 **The adopters of hybrid seeds obtained significantly higher yields than the adopters of other seeds.** The average wet paddy yield of adopters of hybrid seeds was 4.37 tons/ha compared to 3.43 tons/ha obtained by the adopters of certified OPV (open-pollinated varieties) seeds and 2.92 tons/ha by the adopters of farmer saved seeds (Table 112A). Most hybrid seed adopters were in Shan State, while the proportion of hybrid seed users in the other three regions remained insignificant. The high use of hybrid seeds in Shan State is due to its proximity to China, the ultimate buyer of hybrid rice. Hybrid rice is often directly contracted from China.

130 **The survey shows that hybrid rice was not widely used in other parts of the country.** Several reasons explain this. First, the Myanmar people do not eat hybrid rice, so when it is produced it needs to be sold to China. Farmers bear the risk of failure to sell the harvest across the border. Second, this technology is still new to farmers, and hybrid seed is not widely available. Third, hybrid seed is expensive and requires more significant upfront investments than other types of seeds. The price of hybrid seeds ($2.7/kg) is on average five times higher than the price of certified seeds ($0.3/kg). Total costs for producing monsoon rice using hybrid seeds are twice as high as those associated with using other seeds (Table 21).

131 **One of the most important reasons for the low use of hybrid seeds outside of Shan State is unfavorable economics.** Farmers in Shan State get much higher paddy prices than in other regions, due to their proximity to China, the largest importer of rice in the world and the largest user of such seeds. At the prices prevailing in Shan State ($279/ton), the use of hybrid seeds is quite profitable (Table 21). Yet the use of hybrid seeds at the country-average paddy price ($182/ton) is not profitable at all. The net margin actually turns negative and labor productivity declines to $4.46/day, which is about the same as for other seeds. Indeed, in the countries where hybrid seeds are used (in large numbers only in China and Philippines), farmers who use these seeds often get lower output prices, as hybrid seeds are seen to give higher yields but a lower-quality product (e.g., a lower head rice recovery). It seems that some progress has been made in reducing this problem over the years as a result of substantial research, but the problem still exists (Prasad, Viraktamath, and Mohapatra 2014).

132 **Outside Shan State, the use of certified OPV seeds is more profitable than the use of farmer saved seeds.** Certified seeds seem to give higher net margins, primarily due to higher yields (Table 112A). Higher adoption of these seeds is largely constrained by their very low supply, as presented in Table 15 and discussed in Chapter 5.6.

TABLE 21: PROFITABILITY OF MONSOON RICE BY TYPE OF SEED

	Hybrid	Certified	Other
Farm-gate price, $/ton	279	182	186
Gross margin, $/ha	480	235	203
Net margin, $/ha	309	155	126
Labor productivity, $/day	9.09	4.24	3.96
Total costs, $/ha	909	470	416
Yields, dry paddy, tons/ha	3.48	2.74	2.32
Farm-gate price, $/ton	182		
Gross margin, $/ha	66		
Net margin, $/ha	-115		

Source: 2013/14 Myanmar agricultural survey.

5.13 IMPACT OF FERTILIZER USE ON PROFITABILITY

133 It is anticipated that the use of fertilizers will increase yields and eventually profits. To study the impact of fertilizer use, the sampled farms were divided into three equal-size groups based on their expenditures on fertilizers, which is a proxy for the level of nutrients allocated per hectare. The first group (lowest expenditures on fertilizers) spent $23/ha on fertilizers, the second group spent $74/ha, and the third group spent $178/ha (Table 22). Table 113A presents the detailed farm budgets for each quintile of fertilizer users.

134 Surprisingly, in the sampled farms, higher use of fertilizers led to lower gross and net margins. Although the highest users generated the largest revenues due to higher yields, the costs associated with the use of more fertilizers and higher use of labor, animals, machines, and fuel exceeded the yield gains. The high users generated the lowest gross and net margins, although the labor productivity of the highest users was above that of the medium users.

135 Several reasons could explain the low supply response of fertilizers. Fertilizers can be of poor quality. A probably more important reason is that farmers do not have adequate knowledge regarding the use of fertilizers, including the nature of their soils and the fertilizer quantity required for those soils. Yet with a total application rate of 392 kg/ha of urea, NPK, and T-super (high users), yields are still expected to be much higher than the 3.3 tons/ha achieved. Another reason could be an inefficient mix of nutrients applied, an issue briefly studied below.

136 It is expected that the right balance of fertilizer nutrients will increase the profitability of rice production. Yet this does not seem to be the case in Myanmar. Farmers applying urea along with NPK obtained higher yields and generated higher revenues but the increase in production did not offset the cost of additional fertilizers. The use of this mix of fertilizers was associated with higher use of labor and inputs, in addition to higher spending on fertilizers themselves. The farm sample was divided into three groups. Non-users of urea accounted for 11 percent of all farmers; adopters of urea accounted for 52 percent; and adopters of both urea and NPK accounted for the remaining 37 percent. Farmers who did not use urea generated the lowest margins, demonstrating the importance of urea in rice production. But the adopters of urea and the mix of urea and NPK achieved similar margins, although the latter group had slightly higher labor productivity (Table 23 and Table 114A). Farmers applying both urea and NPK did not appear to get the maximum out of a more balanced fertilization of soils.

TABLE 22: PROFITABILITY OF MONSOON RICE BY INTENSITY OF FERTILIZER USE

	Low Use	Medium Use	High Use
Application of fertilizers, kg/ha	30	137	392
Cost of fertilizers, $/ha	23	74	178
Yield, wet paddy, tons/ha	2.74	3.13	3.28
Total costs, $/ha	330	426	617
Gross margin, $/ha	233	221	204
Net margin, $/ha	168	136	109
Labor productivity, $/day	4.52	3.95	4.24

Source: 2013/14 Myanmar agricultural survey.

TABLE 23: PROFITABILITY OF MONSOON RICE BY FERTILIZER MIX

	No Use of Urea	Urea Users	Users of Urea + NPK
Cost of fertilizers, $/ha	22	64	113
Yield, wet paddy, tons/ha	2.16	3.09	3.18
Gross margin, $/ha	152	233	226
Net margin, $/ha	76	148	149
Labor productivity, $/day	3.83	4.14	4.36

Source: 2013/14 Myanmar agricultural survey.

5.14 IMPACT OF FARM SIZE ON PROFITABILITY

137 **The analysis of farm size and yields in Chapter 5.2 showed an inverse relation between them, strong in Shan State but relatively weak in other regions** (Figure 16). Does an inverse relationship also exist between farm size and profitability? The answer is "yes" when considering the overall sample, but the situation differs by region.

138 **In general, small farms generated higher revenues per hectare due to higher yields.** Although they incurred higher costs, their gross and net margins were higher than those of large farms (Table 24). Labor productivity of small farms was also higher.

139 **In Ayeyarwady and Bago, profitability increased with farm size.** The average net margin of small farms in Ayeyarwady was $40/ha compared to $166/ha achieved by large farms. In Bago, the average net margin of small farms was $142/ha, and of large farms, $156/ha (Annex 8).

140 **Irrespective of the profitability per hectare, large farms naturally generated higher profits per farm.** Many small farms are below 1 hectare, so they cannot rely solely on rice production for their livelihood. Unlike large farms, households with small landholdings need to complement their income from rice with other income earned inside and outside of agriculture.

TABLE 24: PROFITABILITY OF MONSOON RICE BY FARM SIZE

	Small Farms	Medium Farms	Large Farms
Number of farms	483	432	458
Revenues, $/ha	753	567	542
Yield, wet paddy, tons/ha	3.40	3.10	2.85
Total costs, $/ha	590	445	399
Labor use, days/ha	108	107	104
Gross margin, $/ha	268	200	217
Net margin, $/ha	163	122	143
Labor productivity, $/day	5.18	4.02	4.03

Source: 2013/14 Myanmar agricultural survey.

5.15 IMPACT OF MECHANIZATION ON PROFITABILITY

141 **It is not necessary for a farmer to own machinery in order to mechanize farm operations, due to the existence of rental markets for machinery services.** Thus, while most farmers do not own machines, more than 60 percent of farms mechanized at least one of the four land preparation operations (rotavating, harrowing, plowing, leveling) in monsoon rice production. Overall, across all 12 ecoregions, farm budgets were not substantially different for mechanized and non-mechanized farms (with mechanized farms being defined as those that mechanized at least one of the four land preparation operations). Farms that used draught oxen for all of these operations are considered non-mechanized.

142 **Not surprisingly, total labor use was 10 percent lower for mechanized farms.** Expenditures on material inputs were about 21 percent higher on mechanized farms, but on balance gross margins for mechanized farms were slightly higher (5 percent). This led to slightly higher net margins ($121/ha versus $94/ha) for mechanized farms, which is not that substantial of a difference (Table 25 and Table 127A). Similar conclusions hold for off-season rice production, and are not discussed further in that chapter.

TABLE 25: PROFITABILITY OF MONSOON RICE BY EXTENT OF MECHANIZATION

	Mechanized Farms	Non-mechanized Farms
Number of farms	856	517
Revenues, $/ha	599	554
Yield, wet paddy, tons/ha	2.44	2.35
Total costs, $/ha	478	460
Labor use, days/ha	101	112
Gross margin, $/ha	198	188
Net margin, $/ha	121	94
Labor productivity, $/day	4.45	3.95

Source: 2013/14 Myanmar agricultural survey.

5.16 IMPACT OF GENDER OF HOUSEHOLD HEAD ON PROFITABILITY

143 **The gender of the household head had the small impact on the profitability of monsoon rice production.** The male- and female-headed households in the sample (1,211 and 162, respectively) generated $138/ha and $170/ha net margins, respectively. Female-headed households achieved slightly higher labor productivity (Table 128A). Overall, the difference between the two groups was small.

5.17 INTERNATIONAL COMPARISONS

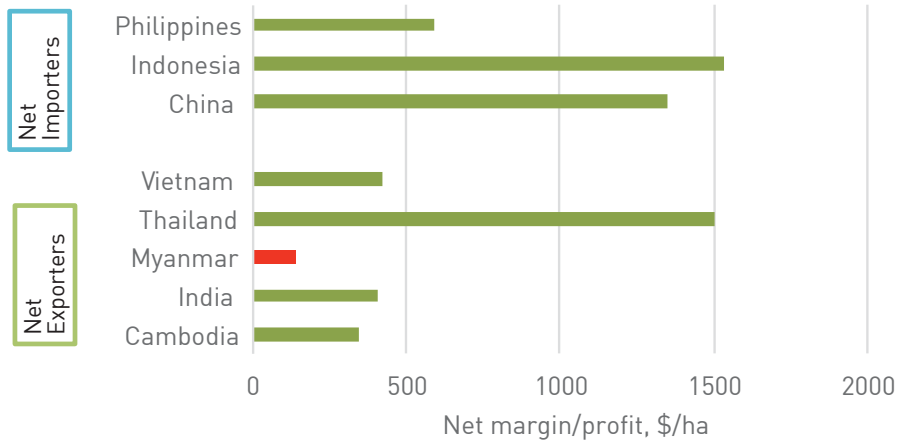
144 **In international comparison, the profitability of monsoon rice in Myanmar looks dismal.** In Ayeyarwady, the main rice-producing area in the country, the average net margin was $139/ha. This is much lower than the averages in the main producing areas of other major Asian rice producers, both exporters and importers (Figure 33). Even if some farms achieve double the average in Myanmar, it would still be below the average margins in Cambodia and India, the two poorest countries in this sample along with Myanmar.

145 **When making international comparisons, it is important to differentiate between net exporters and net importers of rice.** This is because net importers tend to artificially increase domestic prices through import tariffs and non-tariff barriers, which in turn leads to higher profits. Net importers intentionally keep domestic prices above world market prices to stimulate domestic production and discourage imports. For example, China, Indonesia, and the Philippines, all large net importers, follow such policies. In the long run, higher output prices also trigger an increase in production costs, partially reducing profits, but overall farmers in net importing countries generate higher profits than in net exporting countries because of higher output.

146 **Myanmar belongs to the latter group, the net exporters of rice.** These countries cannot maintain domestic prices above world market prices because they would not be able to sell their rice to other countries. On average they make $350-400 of profit per hectare. Thailand is an anomaly among exporters (Figure 33), with its net margin in 2013 temporarily comparable to that of net importing countries. This was the effect of the Thai rice pledging scheme operating during the time of survey in 2013. That scheme doubled farm-gate prices, making it impossible for Thailand to compete on world markets (see Poapongsakorn 2014 for details). Thailand could not export its rice, the stocks piled up, and budget expenditures grew substantially. The rice pledging scheme was eventually abolished in 2014 and domestic prices started to return to a much lower, market-clearing level (in 2013, the average farm-gate price of ordinary rice in Central Plains was $375/ton, versus $240/ton in 2015). At the lower prices, net margins in Thailand are similar to those of other exporters.

147 **What makes Myanmar's profits smaller than those in other net exporting countries?** Production costs in Myanmar were comparable to costs in Cambodia, and half those in India and Vietnam (Table 26). Thus, it was mainly the low gross revenue that made Myanmar's profit very small compared to other countries. Yields were low, comparable only with Cambodia, and Myanmar's paddy prices were the lowest.

FIGURE 33: NET MARGINS FOR MONSOON RICE, INTERNATIONAL COMPARISON



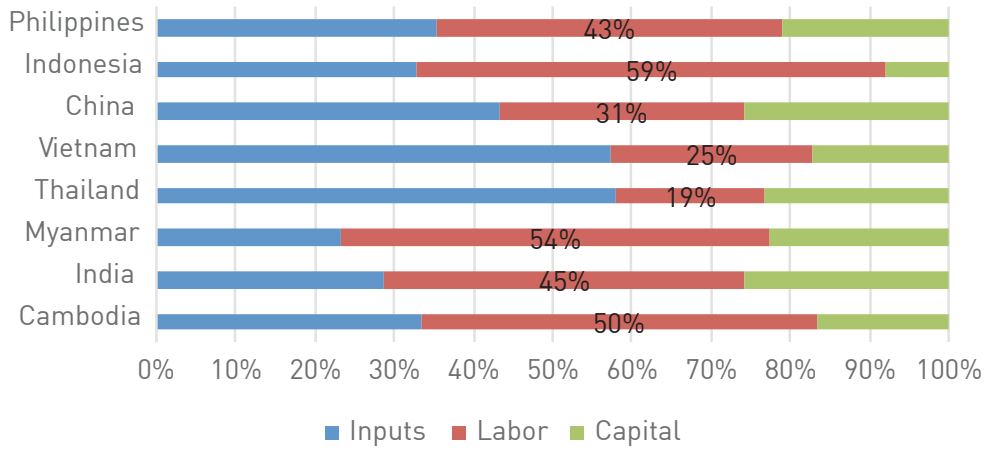
Note: Data for Myanmar are for Ayeyarwady. Data for other countries refer only to one key rice-growing area.
Source: 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 and 2015 for all other countries.

TABLE 26: PROFITABILITY OF MONSOON RICE, INTERNATIONAL COMPARISON

	Cambodia	India	Myanmar	Thailand	Vietnam	China	Indonesia	Philippines
Yield tons/ha	3.20	4.71	3.44	6.09	6.12	8.02	6.65	4.52
Paddy price $/ton	240	244	169	386	200	406	400	364
Gross revenue $/ha	**768**	**1,149**	**582**	**2,350**	**1,244**	**3,256**	**2,690**	**1,648**
Seed	20	52	27	138	68	163	20	57
Fertilizers	80	95	75	199	224	339	146	203
Chemicals	20	22	1	113	141	303	149	38
Hired labor	188	280	136	79	74	91	559	390
Own labor	25	57	104	82	128	498	128	72
Animal, machines, fuel & oil	71	181	94	188	127	493	56	181
Interest on capital	0	10	7	8	11	1	38	43
Other costs	22	45	0	42	27	22	72	78
Total costs $/ha	**426**	**741**	**444**	**849**	**800**	**1,910**	**1,168**	**1,062**
Net margin $/ha	**342**	**408**	**137**	**1,501**	**423**	**1,346**	**1,536**	**587**

Note: Data for Myanmar are for Ayeyarwady. Data for other countries refer only to one key rice-growing area.
Source: 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 and 2015 for all other countries.

FIGURE 34: STRUCTURE OF PRODUCTION COSTS, MONSOON RICE, INTERNATIONAL COMPARISON



Source: Derived from Table 25.

148 **Production costs in Myanmar were among the lowest, comparable to those in Cambodia.** This is good news to some extent, as low costs result in higher profits even with lower gross revenues. The problem with low costs in Myanmar, however, is that they are a result of low input use rather than high production efficiency (Figure 34). Low yields and gross revenues for farmers are the biggest problem. Myanmar needs to invest heavily in creating better varieties, developing an improved seed delivery system, improving farmer knowledge about fertilizer use, and developing infrastructure to cut marketing costs and thereby raise farm prices naturally, not artificially.

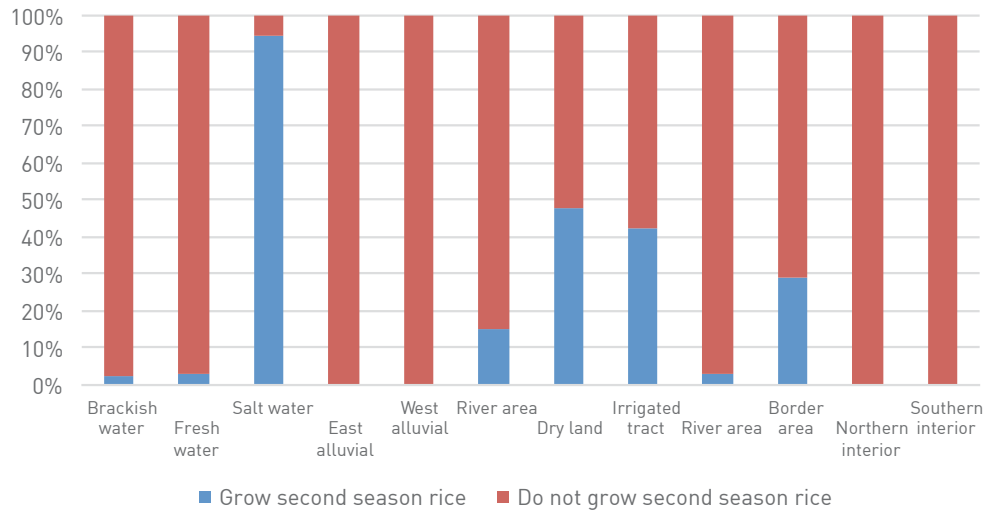
149 **The production costs in Table 26 and Figure 34 for peer countries do not include land rents, which are more common outside Myanmar.** In these other key rice-producing areas, many farmers rent in land to expand their cultivated areas or rent out land to allow themselves to concentrate on nonfarm income. Due to land scarcity and high demand for urban development, land rental fees can be large in some of these areas, ranging from $200-300/ha in India, the Philippines, Thailand, and Vietnam to $600-950/ha in China and Indonesia (Bordey et al. 2014 and 2015). These costs are not included above to make the international data more comparable with Myanmar, where the land rental market is still rudimentary, making it difficult to assign a value to land. As presented in Chapter 3.1, no farmer reported renting land in Ayeyarwady. The proportion of farmers reporting land rentals was a meager 1 percent in Bago and Sagaing and just 3 percent in Shan State. Yet even the inclusion of land rental expenses in the production costs of peer countries would still result in higher profits than in Myanmar.

CHAPTER 6: DRY SEASON RICE PRODUCTION AND PROFITABILITY

150 **A relatively small share of farmers produces dry season rice compared to monsoon rice.** The dry season harvest lasts from March to mid-June depending on ecoregion. Only 336 out of 1,728 surveyed farm households grew dry season rice. They constituted 19 percent of farmers who produced rice during the monsoon season (Figure 35). Almost all of these farmers were concentrated in four ecoregions: saltwater in Ayeyarwady,[30] dryland and irrigated tract in Sagaing, and border area in Shan State.[31] For the country as a whole, the share of dry season rice in total rice production is estimated at 20 percent (World Bank and LIFT 2014a), which seems to roughly correspond to the share of farmers producing rice during that season.

151 **Chapter 6 follows the structure of Chapter 5 on monsoon rice.** It is briefer due to the smaller diversity of ecoregions and it combines the analysis of production and profitability in one chapter, focusing on similarities and differences with monsoon rice production.

FIGURE 35: PERCENT OF FARMERS GROWING DRY SEASON RICE BY ECOREGION



Source: 2013/14 Myanmar agricultural survey.

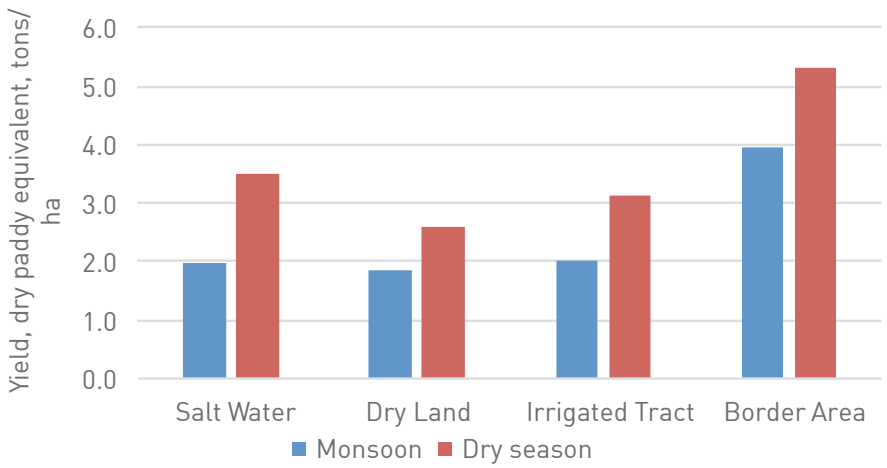
[30] In general, the saltwater ecoregion is known for difficulty of producing paddy in dry season due to high water salinity. Yet, the interviewed farmers in this survey were located in the areas suitable for paddy production, and results of their performance is reported in this chapter.
[31] Nineteen farmers were growing dry season rice outside of the four key dry season rice ecoregions. But because there are so few of them, and because they were scattered across ecoregions, they are not included in the ecoregional analysis.

6.1 YIELDS

152 **Paddy yields during the dry season were higher than those achieved during the monsoon season.** In Ayeyarwady, the difference was 76 percent, in Sagaing 40-54 percent, and in Shan State 35 percent (Figure 36). In dry paddy equivalent, the weighted average yield was 3.38 tons/ha, 25 percent higher than the 2.56 tons/ha average during the monsoon season (Table 11). Yields remained the lowest in Sagaing and the highest in Shan State.

153 **Despite the higher level in the dry season, paddy yields in Myanmar remained below yields in peer countries.** In the commercial rice areas of Asia, the wet paddy yield in the dry season harvest[32] ranged from 4.77 tons/ha in India (the lowest) to 7.01 tons/ha (the highest) in Indonesia (Bordey et al. 2014 and 2015). In Ayeyarwady, the wet paddy yield was only 3.51 tons/ha. Dry season yields in Shan State compared more favorably to those in other key Asian production areas.

FIGURE 36: PADDY YIELDS FOR MONSOON AND DRY SEASONS BY ECOREGION



Source: 2013/14 Myanmar agricultural survey.

6.2 SALES

154 **A greater percentage of farmers sold rice from the dry season crop compared to the monsoon harvest** (Table 27). They also sold large shares of their production: the second rice crop in Myanmar is clearly a commercial one. Most of the harvest was sold as wet paddy, as rains often come during the harvest time. Average farm-gate prices were lower than for the monsoon harvest. Lower prices may not always prevail in the dry season, but in 2013-14 the world market rice prices were declining, which was then reflected in lower prices during the dry season than during the monsoon season.

TABLE 27: PROPORTION OF RICE SELLERS BY SEASON

	Monsoon		Dry Season	
	% of sellers	% of sale	% of sellers	% of sale
Saltwater, Ayeyarwady	94.9	68.4	95.4	70.5
Dryland, Sagaing	77.5	66.3	83.5	60.3
Irrigated tract, Sagaing	83.1	66.4	87.3	86.1
Border area, Shan State	70.1	61.9	97.1	89.4

Source: 2013/14 Myanmar agricultural survey.

[32] In most Asian countries, January-June is considered dry season. In Indonesia, however, it is July-December.

6.3 SEEDS AND CROP ESTABLISHMENT

155 **Two types of rice dominated dry season production (Emata and China), although different types were used in different ecoregions.** Almost all sampled farmers in the saltwater ecoregion used Emata (Table 83A), mainly saved from their previous harvests (66 percent). The other 34 percent got their seeds from local market merchants or relatives/friends (Table 85A). The choices were more diversified in Sagaing, where farmers adopted both Emata and China varieties. Most seed was bought or received from outside of the farm, in contrast to mostly using own seeds during the monsoon season in this ecoregion. In Shan State, most farmers used the China variety and bought their seeds from traders.

156 **Farmers adopted different varieties of rice in the dry season than in the monsoon season.** Farmers in the saltwater ecoregion shifted from the Letywezin group during the monsoon season to Emata during the dry season (Table 85A). Farmers in the dryland area grew the China variety during the dry season, shifting away from the Letywezin and Meedon groups used during the monsoon season. In the irrigated tract ecoregion, adoption of varieties from the Nga Sein group dropped to 10 percent during the dry season from 21 percent during the monsoon season. In the border area, rice farmers predominantly used the China variety in the dry season, while 88 percent of farmers adopted Emata varieties during the monsoon season.

157 **The shorter cycle of Emata varieties, which are recommended for dry season rice, could be behind the major shift to them during the dry season.** Two types of Emata variety exist: (i) one for medium- or long-duration crops, which is more resistant to floods and more suitable for rainfed lowland areas; it is often used by farmers in the Delta; and (ii) a short-duration variety mostly suitable for the irrigated lowlands, and mostly used by farmers during the dry season. The adoption of the Chinese varieties could be related to their shorter cycle as well, making them suitable for dry season rice production.

158 **Low use of certified seeds prevailed during the dry season, just as in the monsoon season.** During the off-season, 80 percent (irrigated tract) to 98 percent (saltwater) of sampled farmers used regular seeds, often from the previous harvest. The exceptions were farmers in the border area, with use of hybrid seeds peaking at 77 percent of the sample in this ecoregion.

159 **Most farmers in the dry season practiced direct seeding, in contrast to the monsoon season during which transplanting prevailed.** All farmers in Ayeyarwady applied direct seeding (Table 87A). In Sagaing, the share of such farms was 61-72 percent. In Shan State, however, all farmers used transplanting, the same as in the monsoon season. Farm size did not appear to affect the decision on crop establishment, except in the irrigated tract ecoregion in Sagaing, where large farms tended to transplant more. The choice between transplanting and direct seeding was not much affected by the gender of the household head.

160 **Paddy was sown or transplanted between December and April, depending on the ecoregion.** In the saltwater ecoregion, more than 80 percent of plots were directly sown in December, with the remainder sown in January. Crop establishment in the main field started a bit later in the border area, with a peak in January (31 percent), but these were the months for transplanting, which means that the tasks at the nursery plots started earlier in November/December. For the two ecoregions in Sagaing, almost all plots were established in March and April. The rice growth cycle lasted for about 120 days for direct seeding and a bit longer for transplanted rice, resulting in a harvest starting in March/April for the saltwater area, predominantly in July for irrigated tract and dryland areas, and June-July for the border area.

161 **The median age of transplanted seedlings for dry season rice was 30 days in the dryland and irrigated tract areas, but twice that in the border area (60 days).** Transplanting old seedlings implies a lengthy rice production cycle for the border area, starting in November and ending only in June of the following year. The age of the seedlings in the border area was striking, depicting the dominance of farmers who continue to use the traditional way of transplanting rice seedlings. Indeed, the age of transplanted seedlings is much lower in other Asian countries, typically between 20-30 days in key rice-growing areas. A lower seedling age at transplanting reduces "transplanting shock" when the plant is uprooted from the nursery and planted in the main field, thereby helping to improve the ultimate yield achieved. In the absence of well-controlled irrigation and drainage, farmers tend to use older plants that are more resistant to flooding.

162 **Direct seeding is less costly and less labor- and water-intensive than transplanting, but in Myanmar it seems to be less profitable in both the monsoon and dry seasons.** Yields from transplanted plots were 35 percent higher than from direct seeded plots, at 3.12 tons/ha versus 2.32 tons/ha during the monsoon season, and 17 percent higher during the dry season, at 4.63 tons/ha versus 3.95 tons/ha (Table 111A and Table 133A). Farmers also used fewer seeds with transplanting, by 7 percent (monsoon season) to 53 percent (dry season). However, transplanting required more use of labor, inputs, livestock, machinery and fuel, and working capital. The overall result was a higher net margin for transplanted plots.

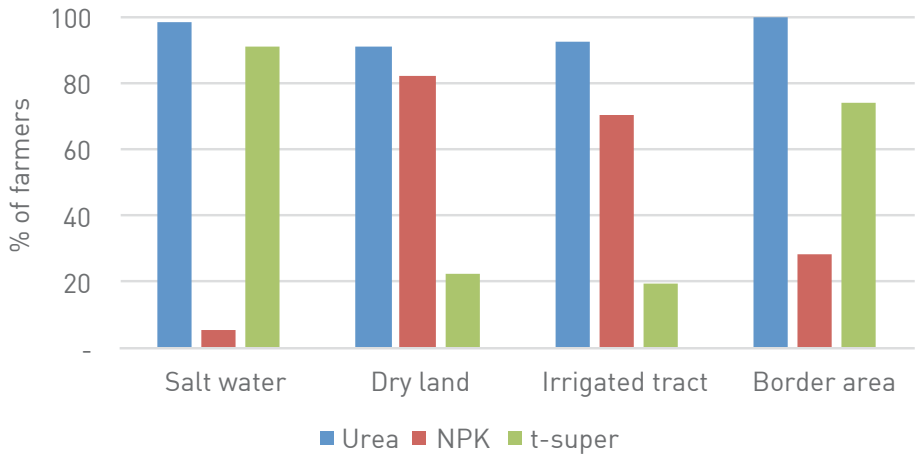
163 **Labor productivity shows a more nuanced story.** During the monsoon season, labor productivity for farmers who transplanted was higher than for those who used direct seeding, at $4.32/day and $3.69/day, respectively (Table 112A). Yet during the dry season, farmers practicing direct seeding obtained higher labor productivity, at $9.67/day compared to $6.88/day for transplanting (Table 133A). This was due to the much lower labor requirement for direct seeding during the dry season (52 days/ha) compared to transplanting (90 days/ha).

6.4 FERTILIZERS

164 **The proportion of farmers using fertilizers on dry season rice was quite high.** Almost all selected farmers used at least one type of fertilizer. The most commonly used fertilizers were urea, NPK, and T-super (Table 88A and Figure 37). Potash fertilizer was infrequently used, by only 2-3 percent of farmers in the saltwater and border areas. Each ecoregion had its preferred fertilizers. In the saltwater and border areas, the ranking was urea, T-super, and less commonly, NPK. The ranking shifted to urea, NPK, and then T-super in Sagaing's dryland and irrigated tract ecoregions. These patterns were also observed during the monsoon season. The percentage of fertilizer users did not change substantially across monsoon and off-season rice production. No significant difference was found in the use of fertilizers across farm size or by gender of the household head.

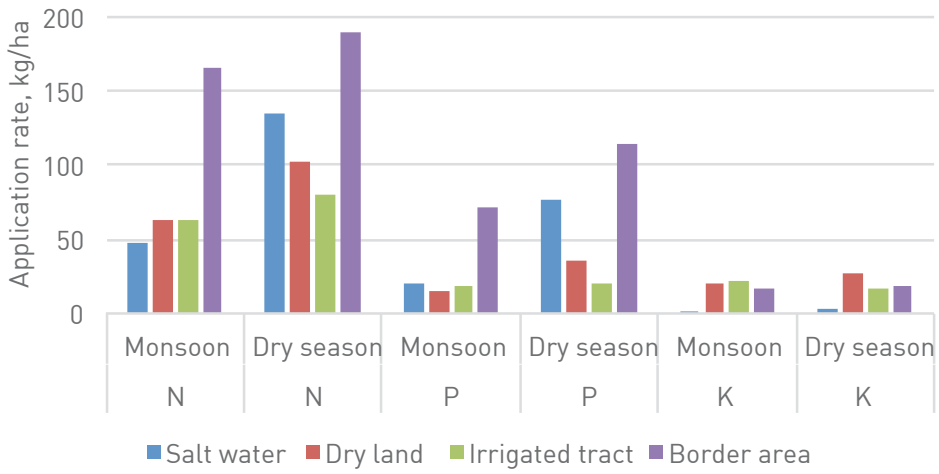
165 **Fertilizer application rates were much higher during the dry season than during the monsoon season** (Figure 38 and Table 91A). In the dry season, they were actually higher than rates in Thailand and Vietnam (Table 28), which was not the case during the monsoon season (Table 17).

FIGURE 37: PERCENTAGE OF FARMERS USING FERTILIZERS IN THE DRY SEASON BY ECOREGION



Source: 2013/14 Myanmar agricultural survey.

FIGURE 38: APPLICATION RATE OF NUTRIENTS FOR MONSOON AND DRY SEASON RICE BY ECOREGION



Source: 2013/14 Myanmar agricultural survey.

166 **Compared to other countries' mix of nutrients, Myanmar's farmers tend to overuse N and P.** This nutrient mix may lead to low partial factor productivity of N. Myanmar farmers produced only 31 kg of paddy from 1 kg of N (Table 28). In China it was 40 kg, and in Thailand and Vietnam, 72 kg.

167 **The spatial price differentials for fertilizer in Myanmar showed similar patterns by season.** They were the cheapest in the border and saltwater areas due to their proximity to China and easy access to the Port of Yangon, respectively. Prices were highest in Sagaing (Table 29). Fertilizer prices were generally lower during the dry season due to the decline in world market fertilizer prices over the course of 2013.[33]

TABLE 28: FERTILIZER USE BY NUTRIENT, 2014 DRY SEASON, INTERNATIONAL COMPARISON

Nutrients	China	India	Thailand	Vietnam	Myanmar*
Use, kg/ha					
Nitrogen (N)	162	107	79	93	137
Phosphorus (P)	20	20	21	26	78
Potassium (K)	90	37	10	29	3
Share in total use, %					
Nitrogen (N)	60	65	72	63	63
Phosphorus (P)	7	12	19	18	36
Potassium (K)	33	23	9	20	1
Partial factor productivity of nitrogen, kg of paddy/kg of N	40	62	72	72	31

Note: *For Myanmar, Ayeyarwady's saltwater ecoregion is used as a proxy for the main rice-producing area. Data for other countries refer only to one key rice-growing area.
Source: 2013/14 Myanmar agricultural survey for Myanmar data and Bordey et al. 2014 and 2015 for other countries.

[33] The world market price relevant for the 2013 monsoon season is assumed to be May 2013, and November 2013 for the 2014 dry season.

168 **Most soils in Myanmar lack organic fertilizers, but as in the monsoon season, farmers did not apply organic matter to their plots during the dry season.** There was no observation of farmers applying manure or bringing cow dung or spreading farm residues on the rice plots during the second rice season. Often, farmers burned crop residues before plowing or used straw for animal feeding, resulting in further loss of soil organic matter. Only one or two isolated cases of farmers using gypsum were observed in the saltwater and irrigated tract ecoregions. Combined with soil erosion, which takes out the upper layer most fertile soils, the application of organic fertilizers application is critical to maintain soil fertility in Myanmar. Chemical fertilizers cannot provide all necessary elements. In mountainous regions with high rainfall and acidic soil, water erosion intensifies the effect of lack of organic matter on agricultural yields. In the dryland area, wind erosion results in a similarly poor soil fertility situation.

TABLE 29: FERTILIZER PRICES BY SEASON

Region	Fertilizer	Monsoon season	Dry season
Ayeyarwady	Urea, $/kg	0.44	0.26
	NPK, $/kg	0.48	0.35
Bago	Urea, $/kg	0.71	n/a
	NPK, $/kg	0.66	n/a
Sagaing	Urea, $/kg	0.54	0.43
	NPK, $/kg	0.51	0.44
Shan State	Urea, $/kg	0.38	0.31
	NPK, $/kg	0.28	0.35
World	Urea, $/kg	0.34	0.31
	DAP, $/kg	0.49	0.35
	Potassium, $/kg	0.39	0.33

Source: 2013/14 Myanmar agricultural survey and World Bank Pink Sheets for world market fertilizer prices.

6.5 CHEMICALS

169 **On average, about half of the farmers used insecticides, herbicides, and, to a lesser extent, fungicides during dry season rice production** (Table 92A). The share of insecticide users ranged from 48 percent of farmers in the dryland area to 63 percent in the border area. Expenditures on insecticides did not vary much across regions, averaging $12/ha. Overall, more farmers used insecticides during the dry season compared to the monsoon season, and average expenditures per hectare were also higher.[34]

[34] The survey team encountered difficulties in identifying pesticides by their names, particularly in the border area where farmers use pesticides from China. The user instructions and other information on the package are in Chinese, precluding farmers from knowing exactly the type of pesticides they use, the application rate, and precautions for use. They often rely on information from traders or relatives/friends in this regard. There was no record of molluscicide or rodenticide use.

6.6 LABOR

170 **The distribution of labor by ecological regions indicates that some tasks were reserved for family labor and some activities required the assistance of hired labor.** For example, irrigation tasks as well as crop management were reserved for family labor. These types of tasks require supervision and careful attention on the work quality, and were thereby more taken up by family labor, often allocated to the head of the household. Crop establishment and harvest/post-harvest are the main bottlenecks in rice production, requiring more labor than the family can supply. These tasks must be conducted within a limited time span; given the relatively large farm size in many regions of Myanmar compared to the quantity of family labor to cover the needs, hired labor is required for these seasonal activities.

171 **In the border area, in addition to the specific tasks previously discussed, activities related to the nursery plots were also managed by family labor.** On average, farmers in this ecoregion allocated 783 hours/ha (or 98 days/ha) to dry season rice cultivation, of which 44 percent was for transplanting, 25 percent for crop management, 15 percent for harvest and post-harvest, and 16 percent for the nursery plot. Harvest and land preparation, both mechanized, each accounted for 5 percent of total labor use (Table 97A). This low use of labor for harvest and post-harvest was a peculiarity of the border area. Another characteristic of that area was its high share of family labor in total labor use (about 50 percent), probably resulting from the smaller size of plots and higher wages in Shan State.

172 **The border area was the only ecoregion where labor use was higher during the dry season than during the monsoon season.** In the other ecoregions, labor use dropped significantly, mainly due to the switch from transplanting to direct seeding. In spite of the higher labor needs for harvest and post-harvest activities caused by higher yield during the dry season, the net effect on labor use was mostly negative (Table 97A). Labor use in the saltwater ecoregion declined from 126 days/ha to 51 days/ha. In Sagaing, the decline was less dramatic but still negative, from 92 days/ha to 71 days/ha in the dryland area and from 86 days/ha to 60 days/ha in the irrigated tract area.

173 **Despite the lower labor intensity of dry season rice, the use of labor in Myanmar was still higher than in peer countries.** In countries with which Myanmar competes on world markets (i.e., Cambodia, Thailand, and Vietnam), labor use was much lower (Table 30). Only India, Indonesia, and the Philippines use more labor for dry season rice than Myanmar.

TABLE 30: LABOR USE IN RICE SYSTEMS, DRY SEASON, INTERNATIONAL COMPARISON

Countries	Labor use, person days/ha
Cambodia	27
China	20
India	77
Indonesia	96
Myanmar	**51 (62)**
Philippines	68
Thailand	10
Vietnam	22

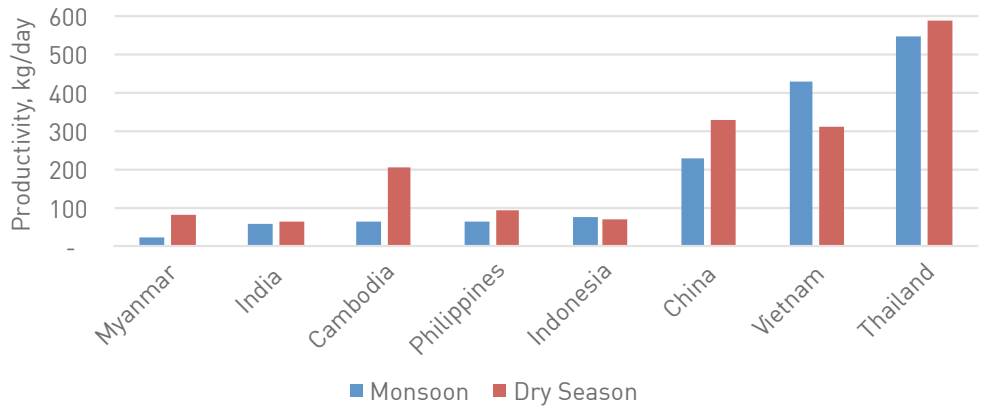
Note: Data for Myanmar is for Ayeyarwady; the average for the four regions is in parentheses. Data for other countries refer only to one key rice-growing area.
Source: 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 and 2015 for all other countries.

174 **Due to the higher yields and lower labor use in the dry season, labor productivity (in kg of paddy per day of work) in Myanmar increased compared to labor productivity in the monsoon season.** But it remained much lower than in peer countries (Figure 39).

175 **The wages of hired labor increased in all regions in the dry season compared with the monsoon season.** Average wages increased by 16 percent in Shan State and 65 percent in Ayeyarwady (Table 31). Wages remained highest in Shan State. The reason for the wage increase in the dry season could be an overall trend of rising wages in Myanmar. Another reason could be increased migration of landless laborers to outside the agricultural production areas due to lower demand for labor during the dry season.

176 **The analysis of the wage rate by task shows different categories depending on the task.** For example, in the border area, hired labor for land preparation, harvest, and post-harvest activities received a 24-72 percent higher wage rate compared to those hired for other tasks (transplanting, irrigation, seedbed preparation). The same patterns were observed in the dryland area, where hired labor for land preparation, harvest, and post-harvest got about 50 percent higher wages than for other tasks; in the irrigated tract area, they were 20-65 percent higher. The wage rate was more uniform in the saltwater ecoregion, where the variation remained within the 20 percent range. Two factors may explain the variability across tasks: demand and supply factors and differences in skills.

FIGURE 39: LABOR PRODUCTIVITY, 2013/14 SEASON, INTERNATIONAL COMPARISON



Source: 2013/14 Myanmar agricultural survey, Bordey et al. 2014 and 2015, and World Bank 2015c.

TABLE 31: WAGES BY SEASON AND ECOREGION

	Monsoon, $/day	Dry season, $/day
Ayeyarwady (saltwater area)	1.85	3.05
Sagaing (irrigated tract area)	2.64	3.40
Shan State (border area)	4.69	5.43

Source: 2013/14 Myanmar agricultural survey.

6.7 LIVESTOCK, MACHINERY, AND FUEL

177 **Motor pumps and equipment for land preparation were the types of machines most commonly used by farmers.** The intensity of their use for dry season rice production varied across regions. Sampled farmers in Shan State were the most intensive users of mechanical equipment: 100 percent used tractors for seedbed preparation and for harrowing, 100 percent used a combine for harvesting, and 69 percent used motorized pumps for irrigation. In the saltwater ecoregion, about 83 percent of farmers used motorized pumps for irrigation, denoting a contrast between the lack of irrigation infrastructure and the availability of water in this ecoregion. The use of motorized pumps increases costs but additional revenues often cover them.

178 **For rice harvesting, a combine was the most common piece of equipment adopted by farmers in the border area.** In other regions, the dominant practice remained manual harvesting, followed by the use of mechanical threshers. Some farmers were starting to use harvesters, however: about one out of five sampled farmers in the saltwater area and one out of ten in the irrigated tract area.

179 **Crop establishment is done manually.** There was no observation of farmers using mechanical transplanters or seeders. These types of agricultural equipment are either not yet known by farmers in Myanmar or are not cost-effective compared to the manual/traditional methods of doing these tasks. These types of equipment are also not yet available on rental markets. Possession of draught oxen is common in Myanmar, so the proportion of farmers seeking to rent draught oxen services was low. When farmers needed to rent services for land preparation, they turned to tractor owners instead.

6.8 PROFITABILITY

180 **The profitability of dry season rice was higher than that of monsoon rice.** The average gross margin for dry season paddy, weighted by the number of farms in each ecoregion, was $325/ha compared to $204/ha during the monsoon season (Table 32). The net margin was $246/ha compared to $114/ha, and the labor productivity was $9.20/day compared to $4.75/day during the monsoon season. The standard deviation of profitability indicators, however, was higher than during the monsoon season, pointing to the less homogenous results and probably the large impact of weather on production during the dry season.

181 **As in the monsoon season, profitability was highest in Shan State, followed by the irrigated tract and saltwater areas.** Farmers in the dryland area received the lowest profits.[35] The different profitability outcomes are explained by differences in revenues and costs. The high costs in Shan State are more than compensated by the higher gross revenue compared to other regions, the latter due to higher prices and yields (Figure 40).

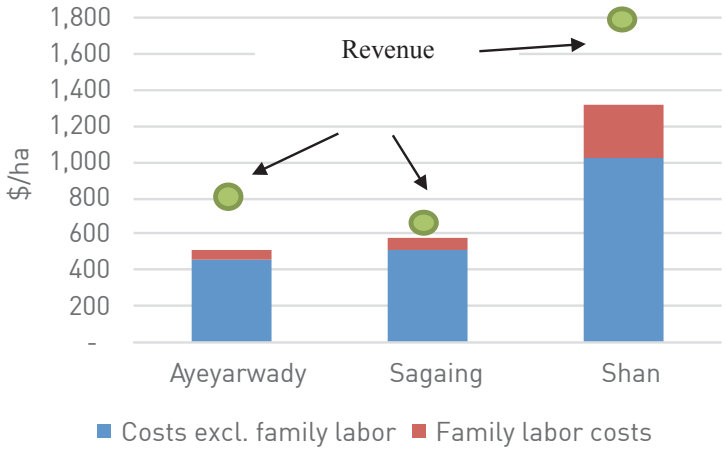
TABLE 32: FARM BUDGETS FOR MONSOON AND DRY SEASON RICE BY REGION

	No. of farms		Gross margin, $/ha		Net margin, $/ha		Labor productivity, $/day	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Ayeyarwady	474	151	203	332	88	279	3.30	10.16
Bago	380	0	196	n/a	146	n/a	5.12	
Sagaing	345	150	71	231	3	170	3.85	7.50
Shan State	174	35	490	698	337	427	9.67	12.39
Weighted average			204	325	114	246	4.75	9.20
Standard deviation			87	236	74	151	1.11	2.84

Source: 2013/14 Myanmar agricultural survey.

[35] See the details of the budget by ecoregion in Tables 128A, 129A, 130A, and 131A.

FIGURE 40: REVENUES AND PRODUCTION COSTS FOR DRY SEASON RICE



Source: 2013/14 Myanmar agricultural survey.

182 **Profitability was affected by ecoregion specificities.** In addition, it was affected by the type of crop establishment, application rate of fertilizers, farm size, and gender. These factors are analyzed in turn below.

183 **The level of fertilizer use was unexpectedly inversely related to profitability during the dry season.** For high users of fertilizers, the average net margin was $119/ha compared to $322/ha for low- and medium-level users (Table 134A). The adopters of urea only, however, were able to obtain higher profits (Table 135A). When urea was combined with NPK, profits declined, pointing to the low use efficiency of NPK vis-à-vis their high costs, and overall the low partial factor productivity of nutrient use (Table 28).

184 **Large farms managed to obtain higher profits per hectare and higher labor productivity than small farms in both Ayeyarwady and Sagaing.** In the saltwater area, for example, profits increased and costs declined along with farm size (Table 33 and Table 136A).[36] This is consistent with the results for the monsoon season in Ayeyarwady. In Sagaing, however, small farms achieved higher net margins than large farms during the monsoon season, a difference from the results found in the dry season. Another difference is the positive relationship between farm size and yields in the dry season in both Ayeyarwady and Sagaing. During the monsoon season, small farms had higher yields.

185 **Male-headed households generated higher profits than female-headed households** (Table 140A). On average, net margins in male-headed households were 60 percent higher than in female-headed households ($175/ha for women versus $280/ha for men). The differences in net margins were largely due to the 12 percent difference in yields: 3.7 tons/ha for female-headed and 4.2 tons/ha for male-headed farms.

TABLE 33: PROFITABILITY OF DRY SEASON RICE PRODUCTION BY FARM SIZE, AYEYARWADY

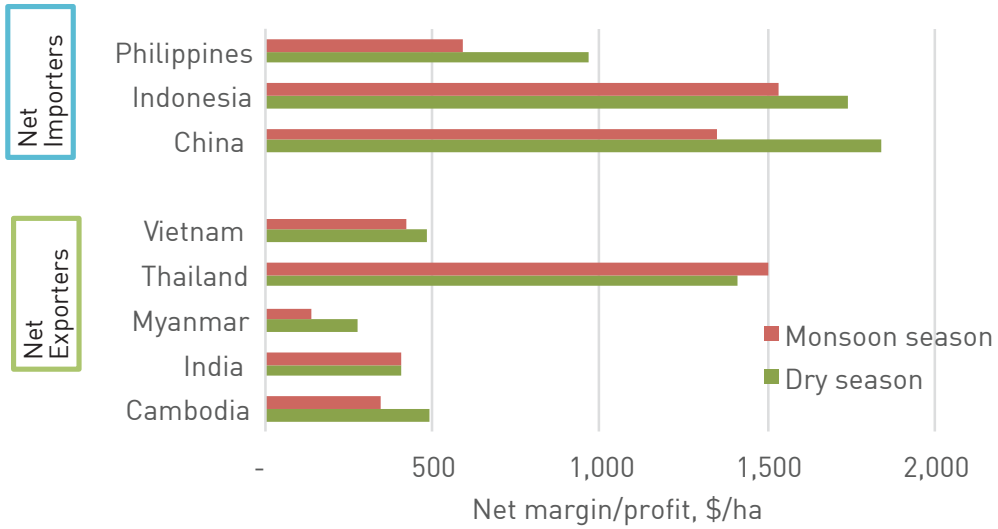
	Small Farms	Medium Farms	Large Farms
Number of farms	30	50	71
Revenues, $/ha	747	779	808
Yield, wet paddy, tons/ha	3.98	4.20	4.34
Total Costs, $/ha	599	549	465
Labor Use, man-days/ha	65	55	48
Gross margin, $/ha	237	294	390
Net margin, $/ha	149	230	342
Labor productivity, $/day	6.99	8.66	11.16

Source: 2013/14 Myanmar agricultural survey.

6.9 INTERNATIONAL COMPARISONS

186 **Although higher than for monsoon rice, the profitability of production of off-season rice in Myanmar was still low in international comparison.** In Ayeyarwady, the country's main rice-producing area, the average net margin was $279/ha. This was much lower than the averages in other rice-producing countries (Figure 41), though it came somewhat close to the margins in Cambodia and India.

FIGURE 41: NET MARGINS FOR MONSOON AND OFF-SEASON RICE, INTERNATIONAL COMPARISON



Source: 2013/14 Myanmar agricultural survey for Myanmar data, World Bank 2015a for Cambodia, and Bordey et al. 2014 and 2015.

[36] See Tables 137A, 138A, and 139A for the other three ecoregions.

CHAPTER 7: BEANS AND PULSES PRODUCTION AND PROFITABILITY

187 **Chapter 7 analyzes the farming practices and profitability of producing beans and pulses.** The most widely planted beans and pulses in Myanmar are chickpeas, black gram, and green gram. During the off-season survey (covering cool and dry seasons), their production was observed in seven ecoregions, while during the monsoon season beans and pulses were produced only in the dryland and river areas of Sagaing (Table 75A). A large number of farmers (787 out of 1,728) were producing one of these three types of pulses, depicting the importance of this category of crops in Myanmar agriculture. According to the official statistics, in 2014/15 the total area sown with beans and pulses was 4.5 million ha, the second largest crop area after paddy (7 million ha) (MOAI 2015b).

188 **Myanmar is the world's second largest exporter of beans and pulses (after Canada) and the largest exporter in the ASEAN region.** Customers include India, United Arab Emirates, Thailand, Bangladesh, and China. In 2014, the export value of beans and pulses was $835 million, larger than the export value of rice, roughly estimated at $630 million.[37]

189 **Myanmar produces more than 20 varieties of beans and pulses.** Pulses are mainly grown during the winter period, sown in November-December, and harvested in February-March. Out of 1,728 interviewed farmers, about 45 percent grew beans and pulses during the 2014 off-season versus 20 percent growing rice (Table 8 and Table 75A).

190 **Beans and pulses are mostly produced in the Dry Zone AEZ (Bago and Sagaing) and in Ayeyarwady.** They are grown more densely by farmers in regions with harsher climatic conditions, especially erratic rainfall. Compared to rice and oilseeds, pulses have a shorter growing period, and thus are able to accommodate a shorter wet period. For the survey, data on black gram were collected from 558 farmers within five ecoregions: the brackish and freshwater areas in Ayeyarwady each accounted for about one-fourth of the sample; about one-fifth each were in the east and west alluvial ecoregions; and about one out of ten farmers were in the river area in Bago. Data on green gram were collected from 113 farmers within four ecoregions: 50 percent were in the river area in Sagaing; 19 percent were in the irrigated tract in Sagaing; 17 percent were in the brackish water area in Ayeyarwady; and 13 percent were in the east alluvial ecoregion in Bago. Chickpea was the third type of pulse commonly grown; 116 farmers within three ecoregions of Sagaing grew chickpeas, 54 percent of them in the dryland area, 37 percent in the irrigated tract, and less than 10 percent in the river area.

191 **Production of beans and pulses was mostly for sale, thereby constituting an important source of cash for farmers.** At the time of the interviews, 75 percent of black gram, 81 percent of green gram, and more than 67 percent of chickpea production had been already sold (Table 142A). There was no mention of selling fresh beans, they were sold as dried products. The proportions of farmers selling beans and pulses were also high: the lowest proportion in any ecoregion was 86 percent. The proportion reached 100 percent in the west alluvial ecoregion for black gram, in the river area (Sagaing) for green gram, and in the irrigated tract and river areas for chickpea.

[37] This assumes a volume of 1.8 million tons and an average export price of $350/ton.

7.1 BLACK GRAM

192 **The average dried beans yield was 780 kg/ha.** The yield variation among ecoregions was small. This average yield is much lower than reported by the official statistics. In 2013, the yield of dried beans was reported as 1,370 kg/ha (FAOSTAT).

193 **Black gram farmers used 80 kg of seeds per ha, without significant variation across regions.** The price of seeds ranged from $0.64/kg in the freshwater ecoregion to $0.80/kg in both the brackish water and river areas (Table 143A), but most farmers (85 percent) used their own seeds from previous harvests. Only 10 percent of farmers purchased seeds from local traders or merchants, and the remaining 5 percent got their seeds from friends and relatives. The proportion of farmers purchasing seeds from traders exceeded 15 percent only in the brackish water and west alluvial ecoregions. The same percentages were observed across farms of different sizes and gender of the household head. Seeds accounted for a large share of production costs, so farmers seemed to prefer to recycle their own seeds. This in turn, however, led to the low yields observed in this survey.

194 **Black gram producers hardly used fertilizers.** The proportion of urea users varied from 3-5 percent (Table 144A). For NPK, the percentage of users dropped to less than 1 percent, and practically no farmers used T-super. The adopters, however, applied large quantities of urea and NPK.[38] The application rates of urea ranged from 35.5 kg/ha in the east alluvial ecoregion to 84.4 kg/ha in the west alluvial ecoregion. For NPK, the application rates averaged 30.0 kg/ha.

195 **In contrast to fertilizers, the use of chemicals was quite high, which is expected for pulse production.** Pulses are very sensitive to pests. But during the survey it was observed that farmers opted for treatment, not prevention. The use of chemicals, therefore, was quite high and varied among ecoregions. The percent of users ranged from 46 percent in the freshwater to 88 percent in the brackish water ecoregions (Table 146A). The percentages in the other three ecoregions were close to 50.

196 **Labor use in black gram production averaged 45 days/ha.** Black gram requires much less labor than off-season rice (63 days/ha) and monsoon rice (103 days/ha). The lowest and highest overall labor use were observed in the ecoregions within Ayeyarwady (Table 147A). Among different tasks, harvest and post-harvest took the most time; a lot of labor was hired for these tasks to complete the harvest on time, reduce losses, and ensure quality. A late harvest results in high losses due to shattering of pods and attacks from insects and rats. The reliance on hired labor was required due to the lack of harvesting machinery for pulses in general.

197 **Labor costs accounted for the largest share of production costs, especially the cost of hired labor** (Figure 42). The intensity of use and cost of inputs also determined the level of production costs. Expenses on animals, machinery, and fuel were relatively small.

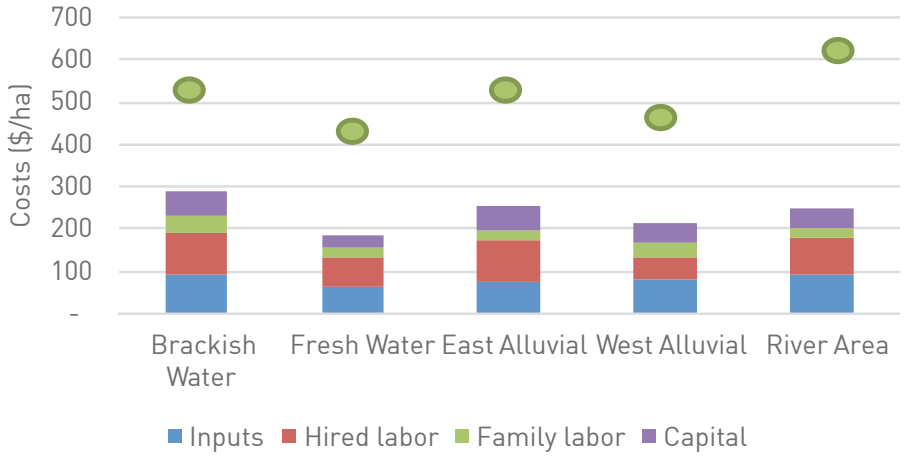
198 **Farmers sold black gram from February to July.** Revenues ranged from $442/ha in Bago's freshwater area to $612/ha in the river area (green points on Figure 42). The observed prices had an increasing trend, with prices higher in July ($0.94/kg) than in February and April ($0.59-$0.69/kg). Prices in Myanmar strongly follow prices in India, the main importer of Myanmar pulses. The increase in prices therefore could have simply reflected price developments in India and other importing countries.

199 **The average gross margin was $296/ha.** The net margin was not much less than the gross margin, $267/ha, due to the low use of own family labor (Table 34).[39] Labor productivity was $9.29/day.

200 **The profitability of black gram was higher than that of rice, especially monsoon rice.** In Ayeyarwady, off-season rice can compete with black gram in terms of both net margins and labor productivity but it cannot compete in terms of working capital requirements. The producers of black gram need half the amount of cash needed by rice producers. Moreover, such comparisons are not always straightforward because farmers growing off-season

[38] The use of large amounts of urea on pulses is quite surprising since by nature, these types of plants are auto-sufficient in N needs. Keep in mind, however, that only a few farmers used these large amounts.
[39] See detailed black gram farm budgets in Tables 148A, 149A, 150A, 151A, and 152A.

FIGURE 42: REVENUES AND PRODUCTION COSTS OF BLACK GRAM BY ECOREGION



Source: 2013/14 Myanmar agricultural survey.

rice do not grow pulses at the same time. In fact, there is regional specificity, which may depend on various factors such as the availability of water, labor, and markets, soil quality and fertility, and the farming system. Most farmers in the saltwater, dryland, irrigated tract, and border areas grew rice during the off-season while farmers in the brackish water, freshwater, east and west alluvial, and river areas cultivated black gram.

201 **Farm size appears to not significantly affect the net margins for black gram.** Labor productivity was slightly higher for large farms (Table 153A). Male-headed households achieved 17 percent higher net margins compared to female-headed farms ($265/ha versus $227/ha) and 18 percent higher labor productivity ($8.68/day versus $7.37/day) (Table 154A).

TABLE 34: PROFITABILITY OF BLACK GRAM

	No. of farms	Gross margin, $/ha	Net margin, $/ha	Labor prod., $/da y	Total costs, $/ha
Ayeyarwady	279	279	250	9.02	234
Bago	279	313	283	9.57	240
Average	**558**	**296**	**267**	**9.29**	**237**
Monsoon rice					
Ayeyarwady	474	203	88	3.30	469
Bago	380	196	146	5.12	391
Average	**1,373**	**204**	**114**	**4.75**	**510**
Off-season rice					
Ayeyarwady	151	332	279	10.16	517
Sagaing	150	231	170	7.50	575
Average	**336**	**325**	**246**	**9.20**	**626**

Source: 2013/14 Myanmar agricultural survey.

7.2 GREEN GRAM

202 **The data for green gram came from 113 farmers in four ecoregions: the brackish water are in Ayeyarwady, the east alluvial ecoregion in Bago, and the irrigated tract and river areas in Sagaing.** The average yield was 933 kg/ha, lower than the national average reported by MOAI, the same case as with black gram. In 2013, the average official dried bean yield was 1,370 kg/ha (FAOSTAT). The yield in Ayeyarwady and the irrigated tract area in Sagaing, however, came close to the national average, at 1,075 kg/ha and 1,134 kg/ha, respectively.

203 **Farmers used various quantities of seeds per hectare.** The lowest application rate was observed in the irrigated tract area (35 kg/ha) and the highest in the east alluvial ecoregion (84 kg/ha). The low seed application rate but high yield in the former may be explained by the use of a different cultivar and more efficient production management. Similar to the situation with black gram, more than two-thirds of green gram producers used their own saved seeds from previous harvests. About 22 percent bought seeds from merchants or on local markets, and the remaining 9 percent received seed from relatives and friends (Table 143A).

204 **The proportion of fertilizer users for green gram was higher than for black gram, but was still relatively low compared to rice production.** In the river area, for example, about 20 percent of farmers adopted urea and T-super, though the proportion of NPK users remained low even there, at 5 percent (Table 144A). In the irrigated tract area, the percentages of users and application rates were especially small, though yields were the highest in this ecoregion.

205 **Almost all farmers producing green gram used pesticides, including all farmers in the irrigated tract area** (Table 146A). Most of the expenditures were for insecticides, with application closely related to the degree of pest attacks. The use of herbicides and fungicides was limited.

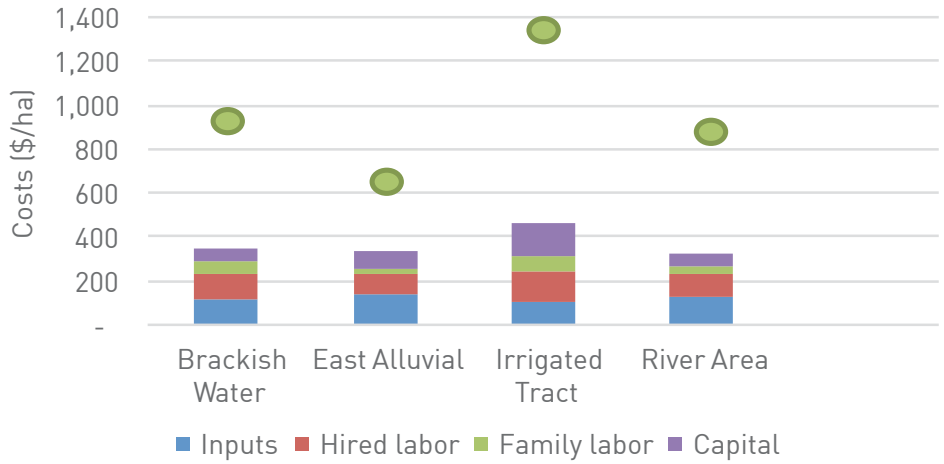
206 **The average labor use was only slightly higher than for black gram.** Total use ranged from 53 days/ha in Sagaing to 66 days/ha in Ayeyarwady. In all regions, the peak labor requirement was during harvest and post-harvest periods. Between 60-80 percent of total labor time was spent on these two tasks (Table 147A). As for black gram, most labor used for harvest and post-harvest tasks was hired: more than 80 percent of labor during harvest was hired, implying the lack of mechanization. Green gram plots managed by women required twice as much labor as male-managed plots (107 days/ha versus 56 days/ha). Among the reasons for the differences was the higher amount of labor time spent by women on crop management and the higher use of hired labor for harvest (Table 160A).

207 **Labor costs accounted for the largest share of production costs, especially the cost of hired labor** (Figure 43). The intensity of input use and their costs also determined the level of production costs. High expenses on seeds and chemicals accounted for most of the spending on inputs. Expenses on animals, machines, and fuel were relatively small in all ecoregions.

208 **Green gram was more profitable than black gram.** The average gross margin was $625/ha and the average net margin reached $581/ha (Table 35), more than twice the profitability of black gram (Table 34). Labor productivity was 70 percent higher, although the production of green gram required slightly more labor (55 days/ha) than the production of black gram (45 days/ha). Green gram has higher production costs, however, a possible reason for many farmers to pick black gram or chickpeas. The profits for green gram grew along with an increase in farm size (Table 159A). In addition, male-headed households generated much higher profits than female-headed households, with the gap being the largest among all crops included in this survey (Table 160A).

[40] See detailed farm budgets for green gram by ecoregion in Tables 155A, 156A, 157A, and 158A.

FIGURE 43: REVENUES AND PRODUCTION COSTS FOR GREEN GRAM BY ECOREGION



Source: 2013/14 Myanmar agricultural survey.

TABLE 35: PROFITABILITY OF GREEN GRAM

	No. of farms	Gross margin, $/ha	Net margin, $/ha	Labor prod., $/day	Total costs, $/ha
Ayeyarwady	19	693	643	13.39	346
Bago	15	355	335	9.80	337
Sagaing	79	660	613	17.69	361
Average	113	625	581	15.92	355

Source: 2013/14 Myanmar agricultural survey.

7.3 CHICKPEAS

209 **Chickpea is the third group of pulses covered in this survey.** Chickpea production was found in all ecoregions of Sagaing, but not in the other three regions.

210 **Chickpea was produced by 116 farm households.** The yield averaged 0.9 tons/ha, lower than the national average of 1.46 tons/ha reported by FAOSTAT for 2013.

211 **Regarding the source of seeds, the story is similar to that of the grams.** Most seeds were saved from own production. When purchased, however, they accounted for more than 60 percent of material inputs. That is an important reason why farmers used their own seeds; in addition, good seeds may not have been available to buy. Lack of good seeds is one reason why yields are low.

212 **Farmers producing chickpeas used fertilizers more frequently than producers of black and green gram.** In the dryland area, 49 percent and 54 percent of farmers used urea and NPK, respectively. These proportions were 30 percent and 53 percent in the irrigated tract area. The application rates of urea and NPK were 21 kg/ha and 48 kg/ha, respectively.

213 **Large shares of farmers in the irrigated tract area (91 percent) and the river area (80 percent) used chemicals, mostly insecticides.** The proportion dropped to 30 percent in the dryland area, which is perhaps expected given that it is arid and faces a lower incidence of pests.

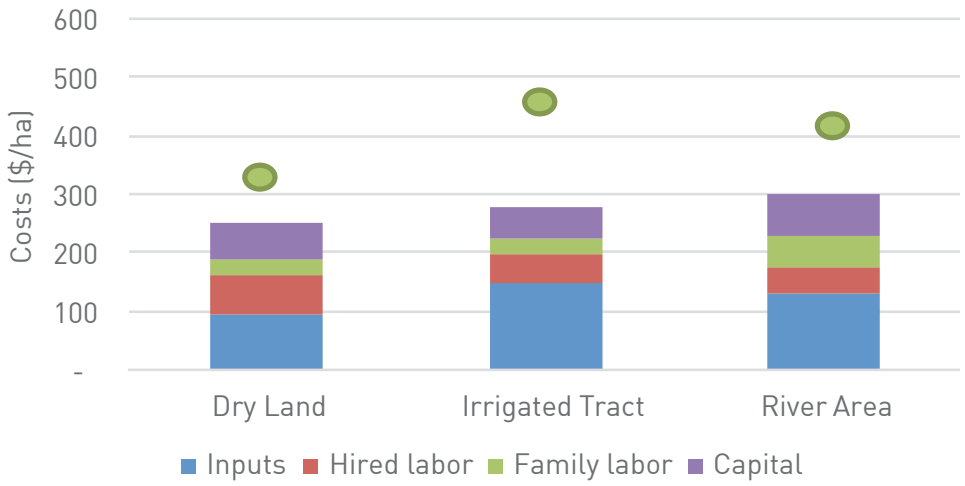
214 **The average labor use was 42 days/ha, which made chickpeas the least labor-**

intensive among the beans and pulses. Half of labor time was used for harvest and post-harvest activities. The other half was allocated to land preparation, sowing, and crop management (Table 147A). This was more balanced compared to green and black gram, where 60-70 percent of labor was allocated to harvest and post-harvest activities. By source, the use of hired labor was highest for land preparation and post-harvest activities.

215 **Labor costs were the second largest component of production costs** (Figure 44). These costs were less than the cost of material inputs, mainly seeds and chemicals.

216 **The profitability of chickpeas was the lowest amongst the beans and pulses.** It was even lower than the profitability of off-season rice in the irrigated tract area of Sagaing (Table 36),[42] the ecoregion where both rice and pulses were produced during the off-season. When water is available for rice production in the dry season, rice seems to be more profitable than chickpeas, assuming farmers have access to finance. The working capital requirements for rice production were twice as high as for chickpeas. Compared to grams, however, off-season rice was less profitable and required much more working capital.

FIGURE 44: REVENUES AND PRODUCTION COSTS FOR CHICKPEAS BY ECOREGION



Source: 2013/14 Myanmar agricultural survey.

TABLE 36: PROFITABILITY OF BEANS AND PULSES

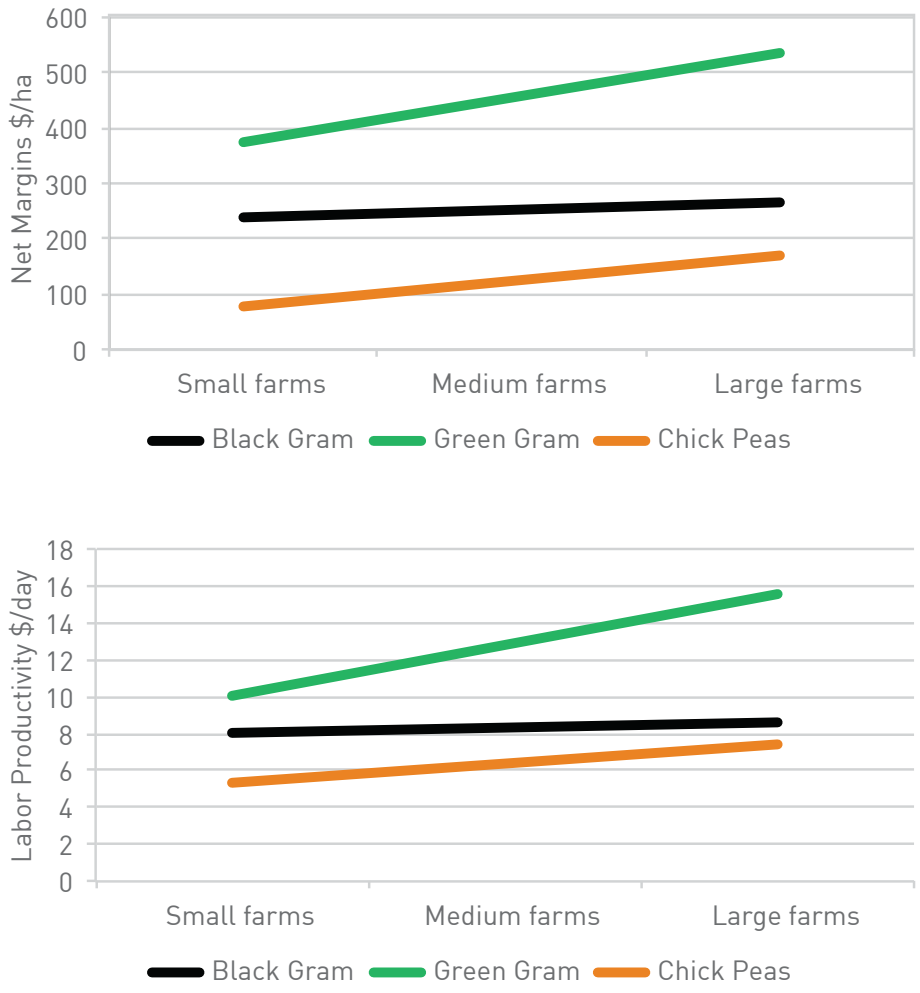
	No. of farms	Gross margin, $/ha	Net margin, $/ha	Labor prod., $/day	Total costs, $/ha
Black gram	558	296	267	9.29	237
Green gram	113	625	581	15.92	355
Chickpeas	116	173	141	6.85	266
Off-season rice, irrigated tract area, Sagaing	71	339	288	9.64	533

Source: 2013/14 Myanmar agricultural survey.

[42] See the detailed farm budgets for chickpeas by ecoregion in Tables 161A, 162A, and 163A.

217 **Profitability increased along with farm size for all of the beans and pulses.** Economies of scale were especially strong in production of green gram and, to a lesser extent, chickpeas (Figure 45). The production of black gram showed positive but relatively weak economies of scale.

FIGURE 45: PROFITABILITY AND LABOR PRODUCTIVITY FOR BEANS AND PULSES BY FARM SIZE



Source: 2013/14 Myanmar agricultural survey.

CHAPTER 8: MAIZE PRODUCTION AND PROFITABILITY

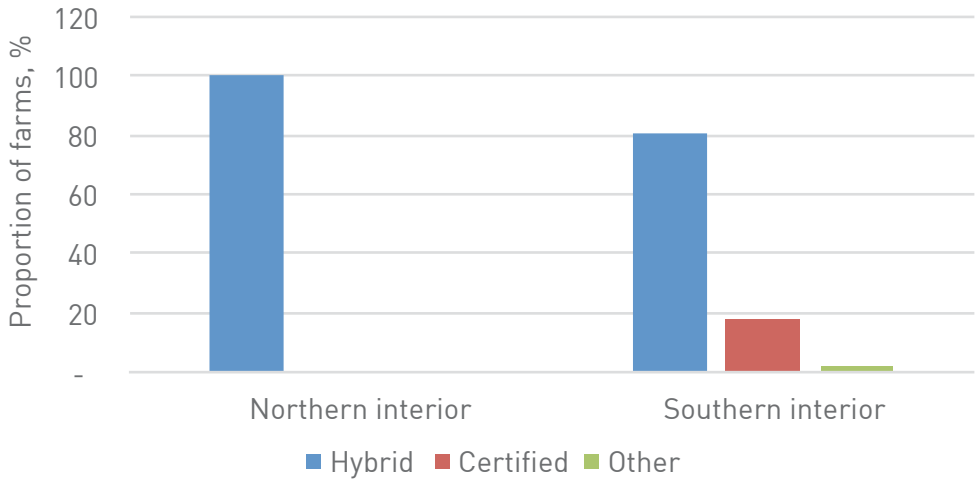
218 **During the survey, farmers producing maize were found only in Shan State.** They produced maize during the monsoon season. While growing in importance, maize is still a minor crop in Myanmar. According to MOAI (2015a), total maize area in 2012 was 415,000 hectares, which is only 10 percent of the area sown to beans and pulses and 6 percent of the area sown to paddy. In the survey, 180 farmers produced maize, 54 percent of them in the southern interior and 46 percent in the northern interior ecoregions of Shan State.

219 **The average yield of maize was 3.95 tons/ha** (Table 166A). This was close to the national average yield reported by MOAI (3.87 tons/ha).

220 **Most farmers used hybrid seeds.** Overall, about nine out of ten farms used hybrid seeds for maize – all farmers in the northern interior and about 81 percent in the southern interior ecoregions (Figure 46 and Table 168A). This situation highlights the availability of maize hybrid seeds in the parts of the country near China, a large supplier of hybrid seeds. Another large supplier of hybrid maize seeds is Thailand, especially by CP group, involved in contract farming, feed milling and integrated poultry industry.

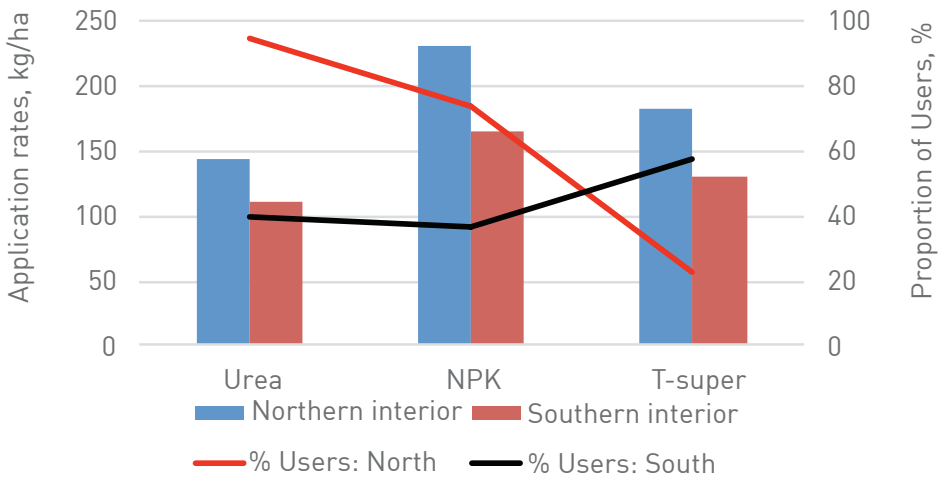
221 **The use and application rates of fertilizers were relatively high. In the northern interior, 94 percent of farms applied urea and 73 percent of farms applied NPK** (Figure 47, Table 170A and Table 171A). In general, farmers in the northern interior ecoregion applied more fertilizers than in the southern interior ecoregion, perhaps due to their greater use of hybrid seeds and closer proximity to China. The greater fertilizer use could be the reason for the 17 percent higher yields achieved there (4.15 tons/ha versus 3.64 tons/ha).

FIGURE 46: TYPES OF SEED USED FOR MAIZE



Source: 2013/14 Myanmar agricultural survey.

FIGURE 47: USE AND APPLICATION RATES OF FERTILIZERS FOR MAIZE

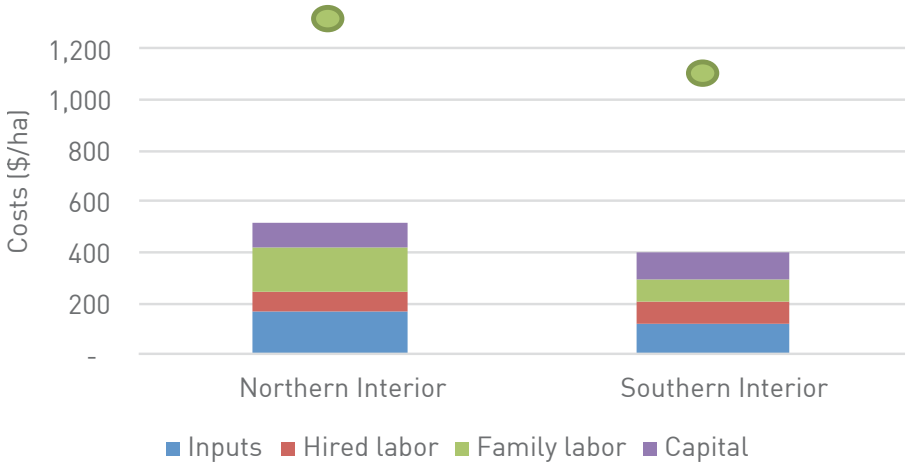


Source: 2013/14 Myanmar agricultural survey.

222 **Labor use for maize production was 62 days/ha.** In both regions, about 43 percent of labor was used for harvest and post-harvest tasks, 30 percent for crop management, and 20 percent for land preparation (Table 173A). Land preparation included plowing, harrowing, leveling, side-plowing, and cleaning of fields. Crop management consisted of field monitoring, applying fertilizers and chemical and non-chemical inputs, and weeding. In the absence of herbicide use, weed control required a large amount of labor. The share of family labor in total use was 34 percent in the northern interior and 55 percent in the southern interior ecoregions.

223 **All maize producers reported to have sold at least some of their crop, with the share typically around 95 percent** (Table 167A). Since maize output prices were similar in both ecoregions, the difference in gross revenue (green points in Figure 48) was due to differences in yield. Higher gross revenue was sufficient to compensate for higher production cost in the northern interior ecoregion, leading to slightly higher net margins. The largest cost item was labor in both the northern and southern interior ecoregions.

FIGURE 48: REVENUES AND PRODUCTION COSTS FOR MAIZE



Source: 2013/14 Myanmar agricultural survey.

TABLE 37: PROFITABILITY OF MAIZE

	No. of farms	Gross margin, $/ha	Net margin, $/ha	Labor prod., $/day	Total costs, $/ha
Northern interior	83	919	767	18.04	513
Southern interior	97	810	744	16.36	396
Total or weighted average	180	854	759	17.04	450

Source: 2013/14 Myanmar agricultural survey.

224 **The average gross margin for maize producers was $854/ha** (Table 37).[43] The average net margin was $759/ha and the labor productivity was $17.04/day. The working capital requirement was comparable among ecoregions ($323/ha on average). The profitability of maize production was the highest among all crops analyzed in this survey.

[43] See the detailed farm budget of maize production in Table 174A.

CHAPTER 9: OILSEED PRODUCTION AND PROFITABILITY

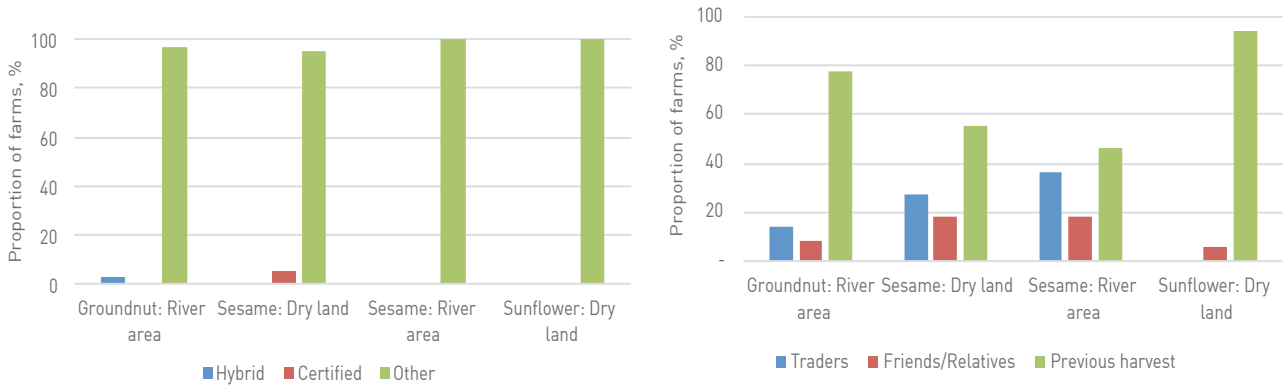
225 **In the survey, oilseeds included groundnut, sesame, and sunflower, all produced only in Sagaing.** Groundnuts were produced by 36 farms in the river area. Sesame was produced by 50 farms in the dryland and river areas. Sunflower seeds were produced by 17 farms in the dryland ecoregion.

226 **The average yields for oilseeds were close to the averages reported by MOAI.** The average yield for groundnut kernel was 0.68 ton/ha, slightly above the average yield reported by MOAI (0.62 ton/ha). For sesame, the average yields for dried seeds varied from a low of 169 kg/ha in the dryland area to 208 kg/ha in the river area (Table 166A).[44] These yields were lower than the average yields reported by MOAI in 2013 (395 kg/ha). Discussions with farmers indicated that the low yield was the consequence of drought during the sesame production season. The average sunflower yield was 730 kg/ha, slightly higher than MOAI's average of 647 kg/ha.

227 **Most seeds used in oilseed production were saved from previous harvests.** Some farmers used hybrid seeds for groundnut but this share was small, just 3 percent (Figure 49, left side). Sesame was the only oilseed crop for which some farmers used certified seeds (Figure 49, right side).

228 **Not many groundnut growers applied fertilizers, but most applied chemicals** (Table 171A and Table 172A). Only 28 percent of farmers used NPK and 11 percent used urea. But those who did use fertilizers applied relatively high quantities. Chemicals, in particular insecticides, were used by 86 percent of groundnut growers.

FIGURE 49: TYPES AND SOURCES OF SEEDS USED FOR OILSEEDS



Source: 2013/14 Myanmar agricultural survey.

[44] Myanmar is one of the leading global producers of sesame, producing even more than China and India.

229 **For sesame production, farmers in the river area rarely used fertilizers, with the proportion of users below 5 percent for NPK and below 20 percent for urea.** On the other hand, about half of sesame producers in the dryland area used urea and/or NPK and applied them at high rates (about 70 kg/ha). Also, more than half of sesame producers in the river area treated their crops against pests by using insecticides, but that proportion was about one in seven in the dryland area.

230 **For sunflower production, about two-thirds of farmers used urea, but at a lower application rate compared to that used for other oilseeds.** The same pattern was observed for NPK: a high proportion of users (88 percent) but a relatively low application rate (52 kg/ha). No chemicals were used for sunflower production.

231 **The average number of person-days of work per hectare was 65 for groundnut, 44 for sesame, and 30 for sunflower seeds.** For oilseeds, farmers mostly used hired labor (Table 173A): the shares of hired labor in total labor use for groundnut, sesame, and sunflower seeds were 75 percent, 53 percent, and 41 percent, respectively.

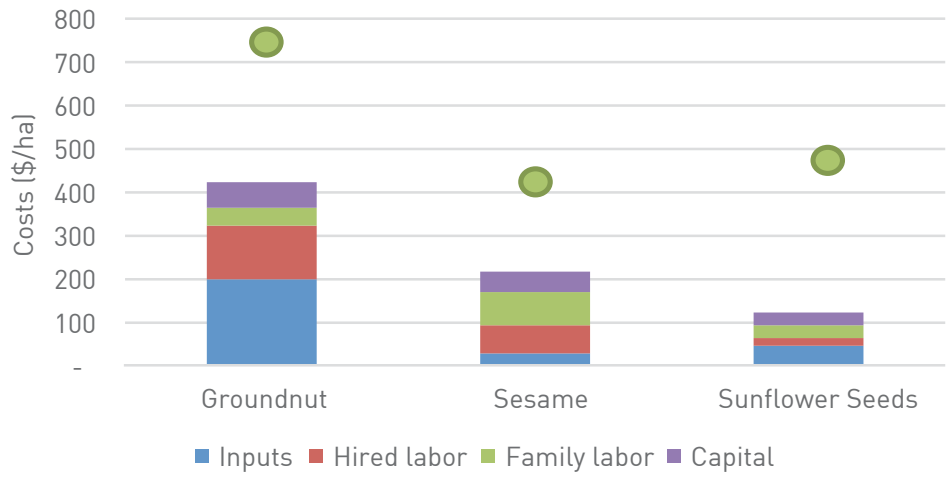
232 **Farmers used the most labor for crop management and harvest.** These two activities accounted for about 70 percent of labor use for groundnut, more than 60 percent for sesame, and 65 percent for sunflower (Table 173A). The average daily wage rate for hired labor was $2.30/day.

233 **Farmers sold sesame seeds and sunflower seeds as a dry product.** The average prices were $2.4/kg for sesame seeds and $0.73/kg for sunflower seeds. For groundnut, farmers had a choice of selling fresh or dried products, with the difference in prices between dry and fresh about 11 percent.

234 **All oilseed growers reported to have sold at least part of their crops** (Table 167A). About 75 percent of groundnut had been sold, 90 percent of sesame, and 66 percent of sunflower.

235 **Production costs were highest for groundnut and lowest for sunflower seeds** (Figure 50). Gross revenues were highest for groundnut and lowest for sesame. The structure of production costs varied by crop. Due to the high cost of seeds, material inputs accounted for 47 percent of the total costs of groundnut production, while labor costs accounted for 40 percent. Labor was the largest cost in the production of both sesame seeds (66 percent) and sunflower seeds (about 45 percent). Expenditures on livestock, machinery, and fuel averaged 18 percent for all oilseeds.

FIGURE 50: REVENUES AND PRODUCTION COSTS FOR OILSEEDS



Source: 2013/14 Myanmar agricultural survey.

TABLE 38: PROFITABILITY OF OILSEEDS

	No. of farms	Gross margin, $/ha	Net margin, $/ha	Labor prod., $/day	Total costs, $/ha
Groundnut	36	356	324	8.32	421
Sesame	50	275	202	8.54	217
Sunflower seeds	17	396	377	15.68	121

Source: 2013/14 Myanmar agricultural survey.

236 **The highest profits were generated by producers of sunflower seeds** (Table 38).[45] The net margin from sunflower seeds ($377/ha) was comparable to that of groundnut ($324/ha) but the lower labor intensity (30 days/ha versus 65 days/ha) resulted in twice as high labor productivity for producers of sunflower seeds ($15.68/day) relative to those of groundnut producers ($8.32). Production of sunflower seeds also required the lowest amount of working capital (and thus lower production costs), making this crop the most attractive one for cash-constrained farmers. The lower labor use for sesame (44 days/ha) resulted in a slightly higher labor productivity for producers of sesame in spite of the small gross and net margins compared to producers of groundnut.

[45] See the detailed farm budgets for oilseeds by type in Tables 175A, 176A, and 177A.

CHAPTER 10: SUMMARY OF THE KEY FINDINGS OF THE REPORT

237 **Agriculture can play an important role in poverty reduction in Myanmar given its large share in GDP and labor force on one hand and the high unrealized agricultural potential on the other.** Yet there is the limited knowledge on prevailing farming practices, the situation with production factors (land, labor, and capital), farm cropping choices, profitability of various crops, and determinants of profitability. Knowledge is also limited on actual problems faced by farmers, market failures, and the implications of the government correcting them. This report sheds light on some of these issues; the key findings are presented below. They are based on the initial analysis of the primary farm data from 1,728 farm households residing in Ayeyarwady, Bago, and Sagaing regions, and Shan State, representing 0.07 percent of all farms in those regions. These areas reflect the rich variety of agro-ecological zones/ecoregions and farming systems in Myanmar. Data were collected for the 2013/14 agricultural season, through two survey rounds, and the targeted crops were paddy, pulses and beans, oilseeds, and maize.

238 **The findings of the report should not be interpreted as Myanmar's averages.** They need to be seen as an insight into the production economics of better-performing farms mainly growing rice during the monsoon season and other crops during the off-season, including second season rice, in selected regions of Myanmar. The surveyed farmers are more receptive to adopting new and modern technologies. They represent the upper tier of farmers, those using higher application rates of fertilizers and better-quality seed, and likely having better access to services such as credit, equipment rental, and irrigation. Overall, the results illustrate the profitability of agricultural production when adequate level of inputs and more modern technologies are used.

239 **First, most farms in Myanmar are relatively small, even though they are larger than the rice-based farms in the region.** Farms are generally larger in Ayeyarwaddy and Bago and smaller in Sagaing and Shan State, but are mostly between 1 and 3 ha. This small farm size limits the income that can be derived from land use. Several policy implications emerge. First, relying on increasing farm size alone to solve the low farm income problem in Myanmar will work only for a tiny minority because the land resource is simply limited. Second, for farm households to keep up with their nonfarm counterparts, it will be essential to grow more profitable crops (primarily nonstaples) and diversify their incomes into nonfarm sectors (or leave farming entirely). Third, the productivity of land needs to be high to provide good farm incomes, putting a premium on sustainable land and water management. Fourth, with higher wages and a labor shortage in the future, mechanization will eventually occur but will need to work at smaller field scales than in North America or Australia. Most farms will have to mechanize through rental markets as farm sizes will simply not be large enough to profitably work machinery full-time without renting out to other farmers.

240 **One way to increase land productivity by overcoming low land availability is to increase access to water.** Usually with irrigation, farmers are willing to invest more in the use of modern inputs, labor, and services, taking into account the reduced climatic risks such as drought and flooding. Yet irrigation coverage in Myanmar is relatively low. In 2011/12, 2.12 million ha of agricultural land were part of public irrigation systems. This constituted 12 percent of crop area, much lower than in other Asian countries, where this figure ranges from 30 percent in Indonesia and Thailand to 70 percent in Vietnam.

241 **Second, the prevailing farming practices, especially for paddy, are highly labor-intensive, mainly due to low agricultural wages.** Farm wages in Myanmar were only $1.8-2.5/day in the 2013 monsoon season and $3.0-3.5/day in the 2014 dry season. These wages are much lower than in neighboring countries. As a result, farm production practices in Myanmar are labor-intensive. For paddy, 131 days are spent per ha in Ayeyarwady, the main paddy-producing area of the country, compared to 11 days in Thailand, 22 days in Vietnam, and 52 days in Cambodia, the countries competing with Myanmar on global rice markets. Labor use for paddy production during the monsoon season in other regions of Myanmar was above 80 days. In the production costs of paddy in surveyed farms, labor accounted for the largest share: 42 percent in Sagaing and Shan State, 51 percent in Ayeyarwady, and 55 percent in Bago. Hired labor accounted for 54 percent of total labor use for paddy production in Ayeyarwady, 61 percent in Shan State, 75 percent in Sagaing, and 81 percent in Bago.

242 **Third, the quality of human capital in Myanmar agriculture is very poor.** More than 70 percent of household heads did not attend school beyond the primary level. The proportion of household heads with little or no education was very high, at more than 90 percent in Shan State, of which about 50 percent have no education. Female heads of households were less educated than male household heads. On average, 19 percent of men did not have any formal education compared to 30 percent of women. While 9 percent of men received tertiary and higher education, the share for women was only 4 percent. It appears that extension services, on-farm training, and vocational skills improvement programs are absolutely necessary to uplift farm labor skills in Myanmar, and with it their productivity.

243 **Fourth, the extent and quality of agricultural mechanization in Myanmar are very low.** Few farmers own machines and not many have access to rental services. The situation is better in Shan State, while most farms in Ayeyarwady, Bago, and Sagaing use draught oxen instead. Oxen constitute an intermediate solution par excellence in developing countries, where most farmers face high initial costs of mechanization. The low extent of agricultural mechanization is not a surprise given the low wages in rural areas, the excess agricultural labor, and the still-lacking infrastructure and regulatory environment for machinery service providers. The small size of farms also matters but experience from other countries shows that this problem can be overcome through rental machinery services, which are booming in other Asian countries but lacking in Myanmar.

244 **Fifth, most farms produce paddy during the monsoon season, mainly due to the excessively high humidity level for production of other crops, but diversify to other crops during the dry season.** During the monsoon season, paddy is the main crop for both small and large farms and across all ecoregions. Out of 1,728 surveyed households, 1,373 (80 percent) reported producing monsoon paddy. In Ayeyarwady, Bago, the irrigated tract in Sagaing, and the border area of Shan State, all farms grew rice during the monsoon season. The proportions were also high in other ecoregions, with the lowest figure being 60 percent in the river area of Sagaing.

245 **Yet very few farmers from the survey practice rice monoculture during the year.** Farming systems are well diversified, with paddy production prevailing during the monsoon season while other crops are produced during the dry season. Only 336 farmers produced paddy during the dry season, as most produced beans and pulses. During the off-season, between 48 percent (dryland area in Sagaing) to 89 percent (brackish water area in Ayeyarwady) of the surveyed farms grew at least one type of pulse. The exception was Shan State, where less than 2 percent of farmers grew off-season pulses. In the northern and southern interior ecoregions in Shan State, maize constituted the second most cultivated crop during the monsoon and off-seasons.

246 **A variety of other crops were grown in other places.** Sagaing was the main location of oilseeds production – i.e., sesame, groundnuts, and sunflower seeds. About one out of ten farmers in the northern and southern interior ecoregions of Shan State grew culinary crops (mainly chilies, onion, garlic, and potatoes), especially during the off-season. The freshwater area in Ayeyarwady was characterized by 20 percent and 7 percent of farmers cultivating tobacco (including betel) during the monsoon and off-seasons, respectively.

247 **The most widely planted beans and pulses in Myanmar are chickpeas, black gram, and green gram.** During the off-season, their production was observed in seven ecoregions, while during the monsoon season beans and pulses were

produced only in the dryland and river areas of Sagaing. A large number of farmers (787 out of 1,728) were producing one of these three types of pulses, depicting the importance of this category of crops in Myanmar agriculture.

248 **Myanmar is the world's second largest exporter of beans and pulses** (after Canada) and the largest exporter in the ASEAN region. Customers include India, United Arab Emirates, Thailand, Bangladesh, and China. In 2014, the export value of beans and pulses was $835 million, larger than the export value of rice, estimated at roughly $630 million.[46]

249 **Sixth, paddy yields are low in Myanmar.** The weighted average yield in dry equivalent in the surveyed sample was 2.73 tons/ha. The average was 2.56 tons/ha for the monsoon season and 3.41 tons/ha for the dry season. These data come from relatively more productive farms, and farms outside of this survey are likely to have lower yields. The survey results are much closer to the yield reported by the USDA than the MOAI. During the monsoon season, the lowest yields were found in Sagaing and the highest in Shan State, with Ayeyarwady and Bago in the middle.

250 **Seventh, average paddy prices in the Delta and Dry Zone regions were lower than those in neighboring countries, while fertilizer prices were higher.** In Ayeyarwady, the average farm-gate price of wet paddy was $200/ton, while urea prices were $440/ton. The resulting price ratio of urea to paddy was 2.2. In comparison, the same ratio was 1.8 in Cambodia, 1.6 in Vietnam, and 1.1 in Thailand. Low farm-gate prices in Myanmar are a result of many factors. Some are related to the poor quality of output (due to high moisture, many impurities, etc.) and the multiple number of varieties used by farmers, which makes it difficult for rice mills to find large volumes of uniform variety. Others are related to the high costs in the downstream parts of the value chain, including high milling, transport, and export costs. All these costs reduce the share of farm-gate prices in wholesale and export prices. Without reducing these downstream costs, farm-gate prices in Myanmar have little scope to increase, as they need to remain on par with prices offered by competing exporters.

251 **Eighth, farmers rarely use good seeds.** Most farmers use their own seeds. Less than 7 percent of farmers reported using good seeds purchased outside of their farms. Some farmers use hybrid seeds, but this is happening exclusively in Shan State (about 66 percent of farmers in the southern interior ecoregion and 92 percent in the border area reported using hybrid seeds). The low use of good seeds is mainly a result of their low supply. The current supply of good rice seeds coming out of the public seed system was estimated to satisfy only less than 1 percent of potential demand. For comparison, the supply/demand ratio was 10 percent in Cambodia, 117 percent in Thailand, and 100 percent in Vietnam.

252 **Ninth, most farmers widely use urea for paddy production, but at low rates.** The proportion of farmers using urea was quite high, above 80 percent in all ecoregions, with the exception of the river area (Sagaing) where the use rate was very low (13 percent). The proportions came close to 100 percent in Shan State's ecoregions. The average application rate of N during the monsoon season was 53 kg/ha, low by international comparison. In the main rice-producing areas of South and East Asia, the use of N is more than 100 kg/ha. A commonly recommended application rate across Asia for monsoon paddy is 95 kg of N per ha, and for dry season paddy 110 kg of N per ha. Actual use may differ from these blanket recommendations depending on agro-ecology and site-specific factors, but this general recommendation is a useful benchmark for Myanmar.

253 **Several reasons explain the low application rates of fertilizer in Myanmar.** One of the most important is economic. In Ayeyarwady, for example, farm-gate prices for monsoon paddy are relatively low while urea prices are relatively high in regional comparison. Therefore, the relative/effective fertilizer prices in Myanmar are much higher than in other countries. Another reason is farmers' poor knowledge about optimal usage and the lack of soil maps to provide information about specific soil nutrient requirements.

254 **In addition to low application rates, farmers in Myanmar used an unbalanced nutrient mix.** Farmers mainly use N (75 percent of all nutrients) at the expense of K (5 percent of all nutrients), while

[46] Myanmar is one of the leading global producers of sesame, producing even more than China and India.

farmers in other key Asian rice-growing areas use lower ratios of N to P and K. This unbalanced application of nutrients reduces yield response and, consequently, farm profits in Myanmar.

255 **Tenth, the average gross margin for monsoon paddy was $204/ha, the net margin was $114/ha, and the labor productivity was $4.75/day.** Gross and net margins were highest in Shan State and lowest in Sagaing. Monsoon paddy was quite profitable in four ecoregions (east alluvial in Bago, and border area, northern interior, and southern interior in Shan State), with higher net margins and labor productivity than in the other ecoregions. Farmers in these ecoregions achieved net margins ranging from $251/ha to $358/ha and labor productivity above $8.0/day. The lowest profits and productivity were observed in river area in Bago, dryland and irrigated tract in Sagaing, and saltwater in Ayeyarwady. Net margins there ranged from negative to $30/ha and labor productivity from $3.0/day to $3.8/day.

256 **The financial outcomes were affected by specific ecoregion characteristics and other factors such as the type of crop establishment, types of seed used, application of fertilizers, farm size, and gender:**

a. **Farmers transplanting rice during the monsoon season obtained higher profits.** Because of more uniform plant spacing, transplanting allows better control of weeds than direct seeding, which in turn leads to higher yield. In the surveyed farms, the average yield in dry paddy equivalent was 2.60 tons/ha for transplanting versus 1.94 tons/ha for direct seeding. Yet transplanting involves higher costs of production: 110 days/ha are required for transplanting versus 85 days/ha for direct seeding. In countries where wages are high and mechanization options are available, the use of direct seeding becomes more common: essentially all farmers in the main producing areas of China, Thailand, and Vietnam practice direct seeding and manage to produce good financial results, much better than farmers in Myanmar. As wages in Myanmar increase to the levels of these countries, direct seeding is certain to become more common. Forward-looking agronomic research should look into this coming transition in the country.

b. **The adopters of hybrid seeds obtained significantly higher yields than the adopters of other seeds, but not always higher profits.** The average wet paddy yield of users of hybrid seeds was 4.37 tons/ha compared to 3.43 tons/ha obtained by the users of certified open-pollinated varieties and 2.92 tons/ha by the users of own saved seeds. Most hybrid seed users were in Shan State, due to its proximity to China, the ultimate supplier of hybrid seeds and buyer of hybrid rice. The survey shows that hybrid rice was not widely used in other parts of the country. Several reasons explain this. First, the Myanmar people do not eat hybrid rice, so when it is produced it needs to be sold to China for noodle production. Usually hybrid rice is priced lower. Farmers bear the risk of failure to sell the harvest across the border. Second, this technology is still new to farmers, and hybrid seeds are not widely available. Third, hybrid seed is about nine times more expensive than other certified seeds. At the input and output prices prevailing in Shan State, the use of hybrid seeds is profitable, but at the country-average paddy prices it is not. In other regions, the net margin turns negative and labor productivity declines to $4.46/day, which is about the same as for other seeds. This profitability consideration needs to be taken into account when promoting hybrid seeds in different parts of the country.

c. **The higher use of fertilizers did not always result in higher profits.** The survey found that higher use of fertilizers often led to lower gross and net margins. Although the highest fertilizer users generated the largest revenues due to higher yields, the costs associated with the use of more fertilizers and higher use of labor, animals, machines, and fuel exceeded the yield gains. Several reasons could explain the low supply response of fertilizers. Fertilizers can be of poor quality. A probably more important reason is that farmers do not

have adequate knowledge regarding the use of fertilizers, including the nature of their soils and the fertilizer quantity required for those soils. Another reason could be an inefficient mix of nutrients applied: adding NPK to urea did not improve profits much, pointing to the low efficiency of fertilizer use.

d. **The use of mechanized services did not affect profitability much.** Across all 12 ecoregions, farm budgets were not substantially different for mechanized and non-mechanized farms (with mechanized farms defined as those that mechanized at least one of four land preparation operations). Total labor use was 10 percent lower for mechanized farms, while expenditures on material inputs were about 21 percent higher on mechanized farms, but on balance gross margins for mechanized farms were only 5 percent higher.

e. **Farm size matters for profit generation. In all regions, smaller farms generated higher revenues per hectare due to higher yields, and the labor productivity of small farms was also higher.** Yet in some regions (Ayeyarwady and Bago), profitability increased with farm size. The average net margin of small farms in Ayeyarwady was $40/ha compared to $166/ha achieved by large farms. In Bago, the average net margin of small farms was $142/ha, and of large farms, $156/ha. Irrespective of the profitability per hectare, large farms naturally generated higher profits per farm. Many small farms are below one hectare, so they cannot rely solely on rice production for their livelihood. Unlike large farms, households with small landholdings need to complement their income from rice with other income earned inside and outside of agriculture.

f. **The gender of the household head had a small impact on the profitability of monsoon rice production.** Female-headed households in the sample generated slightly higher net margins and labor productivity.

257 **Eleventh, the profitability of monsoon paddy in Myanmar looks dismal in international comparison.** In Ayeyarwady, the main rice-producing area in the country, the average net margin was $139/ha. This is much lower than the averages in the main producing areas of other major Asian rice producers, which range from $342 in Cambodia to $423 in Vietnam. Even if some farms achieve double the average in Myanmar, it would still be below the average margins in Cambodia and India, the two poorest countries in this sample along with Myanmar.

258 **What makes Myanmar's profits smaller than those in other net exporting countries?** Production costs in Myanmar were comparable to costs in Cambodia, and half those in India and Vietnam. Thus, low gross revenues primarily explain Myanmar's relatively small profits compared to those of other countries. Yields were low, comparable only with Cambodia, and Myanmar's paddy prices were the lowest.

259 **Twelfth, the profitability of dry season paddy was higher than monsoon season paddy.** The average gross margin for dry season paddy was $325/ha compared to $204/ha during the monsoon season. The net margin was $246/ha compared to $114/ha, and the labor productivity was $9.20/day compared to $4.75/day (due to higher profits and lower labor use, due to the move from transplanting to direct seeding). As in the monsoon season, profitability was highest in Shan State, followed by the irrigated tract in Sagaing and saltwater areas in Ayeyarwady. Although higher than for monsoon paddy, the profitability of production of dry season paddy in Myanmar was still much lower than the averages in other rice-producing countries, though it came somewhat close to the margins in Cambodia and India.

260 **Thirteenth, maize was the most profitable among all crops surveyed.** Yet it was found to be produced only in Shan State, where it competed with paddy production during the monsoon season. The average gross margin was $854/ha, the net margin was $759/ha, and the labor productivity was $17.04/day. The reason for high profitability of maize production in Shan State is its proximity to China, which facilitates the region's use of high-yielding hybrid seeds (about nine out of ten farms used hybrid seeds) and enables it to sell output at remunerative prices to China.

261 **Fourteenth, during the dry season beans and pulses were the most popular crops in the Dry Zone and Delta.** This popularity is due to several reasons. First, some types of beans, especially green gram, are more profitable than dry season paddy. In Sagaing, for example, the net margin of green gram was $613/ha compared to $170/ha for paddy. Second, beans and pulses are cheaper to produce than paddy, and a readily available market exists. Average paddy production costs in the dry season were $626/ha compared to $510/ha for black gram and $355/ha for green gram. Third, beans and pulses require less water and labor, which are in deficit during the dry season. As a result of the latter, labor productivity increases. The average labor productivity was $9.3/day for black gram, $15.9/day for green gram, and $9.6/day for paddy.

262 **Finally, oilseeds were mainly produced in Sagaing region during the dry season.** Oilseeds include groundnut, sesame, and sunflower seeds. The production of oilseeds was less profitable than that of beans and pulses, yet many farmers turned to their production due to the low requirement for labor and working capital. The total costs of producing sunflower ($121/ha) and sesame ($217/ha) were the lowest amongst all crops in the survey.

263 **Several suggestions emerged regarding future research based on the collected data to help close the knowledge gap in Myanmar.** This report presents the initial analysis of the rich primary data, focusing on the prevailing farming practices, extent of diversification, partial factor productivity, analysis of farm profitability, and a simple analysis of determinants of profitability of paddy production. Future research can include analysis of production functions and total factor productivity, econometric analysis of the role various factors play in determining farm productivity and profitability, and analysis of why farmers choose one technology over others. Institutional differences among regions and specific aspects of value chains for various commodities can be studied to better explain farm production choices and farm profitability and develop recommendations to unleash the constraints to growth. Furthermore, this report establishes the baseline for future studies of changes in farm production economics over time, creating a solid foundation for future research and applied policy studies.

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ANNEX 1: METHODOLOGY, APPROACH, AND SURVEY AREAS

1 **Ayeyarwady, Bago, and Sagaing Regions and Shan State were selected as target areas for the data collection.** They represent a rich variety of agro-ecological zones/ecoregions and farming systems in Myanmar. The Myanmar Marketing Research and Development Organization designed the survey and collected the data, with technical support from the International Rice Research Institute, the Philippine Rice Research Institute, and the United Nations Food and Agriculture Organization. Data were collected for the 2013/14 agricultural season, through two survey rounds. The targeted crops were paddy, pulses and beans, oil crops, and maize.

The first round of the survey

2 **The first round of this survey was conducted from November to December 2013.** In each of the four selected regions/states, three representative ecosystems were chosen (see below). Within each of the 12 region-specific ecosystems, two townships were randomly selected using probability proportional to size based on the net sown acres of each township. Within each of these 24 townships, four village tracts (an administrative unit composed of groups of villages) were chosen by simple random sampling. In Shan State, with the exception of Taunggyi Township, village tracts were not selected at random, but were chosen in consultation with Township Agricultural Officers, who could advise on village tracts with a satisfactory security situation. Within each village tract, the main village was selected to minimize the survey team's transport costs. If the selected main village turned out to have less than half of its area planted to the target crops, another randomly selected main village elsewhere in the township was chosen as a substitute.

3 **Within each of these 96 main villages, all agricultural households were listed and organized under the categories of smallholder farmer (owns less than 5 acres),** medium holder farmer (owns 5 to 10 acres) and large holder farmers (owns more than 10 acres). Individual farmers who double-cropped (two target crops or one target crop and one nontarget crop) were then chosen from each of the three size categories according to simple random sampling, with the number of farmers in each category proportional to the number of each category of farms in that village. Main villages are likely to have better agricultural performance than more remote villages. They are likely to be more economically active, receive more public services, have better access to markets, and represent long-established production areas with better soils and production environment.

4 **The decision to select farmers from main villages was driven by a number of considerations.** First, most studies with international comparisons use a similar approach by collecting data from more developed farming areas, often equipped with irrigation. A comparison of the findings from Myanmar with its peers required a similar approach. Second, the limited budget available to the team required prioritization and clear focus on capturing the state of farm production economics in selected regions. Third, insecurity in some areas precluded the team from surveying more remote villages.

5 **The survey collected information from 1,728 farmers during the first round.** However, in some cases data on yield for plots observed during the first round were not available at the time of the survey, so the team collected the yield information during the second round. This was mostly the case for farmers in Labutta Township in Ayeyarwady due to flooding that caused delayed cropping. By region, the sample included 484 households in Ayeyarwady, 380 households in Bago, 501 households in Sagaing, and 363 households in Shan State. They represent 0.07 percent of all farms in these regions (Table 39A).

TABLE 39: SURVEY FARM SAMPLE

Region	Total number of farms	Number of farms surveyed	Farms surveyed as % of all farms
Ayeyarwady	711,575	484	0.07
Bago	513,750	380	0.07
Sagaing	748,168	501	0.07
Shan State	524,654	363	0.07
Total	2,498,147	1,728	0.07

Source: Myanmar Agricultural Census 2010 and the 2013/14 Myanmar agricultural survey.

6 Respondents were farmers who met the following criteria: (i) had resided in the village at least two years; (ii) expressed availability and willingness to fully participate in the survey; (iii) was actively cultivating land whether as the landowner, land tenant, or landowner who rents additional land; and (iv) was the head of the household or a household member who led the farm work.

7 The townships within each state or region were organized under three clusters defined by geographical area and zone-specific agro-ecological characteristics (Table 40A, Table 41A, and Figure 51A). They are the following:

a. Ayeyarwady's ecoregions include the land under saltwater, brackish water, and freshwater. These areas are the part of the larger Delta Region agro-ecological zone (AEZ) (Figure 52A).

TABLE 40: PHASE I: SAMPLE ALLOCATION BY AEZ, REGION, AND STATE

	Stratum	Agro-ecological zone	First stage (Township)	Second stage (Village tract)
1	Ayeyarwady	Saltwater area	2	8
2		Brackish water	2	8
3		Freshwater	2	8
4		Total	6	24
5	Bago	West alluvial	2	8
6		East alluvial	2	8
7		East/west flooded land/river	2	8
8		Total	6	24
9	Sagaing	Irrigated tract	2	8
10		Dryland	2	8
11		River area	2	8
12		Total	6	24
13	Shan State	Southern interior	2	8
14		Northern interior	2	8
15		Border area	2	8
16		Total	6	24
		Grand total	**24**	**96**

Source: Own estimates.

b. Bago's ecoregions are west alluvial, east alluvial, and east/west flooded lands. Together with Sagaing, they belong to the larger Dry Zone AEZ (Figure 53A).
c. Also part of the larger Dry Zone AEZ, Sagaing's ecoregions include irrigated tract land, dryland, and riverbed areas (Figure 54A).
d. Shan State's ecoregions include southern interior, northern interior, and border areas representing the Shan Plateau/Mountainous Region AEZ (Figure 55A).

TABLE 41: TOWNSHIP SURVEYED AND NET SOWN ACRES

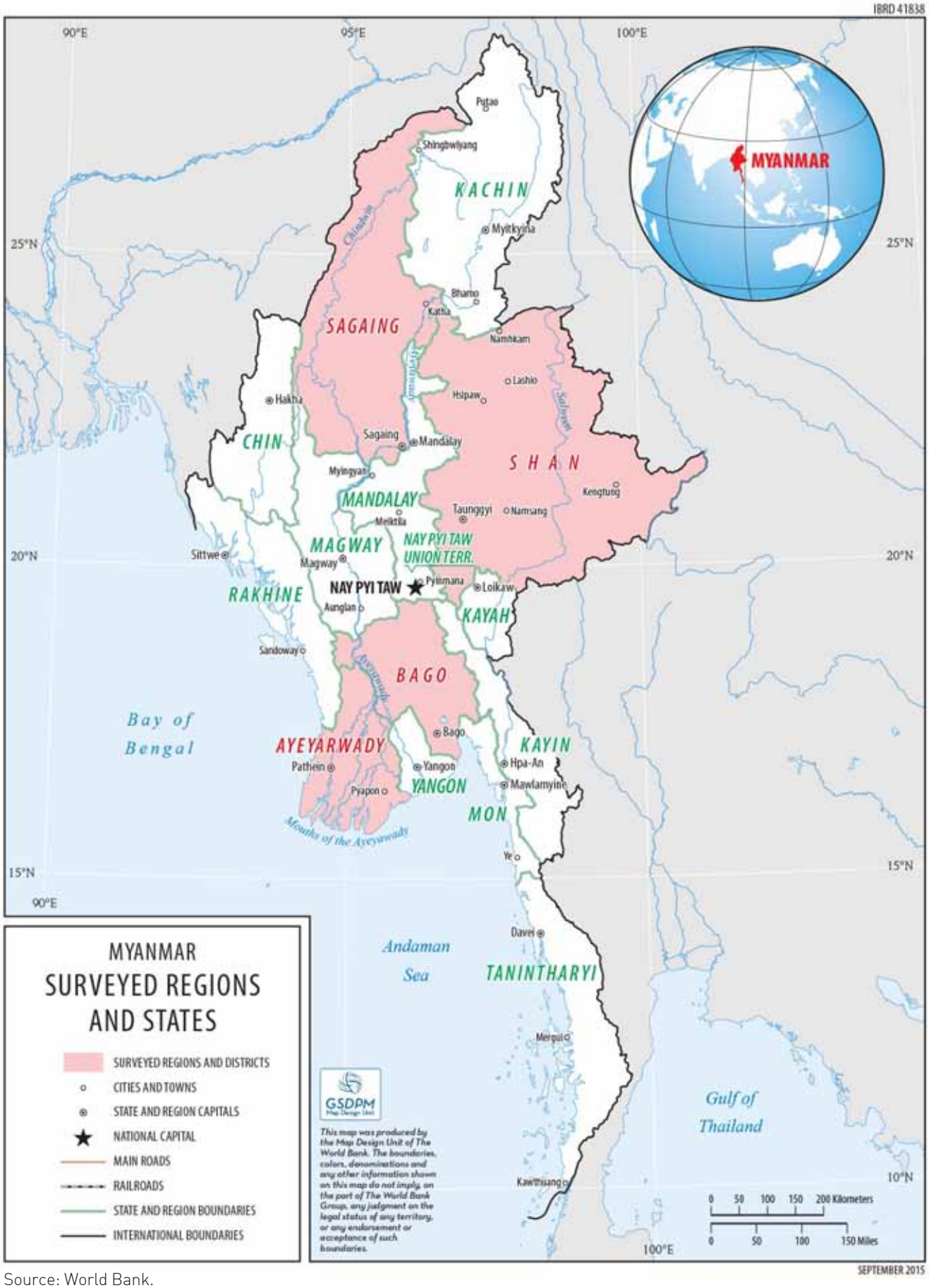
Sr.	State/Region	District	Township	Stratum	Total Net Sown Acres	Village Tract	HH Sample
1	**Ayeyarwady**	Pathein	Kyonpyaw	brackish water	153,463	4	80
2		Pathein	Yegyi	brackish water	158,052	4	80
3		Hinthada	Hinthada	freshwater	176,793	4	80
4		Myaungmya	Nyaungdon	freshwater	126,365	4	80
5		Labutta	Labutta	saltwater area	334,071	4	80
6		Pyapon	Pyapon	saltwater area	174,897	4	80
	Total					**24**	**480**
7	**Bago**	Bago	Kyauktaga	east alluvial	294,310	4	64
8		Taungoo	Phyu	east alluvial	274,625	4	64
9		Bago	Kawa	east/west flooded land	352,918	4	64
10		Taungoo	Htantabin	east/west flooded land	148,279	4	64
11		Pyay	Shwedaung	west alluvial	118,212	4	64
12		Thayarwady	Okpho	west alluvial	179,086	4	64
	Total					**24**	**384**
13	**Sagaing**	Monywa	Budalin	dry land	221,084	4	84
14		Shwebo	Tabayin	dry land	250,464	4	84
15		Monywa	Yinmabin	irrigated tract	165,896	4	84
16		Shwebo	Shwebo	irrigated tract	191,008	4	84
17		Katha	Banmauk	river area	36,798	4	84
18		Sagaing	Myaung	river area	91,737	4	84
	Total					**24**	**504**
19	Shan State	Muse	Muse	border area	27,358	4	60
20		Muse	Namhkan	border area	43,032	4	60
21		Kyaukme	Kyaukme	northern interior	86,632	4	60
22		Lashio	Lashio	northern interior	131,761	4	60
23		Loilen	Nansang	southern interior	59,532	4	60
24		Taunggyi	Taunggyi	southern interior	132,407	4	60
	Total					**24**	**360**
	Grand Total					**96**	**1,728**

Source: Myanmar Census of Agriculture 2010 and the 2013/14 Myanmar agricultural survey.

The second round of the survey

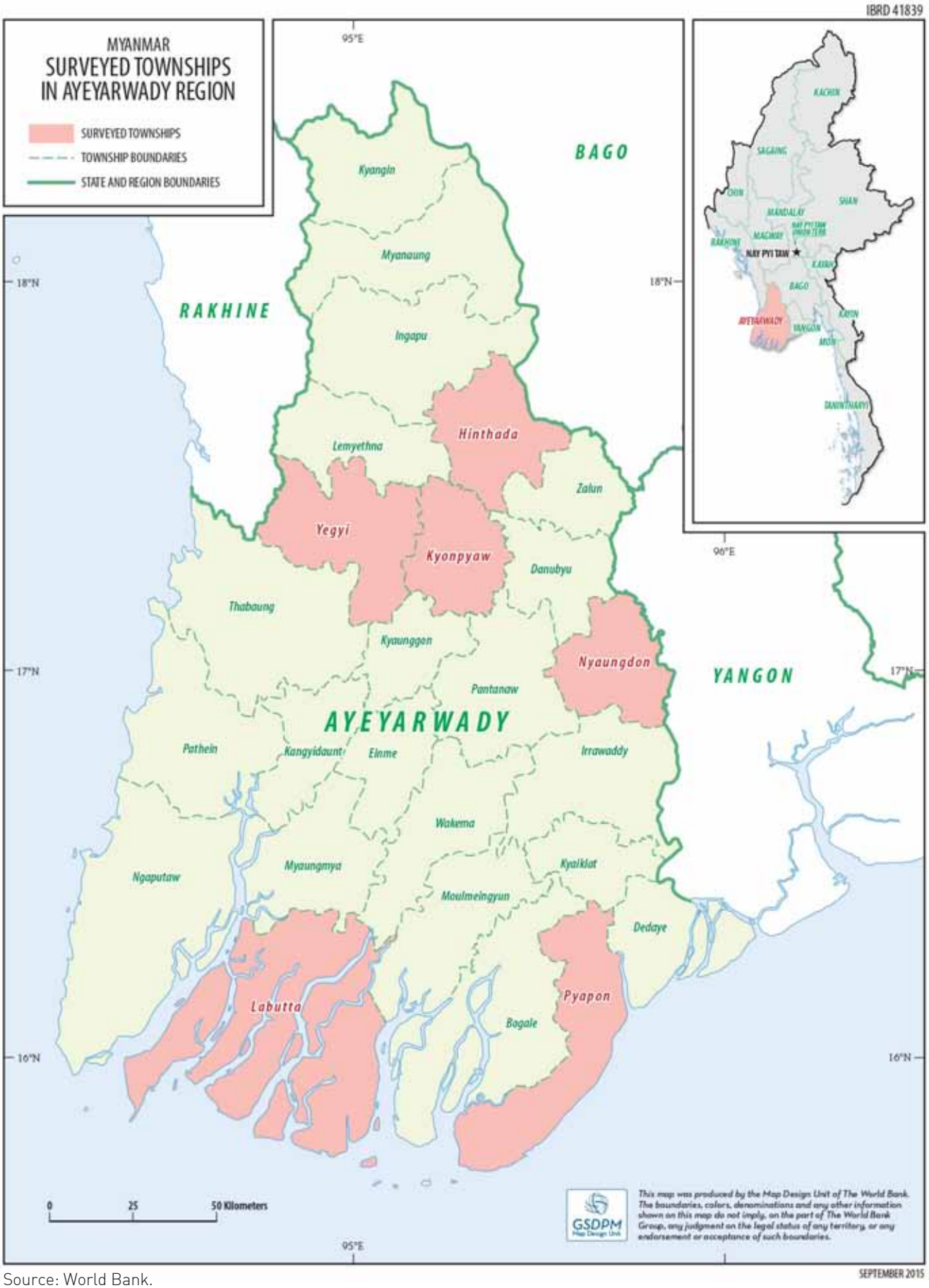
8 Data for the second round of the survey were collected during the months of March to May 2014. The interviewers returned to the same households visited in 2013 and requested information on the second season rice and other crops (maize, pulses and beans, oil seeds) for the summer crop. Out of the 1,728 initially selected farms, about 56 percent provided information on non-rice production, mainly pulses, and about 20.5 percent on rice production. The remaining households grew a nontarget crop (e.g., fruits, culinary crops) during the second season, and further data particular to these crops were not collected. The maps below show the location of village tracts visited during the survey.

FIGURE 51: MAP OF SURVEYED REGIONS AND STATES, MYANMAR



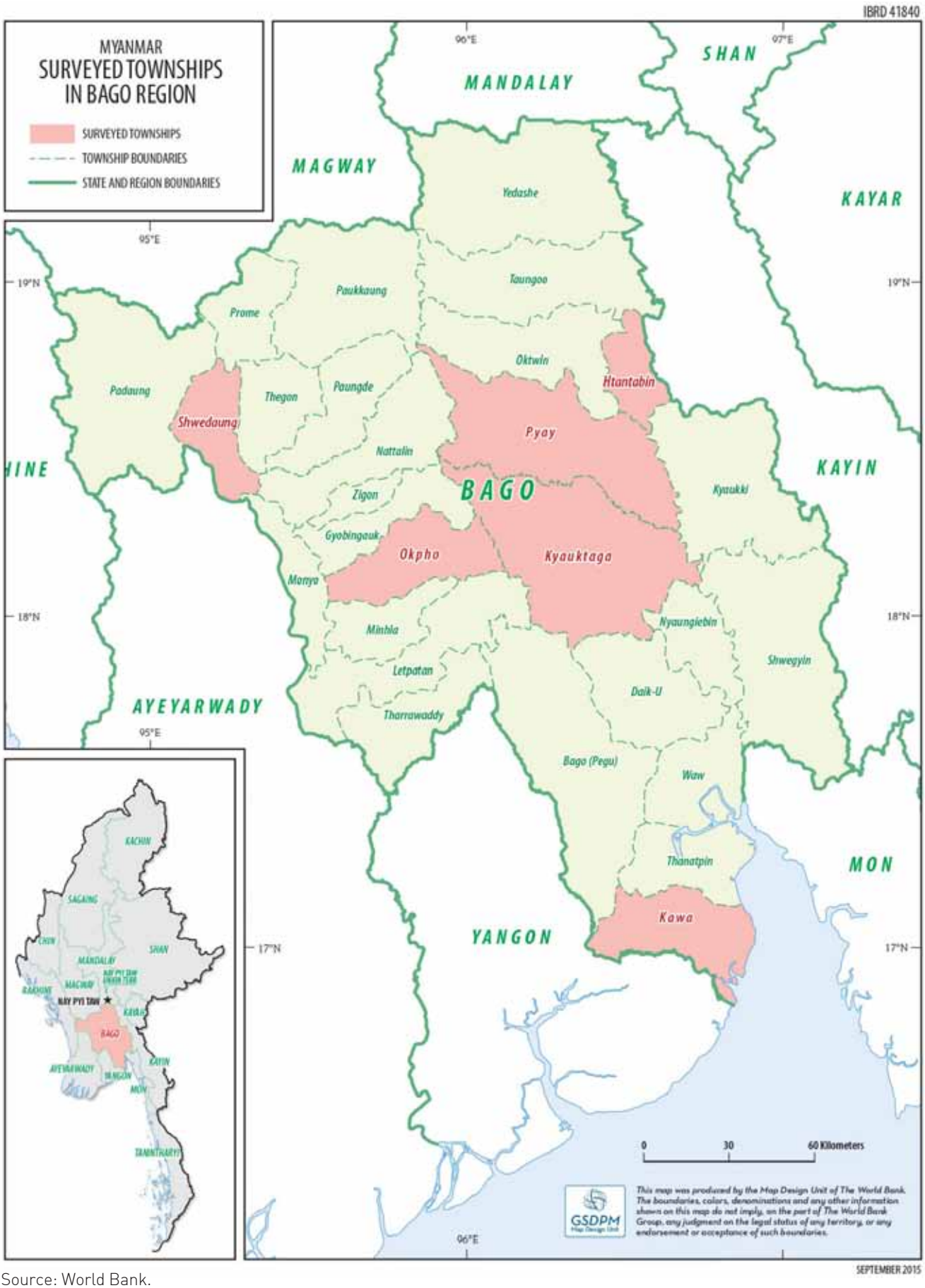
Source: World Bank.

FIGURE 52: MAP OF SURVEYED DISTRICTS IN AYEYARWADY REGION



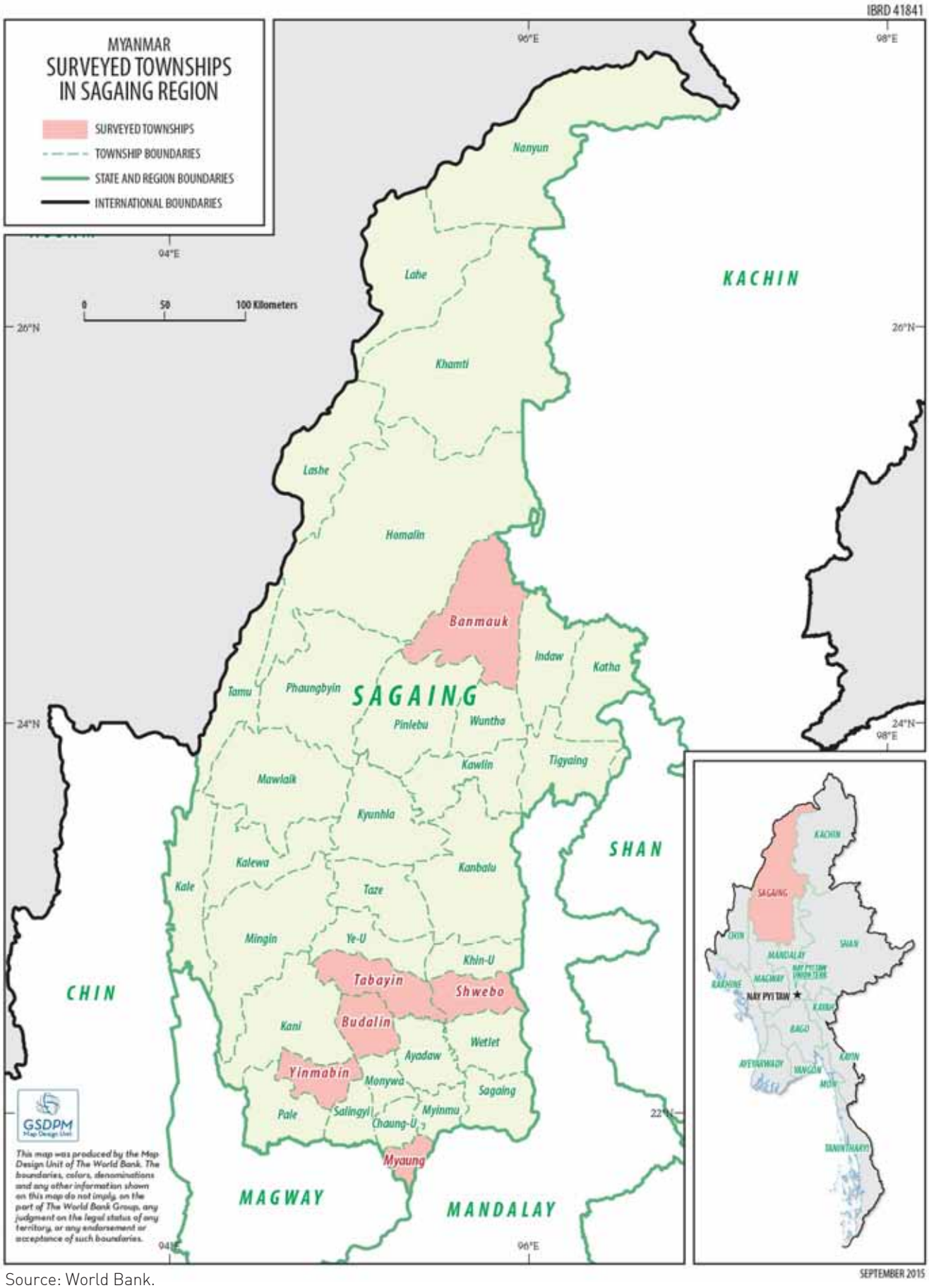
Source: World Bank.

FIGURE 53: MAP OF SURVEYED DISTRICTS IN BAGO REGION



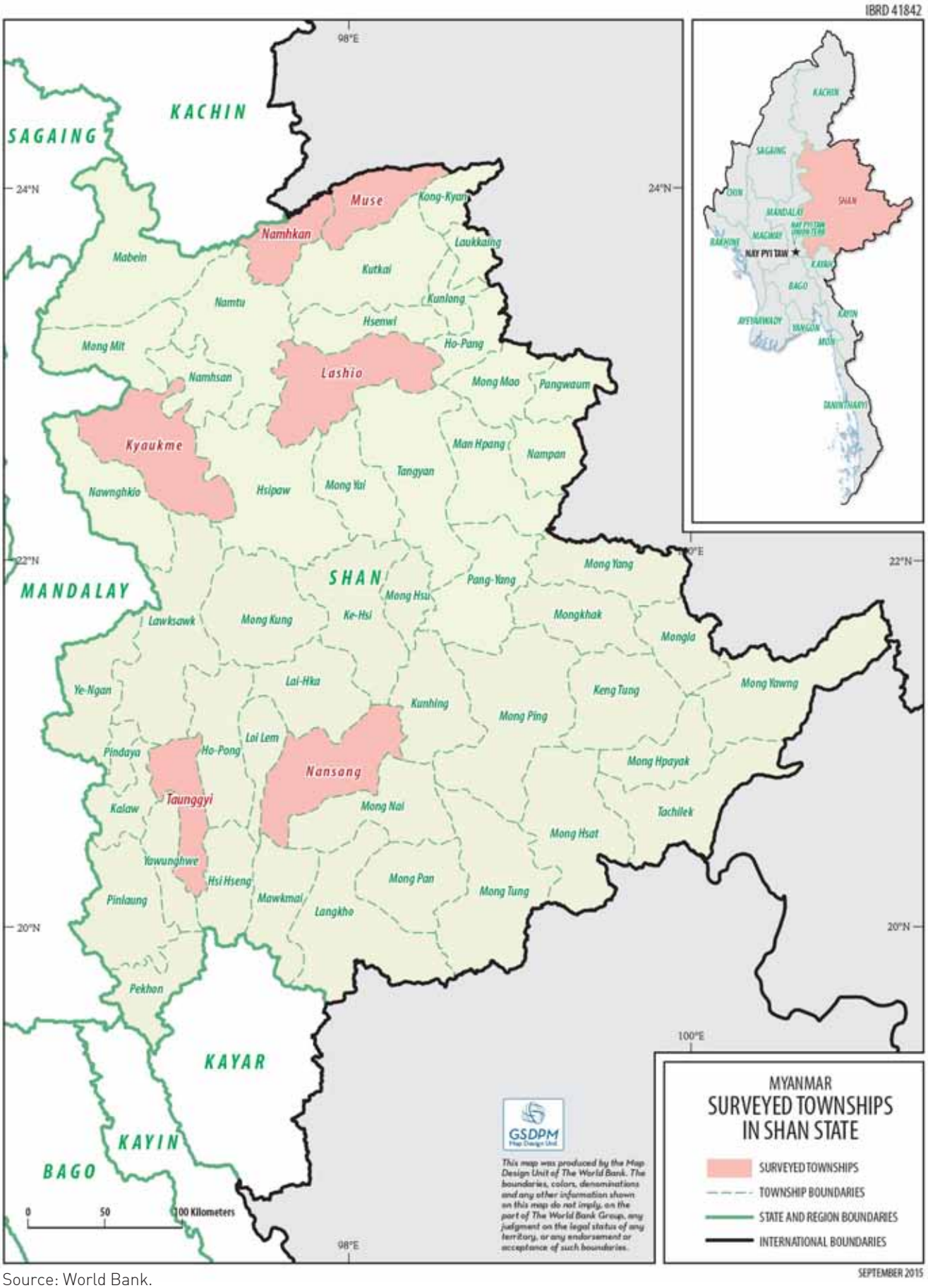
Source: World Bank.

FIGURE 54: MAP OF SURVEYED DISTRICTS IN SAGAING REGION



Source: World Bank.

FIGURE 55: MAP OF SURVEYED DISTRICTS IN SHAN STATE



Source: World Bank.

Characteristics of the survey areas

9 **The dwelling mode for the sampled households is to have a one-story house, with the floor level used to store equipment and keep livestock.** The proportions of households having a dwelling with two levels were as low as 18 percent in Ayeyarwady to as high as 52 percent in Shan State (Table 42A). About two out of three farmers in Muse, Taungoo, and Taunggyi mainly lived in a two-story house. However at the low end, between few and 10 percent of the sampled households still lived in a hut; these were concentrated in Ayeyarwady, especially in the saltwater ecoregion (24 percent), of which 29 percent were in Pyapon and 19 percent in Labutta. Gender did not affect the type of dwelling.

10 **Dwellings' walls are often made of wood and bamboo though stone is used more in Shan State.** For the roof, more than 70 percent of households in every region use zinc and tin; and for the floor, brick and cement are the most used material (Table 43A). Shan State is characterized by more households using wood (64 percent) and bamboo (11 percent) as floor even though their walls are made of cement and brick. About one out of three farmers in Sagaing (32 percent) still has bare soil as a floor; the proportion is still high in the district of Shwebo (one out of five) and in the district of Kyaukme (one out of ten).

11 **Wells and boreholes are the most frequently observed infrastructure, although the proportion of each type of water source varies by regions.** Access to public water infrastructure peaks to 88 percent in Ayeyarwady and goes as low as 36 percent in Shan State (Table 40A). A well is a hole or shaft sunk to obtain water. A spring is where water comes naturally to the surface. A borehole is drilled to tap into the water table. In wells, boreholes, and springs, the water goes through some natural filters (clay, sand, and soil) before being used by the population. Borehole is the most common infrastructure in Ayeyarwady and Bago (53 percent and 40 percent of the water sources, respectively). The most rudimentary source of water is rivers, still used by about one in ten farmers, mostly located in Ayeyarwady (27 percent) and Shan State (12 percent). The use of pipe is still limited, with the exception of farmers in the dryland (12 percent) and irrigated tract areas (12 percent) in Sagaing. No sampled farmers in several districts of Ayeyarwady (Hinthada, Maubin, Labutta, and Pyapon) and no households in the district of Pyay in Bago use this type of water infrastructure.

12 **Access to electricity varies greatly across regions.** About 88 percent of farmers in Shan State have access to electricity, more than double the access for farmers in Ayeyarwady (37 percent); and about two out of three in Sagaing and in Bago (Table 45A). The proportion is very low in the freshwater area (district of Hinthada and Maubin at 29 percent) and in the saltwater area (district of Pyapon and Labutta at 34 percent). For the source of electricity, public grid distribution and private generator dominate in Ayeyarwady and Bago; public and community distribution in Sagaing; and public grid in Shan State (more than 68 percent). However, the data do not show the share of farmers unable to access electricity even when the service is available at the village level. Producing own electricity is common in five ecoregions: southern interior, northern interior, river areas, saltwater, and west alluvial. In these cases, most farmers use a fuel generator to produce electricity.

13 **The survey uses four measures to assess the access to services by households: social service through access to the nearest health clinics and source of drinking water used, and economic services through access to markets and access to the nearest public transportation.** Access was assessed both by the time spent to reach these services and by the distance in kilometers. For the analysis, however, the consultant team used the time spent since the distance may be misleading because of different means of transportation, which in turn is related to the quality of the road infrastructure.

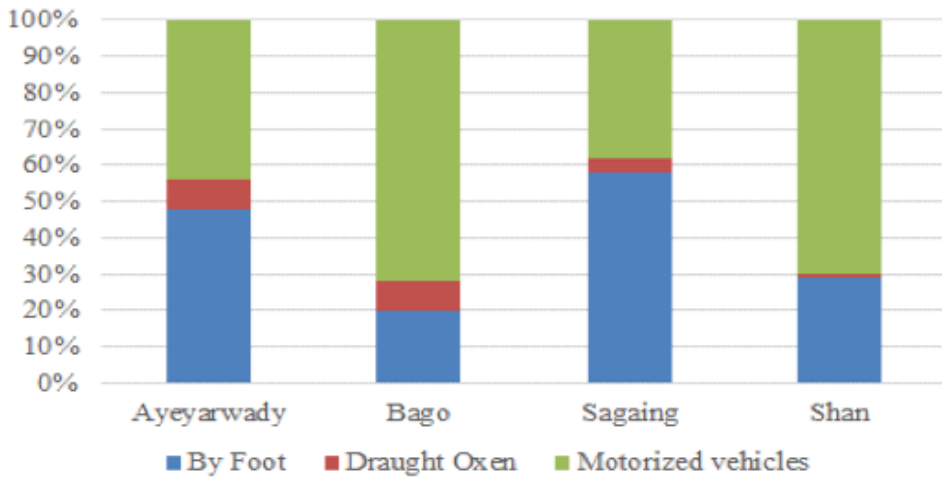
14 **Farmers spent about 30 minutes to reach the nearest health clinic, 15-30 minutes to the nearest transportation station, 25-30 minutes to the market, and 1-10 minutes to the water source.** The times to access health clinics are essentially the same for all regions, ranging from 23 minutes in Shan State to 33 minutes in Bago (Table 46A). Even across ecoregions, no huge disparities are found. Some households need more time but the proportion of such households remain low (e.g., less than 5 percent of households spent more than two hours to reach the nearest health clinic).

15 **The average time to access a water source ranges between one minute (Bago) and nine minutes (Ayeyarwady).** Less than 2 percent of the sampled households spend more than 30 minutes to get their water. Most of these households are located in the districts of Labutta and Pyapon in the saltwater ecoregion and in the district of Loilen in the southern interior ecoregion.

16 **The average time to get to the preferred market ranges between 25-32 minutes.** Access to market is a critical factor for agricultural production, both for input supply and output sales. Figure 56 shows that the time to get transportation is pretty much similar for all four regions. However, if one needs public transportation such as a taxi, then Sagaing has the highest time at more than 30 minutes, almost double the figures for other regions. The time spent to reach the nearest clinic is also very close to the duration to get to market, denoting a critical issue on the access to health service providers.

17 **Motorized vehicles (cars and motorcycles) are the most frequently used means of transportation for farmers in Bago and Shan State.** Farmers in Ayeyarwady and Sagaing still rely more on foot to get to their preferred market places. About 10 percent of farmers in Bago and Ayeyarwady use oxcart for their transportation; this percentage drops below 2 percent for households in Sagaing and Shan State. There are about 34,000 km of roads for a country larger than 653,000 square kilometers (i.e., 0.05 km of road per square kilometer of land). Most roads are in poor condition, with only 358 km of expressway. Waterways are about 12,800 km but not all major towns can be reached this way. Myanmar also has about 5,000 km of railways but they are in poor condition.

FIGURE 56: MEANS OF TRANSPORTATION TO MARKET BY REGION



Source: 2013/14 Myanmar agricultural survey.

TABLE 42: DISTRIBUTION OF HOUSEHOLDS BY SIZE OF MAIN DWELLING

In percent from total HH number

	N	2 stores	1 store	hut
BY REGION				
Ayeyarwady	**480**	**18**	**72**	**10**
Brackish water	160	20	76	4
Freshwater	160	24	73	3
Saltwater	160	10	66	24
Bago	**384**	**51**	**48**	**1**
East alluvial	128	55	43	2
West alluvial	128	50	50	0
River area	128	49	51	0
Sagaing	**504**	**39**	**61**	**0**
Dryland	168	58	42	0
Irrigated tract	168	26	73	1
River area	168	32	68	0
Shan State	**360**	**52**	**47**	**1**
Border area	120	73	27	0
Northern interior	120	40	57	3
Southern interior	120	41	57	2
BY FARM SIZE				
Ayeyarwady				
Small	143	10	76	15
Medium	168	13	76	11
Large	169	31	64	5
Bago				
Small	98	40	59	1
Medium	144	48	52	0
Large	142	63	37	1
Sagaing				
Small	158	21	78	1
Medium	174	36	64	0
Large	172	59	41	0
Shan State				
Small	183	56	43	2
Medium	97	46	53	1
Large	80	49	50	1
BY SEX				
Female	225	38	59	3
Male	1,503	39	58	3

TABLE 43: DISTRIBUTION OF HOUSEHOLDS BY ROOF AND WALL MATERIALS

In percent from total HH number

	Roof Zinc	Wall stone	Wall wood	Wall bamboo	Wall other
BY REGION					
Ayeyarwady	**70**	**10**	**43**	**30**	**17**
Brackish water	89	11	51	36	3
Freshwater	90	15	51	26	8
Saltwater	31	5	26	29	39
Bago	**82**	**21**	**38**	**38**	**3**
East alluvial	76	29	20	48	2
West alluvial	91	7	55	36	2
River area	80	28	37	30	5
Sagaing	**81**	**16**	**35**	**39**	**10**
Dryland	82	23	38	32	8
Irrigated tract	80	15	24	48	13
River area	80	10	44	37	9
Shan State	**97**	**48**	**9**	**40**	**3**
Border area	100	48	7	38	8
Northern interior	93	52	6	43	0
Southern interior	98	45	15	40	0
BY FARM SIZE					
Ayeyarwady					
Small	71	6	36	41	16
Medium	67	5	42	32	21
Large	71	18	49	19	14
Bago					
Small	69	13	23	60	3
Medium	78	14	44	38	4
Large	95	35	40	24	1
Sagaing					
Small	78	8	44	34	14
Medium	78	13	28	49	10
Large	86	27	34	34	5
Shan State					
Small	97	46	6	43	5
Medium	95	46	13	40	0
Large	99	54	11	35	0
BY SEX					
Female	83	21	38	31	9
Male	81	22	31	38	9

TABLE 44: DISTRIBUTION OF HOUSEHOLDS BY MAIN SOURCE OF WATER

In percent from total HH number

	Pipe	Well	Spring	Borehole	Other
BY REGION					
Ayeyarwady	**0**	**19**	**1**	**53**	**27**
Brackish water	1	16	0	83	1
Freshwater	0	18	0	73	9
Saltwater	0	22	3	04	71
Bago	**2**	**50**	**0**	**40**	**8**
East alluvial	2	41	0	56	1
West alluvial	1	62	0	36	2
River area	2	47	0	28	23
Sagaing	**12**	**63**	**0**	**22**	**3**
Dryland	22	46	0	27	5
Irrigated tract	12	63	1	24	1
River area	3	79	0	14	4
Shan State	**2**	**59**	**17**	**11**	**12**
Border area	1	64	30	5	0
Northern interior	2	71	17	0	1
Southern interior	3	42	4	18	34
BY FARM SIZE					
Ayeyarwady					
Small	0	18	1	63	17
Medium	1	20	1	54	26
Large	0	18	1	44	37
Bago					
Small	2	51	0	40	7
Medium	0	53	0	38	9
Large	4	46	0	42	8
Sagaing					
Small	11	66	0	19	4
Medium	11	64	1	22	3
Large	15	58	0	24	3
Shan State					
Small	2	64	21	6	6
Medium	1	55	18	11	15
Large	1	51	6	21	20
BY SEX					
Female	8	49	2	30	11
Male	4	46	4	33	13

TABLE 45: DISTRIBUTION OF HOUSEHOLDS BY MAIN SOURCE OF ELECTRICITY

In percent from total HH number

	No electricity	With electricity	Public	Private	Community
BY REGION					
Ayeyarwady	**63**	**37**	**13**	**15**	**9**
Brackish water	52	48	34	09	5
Freshwater	71	29	6	14	9
Saltwater	66	34	0	21	14
Bago	**34**	**66**	**27**	**20**	**19**
East alluvial	25	75	34	16	25
West alluvial	45	55	23	21	11
River area	33	67	23	24	20
Sagaing	**32**	**68**	**26**	**16**	**26**
Dryland	26	74	35	14	24
Irrigated tract	30	70	42	08	19
River area	38	62	0	26	36
Shan State	**12**	**88**	**59**	**23**	**6**
Border area	1	99	86	1	13
Northern interior	8	92	61	31	0
Southern interior	28	73	32	36	5
BY FARM SIZE					
Ayeyarwady					
Small	75	25	10	8	7
Medium	64	36	15	13	8
Large	51	49	14	22	13
Bago					
Small	40	60	16	22	21
Medium	38	63	24	17	21
Large	27	73	37	22	15
Sagaing					
Small	39	61	20	13	28
Medium	33	67	29	16	22
Large	23	77	27	20	30
Shan State					
Small	5	95	74	11	9
Medium	20	80	46	32	2
Large	19	81	41	36	4
BY SEX					
Male	36	64	29	19	15
Female	40	60	30	11	20

TABLE 46: TIME SPENT IN MINUTES TO REACH SPECIFIC SERVICES

In percent from total HH number

	Clinic	Taxi	Market	Water
BY REGION				
Ayeyarwady	31.1	15.6	27.8	8.9
Brackish water	28.2	12.4	19.6	4.1
Freshwater	29.0	12.6	26.7	7.5
Saltwater	36.1	21.9	36.9	15.2
Bago	33.4	16.3	31.8	1.0
East alluvial	34.0	15.8	34.9	0.4
West alluvial	32.5	15.0	34.4	1.3
River area	33.6	18.0	26.1	1.3
Sagaing	28.1	32.9	30.3	3.1
Dryland	25.8	21.7	20.0	1.9
Irrigated tract	29.1	34.1	34.4	2.8
River area	29.4	43.0	36.4	4.6
Shan State	**23.1**	**14.1**	**25.9**	**5.0**
Border area	21.5	7.8	20.5	1.7
Northern interior	24.2	5.8	24.2	2.8
Southern interior	23.8	28.8	32.8	10.7
BY FARM SIZE				
Ayeyarwady				
Small	29.9	14.7	24.3	7.8
Medium	33.6	18.0	30.6	9.0
Large	29.7	14.0	27.8	9.8
Bago				
Small	33.5	17.0	30.8	1.2
Medium	32.8	16.5	32.6	1.0
Large	33.8	15.5	31.6	0.8
Sagaing				
Small	30.9	39.6	34.7	3.9
Medium	25.7	31.2	29.0	3.1
Large	28.0	28.5	27.5	2.5
Shan State				
Small	20.6	8.9	21.0	2.5
Medium	21.5	16.1	27.3	5.7
Large	31.1	23.5	35.1	10.0
BY SEX				
Male	29.4	20.4	28.8	4.6
Female	27.2	21.2	30.2	5.0

ANNEX 2: CONVERSION FACTORS

1 **Conversion rates in Myanmar vary by region and by the actor involved.** For example, a farmer may quote productivity in baskets (volume), but a trader or wholesaler deals in weights and metric units. Enumerators for the data collection were trained on the commonly quoted units by all actors in the market chain, as well as on rough formulas for how to convert and ask clarifying questions if needed. The interviewers recorded the data exactly as farmers reported them, and the actual conversions were completed in the head office in Yangon with the data team to minimize conversion errors. The conversion factors are presented below.

TABLE 47: TRADERS' STANDARDIZED CONVERSIONS FROM LOCAL UNITS BY CROP

SN	CROP	Equivalent weight per local basket			Regional weight (viss) basis/bag for wholesale market					
		lbs/ basket	kg/ basket	Basket/ ton	Yangon	Man-dalay	Pyay	Pakoku	Monywa	Taung-gyi
1	Paddy	46	20.87	47.92						
2	Rice	75	34.02	29.39	30	30	30	30	20	30
3	Wheat	72	32.66	30.62						
4	Black gram	72	32.66	30.62	60	60	20		20	
5	Green gram	72	32.66	30.62	60	56.25	20	19	19	
6	Pigeonpea	72	32.66	30.62		60	20	20	20	
7	Chickpea	69	31.3	31.95	57.25	20	19	19		
8	Cow pea	72	32.66	30.62	60	60	20	19		
9	Rice bean	72	32.66	30.62		60		20	20	
10	Sultini	69	31.3	31.95						
11	Sultapya	69	31.3	31.95						
12	Butterbean	69	31.3	31.95		56.25	20	19	19	
13	Soybean	72	32.66	30.62	60	53.25	20		18	
14	Pebyugalay	69	31.3	31.95						
15	Pegyi (Dolichos lablab	69	31.3	31.95	60	55.25	20	19	19	
16	Pegya	69	31.3	31.95						
17	Garden pea	72	32.66	30.62	60	59.25	20	20	20	
18	Lentil	72	32.66	30.62						
19	Pe nauk	72	32.66	30.62						
20	Kidney bean	69	31.3	31.95		54			18	
21	Bocate	72	32.66	30.62	60		20			
22	Maize (Corn)	55	24.95	40.08						
23	Sesame	54	24.49	40.83	45	45	15	15		
24	Groundnut- pod	25	11.34	88.18						
25	Groundnut- kernal	50-55	22.93	43.61						
26	Sunflower	32.4	14.51	68.89	27				9	

Note: 1 viss = 3.6 lbs (1.63 kg) for all crops except rice; 1 viss of rice = 3.75 lbs; standard packing basis for milled rice: 1.5 basket = 30 viss; 1 basket = 16 pyi.

2 **Other conversions are presented below.**

TABLE 48: PROCESSING RATIOS FOR EDIBLE OILSEED CROPS

crop	feed stock (viss)	oil outturn (viss)	process ratio (Percent)
Groundnut seeds	100	35.38	35.38
Sesame	15	7.1	47
Sunflower	9	2.75	30.6

FERTILIZERS

Type of fertilizer	Nutrient content	Size
Urea	46 % N	50 kg bag
TSP (T-Super)	46 % P2 O5	50 kg bag
MOP (Potash)	60 % K2 O	50 kg bag
NPK		50 kg bag

Liquid measure: 1 gallon = 320 tablespoons

Customary land area measurement unit in Delta Zone villages

1 acre = 12 plots

1 plot = 10 bamboo pole length squared

1 bamboo pole length = 6 feet

12 plots = 43,200 square feet (ca. 1 acre, 43560 square feet)

Standard measured paddy field plot = 16 plots for one unit field

1 Khwat = 16 plots

ANNEX 3: FARM LAND

TABLE 49: AVERAGE FARM AND PLOT SIZE

	Average farm size (acres)*	Average farm size (Ha)	Average main plot size (acres)*	Average main plot size (Ha)
BY REGION				
Ayeyarwady	8.55	3.46	5.85	2.37
Brackish water	7.19	2.91	4.83	1.96
Freshwater	6.65	2.69	3.93	1.59
Saltwater	11.80	4.78	9.84	3.98
Bago	8.87	3.59	4.85	1.96
East alluvial	9.07	3.67	5.05	2.04
West alluvial	7.55	3.06	3.78	1.53
River area	9.99	4.04	5.92	2.40
Sagaing	8.91	3.61	3.53	1.43
Dryland	10.58	4.28	3.93	1.59
Irrigated tract	7.57	3.06	3.27	1.32
River area	8.59	3.48	3.33	1.35
Shan State	6.31	2.55	3.01	1.22
Border area	2.12	0.86	1.76	0.71
Northern interior	6.11	2.47	2.78	1.12
Southern interior	10.69	4.32	3.71	1.50
BY FARM SIZE				
Ayeyarwady				
Small	2.83	1.15	2.21	0.89
Medium	6.63	2.68	5.00	2.02
Large	15.29	6.19	8.76	3.55
Bago				
Small	3.01	1.22	2.19	0.89
Medium	6.69	2.71	3.75	1.52
Large	15.13	6.12	6.93	2.80
Sagaing				
Small	2.72	1.10	1.68	0.68
Medium	6.75	2.73	2.63	1.07
Large	16.79	6.79	5.04	2.04
Shan State				
Small	2.21	0.90	1.79	0.72
Medium	6.66	2.69	2.76	1.12
Large	15.25	6.17	4.14	1.67
BY SEX				
Male	8.33	3.37	4.19	1.70
Female	7.79	3.15	3.95	1.60
OVERALL	8.26	3.34	4.16	1.68

* Average farm size based on 1,728 farms.
* Average plot size based on 3,432 plots.

TABLE 50: NUMBER OF PARCELS PER FARM BY CATEGORY

In percent from total HH number

	N	One parcel	2 parcels	3 parcels	4 or more parcels
BY REGION					
Ayeyarwady	701	68	17	5	9
Brackish water	238	67	23	7	3
Freshwater	271	59	18	6	17
Saltwater	192	83	10	3	04
Bago	702	55	30	12	4
East alluvial	230	56	30	10	4
West alluvial	256	50	31	15	4
River area	216	59	29	9	3
Sagaing	1,274	40	30	18	12
Dryland	452	37	30	19	14
Irrigated tract	389	43	31	17	9
River area	433	39	30	19	12
Shan State	755	48	26	14	12
Border area	145	83	14	3	0
Northern interior	264	45	30	15	10
Southern interior	346	35	29	19	18
BY FARM SIZE					
Ayeyarwady					
Small	183	78	9	2	11
Medium	223	75	15	2	7
Large	295	57	24	10	9
Bago					
Small	135	73	22	4	1
Medium	257	56	30	12	1
Large	310	45	33	15	7
Sagaing					
Small	255	62	28	8	2
Medium	446	39	32	20	9
Large	573	30	30	22	18
Shan State					
Small	226	81	16	3	0
Medium	234	41	35	15	8
Large	295	27	27	22	24
BY SEX					
Male	2,988	50	27	13	10
Female	444	51	25	15	9

TABLE 51: PROPORTION OF PARCELS BY PLOT SIZE

In percent from total HH number

	Less than 1 acre	Between 1 and 2.5 acres	Between 2.6 and 5 acres	Between 5 and 10 acres	More than 10 acres
BY REGION					
Ayeyarwady	12	16	30	28	14
Brackish water	9	22	35	27	6
Freshwater	23	20	30	23	5
Saltwater	2	3	22	37	36
Bago	12	25	34	21	9
East alluvial	13	26	28	23	10
West alluvial	13	28	39	17	3
River area	8	21	34	23	14
Sagaing	17	34	31	15	3
Dryland	12	28	37	19	4
Irrigated tract	18	38	30	12	2
River area	21	36	26	13	4
Shan State	18	37	34	8	1
Border area	35	50	14	1	0
Northern interior	18	40	34	7	0
Southern interior	11	30	43	13	3
BY FARM SIZE					
Ayeyarwady					
Small	27	30	43	0	0
Medium	8	11	32	49	0
Large	6	11	19	30	33
Bago					
Small	27	39	33	0	0
Medium	12	26	40	23	0
Large	5	18	29	28	19
Sagaing					
Small	35	46	18	0	0
Medium	20	38	35	8	0
Large	7	25	34	27	7
Shan State					
Small	32	52	16	0	0
Medium	16	37	42	5	0
Large	9	27	43	18	4
BY SEX					
Male	15	29	32	17	6
Female	16	31	29	21	4

TABLE 52: PAYMENT FOR LAND (TO LESSORS AND TAXES) BY CATEGORY

	% of HHs leasing land and paying lease	Average leasing payment ($/acre)	% of HHs paying land tax	Average tax paid ($)
BY REGION				
Ayeyarwady	0		65	0.51
Brackish water	0		60	0.48
Freshwater	0		58	0.36
Saltwater	0		81	0.70
Bago	1	333.31	0	0.72
East alluvial	3	333.31	0	0.72
West alluvial	0		0	
River area	0		0	
Sagaing	1	75.86	24	3.93
Dryland	2	27.29	35	5.37
Irrigated tract	1	97.38	19	1.38
River area	1	183.86	16	3.36
Shan State	3	340.53	31	0.15
Border area	7	481.61	9	0.44
Northern interior	4	172.83	8	0.07
Southern interior	1	393.77	58	0.13
BY FARM SIZE				
Ayeyarwady				
Small	0		59	0.26
Medium	0		65	0.49
Large	0		68	0.67
Bago				
Small	1	278.86	0	
Medium	2	212.04	0	0.72
Large	0	1,115.42	0	
Sagaing				
Small	2	174.67	26	4.47
Medium	1	58.22	23	2.66
Large	1	3.51	24	4.59
Shan State				
Small	4	366.93	14	0.22
Medium	3	323.54	28	0.20
Large	3	327.82	47	0.10
BY SEX				
Male	2	261.70	28	1.48
Female	0	232.64	33	1.38

TABLE 53: LAND USERS' RIGHT CERTIFICATE AND OTHER DOCUMENTS BY CATEGORY

In percent from total HH number

	N	With Certificate	Request for Certificate	Paper from local authorities	Overall with documents
BY REGION					
Ayeyarwady	701	47	13	27	87
Brackish water	238	46	5	42	93
Freshwater	271	41	19	25	86
Saltwater	192	55	14	11	80
Bago	702	21	9	69	98
East alluvial	230	20	12	65	97
West alluvial	256	18	9	72	99
River area	216	25	6	69	99
Sagaing	1,274	88	5	4	97
Dryland	452	91	4	2	97
Irrigated tract	389	91	5	1	97
River area	433	82	6	9	96
Shan State	755	44	7	6	57
Border area	145	66	4	7	77
Northern interior	264	37	5	9	51
Southern interior	346	40	9	3	52
BY FARM SIZE					
Ayeyarwady					
Small	183	49	11	26	86
Medium	223	47	11	26	84
Large	295	45	15	28	89
Bago					
Small	135	17	16	67	100
Medium	257	16	6	77	98
Large	310	26	9	62	97
Sagaing					
Small	255	86	3	5	94
Medium	446	84	9	2	96
Large	573	92	3	4	98
Shan State					
Small	226	56	4	4	65
Medium	234	38	6	10	54
Large	295	41	8	3	53
BY SEX					
Male	2,988	55	8	23	86
Female	444	66	6	17	89

TABLE 54: MODE OF LAND ACQUISITION BY CATEGORY

In percent from total HH number

	N	Inheritance	Purchase	Other
BY REGION				
Ayeyarwady	701	46	52	2
Brackish water	238	40	58	2
Freshwater	271	48	51	1
Saltwater	192	49	47	3
Bago	702	42	55	2
East alluvial	230	45	47	5
West alluvial	256	45	53	0
River area	216	33	66	1
Sagaing	1,274	76	20	2
Dryland	452	74	21	1
Irrigated tract	389	76	21	2
River area	433	77	17	2
Shan State	755	58	19	18
Border area	145	77	12	2
Northern interior	264	56	17	20
Southern interior	346	52	23	23
BY FARM SIZE				
Ayeyarwady				
Small	183	44	54	2
Medium	223	55	43	1
Large	295	40	58	2
Bago				
Small	135	44	51	4
Medium	257	46	51	1
Large	310	37	59	2
Sagaing				
Small	255	79	17	3
Medium	446	72	22	3
Large	573	77	20	0
Shan State				
Small	226	73	14	5
Medium	234	53	21	21
Large	295	51	20	26
BY SEX				
Male	2,988	56	35	6
Female	444	73	23	2

TABLE 55: YEARS OF LAND ACQUISITION BY CATEGORY

In percent from total HH number

	Before 1980	1981-1990	1991-2000	2001-2005	2005-2013
BY REGION					
Ayeyarwady	19	22	24	14	21
Brackish water	22	22	18	17	21
Freshwater	20	20	22	13	25
Saltwater	15	25	32	13	15
Bago	22	26	23	15	12
East alluvial	20	25	20	19	13
West alluvial	24	26	27	12	9
River area	21	28	20	14	16
Sagaing	35	22	22	9	10
Dryland	38	23	14	11	10
Irrigated tract	33	22	25	9	11
River area	34	20	28	6	10
Shan State	18	20	27	13	17
Border area	23	22	17	11	18
Northern interior	17	16	33	11	16
Southern interior	16	21	27	15	18
BY FARM SIZE					
Ayeyarwady					
Small	17	20	20	14	28
Medium	22	21	25	15	17
Large	18	24	25	14	19
Bago					
Small	20	26	17	19	17
Medium	25	23	23	18	11
Large	21	29	25	11	12
Sagaing					
Small	28	18	27	8	18
Medium	32	16	25	13	10
Large	40	27	17	5	7
Shan State					
Small	18	20	21	12	22
Medium	20	18	28	13	15
Large	16	20	31	14	16
BY SEX					
Male	25	22	24	12	14
Female	30	24	19	9	17

TABLE 56: USE OF PLOTS AS COLLATERAL FOR LOANS BY CATEGORY

	Can use plot as collateral, %	Had used plot as collateral, %	Had land conflict, %	Plot under the responsibility of HH Head, %
BY REGION				
Ayeyarwady	89	3	1	86
Brackish water	97	1	0	82
Freshwater	88	1	0	86
Saltwater	79	7	5	90
Bago	95	2	2	91
East alluvial	93	1	3	92
West alluvial	98	5	0	92
River area	94	0	3	88
Sagaing	97	3	2	87
Dryland	97	3	0	88
Irrigated tract	99	3	0	85
River area	95	3	5	87
Shan State	81	3	1	94
Border area	86	0	1	92
Northern interior	83	3	0	95
Southern interior	78	3	2	95
BY FARM SIZE				
Ayeyarwady				
Small	93	3	1	92
Medium	90	3	0	86
Large	85	3	3	82
Bago				
Small	93	4	1	84
Medium	98	2	4	95
Large	95	2	0	91
Sagaing				
Small	95	3	6	84
Medium	95	5	1	90
Large	99	2	0	86
Shan State				
Small	84	0	1	94
Medium	79	3	2	93
Large	81	4	1	95
BY SEX				
Male	91	3	1	91
Female	95	4	3	78

TABLE 57: LOCATION OF PARCELS AND EXPOSURE TO EROSION BY CATEGORY

	Location of parcels, %			Erosion status, %	
	Lowland	Upland	Kailand	Flat slope	Eroded plot
BY REGION					
Ayeyarwady	95	4	1	91	9
Brackish water	99	0	0	95	5
Freshwater	88	9	3	92	2
Saltwater	99	1	0	84	18
Bago	99	1	0	82	4
East alluvial	100	0	0	80	6
West alluvial	98	2		84	2
River area	98	2	0	82	5
Sagaing	54	39	7	93	9
Dryland	54	46	0	97	5
Irrigated tract	70	28	2	92	8
River area	38	44	18	90	16
Shan State	40	59	1	67	18
Border area	92	7	1	83	13
Northern interior	36	64	0	51	21
Southern interior	22	77	1	73	17
BY FARM SIZE					
Ayeyarwady					
Small	92	5	3	96	4
Medium	95	4	1	90	9
Large	97	3	0	89	8
Bago					
Small	100	0	0	87	5
Medium	98	2	0	80	3
Large	98	2	0	82	4
Sagaing					
Small	80	15	5	89	11
Medium	59	36	5	94	12
Large	38	53	9	94	6
Shan State					
Small	71	28	0	75	15
Medium	30	70	0	55	24
Large	25	74	1	71	14
BY SEX					
Male	70	27	3	84	10
Female	58	38	4	89	9

TABLE 58: TYPE OF SOILS BY CATEGORY

In percent of all soil types

	N	Loamy	Clay	Sandy
BY REGION				
Ayeyarwady	701	27	64	9
Brackish water	238	39	48	12
Freshwater	271	31	57	12
Saltwater	192	5	94	1
Bago	702	41	47	12
East alluvial	230	53	31	15
West alluvial	256	43	47	10
River area	216	24	63	13
Sagaing	1,274	22	63	15
Dryland	452	16	75	9
Irrigated tract	389	29	68	3
River area	433	21	48	31
Shan State	755	7	53	40
Border area	145	4	88	8
Northern interior	264	3	47	50
Southern interior	346	11	44	45
BY FARM SIZE				
Ayeyarwady				
Small	183	30	57	13
Medium	223	25	67	8
Large	295	26	67	7
Bago				
Small	135	36	55	10
Medium	257	48	39	14
Large	310	37	51	13
Sagaing				
Small	255	22	75	4
Medium	446	25	61	14
Large	573	19	60	21
Shan State				
Small	226	4	73	23
Medium	234	8	48	44
Large	295	8	43	48
BY SEX				
Male	2,988	23	58	19
Female	444	24	59	17

TABLE 59: WATER IRRIGATION BY SEASON AND CATEGORY

	No. of HHs using irrigation in wet season	% of land area irrigated in wet season	No. of HHs using irrigation in cool season	% of land area irrigated in cool season	No. of HHs using irrigation in dry season	% of land area irrigated in dry season
BY REGION						
Ayeyarwady	693	2	377	3	14	50
Brackish water	236	1	231	3	0	0
Freshwater	267	5	138	5	11	64
Saltwater	190	1	8	0	3	0
Bago	695	5	676	2	118	6
East alluvial	228	1	227	0	71	0
West alluvial	254	8	238	2	28	14
River area	213	6	211	6	19	16
Sagaing	1,132	62	841	45	572	59
Dryland	422	65	268	39	288	66
Irrigated tract	347	85	227	72	156	90
River area	363	36	346	32	128	3
Shan State	742	23	103	28	198	66
Border area	142	39	16	81	122	95
Northern interior	256	28	18	44	18	67
Southern interior	344	14	69	12	58	5
BY FARM SIZE						
Ayeyarwady						
Small	180	3	96	4	6	50
Medium	221	1	131	5	3	100
Large	292	3	150	2	5	20
Bago						
Small	135	2	132	2	27	15
Medium	256	7	247	2	44	2
Large	304	5	297	3	47	4
Sagaing						
Small	243	80	165	66	118	64
Medium	399	65	274	46	206	60
Large	490	50	402	36	248	55
Shan State						
Small	220	36	20	75	124	93
Medium	233	20	18	39	22	59
Large	289	17	65	11	52	6
BY SEX						
Male	2,839	28	1,712	22	765	55
Female	423	28	285	23	137	47

TABLE 60: MAIN SOURCE OF WATER IRRIGATION BY CATEGORY

	% of HHs responded positively	Canal	Well	Rivers	% of HHs with private irrigation
BY REGION					
Ayeyarwady	**4**	**1**	**2**	**0**	**3**
Brackish water	3	0	3	0	3
Freshwater	8	2	5	1	5
Saltwater	1	0	0	1	0
Bago	**7**	**4**	**2**	**1**	**2**
East alluvial	1	1	0	0	0
West alluvial	8	7	0	1	0
River area	12	5	6	2	6
Sagaing	**65**	**37**	**11**	**17**	**8**
Dryland	70	59	2	10	1
Irrigated tract	88	36	32	20	24
River area	38	15	1	21	1
Shan State	**35**	**6**	**8**	**21**	**8**
Border area	94	0	41	53	40
Northern interior	30	6	0	23	0
Southern interior	15	9	0	6	0
BY FARM SIZE					
Ayeyarwady					
Small	5	1	3	1	3
Medium	4	0	4	0	4
Large	3	1	2	0	2
Bago					
Small	2	0	0	2	
Medium	9	7	2	1	1
Large	7	4	3	1	3
Sagaing					
Small	80	47	9	24	7
Medium	70	39	12	19	9
Large	54	31	11	12	8
Shan State					
Small	68	3	25	40	24
Medium	24	2	1	21	1
Large	19	12	0	6	
BY SEX					
Male	34	16	7	11	6
Female	36	20	5	12	4

TABLE 61: USE OF WATER PUMPS FOR IRRIGATION BY CATEGORY

	% of HHs provided response	% of water pump users out of households provided response	% of motor water pump users	Average power (HP)	% of water pump users out of total number of farms
BY REGION					
Ayeyarwady	4	73	95	9.2	2.7
Brackish water	3	100	86	11.9	2.9
Freshwater	7	63	100	7.0	4.4
Saltwater	0				0
Bago	7	59	93	13.0	4.1
East alluvial	1	100	100	30.5	0.9
West alluvial	8	24	60	13.0	2.0
River area	12	85	100	11.2	10.2
Sagaing	61	22	99	19.3	13.7
Dryland	65	6	100	14.8	4.0
Irrigated tract	86	24	100	18.2	20.6
River area	35	51	99	21.3	17.8
Shan State	35	40	100	12.1	13.8
Border area	94	69	100	12.6	64.8
Northern interior	30	6	100	10.8	1.9
Southern interior	14	11	100	6.4	1.4
BY FARM SIZE					
Ayeyarwady					
Small	4	63	100	8.0	2.7
Medium	4	67	100	10.0	2.7
Large	3	89	88	9.2	2.7
Bago					
Small	2	0			0
Medium	9	52	92	17.4	4.7
Large	7	74	94	10.2	5.5
Sagaing					
Small	80	24	98	20.0	19.6
Medium	66	26	100	20.0	17.3
Large	49	17	100	17.5	8.4
Shan State					
Small	68	55	100	12.7	37.2
Medium	23	30	100	10.5	6.8
Large	19	7	100	8.0	1.4
BY SEX					
Male	32	30	99	15.9	9.7
Female	34	24	100	16.4	8.3

TABLE 62: AVERAGE EXPENSE FOR IRRIGATION BY SEASON

	% of HH with response in wet season	Average expense wet season ($/acre)	% of HH with response in cool season	Average expense cool season ($/acre)	% of HH with response in dry season	Average expense dry season ($/acre)
BY REGION						
Ayeyarwady	1	8.38	1	35.03		4.31
Brackish water	1	4.09	2	39.10		4.09
Freshwater	3	8.86	1	29.95	1	4.43
Saltwater						
Bago	3	12.32	2	8.28	1	10.96
East alluvial	1	8.15				
West alluvial	2	17.73		13.79	1	16.39
River area	6	10.76	5	7.73	1	5.53
Sagaing	19	16.55	11	21.78	6	4.90
Dryland	19	5.71	3	2.93	9	3.49
Irrigated tract	24	24.77	19	29.84	8	7.13
River area	15	19.32	12	15.95		1.10
Shan State	6	11.24	3	22.35	11	45.83
Border area	19	17.99	11	24.52	53	50.66
Northern interior	2	2.03	1	13.28	3	5.04
Southern interior	5	2.31	1	18.20		0.23
BY FARM SIZE						
Ayeyarwady						
Small	2	12.88	2	30.70	1	4.43
Medium	1	1.56	2	36.25		
Large	1	7.29		47.46	1	4.09
Bago						
Small	1	0.26			1	7.66
Medium	4	16.06	2	15.99	1	11.95
Large	3	9.91	2	3.87	1	13.28
Sagaing						
Small	26	16.46	16	16.53	6	2.88
Medium	22	14.28	11	19.40	6	5.96
Large	13	19.60	9	28.44	5	4.93
Shan State						
Small	14	15.79	6	23.50	33	50.97
Medium	2	7.12	3	25.49	4	16.79
Large	5	2.36	1	3.87	1	0.59
BY SEX						
Male	9	15.66	5	23.34	5	27.31
Female	9	12.14	6	12.31	5	15.70

ANNEX 4: FARM HOUSEHOLD LABOR

TABLE 63: BREAKDOWN OF TOTAL INCOME OF HOUSEHOLD HEAD

In percent from total income

	N	Wage earner	Farming	Nonfarm	Others
BY REGION					
Ayeyarwady	480	3	96	1	0
Brackish water	160	3	96	2	0
Freshwater	160	3	97	1	0
Saltwater	160	3	96	2	0
Bago	384	7	91	2	1
East alluvial	128	5	92	2	2
West alluvial	128	9	91	0	0
River area	128	8	89	3	0
Sagaing	504	11	84	5	0
Dryland	168	15	81	4	0
Irrigated tract	168	8	87	5	0
River area	168	10	83	7	0
Shan State	360	3	92	5	0
Border area	120	2	92	7	0
Northern interior	120	0	94	6	0
Southern interior	120	8	89	2	1
BY FARM SIZE					
Ayeyarwady					
Small	143	3	94	3	0
Medium	168	1	99	0	0
Large	169	4	94	2	0
Bago					
Small	98	2	94	4	0
Medium	144	8	89	1	1
Large	142	10	90	0	0
Sagaing					
Small	158	10	78	12	0
Medium	174	9	88	3	0
Large	172	14	85	1	0
Shan State					
Small	183	3	90	7	0
Medium	97	3	95	2	0
Large	80	5	91	3	1
BY SEX					
Male	1,503	6	91	3	0
Female	225	9	88	3	0

TABLE 64: NUMBER OF HOUSEHOLD MEMBERS

	N	Mean	Median	Min	Max
BY REGION					
Ayeyarwady	2,160	5.2	5.0	1.0	11.0
Brackish water	692	5.0	5.0	1.0	10.0
Freshwater	691	4.9	5.0	1.0	10.0
Saltwater	777	5.6	5.0	1.0	11.0
Bago	2,116	6.2	6.0	1.0	15.0
East alluvial	774	6.8	7.0	2.0	15.0
West alluvial	650	5.6	5.0	1.0	9.0
River area	692	6.2	6.0	2.0	13.0
Sagaing	2,636	6.1	6.0	1.0	13.0
Dryland	867	6.0	6.0	1.0	11.0
Irrigated tract	822	5.7	5.0	1.0	13.0
River area	947	6.5	6.0	1.0	13.0
Shan State	1,837	5.9	6.0	2.0	15.0
Border area	661	6.3	6.0	2.0	15.0
Northern interior	586	5.5	5.0	2.0	10.0
Southern interior	590	5.7	5.0	2.0	11.0
BY FARM SIZE					
Ayeyarwady					
Small	613	4.9	5.0	1.0	9.0
Medium	711	5.0	5.0	1.0	10.0
Large	836	5.6	6.0	1.0	11.0
Bago					
Small	474	5.5	5.0	2.0	10.0
Medium	757	5.8	6.0	1.0	12.0
Large	885	6.9	7.0	2.0	15.0
Sagaing					
Small	832	6.2	6.0	1.0	13.0
Medium	873	5.9	6.0	1.0	13.0
Large	931	6.2	6.0	2.0	11.0
Shan State					
Small	932	5.9	5.0	2.0	15.0
Medium	480	5.6	5.0	2.0	10.0
Large	425	6.1	6.0	2.0	11.0
BY SEX					
Female	1,000	5.3	5.0	1.0	11.0
Male	7,749	5.9	6.0	1.0	15.0

TABLE 65: SEX RATIO AND DEPENDENCY RATIO

	N	Sex ratio	Dependency ratio	Proportion of permanent
BY REGION				
Ayeyarwady	2,160	0.47	0.55	0.01
Brackish water	692	0.46	0.59	0.01
Freshwater	691	0.47	0.54	0.01
Saltwater	777	0.49	0.53	0.01
Bago	2,116	0.52	0.48	0.10
East alluvial	774	0.50	0.56	0.07
West alluvial	650	0.57	0.41	0.13
River area	692	0.51	0.46	0.09
Sagaing	2,636	0.46	0.57	0.01
Dryland	867	0.47	0.57	0.01
Irrigated tract	822	0.46	0.49	0.00
River area	947	0.46	0.63	0.01
Shan State	1,837	0.49	0.55	0.01
Border area	661	0.51	0.66	0.00
Northern interior	586	0.49	0.54	0.01
Southern interior	590	0.49	0.44	0.01
BY FARM SIZE				
Ayeyarwady				
Small	613	0.46	0.62	0.00
Medium	711	0.46	0.52	0.01
Large	836	0.50	0.52	0.02
Bago				
Small	474	0.51	0.58	0.03
Medium	757	0.52	0.50	0.09
Large	885	0.53	0.42	0.14
Sagaing				
Small	832	0.46	0.67	0.01
Medium	873	0.46	0.51	0.00
Large	931	0.47	0.52	0.01
Shan State				
Small	932	0.50	0.60	0.01
Medium	480	0.50	0.55	0.00
Large	425	0.49	0.44	0.01
BY SEX				
Female	1,000	0.38	0.50	0.02
Male	7,749	0.50	0.54	0.03

TABLE 66: GENDER AND AGE OF HOUSEHOLD HEAD

	N	Ratio of male-headed	Ratio of female headed	Average age (years)	Median age (years)
BY REGION					
Ayeyarwady	480	0.88	0.12	53.60	52.00
Brackish water	160	0.87	0.13	55.18	54.00
Freshwater	160	0.86	0.14	54.75	53.00
Saltwater	160	0.92	0.08	50.88	51.00
Bago	384	0.92	0.08	52.76	52.00
East alluvial	128	0.89	0.11	51.48	51.50
West alluvial	128	0.93	0.07	54.10	52.00
River area	128	0.95	0.05	52.70	53.50
Sagaing	504	0.82	0.18	54.35	53.00
Dryland	168	0.79	0.21	55.39	54.50
Irrigated tract	168	0.86	0.14	53.87	53.00
River area	168	0.80	0.20	53.79	53.00
Shan State	360	0.88	0.13	50.03	50.00
Border area	120	0.87	0.13	52.18	52.00
Northern interior	120	0.94	0.06	49.84	50.00
Southern interior	120	0.82	0.18	48.06	49.50
BY FARM SIZE					
Ayeyarwady					
Small	143	0.88	0.12	53.10	52.00
Medium	168	0.85	0.15	53.74	52.00
Large	169	0.91	0.09	53.89	54.00
Bago					
Small	98	0.90	0.10	52.47	51.50
Medium	144	0.90	0.10	53.12	53.50
Large	142	0.96	0.04	52.59	52.00
Sagaing					
Small	158	0.77	0.23	53.30	52.50
Medium	174	0.85	0.15	52.99	52.00
Large	172	0.82	0.18	56.69	56.00
Shan State					
Small	183	0.86	0.14	50.63	50.00
Medium	97	0.90	0.10	49.56	50.00
Large	80	0.89	0.11	49.20	50.00

TABLE 67: EDUCATION OF HOUSEHOLD HEAD

In percent from total HH number

	N	No education	Primary education	Secondary education	Tertiary and beyond
BY REGION					
Ayeyarwady	**480**	**12**	**61**	**20**	**7**
Brackish water	160	9	59	20	13
Freshwater	160	13	58	24	6
Saltwater	160	16	67	16	1
Bago	**384**	**4**	**64**	**15**	**17**
East alluvial	128	9	65	9	17
West alluvial	128	2	63	18	16
River area	128	2	64	18	16
Sagaing	**504**	**21**	**62**	**10**	**7**
Dryland	168	15	65	10	10
Irrigated tract	168	25	60	11	4
River area	168	21	61	10	8
Shan State	**360**	**49**	**44**	**5**	**2**
Border area	120	60	33	6	2
Northern interior	120	56	43	1	0
Southern interior	120	32	58	8	3
BY FARM SIZE					
Ayeyarwady					
Small	143	13	62	17	8
Medium	168	14	61	18	7
Large	169	10	61	24	5
Bago					
Small	98	5	64	15	15
Medium	144	2	71	13	14
Large	142	6	57	16	20
Sagaing					
Small	158	23	59	13	6
Medium	174	17	67	8	7
Large	172	22	60	10	8
Shan State					
Small	183	55	38	5	1
Medium	97	44	53	2	1
Large	80	41	49	6	4
BY SEX					
Female	225	30	60	6	4
Male	1,503	19	58	14	9

TABLE 68: PROPORTION OF HOUSEHOLDS HAVING MEDIA EQUIPMENT

In percent from total HH number

	Radio	TV	Landline	Cell phone
BY REGION				
Ayeyarwady	66	67	9	44
Brackish water	66	74	9	49
Freshwater	63	73	4	47
Saltwater	69	55	13	36
Bago	51	73	5	45
East alluvial	48	66	6	47
West alluvial	48	80	2	39
River area	55	74	8	49
Sagaing	50	44	4	17
Dryland	43	44	3	28
Irrigated tract	59	45	4	17
River area	49	42	4	8
Shan State	32	77	1	56
Border area	23	96	1	87
Northern interior	30	65	1	45
Southern interior	44	71	1	36
BY FARM SIZE				
Ayeyarwady				
Small	59	57	2	29
Medium	70	64	5	41
Large	69	80	17	59
Bago				
Small	44	56	2	27
Medium	49	74	3	44
Large	57	85	10	59
Sagaing				
Small	42	42	3	10
Medium	46	36	1	19
Large	62	54	8	23
Shan State				
Small	28	84	1	66
Medium	27	66	0	42
Large	49	75	3	50
BY SEX				
Male	52	66	5	40
Female	44	52	3	35

ANNEX 5: PRODUCTIVE ASSETS – CAPITAL

TABLE 69: PROPORTION OF HOUSEHOLDS HAVING TRANSPORTATION EQUIPMENT

In percent from total HH number

	Bike	Motorcycle	Car	Trailer	Boat
BY REGION					
Ayeyarwady	62	45	0	14	28
Brackish water	73	58	0	19	5
Freshwater	81	56	1	21	12
Saltwater	33	19	0	2	68
Bago	72	66	1	5	4
East alluvial	77	64	2	5	2
West alluvial	73	69	0	3	0
River area	66	64	2	6	9
Sagaing	61	73	1	3	1
Dryland	65	73	1	6	0
Irrigated tract	66	68	0	2	0
River area	52	77	1	1	2
Shan State	21	91	6	51	0
Border area	29	97	13	75	0
Northern interior	10	92	4	36	0
Southern interior	24	85	3	41	0
BY FARM SIZE					
Ayeyarwady					
Small	68	33	0	8	14
Medium	64	44	1	9	28
Large	56	55	0	24	40
Bago					
Small	61	51	0	1	1
Medium	76	63	0	1	2
Large	77	79	4	11	7
Sagaing					
Small	51	62	0	1	1
Medium	58	74	1	3	1
Large	73	81	1	3	0
Shan State					
Small	23	92	6	56	0
Medium	11	84	6	36	0
Large	29	99	8	56	0
BY SEX					
Male	57	68	2	17	9
Female	48	60	0	14	4

TABLE 70: PROPORTION OF HOUSEHOLDS HAVING AGRICULTURAL TRACTOR, INCL. POWER TILLER

In percent from total HH number

Ecological Zone	Not owner	Owner
Brackish water	63.8	36.3
Freshwater	51.3	48.8
Saltwater	55.0	45.0
East alluvial	61.7	38.3
West alluvial	69.5	30.5
Dryland	82.1	17.9
Irrigated tract	70.2	29.8
River area	75.3	24.7
Border area	16.7	83.3
Northern interior	55.0	45.0
Southern interior	51.7	48.3
Total	**61.8**	**38.3**

TABLE 71: PROPORTION OF HOUSEHOLDS HAVING AGRICULTURAL TRACTOR BY CATEGORY

In percent from total HH number

	Small tractor	Medium tractor	Large tractor	Power tiller
BY REGION				
Ayeyarwady	18	8	0	19
Brackish water	14	6	0	18
Freshwater	10	14	0	26
Saltwater	31	4	1	14
Bago	7	15	2	12
East alluvial	9	12	2	20
West alluvial	5	19	1	6
River area	5	14	3	10
Sagaing	5	8	0	11
Dryland	2	8	0	08
Irrigated tract	7	7	0	17
River area	5	9	0	7
Shan State	8	5	1	46
Border area	8	7	3	69
Northern interior	9	2	1	33
Southern interior	8	7	0	34
BY FARM SIZE				
Ayeyarwady				
Small	8	3	0	8
Medium	15	8	0	14
Large	30	12	1	34
Bago				
Small	2	4	1	1
Medium	6	10	0	7
Large	11	27	4	25
Sagaing				
Small	3	1	0	6
Medium	5	9	0	10
Large	7	13	0	15
Shan State				
Small	9	3	2	51
Medium	6	2	0	32
Large	10	13	1	49
BY SEX				
Male	10	10	1	21
Female	6	4	0	17

TABLE 72: PROPORTION OF HOUSEHOLDS HAVING WATER PUMP AND HARVESTING EQUIPMENT

In percent from total HH number

	Motor water pump	Manual water pump	Thresher	Harvester	Dry pavement
BY REGION					
Ayeyarwady	5	1	17	1	26
Brackish water	5	0	9	1	32
Freshwater	4	2	4	0	23
Saltwater		1	36	1	24
Bago	5	1	5	0	4
East alluvial	7	0	5	0	5
West alluvial	0	2	3	0	4
River area	7	2	8	0	3
Sagaing	3	8	6	0	6
Dryland	5	7	10	0	7
Irrigated tract	2	11	7	1	5
River area	2	5	3	0	5
Shan State	16	1	5	1	8
Border area	23	0	3	4	18
Northern interior	8	1	6	0	4
Southern interior	17	2	5	0	3
BY FARM SIZE					
Ayeyarwady					
Small	6	1	3	1	17
Medium	2	1	11	0	26
Large	7	1	33	1	34
Bago					
Small	4	1	2	0	5
Medium	1	1	1	0	1
Large	8	2	12	0	6
Sagaing					
Small	3	8	1	0	4
Medium	2	10	6	1	6
Large	5	6	11	0	6
Shan State					
Small	15	1	3	2	12
Medium	13	2	5	2	3
Large	21	0	9	0	6
BY SEX					
Male	7	3	9	1	12
Female	8	4	4	0	11

TABLE 73: PROPORTION OF HOUSEHOLDS HAVING DRAUGHT OXEN

In percent from total HH number

	Average number	None	1-2 oxen	3-4 oxen	More than 4
BY REGION					
Ayeyarwady	1.74	42	34	15	4
Brackish water	1.76	33	45	16	3
Freshwater	1.13	58	29	08	4
Saltwater	2.34	36	27	22	4
Bago	2.10	22	55	17	2
East alluvial	2.26	16	63	15	0
West alluvial	1.86	23	55	20	2
River area	2.17	27	48	16	3
Sagaing	1.84	32	46	16	2
Dryland	1.73	35	44	17	2
Irrigated tract	1.73	39	40	14	2
River area	2.06	23	54	17	2
Shan State	0.99	79	12	5	1
Border area	0.15	93	6	2	0
Northern interior	0.68	70	20	8	1
Southern interior	2.13	74	10	4	2
BY FARM SIZE					
Ayeyarwady					
Small	1.27	55	29	10	5
Medium	1.36	48	35	14	1
Large	2.53	27	36	21	5
Bago					
Small	1.37	44	44	9	1
Medium	1.82	19	66	13	1
Large	2.88	10	52	27	3
Sagaing					
Small	1.22	54	32	10	1
Medium	1.75	31	52	11	2
Large	2.49	14	52	26	2
Shan State					
Small	0.24	90	7	2	1
Medium	0.99	67	21	9	1
Large	2.69	68	13	6	1
BY SEX					
Male	1.75	41	38	14	2
Female	1.27	51	35	10	2

ANNEX 6: CROPPING DECISIONS

TABLE 74: MAIN CULTIVATED CROPS

In percent of all crops

	Paddy	Pulses	Maize	Sesame	Culinary crops	Sunflower	Other
BY REGION							
Ayeyarwady	93				4		3
Brackish water	99				1		
Freshwater	85				9		6
Saltwater	96				3		1
Bago	12	85					2
East alluvial	13	87					
West alluvial	12	84					4
River area	12	86					2
Sagaing	52	32		4	3	6	5
Dryland	53	27		3	4	12	5
Irrigated tract	70	23		2	2	2	1
River area	35	46		7	2	4	9
Shan State	48	2	43		6		1
Border area	90		6		3		1
Northern interior	41	3	53	1	2		1
Southern interior	35	2	51		10		2
BY FARM SIZE							
Ayeyarwady							
Small	90				8		2
Medium	93				4		4
Large	95				3		2
Bago							
Small	4	94			1		1
Medium	14	84					2
Large	14	83					3
Sagaing							
Small	81	13		3		4	
Medium	57	26		4	4	5	7
Large	36	45		4	3	8	6
Shan State							
Small	70		27		3		
Medium	39	3	47		9		2
Large	37	3	53	1	5		2
BY SEX							
Male	51	30	10	1	3	2	3
Female	52	27	9	2	2	3	5

TABLE 75: FARM CROP CHOICES IN MONSOON AND DRY SEASONS

Percentage of Practicing Farmers

BY REGION	Rice	Wheat Millet	Maize	Ground nut	Sesame	Mustard	Pulses	Tobacco	Perennial crops	Culinary crops
MONSOON SEASON										
Ayeyarwady										
Brackish water	100						1	1		
Freshwater	100		1				2	20		1
Saltwater	100							2		1
Bago										
East alluvial	100						1			
West alluvial	99		1				1			
River area	100									1
Sagaing										
Dryland	65	14	2	3	30	17	11	1	1	4
Irrigated tract	96	1	1	2	12	9	2			1
River area	60	20	1	23	21		23	1		2
Shan State										
Border area	98	1	6							
Northern interior	81		74	6					1	3
Southern interior	70	1	96	3			3		3	4
DRY SEASON										
Ayeyarwady										
Brackish water	4			2			90	1		
Freshwater							50	7		1
Saltwater	94									
Bago										
East alluvial	2			2			98			
West alluvial	5		1	1			88			2
River area	15		1	6			90			
Sagaing										
Dryland	29	13	2	2	7	24	41	1	1	4
Irrigated tract	48	7		8	4	14	44			
River area	6	20	1	83	6	2	18		2	1
Shan State										
Border area	58	3	37					1		2
Northern interior	2	2	8	2	4		1			10
Southern interior	1	1		2	2		3			5

ANNEX 7: RICE PRODUCTION

TABLE 76: FARM SIZE AND CULTIVATED AREAS FOR RICE BY SEASON

In percent of all crops

		Monsoon Rice				Off-Season Rice		
			Rice area in acres			Rice area in acres		
BY REGION	N	Farm size	acres	hectare	% rice	acres	hectare	% rice
Ayeyarwady	474	8.5	5.3	2.12	62			
Brackish water	159	7.2	4.6	1.85	63			
Freshwater	159	6.6	4.5	1.82	68			
Saltwater	156	11.7	6.7	2.71	57	8.1	3.27	69
Bago	380	8.8	5.4	2.20	62			
East alluvial	128	8.9	5.8	2.34	65			
West alluvial	128	7.6	4.4	1.78	58			
River area	124	9.9	6.1	2.48	62			
Sagaing	345	7.2	2.2	0.89	30			
Dryland	102	10.2	3.1	1.24	30	4.1	1.66	40
Irrigated tract	160	7.4	2.5	1.00	34	3.1	1.26	42
River area	83	3.3	0.6	0.23	17			
Shan State	174	3.8	2.5	0.99	65			
Border area	117	2.2	1.8	0.74	85	2.0	0.79	91
Northern interior	35	3.6	2.9	1.19	82			
Southern interior	22	12.7	4.9	2.00	39			
BY FARM SIZE								
Ayeyarwady								
Small	127	2.7	2.3	0.93	86	3.5	1.40	
Medium	164	6.2	4.4	1.78	71	6.4	2.58	
Large	183	14.4	8.0	3.24	55	11.3	4.56	
Bago								
Small	94	2.9	2.4	0.99	83			
Medium	132	6.4	4.5	1.82	71			
Large	154	14.4	8.1	3.26	56			
Sagaing								
Small	127	2.5	1.3	0.52	50	2.6	1.05	
Medium	116	6.1	2.3	0.92	37	3.7	1.48	
Large	102	14.3	3.2	1.30	22	5.2	2.12	
Shan State								
Small	135	2.0	1.9	0.75	92	2.0	0.79	
Medium	23	6.1	4.0	1.60	65			
Large	16	15.3	5.2	2.11	34			
BY SEX								
Male	1,211	7.8	4.2	1.72		5.6	2.27	71%
Female	162	6.2	3.7	1.48		4.3	1.76	70%
OVERALL	1,373	7.7	4.2	1.69		5.5	2.21	71%

Note: Rice area is main plot on which rice is produced.

TABLE 77: CULTIVATED AREA, PRODUCTION, AND YIELDS FOR RICE BY SEASON

	Monsoon Rice			Off-season Rice		
	Area (acres)	Yields (kg/acre)*	Production (kg)	Area (acres)	Yields (kg/acre)*	Production (kg)
BY REGION						
Ayeyarwady	5.3	1,259	6,442			
Brackish water	4.6	1,483	6,822			
Freshwater	4.5	1,303	5,864			
Saltwater	6.7	991	6,640	8.1	1,746	14,143
Bago	5.4	1,233	6,663			
East alluvial	5.8	1,355	7,859			
West alluvial	4.4	1,272	5,597			
River area	6.1	1,071	6,533			
Sagaing	2.2	1,157	2,104			
Dryland	3.1	927	2,874	4.1	1,298	5,322
Irrigated tract	2.5	1,006	2,515	3.1	1,553	4,814
River area	0.6	1,538	923			
Shan State	2.5	1,451	4,168			
Border area	1.8	1,958	3,524	2.0	2,649	5,297
Northern interior	2.9	1,377	3,993			
Southern interior	4.9	1,018	4,988			
BY FARM SIZE						
Ayeyarwady						
Small	2.3	1,322	3,029	3.5	1,611	5,572
Medium	4.4	1,234	5,420	6.4	1,701	10,841
Large	8.0	1,204	9,644	11.3	1,754	19,750
Bago						
Small	2.4	1,291	3,143			
Medium	4.5	1,387	6,245			
Large	8.1	1,146	9,224			
Sagaing						
Small	1.3	1,103	1,406	2.6	1,383	3,584
Medium	2.3	973	2,218	3.7	1,377	5,048
Large	3.2	986	3,173	5.2	1,439	7,542
Shan State						
Small	1.9	1,834	3,418	2.0	2,649	5,297
Medium	4.0	1,373	5,439			
Large	5.2	1,055	5,510			
BY SEX						
Male	4.2	1,219	5,172	5.6	1,691	9,478
Female	3.7	1,284	4,706	4.3	1,480	6,437
OVERALL	**4.2**	**1,226**	**5,117**	**5.5**	**1,672**	**9,134**

* In wet paddy equivalent.
** Simple averages by ecoregion, farm size, and sex.

TABLE 78: PROPORTION OF FARMS HARVESTING RICE BY MONTH AND BY CATEGORY

	Monsoon Rice				Off-season Rice			
	Aug/Sep	Oct	Nov	Dec/Jan	Feb/Mar	Apr	May-June	July
BY REGION								
Ayeyarwady	0.8	16.6	67.8	14.9				
Brackish water	0.8	32.8	65.1	1.3				
Freshwater	1.8	19.3	74.3	4.6				
Saltwater		3.4	65.2	31.4	57.0	41.6	1.4	
Bago	1.3	35.9	60.3	2.5				
East alluvial		47.2	51.8	0.9				
West alluvial	0.9	16.1	75.1	7.9				
River area	2.9	39.6	57.5	-				
Sagaing	5.6	2.3	10.7	81.3				
Dryland			3.5	96.5			14.1	85.9
Irrigated tract	10.7	0.9	9.3	79.1	2.3		9.9	87.8
River area	0.5	29.6	69.8	-				
Shan State	3.9	43.9	44.7	7.5				
Border area	5.8	44.5	48.6	1.0			49.7	50.3
Northern interior	3.9	53.6	39.1	3.4				
Southern interior		33.6	42.2	24.2				
BY FARM SIZE								
Ayeyarwady								
Small		16.2	74.3	9.5	41.4	55.7	2.9	
Medium	0.7	15.8	70.1	13.3	50.5	44.9	4.5	
Large	0.9	17.0	65.4	16.7	61.6	38.4		
Bago								
Small	0.9	25.8	66.6	6.8				
Medium	1.5	32.8	61.3	4.4				
Large	1.3	39.3	58.6	0.8				
Sagaing								
Small	1.5	8.7	18.6	71.2	3.3		9.5	87.2
Medium	3.2	1.1	10.3	85.4			10.6	89.4
Large	9.6	0.2	7.1	83.1			16.5	83.5
Shan State								
Small	6.6	47.5	43.6	2.3			49.7	50.3
Medium		44.0	53.8	2.2				
Large		32.9	38.1	29.1				
BY SEX								
Male	2.0	23.8	56.5	17.7	38.0	29.4	5.6	27.0
Female	0.3	22.9	50.3	26.5	40.5	10.4	15.5	33.6
OVERALL	**1.8**	**23.7**	**55.9**	**18.6**	**38.2**	**27.7**	**6.5**	**27.6**

TABLE 79: PROPORTION OF SELLERS OF RICE BY SEASON

	Monsoon Rice (% of farms)				Off-season Rice (% of farms)			
	Sellers	Wet paddy	Dry paddy	Milled paddy	Sellers	Wet paddy	Dry paddy	Milled paddy
BY REGION								
Ayeyarwady	96.2	80.6	16.7	1.3				
Brackish water	100.0	81.8	19.5	0.6				
Freshwater	93.7	81.1	13.2					
Saltwater	94.9	78.8	17.3	3.2	95.4	86.1	9.3	
Bago	95.3	62.1	18.4	15.3				
East alluvial	93.0	37.5	16.4	39.1				
West alluvial	99.2	81.3	18.0	0.8				
River area	93.5	67.7	21.0	5.6				
Sagaing	63.8	36.2	26.7	1.2				
Dryland	77.5	43.1	31.4	2.9	83.5	78.5	5.1	
Irrigated tract	83.1	50.0	33.8	0	87.3	78.9	8.5	
River area	9.6	1.2	7.2	1.2				
Shan State	74.7	10.9	62.6	2.3				
Border area	70.1	12.0	56.4	2.6	97.1	85.7	11.4	
Northern interior	74.3	2.9	68.6	2.9				
Southern interior	100.0	18.2	86.4					
BY FARM SIZE								
Ayeyarwady								
Small	93.7	83.5	9.4	0.8	100.0	86.7	13.3	
Medium	96.9	82.6	14.3	0.6	96.0	90.0	6.0	
Large	97.3	76.9	23.7	2.2	93.0	83.1	9.9	
Bago								
Small	92.6	59.6	11.7	21.3				
Medium	96.2	66.7	17.4	12.9				
Large	96.1	59.7	23.4	13.6				
Sagaing								
Small	51.2	27.6	23.6		91.5	83.1	8.5	
Medium	67.2	41.4	23.3	2.6	85.2	81.5	3.7	
Large	75.5	41.2	34.3	1.0	75.7	67.6	8.1	
Shan State								
Small	68.9	11.1	55.6	3.0	97.1	85.7	11.4	
Medium	91.3		91.3					
Large	100.0	25.0	81.3					
BY SEX								
Male	85.1	55.7	25.2	5.1	90.3	82.6	7.7	
Female	85.2	53.7	27.8	6.2	97.4	84.2	13.2	
OVERALL	**85.1**	**55.5**	**25.5**	**5.2**	**91.1**	**82.7**	**8.3**	

TABLE 80: PERCENTAGE OF SALES OF RICE PRODUCTION BY SEASON

In percent from total sale

	Monsoon Rice (% of total production)				Off-season Rice (% of total production)			
	Total Sales	Wet paddy	Dry paddy	Milled paddy	Total Sales	Wet paddy	Dry paddy	Milled paddy
BY REGION								
Ayeyarwady	69.9	51.4	17.7	0.9				
Brackish water	69.4	50.6	18.3	0.6				
Freshwater	73.9	59.3	14.6					
Saltwater	68.4	48.1	18.9	1.4	70.5	54.3	16.1	
Bago	65.1	37.0	22.6	5.5				
East alluvial	66.1	30.7	24.6	10.9				
West alluvial	62.7	47.2	15.3	0.2				
River area	65.2	39.0	24.8	1.4				
Sagaing	65.1	36.8	28.0	0.3				
Dryland	66.3	33.7	32.0	0.6	60.3	59.0	1.3	
Irrigated tract	66.4	41.1	25.3		86.1	77.5	8.7	
River area	4.8	0.1	4.7					
Shan State	62.9	12.8	49.1	1.0				
Border area	61.9	7.4	54.1	0.4	89.4	80.8	8.6	
Northern interior	44.8	0.2	41.1	3.5				
Southern interior	76.9	28.8	48.0					
BY FARM SIZE								
Ayeyarwady								
Small	61.6	56.4	5.0	0.2	89.1	73.7	15.4	
Medium	65.8	54.4	11.3	0.1	81.4	74.2	7.2	
Large	71.3	50.4	19.9	1.1	68.2	50.5	17.6	
Bago								
Small	49.5	34.6	5.6	9.3				
Medium	60.8	41.2	13.8	5.7				
Large	67.2	36.0	26.1	5.2				
Sagaing								
Small	59.9	38.6	21.3		82.8	73.9	8.9	
Medium	66.3	47.0	19.3	0.1	79.7	79.0	0.6	
Large	65.5	30.5	34.5	0.5	59.9	54.9	4.9	
Shan State								
Small	50.0	7.0	40.9	2.1	89.4	80.8	8.6	
Medium	72.5		72.5					
Large	76.2	36.1	40.1					
BY SEX								
Male	67.0	43.8	20.5	2.7	69.8	54.7	15.1	
Female	70.3	35.7	32.3	2.3	88.8	84.9	4.0	
OVERALL	**67.4**	**43.0**	**21.7**	**2.7**	**70.7**	**56.1**	**14.6**	

TABLE 81: TYPE OF CLIENTS AND PLACE OF SALES FOR MONSOON RICE

In percent from total sale

	Final consumers	Millers	Traders	Others
WET PADDY SALES				
Ayeyarwady	3.7	5.8	90.3	0.3
Bago	2.4	7.3	90.3	
Sagaing	13.5	8.1	73.0	5.4
Shan State		21.1	68.4	10.5
DRY PADDY SALES				
Ayeyarwady	1.4	12.2	86.5	
Bago		5.4	94.6	
Sagaing	3.3	6.6	90.2	
Shan State	3.7	13.8	78.9	3.7
MILLED RICE SALES				
Ayeyarwady	20.0		80.0	
Bago	11.5	61.5	26.9	
Sagaing		66.7	33.3	
Shan State		66.7	33.3	

	Villages	Nearby villages	Closest town	Itinerant traders
WET PADDY SALES				
Ayeyarwady	69.4	12.7	8.2	9.8
Bago	68.1	6.8	24.2	1.0
Sagaing	50.0	13.9	36.1	
Shan State	21.1	26.3	42.1	10.5
DRY PADDY SALES				
Ayeyarwady	63.5	13.5	16.2	6.8
Bago	62.2	5.4	32.4	
Sagaing	33.9	9.7	53.2	3.2
Shan State	27.5	8.3	50.5	13.8
MILLED RICE SALES				
Ayeyarwady	40.0		40.0	20.0
Bago	46.2	7.7	46.2	
Sagaing		50.0	50.0	
Shan State		66.7	33.3	

TABLE 82: TYPE OF RICE SEEDS USED BY FARMER BY SEASON

In percent from total sale

	Monsoon Rice			Off-season Rice		
	Hybrid	Certified	Other	Hybrid	Certified	Other
BY REGION						
Ayeyarwady		**9.1**	**90.9**			
Brackish water		14.5	85.5			
Freshwater		11.3	88.7			
Saltwater		1.3	98.7		1.3	98.7
Bago		**7.1**	**92.9**			
East alluvial		3.9	96.1			
West alluvial		6.3	93.8			
River area		11.3	88.7			
Sagaing		**3.5**	**96.5**			
Dryland		4.9	95.1		13.9	86.1
Irrigated tract		3.8	96.3		19.7	80.3
River area		1.2	98.8			
Shan State	**75.9**	**4.6**	**19.5**			
Border area	92.3	3.4	4.3	77.1		22.9
Northern interior	65.7	5.7	28.6			
Southern interior	4.5	9.1	86.4			
BY FARM SIZE						
Ayeyarwady						
Small		12.6	87.4			100.0
Medium		9.3	90.7			100.0
Large		6.5	93.5		2.8	97.2
Bago						
Small		4.3	95.7			
Medium		6.8	93.2			
Large		9.1	90.9			
Sagaing						
Small		1.6	98.4		15.3	84.7
Medium		4.3	95.7		16.7	83.3
Large		4.9	95.1		18.9	81.1
Shan State						
Small	88.1	3.7	8.1	77.1		22.9
Medium	52.2	4.3	43.5			
Large	6.3	12.5	81.3			
BY SEX						
Male	9.5	7.2	83.3	8.1	7.0	84.9
Female	10.5	1.9	87.7	7.9	15.8	76.3
OVERALL	**9.6**	**6.6**	**83.8**	**8.0**	**8.0**	**83.9**

TABLE 83: QUANTITY OF RICE SEEDS USED BY FARMER BY TYPE OF SEEDS AND BY SEASON

In kg per acre

	Monsoon Rice				Off-season Rice			
	Hybrid	Certified	Other	Overall	Hybrid	Certified	Other	Overall
BY REGION								
Ayeyarwady		45.9	51.8	51.4				
Brackish water		42.6	49.5	48.6				
Freshwater		48.1	56.0	55.2				
Saltwater		55.5	50.7	51.0		91.3	86.4	86.5
Bago		50.3	44.8	45.2				
East alluvial		43.4	44.8	45.1				
West alluvial		35.9	42.4	42.3				
River area		57.4	46.7	48.0				
Sagaing		43.3	44.4	44.3				
Dryland		38.2	49.1	49.0		56.1	52.9	53.4
Irrigated tract		47.6	42.3	43.2		48.8	62.2	60.0
River area		34.8	30.6	32.7				
Shan State	18.2		35.8	23.7				
Border area	15.4		31.2	16.1	12.3		41.7	18.0
Northern interior	21.7		35.6	25.8				
Southern interior	39.4		36.4	36.5				
BY FARM SIZE								
Ayeyarwady								
Small		45.8	55.3	54.0			80.4	80.4
Medium		42.0	53.1	52.1			87.9	87.9
Large		48.9	50.6	50.5		91.3	86.6	86.7
Bago								
Small		45.5	46.4	46.4				
Medium		44.2	46.2	46.1				
Large		52.7	43.8	44.6				
Sagaing								
Small		18.4	40.8	40.3		63.1	57.7	58.5
Medium		49.3	44.9	45.1		60.8	58.1	58.5
Large		43.8	45.7	45.6		40.9	54.3	51.7
Shan State								
Small	17.0		34.9	18.6	12.3		41.7	18.0
Medium	16.9		37.0	26.6				
Large	39.4		35.4	36.1				
BY SEX								
Male	18.5	47.2	47.8	46.2	12.3	58.6	78.1	75.0
Female	15.2	55.3	47.0	45.8	12.8	60.7	76.7	73.5
OVERALL	**18.2**	**47.5**	**47.7**	**45.7**	**12.3**	**58.9**	**78.0**	**74.9**

TABLE 84: SOURCE OF RICE SEEDS BY SEASON

In percent to all farms

	Monsoon Rice				Off-season Rice			
	Traders Business	Relatives Friends	NGO/ Government	Own	Traders Business	Relatives Friends	NGO/ Government	Own
BY REGION								
Ayeyarwady	12.2	28.1	10.3	49.4				
Brackish water	10.7	25.8	16.4	47.2				
Freshwater	9.4	25.8	13.2	51.6				
Saltwater	16.7	32.7	1.3	49.4	25.8	8.6	0	65.6
Bago	4.5	10.5	7.4	77.6				
East alluvial	3.9	10.9	6.3	78.9				
West alluvial	3.9	6.3	5.5	84.4				
River area	5.6	14.5	10.5	69.4				
Sagaing	**4.9**	**12.8**	**2.0**	**80.3**				
Dryland	10.8	16.7	2.9	69.6	48.1	26.6	0	25.3
Irrigated tract	3.8	16.9	1.9	77.5	52.1	16.9	0	31.0
River area	0	0	1.2	98.8				
Shan State	**79.3**	**5.2**	**0.6**	**14.9**				
Border area	91.5	1.7	0	6.8	77.1	0	0	22.9
Northern interior	74.3	8.6	0	17.1				
Southern interior	22.7	18.2	4.5	54.5				
BY FARM SIZE								
Ayeyarwady								
Small	11.8	31.5	14.2	42.5	23.3	16.7	0	60.0
Medium	12.4	26.1	9.3	52.2	28.0	2.0	0	70.0
Large	12.4	27.4	8.6	51.6	25.4	9.9	0	64.8
Bago								
Small	5.3	9.6	7.4	77.7				
Medium	3.8	15.2	4.5	76.5				
Large	4.5	7.1	9.7	78.6				
Sagaing								
Small	2.4	7.9	0.8	89.0	50.8	25.4	0	23.7
Medium	5.2	17.2	3.4	74.1	50.0	18.5	0	31.5
Large	7.8	13.7	2.0	76.5	48.6	21.6	0	29.7
Shan State								
Small	88.9	2.2	0	8.9	77.1	0	0	22.9
Medium	60.9	17.4	0	21.7				
Large	25.0	12.5	6.3	56.3				
BY SEX								
Male	16.6	16.6	6.8	60.0	39.3	14.1	0	46.6
Female	17.9	15.4	1.9	64.8	63.2	10.5	0	26.3
OVERALL	**16.8**	**16.5**	**6.2**	**60.6**	**42.0**	**13.7**	**0**	**44.3**

TABLE 85: CULTIVATED VARIETY OF RICE BY SEASON

In percent to all farms

	Monsoon Rice				Off-season Rice			
	Letywezin	Emata	Meedon	Ngasein	Letywezin	Emata	China	Ngasein
BY REGION								
Ayeyarwady	73.4	19.4	3.0	4.2				
Brackish water	88.1	10.1		1.9				
Freshwater	91.2	7.5		1.3				
Saltwater	40.4	41.0	9.0	9.6	0.7	99.3		
Bago	18.4	77.1	0.3	4.2				
East alluvial	1.6	92.2		6.3				
West alluvial	32.0	67.2		0.8				
River area	21.8	71.8	0.8	5.6				
Sagaing	34.8	21.2	30.4	13.6				
Dryland	16.7	46.1	24.5	12.7		60.8	39.2	
Irrigated tract	15.0	13.8	50.0	21.3		29.6	60.6	9.9
River area	95.2	4.8						
Shan State	14.4	85.6						
Border area	12.0	88.0				14.3	85.7	
Northern interior	2.9	97.1						
Southern interior	45.5	54.5						
BY FARM SIZE								
Ayeyarwady								
Small	84.3	11.8	1.6	2.4		100.0		
Medium	74.5	14.9	4.3	6.2		100.0		
Large	65.1	28.5	2.7	3.8	1.4	98.6		
Bago								
Small	23.4	72.3	-	4.3				
Medium	20.5	75.8	0.8	3.0				
Large	13.6	81.2	-	5.2				
Sagaing								
Small	52.8	13.4	26.0	7.9		35.6	61.0	3.4
Medium	30.2	17.2	40.5	12.1		44.4	51.9	3.7
Large	17.6	35.3	24.5	22.5		64.9	27.0	8.1
Shan State								
Small	9.6	90.4				14.3	85.7	
Medium	17.4	82.6						
Large	50.0	50.0						
BY SEX								
Male	40.3	45.0	8.2	6.5	0.3	69.1	28.5	2.0
Female	46.3	38.3	13.0	2.5		47.4	50.0	2.6
OVERALL	**41.0**	**44.2**	**8.7**	**6.0**	**0.3**	**66.7**	**31.0**	**2.1**

* There is no China variety during monsoon season and no Meedon variety during dry season rice production.

TABLE 86: MONTH OF SOWING/TRANSPLANTING RICE BY SEASON

In percent to all farms

	Monsoon Rice				Off-season Rice			
	May	June	July	Aug	Dec	Jan-Feb	Mar	Apr
BY REGION								
Ayeyarwady	5.3	38.9	49.4	6.4				
Brackish water	10.0	55.7	33.2	1.0				
Freshwater	7.3	54.6	36.1	2.0				
Saltwater	0.7	16.4	69.8	13.1	92.2	7.8		
Bago	9.0	67.0	22.9	1.2				
East alluvial	10.3	63.4	25.4	0.8				
West alluvial	3.6	66.5	26.7	3.2				
River area	11.5	70.9	17.5					
Sagaing	4.3	12.3	43.6	39.9				
Dryland		8.0	47.9	44.1		3.4	61.7	34.9
Irrigated tract	8.1	12.2	39.5	40.2		2.7	56.7	40.6
River area		42.5	48.5	9.0				
Shan State	25.5	42.5	26.9	4.9				
Border area	37.7	40.3	22.0		29.7	47.0	23.3	
Northern interior	10.5	53.4	26.7	8.0				
Southern interior	15.5	36.4	36.6	11.5				
BY FARM SIZE								
Ayeyarwady								
Small	4.1	41.1	47.4	7.4	88.7	11.3		
Medium	7.5	41.7	46.3	4.6	85.9	14.1		
Large	4.6	37.2	51.2	7.0	95.1	4.9		
Bago								
Small	3.1	63.1	33.8					
Medium	9.7	57.0	30.3	2.9				
Large	9.7	72.5	17.3	0.5				
Sagaing								
Small	1.5	11.8	46.0	40.6			65.2	34.8
Medium	4.7	12.7	33.0	49.6		5.1	54.5	40.4
Large	5.3	12.2	50.8	31.7		3.6	60.5	35.8
Shan State								
Small	32.4	40.8	23.0	3.3	29.7	47.0	23.3	
Medium	14.7	56.9	28.4					
Large	16.5	31.7	36.8	15.0				
BY SEX								
Male	8.3	46.4	36.9	8.4	63.7	8.1	17.0	11.2
Female	5.6	40.9	41.6	11.9	50.1	6.2	34.2	9.5
OVERALL	**8.0**	**45.8**	**37.4**	**8.8**	**62.5**	**7.9**	**18.6**	**11.0**

TABLE 87: RICE CROP ESTABLISHMENT BY SEASON

	Monsoon Rice				Off-season Rice			
	Direct Seeding		Transplanting		Direct Seeding		Transplanting	
	% users	Seeds:Kg/acre	% users	Seeds:Kg/acre	% users	Seeds:Kg/acre	% users	Seeds:Kg/acre
BY REGION								
Ayeyarwady	29.1	51.8	70.9	51.2				
Brackish water	30.8	43.8	69.2	50.9				
Freshwater	11.9	48.3	88.1	56.4				
Saltwater	44.9	57.8	55.1	46.6	100.0	85.3		
Bago	11.8	43.1	88.2	45.7				
East alluvial			100.0	44.7				
West alluvial			100.0	42.1				
River area	36.3	43.1	63.7	52.3				
Sagaing	2.9	45.8	97.1	44.3				
Dryland	9.8	45.8	90.2	48.8	72.2	57.2	27.8	48.1
Irrigated tract			100.0	42.5	60.6	67.7	39.4	44.5
River area			100.0	30.7				
Shan State			100.0	23.7				
Border area			100.0	16.1			100.0	19.7
Northern interior			100.0	25.9				
Southern interior			100.0	36.8				
BY FARM SIZE								
Ayeyarwady								
Small	23.6	54.5	76.4	53.8	100.0	81.1		
Medium	28.0	53.9	72.0	51.3	100.0	87.5		
Large	33.9	50.5	66.1	50.5	100.0	85.5		
Bago				-		-		
Small	8.5	50.6	91.5	46.0		62.2		50.4
Medium	7.6	42.3	92.4	46.4		62.3		43.6
Large	17.5	42.6	82.5	45.2		59.5		44.2
Sagaing								
Small	1.6	34.0	98.4	40.5	71.2		28.8	19.7
Medium	0.9	29.8	99.1	45.2	70.4		29.6	
Large	6.9	49.3	93.1	45.4	54.1		45.9	
Shan State								
Small			100.0	18.6			100.0	
Medium			100.0	26.6				
Large			100.0	36.1				
BY SEX								
Male	14.6	49.1	85.4	45.5	74.2	75.9	25.8	36.6
Female	9.9	47.2	90.1	45.6	78.9	75.9	21.1	22.3
OVERALL	**14.1**	**48.9**	**85.9**	**45.5**	**74.7**	**75.9**	**25.3**	**35.2**

TABLE 88: PROPORTION OF USERS OF FERTILIZERS FOR RICE BY SEASON

Percent of users

	Monsoon Rice				Off-season Rice			
	Urea	NPK	T-super	Potash	Urea	NPK	T-super	Potash
BY REGION								
Ayeyarwady	89.5	23.8	27.8	1.5				
Brackish water	96.9	40.9	17.0	1.3				
Freshwater	89.3	29.6	13.2	0.6				
Saltwater	82.1	0.6	53.8	2.6	98.7	5.3	91.4	2.0
Bago	90.3	29.7	5.8	0.8				
East alluvial	96.1	31.3	3.9	0				
West alluvial	95.3	32.8	7.8	0.8				
River area	79.0	25.0	5.6	1.6				
Sagaing	72.8	60.6	6.7	2.6				
Dryland	94.1	81.4	4.9	2.9	91.1	82.3	22.8	0
Irrigated tract	90.0	78.8	11.3	3.8	93.0	70.4	19.7	0
River area	13.3	0	0	0				
Shan State	98.9	39.1	48.9	0				
Border area	99.1	36.8	51.3	0	100.0	28.6	74.3	2.9
Northern interior	97.1	60.0	42.9	0				
Southern interior	100.0	18.2	45.5	0				
BY FARM SIZE								
Ayeyarwady								
Small	89.0	27.6	17.3	0.8	100.0	6.7	93.3	3.3
Medium	87.0	23.0	25.5	2.5	98.0	6.0	90.0	2.0
Large	91.9	22.0	37.1	1.1	98.6	4.2	91.5	1.4
Bago								
Small	94.7	19.1	3.2	0				
Medium	93.2	33.3	7.6	0				
Large	85.1	33.1	5.8	1.9				
Sagaing								
Small	52.0	40.2	3.9	1.6	91.5	81.4	15.3	0
Medium	81.0	69.0	10.3	3.4	92.6	64.8	20.4	0
Large	89.2	76.5	5.9	2.9	91.9	86.5	32.4	0
Shan State								
Small	98.5	40.0	51.1	0	100.0	28.6	74.3	2.9
Medium	100.0	47.8	43.5	0				
Large	100.0	18.8	37.5	0				
BY SEX								
Male	87.3	36.1	19.3	1.3	96.0	39.3	59.1	1.0
Female	82.1	40.7	17.3	1.9	94.7	42.1	52.6	2.6
OVERALL	**86.7**	**36.6**	**19.1**	**1.4**	**95.8**	**39.6**	**58.3**	**1.2**

TABLE 89: AVERAGE FERTILIZER CONSUMPTION FOR RICE BY SEASON

In kg per acre

	Monsoon Rice				Off-season Rice			
	Urea	NPK	T-super	Potash	Urea	NPK	T-super	Potash
BY REGION								
Ayeyarwady	44.8	8.3	11.5	0.3				
Brackish water	53.3	17.3	7.5	0.3				
Freshwater	38.9	10.7	4.7	0.2				
Saltwater	43.0	0.4	18.5	0.3	119.7	6.7	70.4	0.3
Bago	22.6	9.6	0.6	0.3				
East alluvial	17.6	6.9	0.3	0				
West alluvial	29.5	11.0	1.0	0.9				
River area	23.9	9.9	0.8	0.2				
Sagaing	42.5	50.8	3.8	0.8				
Dryland	45.3	49.8	2.3	1.0	75.8	73.0	17.7	0
Irrigated tract	45.8	57.9	5.1	0.9	61.6	47.1	8.9	0
River area	5.6	0	0	0				
Shan State	118.1	39.8	47.4					
Border area	139.3	45.0	57.4		160.6	46.4	97.7	1.5
Northern interior	98.4	61.5	51.5					
Southern interior	91.7	8.9	23.4					
BY FARM SIZE								
Ayeyarwady								
Small	40.9	8.4	6.2	0.2	91.1	5.5	74.4	0.2
Medium	48.4	10.4	8.0	0.6	112.0	5.5	68.6	0.8
Large	43.8	7.2	14.2	0.2	126.5	7.3	70.7	0.1
Bago								
Small	32.5	6.7	0.5	0				
Medium	22.3	9.1	1.3	0				
Large	20.9	10.4	0.3	0.5				
Sagaing								
Small	29.2	39.2	3.1	0.5	69.7	67.0	12.1	0
Medium	43.0	55.1	4.9	0.8	77.6	68.5	18.4	0
Large	48.7	53.2	3.2	1.1	62.6	52.8	11.4	0
Shan State								
Small	128.3	47.7	58.0	0	160.6	46.4	97.7	1.5
Medium	110.5	48.1	40.6	0				
Large	95.5	7.2	22.7	0				
BY SEX								
Male	41.2	16.2	8.8	0.3	106.3	24.7	55.3	0.2
Female	48.7	21.2	13.2	0.4	108.7	25.0	49.6	0.6
OVERALL	**43.7**	**18.6**	**10.3**	**0.3**	**106.5**	**24.7**	**54.8**	**0.3**

TABLE 90: APPLICATION RATE OF FERTILIZERS FOR RICE BY SEASON

In kg per acre

	Monsoon Rice				Off-season Rice			
	Urea	NPK	T-super	Potash	Urea	NPK	T-super	Potash
BY REGION								
Ayeyarwady	50.0	34.6	41.4	19.8				
Brackish water	55.0	42.3	44.2	27.3				
Freshwater	43.5	36.2	35.6	33.3				
Saltwater	52.4	62.4	34.4	12.3	121.3	126.7	77.1	15.3
Bago	25.0	32.4	10.9	38.6				
East alluvial	18.3	22.1	7.7					
West alluvial	31.0	33.5	12.2	113.5				
River area	30.3	39.5	14.3	10.5				
Sagaing	58.4	83.9	56.9	32.3				
Dryland	48.1	61.2	46.9	32.6	83.2	88.8	77.8	0
Irrigated tract	50.9	73.5	45.3	22.7	66.3	66.8	45.2	0
River area	42.3	0	0	0				
Shan State	119.5	101.9	96.9					
Border area	140.5	122.4	111.9		160.6	162.5	131.6	52.2
Northern interior	101.3	102.5	120.2					
Southern interior	91.7	48.9	51.5					
BY FARM SIZE								
Ayeyarwady								
Small	46.0	30.6	35.8	21.8	91.1	83.1	79.7	5.4
Medium	55.6	45.4	31.6	25.6	114.3	91.5	76.2	39.5
Large	47.7	32.6	38.4	14.2	128.3	173.9	77.2	8.9
Bago								
Small	34.4	35.2	15.8	0				
Medium	23.9	27.3	16.8	0				
Large	24.5	31.6	5.9	26.0				
Sagaing								
Small	56.2	97.5	78.9	29.4	76.2	82.4	79.3	0
Medium	53.1	79.9	47.6	23.1	83.8	105.6	90.5	0
Large	54.6	69.5	54.7	36.3	68.1	61.0	35.1	0
Shan State								
Small	130.3	119.1	113.4		160.6	162.5	131.6	52.2
Medium	110.5	100.5	93.4					
Large	95.5	38.3	60.6					
BY SEX								
Male	47.1	44.9	45.5	25.7	110.8	63.0	93.6	22.1
Female	59.3	52.1	76.4	22.7	114.8	59.5	94.2	23.5
OVERALL	**50.4**	**50.8**	**54.0**	**25.1**	**111.1**	**62.5**	**93.9**	**21.6**

TABLE 91: FERTILIZER CONSUMPTION BY NUTRIENT FOR RICE BY SEASON

In kg per acre

	Monsoon Rice			Off-season Rice		
	Nitrogen	Phosphorus	Potassium	Nitrogen	Phosphorus	Potassium
BY REGION						
Ayeyarwady	21.4	5.9	1.4			
Brackish water	26.1	5.1	2.8			
Freshwater	18.9	3.2	1.7			
Saltwater	19.9	8.3	0.3	55.7	31.7	1.2
Bago	11.3	1.2	1.6			
East alluvial	8.2	0.9	1.2			
West alluvial	14.6	1.6	2.3			
River area	11.9	1.3	1.6			
Sagaing	24.6	6.8	8.1	38.5	12.5	9.4
Dryland	26.2	6.2	8.3	42.2	15.1	11.0
Irrigated tract	26.1	8.0	9.0	33.0	8.6	7.1
River area	2.6	0	0			
Shan State	58.3	24.8	6.0			
Border area	68.6	29.7	6.8	78.5	47.6	7.9
Northern interior	51.9	29.1	9.2			
Southern interior	44.0	11.0	1.3			
BY FARM SIZE						
Ayeyarwady						
Small	19.7	3.6	1.4	42.4	33.3	0.9
Medium	23.3	4.6	1.9	52.1	30.7	1.3
Large	20.9	7.0	1.2	58.9	31.8	1.2
Bago						
Small	15.6	0.9	1.0			
Medium	11.0	1.4	1.3			
Large	10.6	1.2	1.9			
Sagaing						
Small	17.3	5.3	6.2	38.8	12.0	10.1
Medium	25.3	7.7	8.7	42.5	15.0	10.3
Large	27.7	6.7	8.6	34.1	10.3	7.9
Shan State						
Small	63.8	30.3	7.1	78.5	47.6	7.9
Medium	55.6	22.7	7.2			
Large	44.6	10.7	1.1			
BY SEX						
Male	20.5	5.5	2.6	51.4	26.8	3.8
Female	24.5	7.9	3.4	52.5	24.3	4.1
OVERALL	**20.9**	**5.7**	**2.7**	**51.5**	**26.6**	**3.9**

*Calculation of nutrient is based on 46% of nitrogen for urea; 10% of nitrogen, 10% of phosphorus, and 15% of potassium for NPK; 44% of phosphorus for T-super; and 60% of potassium for potash.

TABLE 92: PERCENTAGE OF USERS AND AVERAGE COSTS OF CHEMICALS FOR RICE BY SEASON

In MMK per acre

	Monsoon Rice				Off-season Rice			
	Insecticides		Herbicides		Insecticides		Herbicides	
	% users	Costs	% users	Costs	% users	Costs	% users	Costs
BY REGION								
Ayeyarwady	12.2	702	7.6	263				
Brackish water	8.2	139	12.6	620				
Freshwater	1.3	91	9.4	283				
Saltwater	27.6	1,439	0.6	1	57.6	3,741	7.9	193
Bago	0.3	68	1.6	52				
East alluvial			3.1	150				
West alluvial			0.8	1				
River area	0.8	184	0.8	11				
Sagaing	37.4	3,690	12.8	1,028				
Dryland	47.1	2,782	13.7	1,144	48.1	3,908	63.3	4,775
Irrigated tract	50.6	4,706	18.8	1,060	59.2	8,573	40.8	3,509
River area								
Shan State	27.0	1,328	0.6	5				
Border area	22.2	1,135	0.9	9	62.9	4,671	0	0
Northern interior	25.7	2,466						
Southern interior	54.5	606						
BY FARM SIZE								
Ayeyarwady								
Small	7.1	276	8.7	860	63.3	5,443	6.7	241
Medium	8.7	258	5.0	197	66.0	4,579	8.0	143
Large	18.8	996	9.1	178	49.3	3,186	8.5	206
Bago								
Small			1.1	2				
Medium			1.5	42				
Large	0.6	113	1.9	66				
Sagaing								
Small	26.0	3,027	8.7	624	57.6	5,331	55.9	3,700
Medium	44.0	4,553	16.4	2,039	48.1	8,748	55.6	5,771
Large	44.1	3,322	13.7	413	54.1	3,176	43.2	3,159
Shan State								
Small	23.0	1,308	0.7	8	62.9	4,671		
Medium	21.7	2,041						
Large	68.8	612						
BY SEX								
Male	17.2	881	6.7	276	55.0	4,381	27.2	1,427
Female	16.7	1,324	3.7	208	65.8	4,467	26.3	1,041
OVERALL	**17.1**	**1,025**	**6.3**	**269**	**56.3**	**4,389**	**27.1**	**1,393**

TABLE 93: FAMILY LABOR USE FOR RICE BY SEASON

In hours per acre

	Monsoon Rice				Off-season Rice			
	Prepa-ration	Planting	Manage-ment	Harvest	Prepa-ration	Planting	Manage-ment	Harvest
BY REGION								
Ayeyarwady	36.4	11.4	65.5	19.2				
Brackish water	40.2	14.5	36.4	21.1				
Freshwater	26.5	16.9	90.8	14.0				
Saltwater	25.7	13.5	90.0	21.8	7.6	4.1	26.6	13.0
Bago	16.4	3.4	4.6	3.9				
East alluvial	14.9	4.3	3.6	2.0				
West alluvial	22.1	5.2	7.9	6.4				
River area	13.6	2.5	4.2	5.9				
Sagaing	22.1	4.6	30.5	10.5				
Dryland	19.3	3.5	34.8	10.6	11.4	3.2	32.4	20.3
Irrigated tract	20.9	15.9	28.2	10.7	9.6	3.2	28.8	16.1
River area	50.5	34.0	19.9	40.8				
Shan State	46.9	20.3	22.9	20.3				
Border area	53.9	25.4	27.2	23.4	45.0	10.6	72.4	26.1
Northern interior	45.5	26.4	17.7	24.9				
Southern interior	34.2	4.9	19.3	9.8				
BY FARM SIZE								
Ayeyarwady								
Small	48.6	18.9	121.5	30.1	10.4	3.8	47.4	23.5
Medium	38.3	10.9	85.5	24.4	9.8	3.7	36.0	15.1
Large	33.1	10.2	45.0	14.6	6.3	4.3	20.2	10.7
Bago								
Small	35.0	7.7	12.6	7.5				
Medium	20.6	3.5	5.1	4.0				
Large	11.0	2.6	2.9	3.2				
Sagaing								
Small	24.7	8.2	32.2	12.3	9.0	2.9	34.1	18.0
Medium	23.2	4.7	25.4	11.0	11.7	3.4	30.5	18.7
Large	19.9	2.7	33.7	9.1	10.9	3.2	29.0	19.0
Shan State								
Small	52.1	23.3	26.2	23.3	45.0	10.6	72.4	26.1
Medium	45.5	27.2	17.2	23.7				
Large	32.5	3.7	19.4	7.7				
BY SEX								
Male	29.1	8.3	35.6	12.6	10.2	4.2	30.2	15.4
Female	19.9	8.0	37.8	13.0	6.6	2.5	23.7	12.3
OVERALL	**28.1**	**8.3**	**35.8**	**12.6**	**9.9**	**4.1**	**29.6**	**15.1**

TABLE 94: HIRED LABOR USE FOR RICE BY SEASON

In hours per acre

	Monsoon Rice				Off-season Rice			
	Prepa-ration	Planting	Manage-ment	Harvest	Prepa-ration	Planting	Manage-ment	Harvest
BY REGION								
Ayeyarwady	23.2	108.1	8.2	91.6				
Brackish water	37.3	104.4	8.9	94.8				
Freshwater	18.8	116.6	6.2	95.7				
Saltwater	13.5	103.3	9.4	84.4	7.7	2.2	9.5	79.2
Bago	43.4	84.7	28.1	66.4				
East alluvial	44.7	108.1	30.7	59.5				
West alluvial	36.7	77.8	37.0	58.1				
River area	49.0	65.2	19.1	75.9				
Sagaing	50.8	86.4	19.8	47.2				
Dryland	59.4	97.5	15.3	46.8	4.9	31.4	15.9	107.5
Irrigated tract	47.9	76.0	25.6	46.2	6.1	36.0	13.9	82.4
River area	17.1	55.5	1.7	54.0				
Shan State	8.7	90.4	12.6	66.5				
Border area	7.7	103.5	7.6	41.0	6.2	128.2	6.2	20.5
Northern interior	2.5	82.4	8.4	58.3				
Southern interior	17.4	71.2	26.7	126.3				
BY FARM SIZE								
Ayeyarwady								
Small	25.8	123.8	10.2	92.3	11.2	3.1	13.1	87.7
Medium	25.0	107.3	8.5	85.0	8.8	2.2	8.3	84.8
Large	25.0	99.0	5.5	81.1	6.8	2.1	9.5	75.9
Bago								
Small	43.8	76.5	26.5	59.0				
Medium	44.7	76.3	29.8	67.5				
Large	42.7	90.3	27.6	67.3				
Sagaing								
Small	49.5	90.1	14.4	44.8	7.2	29.9	13.9	93.3
Medium	48.8	98.1	17.2	48.3	5.3	27.1	10.5	100.3
Large	53.0	75.2	24.7	47.6	4.0	42.2	20.8	97.3
Shan State								
Small	6.4	101.2	7.2	46.5	6.2	128.2	6.2	20.5
Medium	5.0	84.3	13.9	68.9				
Large	19.5	64.7	27.4	124.4				
BY SEX								
Male	33.4	92.3	16.3	70.7	6.9	16.3	11.0	83.1
Female	37.6	107.7	20.1	76.6	7.0	15.1	11.4	75.0
OVERALL	**33.8**	**93.9**	**16.7**	**71.3**	**6.9**	**16.2**	**11.1**	**82.4**

TABLE 95: PERMANENT LABOR USE FOR RICE BY SEASON

In hours per acre

	Monsoon Rice				Off-season Rice			
	Prepa-ration	Planting	Manage-ment	Harvest	Prepa-ration	Planting	Manage-ment	Harvest
BY REGION								
Ayeyarwady	33.6	7.9	7.3	9.7				
Brackish water	49.0	8.1	6.5	9.9				
Freshwater	24.1	4.7	11.0	8.7				
Saltwater	22.9	6.8	4.6	10.5	3.9	1.1	7.0	4.8
Bago	18.8	3.6	1.1	1.8				
East alluvial	11.9	2.4	1.1	1.1				
West alluvial	29.4	5.8	0.5	1.7				
River area	17.7	3.2	1.4	2.7				
Sagaing	0.7	0.1	1.0	0.1				
Dryland	1.4	0.2	2.4	0.3	1.1	0.2	0.4	0.2
Irrigated tract	0.3	0.1	0.0		0.4	0.0	0.2	-
River area								
Shan State	0.7	2.7	0.7	1.7				
Border area					0.8	0.1	0.4	0.1
Northern interior								
Southern interior	2.8	10.5	2.9	6.6				
BY FARM SIZE								
Ayeyarwady								
Small	8.2	1.1	5.1	2.4	1.5	0.3	4.2	1.5
Medium	24.8	6.3	7.9	8.7	3.1	0.7	4.2	3.9
Large	42.8	10.0	7.4	11.6	4.5	1.3	8.5	5.5
Bago								
Small	7.2	0.9	0.1	0.1				
Medium	17.9	1.9	0.6	0.8				
Large	21.4	5.0	1.4	2.7				
Sagaing								
Small								
Medium	0.4	0.1	0.1					
Large	1.3	0.2	2.3	0.3	2.2	0.3	1.0	0.3
Shan State								
Small								
Medium								
Large	3.6	13.7	3.8	8.5				
BY SEX								
Male	21.6	5.1	3.5	5.1	2.9	0.7	4.8	3.5
Female	20.5	3.6	5.8	4.1	2.4	0.9	4.9	0.2
OVERALL	**21.5**	**5.0**	**3.7**	**5.0**	**2.8**	**0.7**	**4.8**	**3.2**

TABLE 96: BREAKDOWN OF TOTAL LABOR USE BY TASK FOR RICE PRODUCTION

In percent to total labor use

	Monsoon Rice				Off-season Rice			
	Prepa-ration	Planting	Manage-ment	Harvest	Prepa-ration	Planting	Manage-ment	Harvest
BY REGION								
Ayeyarwady	23.2	30.1	19.4	27.4				
Brackish water	33.4	29.3	11.0	26.3				
Freshwater	16.7	30.8	24.1	28.4				
Saltwater	15.5	30.4	26.4	27.7	11.5	4.4	25.9	58.2
Bago	28.4	33.2	12.2	26.1				
East alluvial	24.5	40.9	12.1	22.5				
West alluvial	30.6	30.8	15.8	22.7				
River area	31.0	26.5	9.3	33.1				
Sagaing	26.9	33.3	18.7	21.1				
Dryland	27.2	35.3	17.8	19.8	7.6	15.2	21.3	55.9
Irrigated tract	26.9	31.4	21.0	20.6	8.2	19.9	21.8	50.1
River area	24.4	33.4	7.8	34.4				
Shan State	19.1	38.5	12.3	30.1				
Border area	21.2	44.6	12.0	22.2	16.4	43.9	24.9	14.8
Northern interior	17.7	40.9	9.9	31.5				
Southern interior	16.4	26.1	14.8	42.7				
BY FARM SIZE								
Ayeyarwady								
Small	10.2	49.1	4.1	36.6	11.2	3.5	31.1	54.2
Medium	11.1	47.5	3.7	37.6	12.1	3.6	26.8	57.5
Large	11.9	47.0	2.6	38.5	11.3	5.0	24.5	59.2
Bago								
Small	21.3	37.2	12.9	28.7				
Medium	20.5	35.0	13.6	30.9				
Large	18.7	39.6	12.1	29.5				
Sagaing								
Small	24.9	45.3	7.2	22.5	7.8	15.7	23.0	53.5
Medium	23.0	46.2	8.1	22.7	8.2	14.7	19.8	57.4
Large	26.4	37.5	12.3	23.8	7.5	19.8	22.0	50.6
Shan State								
Small	4.0	62.7	4.5	28.8	16.2	44.0	24.9	14.8
Medium	2.9	49.0	8.1	40.0				
Large	8.3	27.4	11.6	52.7				
BY SEX								
Male	15.7	43.4	7.7	33.3	10.6	11.2	24.3	53.9
Female	15.6	44.5	8.3	31.6	9.9	11.4	24.7	54.0
OVERALL	**15.7**	**43.5**	**7.7**	**33.1**	**10.5**	**11.2**	**24.3**	**53.9**

TABLE 97: BREAKDOWN OF TOTAL LABOR USE BY TYPE OF LABOR FOR RICE PRODUCTION

	Monsoon Rice				Off-season Rice			
	Family %	Perma-	Hired %	Total Hours/Acre	Family %	Perma-nent %	Hired %	Total Hours/Acre
BY REGION								
Ayeyarwady	32.3	14.2	53.5	424				
Brackish water	30.3	19.2	50.5	433				
Freshwater	31.4	11.6	57.0	433				
Saltwater	35.9	10.0	54.1	408	30.8	10.0	59.2	167
Bago	10.3	9.2	80.6	278				
East alluvial	8.1	5.6	86.3	284				
West alluvial	14.0	13.0	73.0	290				
River area	9.6	9.9	80.5	260				
Sagaing	24.7	0.7	74.6	286				
Dryland	23.1	1.5	75.4	299	29.4	0.8	69.8	229
Irrigated tract	22.5	0.2	77.3	279	29.3	0.3	70.4	197
River area	52.4	0	47.6	285				
Shan State	37.5	2.0	60.5	289				
Border area	44.8	0	55.2	290	48.6	0.4	50.9	317
Northern interior	43.1	0	56.9	264				
Southern interior	20.6	6.9	72.5	330				
BY FARM SIZE								
Ayeyarwady								
Small	44.9	3.4	51.7	488	41.0	3.7	55.4	208
Medium	36.8	11.0	52.2	433	35.7	6.6	57.7	181
Large	26.7	18.6	54.7	385	26.7	12.7	60.6	156
Bago								
Small	22.7	3.0	74.3	277				
Medium	12.2	7.8	80.0	273				
Large	7.1	10.9	82.0	278				
Sagaing								
Small	28.0	0	72.0	276	30.7	0	69.3	208
Medium	23.2	0.2	76.6	277	31.0	0	69.0	207
Large	24.2	1.5	74.3	270	26.9	1.7	71.4	230
Shan State								
Small	43.6	0	56.4	286	48.9	0	51.1	315
Medium	39.8	0	60.2	286				
Large	19.2	9.0	71.8	329				
BY SEX								
Male	25.7	10.6	63.8	338	31.7	6.3	62.0	189
Female	22.2	9.6	68.2	356	27.8	5.2	67.0	162
OVERALL	**25.3**	**10.5**	**64.2**	**331**	**31.4**	**6.2**	**62.4**	**187**

ANNEX 8: MONSOON RICE FARM BUDGETS

TABLE 98: MONSOON RICE FARM BUDGET: OVERALL SAMPLE

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,237.0	191	235,685
Costs				
Seeds	Kg	45.7	301	13,738
Urea	Kg	43.7	474	20,713
NPK	Kg	18.6	472	8,773
T-Super	Kg	10.3	364	3,745
Other inorganic fertilizers	Kg			1,231
Pesticides	Unit			1,293
Total material inputs				*49,493*
Seed bed	Hours	24.3	414	10,067
Land preparation	Hours	6.6	359	2,359
Transplanting	Hours	97.1	267	25,935
Irrigation	Hours	0.1	260	26
Crop Management	Hours	15.9	168	2,665
Harvest	Hours	55.1	250	13,768
Post-harvest	Hours	15.3	332	5,098
Total hired labor		*214.4*	*279*	*59,922*
Seed bed	Hours	12.1	414	5,035
Land preparation	Hours	31.4	361	11,338
Transplanting	Hours	12.9	267	3,450
Irrigation	Hours	3.2	281	905
Crop Management	Hours	38.3	168	6,439
Harvest	Hours	4.0	250	989
Post-harvest	Hours	14.3	332	4,752
Total own labor		*116.3*	*279*	*32,909*
Seed bed	Unit			4,468
Land preparation	Unit			10,900
Crop management	Unit			79
Harvest and postharvest	Unit			6,167
Fuel	Unit			8,165
Draught oxen	Unit			5,900
Other services	Unit			7,686
Total livestock, machinery and fuel				*43,373*
Working capital before interest	Unit			
Interest on working capital				
Total Costs	MMK/acre			
Gross margin	MMK/acre			
Gross margin	$/ha			
Net margin	MMK/acre			
Net margin	$/ha			
Labor productivity	$/day			**4.40**
Total labor	Days/ha			105
Yield (dried paddy equivalent)	Kg/ha			**2,434**
Average cultivated area	Ha			1.75
Number of observations				1,373

TABLE 99: MONSOON RICE FARM BUDGET IN BRACKISH WATER ECOREGION, AYEYARWADY

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,482.7	171	252,926
Costs				
Seeds	Kg	48.6	208	10,115
Urea	Kg	53.3	419	22,330
NPK	Kg	17.3	488	8,436
T-Super	Kg	7.5	386	2,907
Other inorganic fertilizers	Kg			1,899
Organic fertilizers	Kg			
Pesticides	Unit			758
Total material inputs				*46,446*
Seed bed	Hours	9.0	342	3,068
Land preparation	Hours	9.9	271	2,694
Transplanting	Hours	124.5	189	23,570
Irrigation	Hours	0.0	167	5
Crop Management	Hours	6.5	201	1,306
Harvest	Hours	71.6	252	18,061
Post-harvest	Hours	25.2	253	6,385
Total hired labor		*246.8*	*223*	*55,089*
Seed bed	Hours	10.8	348	3,757
Land preparation	Hours	41.9	270	11,320
Transplanting	Hours	11.7	190	2,232
Irrigation	Hours	0.8	189	152
Crop Management	Hours	97.3	202	19,627
Harvest	Hours	3.4	251	854
Post-harvest	Hours	19.7	254	5,013
Total own labor		*185.7*	*223*	*42,955*
Seed bed	Unit			782
Land preparation	Unit			6,282
Crop management	Unit			
Harvest and postharvest	Unit			7,591
Fuel	Unit			4,664
Draught oxen	Unit			8,928
Other services	Unit			7,944
Total livestock, machinery and fuel				*36,191*
Working capital before interest	Unit			113,280
Interest on working capital				*2447*
Total Costs	MMK/acre			**183,128**
Gross margin	MMK/acre			112,753
Gross margin	$/ha			**278**
Net margin	MMK/acre			69,798
Net margin	$/ha			**176**
Labor productivity	$/day			**3.81**
Total labor	Days/ha			134
Yield (dried paddy equivalent)	Kg/ha			**2,917**
Average cultivated area	Ha			1.85
Number of observations				159

TABLE 100: MONSOON RICE FARM BUDGET IN FRESHWATER ECOREGION, AYEYARWADY

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,302.8	160	207,950
Costs				
Seeds	Kg	55.2	208	11,481
Urea	Kg	38.9	442	17,211
NPK	Kg	10.7	431	4,619
T-Super	Kg	4.7	363	1,722
Other inorganic fertilizers	Kg			307
Organic fertilizers	Kg			
Pesticides	Unit			374
Total material inputs				*35,713*
Seed bed	Hours	7.6	312	2,370
Land preparation	Hours	6.7	271	1,809
Transplanting	Hours	120.7	191	23,038
Irrigation	Hours	0.0	295	9
Crop Management	Hours	16.3	97	1,580
Harvest	Hours	64.1	270	17,280
Post-harvest	Hours	20.5	335	6,891
Total hired labor		*235.9*	*225*	*52,977*
Seed bed	Hours	11.9	347	4,134
Land preparation	Hours	41.4	273	11,309
Transplanting	Hours	14.3	191	2,721
Irrigation	Hours	1.2	269	325
Crop Management	Hours	95.3	103	9,775
Harvest	Hours	2.5	265	663
Post-harvest	Hours	30.1	338	10,163
Total own labor		*196.7*	*225*	*39,090*
Seed bed	Unit			1,489
Land preparation	Unit			10,698
Crop management	Unit			25
Harvest and postharvest	Unit			5,141
Fuel	Unit			6,819
Draught oxen	Unit			7,331
Other services	Unit			6,517
Total livestock, machinery and fuel				*38,019*
Working capital before interest	Unit			102,538
Interest on working capital				*2,215*
Total Costs	MMK/acre			**168,015**
Gross margin	MMK/acre			79,026
Gross margin	$/ha			**195**
Net margin	MMK/acre			39,936
Net margin	$/ha			**101**
Labor productivity	$/day			**3.12**
Total labor	Days/ha			134
Yield (dried paddy equivalent)	Kg/ha			**2,563**
Average cultivated area	Ha			1.82
Number of observations				159

TABLE 101: MONSOON RICE FARM BUDGET IN SALTWATER ECOREGION, AYEYARWADY

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	990.9	203	201,425
Costs				
Seeds	Kg	51.0	242	12,315
Urea	Kg	43.0	433	18,623
NPK	Kg	0.4	470	203
T-Super	Kg	18.5	479	8,848
Other inorganic fertilizers	Kg			141
Organic fertilizers	Kg			
Pesticides	Unit			1,440
Total material inputs				*41,570*
Seed bed	Hours	29.6	332	9,825
Land preparation	Hours	7.6	311	2,355
Transplanting	Hours	98.0	201	19,672
Irrigation	Hours			
Crop Management	Hours	0.9	359	326
Harvest	Hours	52.4	186	9,736
Post-harvest	Hours	22.2	268	5,932
Total hired labor		*210.6*	*227*	*47,855*
Seed bed	Hours	21.7	337	7,322
Land preparation	Hours	72.3	315	22,743
Transplanting	Hours	27.6	204	5,628
Irrigation	Hours	1.3	235	297
Crop Management	Hours	43.2	379	16,399
Harvest	Hours	7.1	192	1,362
Post-harvest	Hours	24.6	268	6,597
Total own labor		*197.9*	*227*	*60,346*
Seed bed	Unit			9,851
Land preparation	Unit			9,524
Crop management	Unit			
Harvest and postharvest	Unit			14,954
Fuel	Unit			12,164
Draught oxen	Unit			6,068
Other services	Unit			12,432
Total livestock, machinery and fuel				*64,993*
Working capital before interest	Unit			138,751
Interest on working capital				*2,997*
Total Costs	MMK/acre			**217,762**
Gross margin	MMK/acre			54,567
Gross margin	$/ha			**134**
Net margin	MMK/acre			-5,780
Net margin	$/ha			**-15**
Labor productivity	$/day			**2.96**
Total labor	Days/ha			126
Yield (dried paddy equivalent)	Kg/ha			**1,950**
Average cultivated area	Ha			2.71
Number of observations				156

TABLE 102: MONSOON RICE FARM BUDGET IN EAST ALLUVIAL ECOREGION, BAGO

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,354.6	180	244,429
Costs				
Seeds	Kg	45.1	192	8,653
Urea	Kg	17.6	666	11,722
NPK	Kg	6.9	711	4,936
T-Super	Kg	0.3	758	207
Other inorganic fertilizers	Kg			1,538
Organic fertilizers	Kg			
Pesticides	Unit			150
Total material inputs				*27,206*
Seed bed	Hours	42.7	435	18,576
Land preparation	Hours	4.0	448	1,811
Transplanting	Hours	101.9	293	29,865
Irrigation	Hours			
Crop Management	Hours	30.5	154	4,706
Harvest	Hours	60.3	241	14,545
Post-harvest	Hours	3.5	334	1,177
Total hired labor		*243.0*	*291*	*70,680*
Seed bed	Hours	7.7	436	3,334
Land preparation	Hours	20.7	446	9,239
Transplanting	Hours	5.3	307	1,617
Irrigation	Hours	0.1	287	42
Crop Management	Hours	4.6	154	706
Harvest	Hours	0.9	232	214
Post-harvest	Hours	2.0	333	676
Total own labor		*41.3*	*291*	*15,829*
Seed bed	Unit			3,528
Land preparation	Unit			4,197
Crop management	Unit			
Harvest and postharvest	Unit			2,172
Fuel	Unit			2,378
Draught oxen	Unit			12,547
Other services	Unit			3,836
Total livestock, machinery and fuel				*28,658*
Working capital before interest	Unit			110,823
Interest on working capital				*2,494*
Total Costs	MMK/acre			**144,867**
Gross margin	MMK/acre			115,391
Gross margin	$/ha			**284**
Net margin	MMK/acre			99,562
Net margin	$/ha			**241**
Labor productivity	$/day			**6.17**
Total labor	Days/ha			88
Yield (dried paddy equivalent)	Kg/ha			**2,665**
Average cultivated area	Ha			2.34
Number of observations				128

TABLE 103: MONSOON RICE FARM BUDGET IN WEST ALLUVIAL ECOREGION, BAGO

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,271.7	182	231,025
Costs				
Seeds	Kg	42.3	227	9,596
Urea	Kg	29.5	725	21,373
NPK	Kg	11.0	658	7,213
T-Super	Kg	1.0	598	589
Other inorganic fertilizers	Kg			1,511
Organic fertilizers	Kg			
Pesticides	Unit			1
Total material inputs				*40,283*
Seed bed	Hours	34.9	407	14,192
Land preparation	Hours	2.4	404	952
Transplanting	Hours	78.2	307	24,029
Irrigation	Hours	0.0	750	3
Crop Management	Hours	36.7	146	5,361
Harvest	Hours	48.1	360	17,333
Post-harvest	Hours	10.6	366	3,875
Total hired labor		*210.8*	*312*	*65,744*
Seed bed	Hours	11.8	409	4,823
Land preparation	Hours	40.4	402	16,228
Transplanting	Hours	11.3	307	3,486
Irrigation	Hours	0.4	681	287
Crop Management	Hours	8.2	150	1,228
Harvest	Hours	2.2	362	790
Post-harvest	Hours	4.7	366	1,729
Total own labor		*79.0*	*312*	*28,572*
Seed bed	Unit			3,204
Land preparation	Unit			3,158
Crop management	Unit			
Harvest and postharvest	Unit			3,277
Fuel	Unit			2,813
Draught oxen	Unit			17,898
Other services	Unit			2,906
Total livestock, machinery and fuel				*33,257*
Working capital before interest	Unit			118,076
Interest on working capital				*2,657*
Total Costs	MMK/acre			**170,513**
Gross margin	MMK/acre			89,084
Gross margin	$/ha			**219**
Net margin	MMK/acre			60,512
Net margin	$/ha			**153**
Labor productivity	$/day			**5.30**
Total labor	Days/ha			90
Yield (dried paddy equivalent)	Kg/ha			**2,502**
Average cultivated area	Ha			1.78
Number of observations				128

TABLE 104: MONSOON RICE FARM BUDGET IN RIVER AREA ECOREGION, BAGO

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,071.1	151	161,611
Costs				
Seeds	Kg	48.0	224	10,745
Urea	Kg	23.9	699	16,728
NPK	Kg	9.9	565	5,593
T-Super	Kg	0.8	383	311
Other inorganic fertilizers	Kg			2,778
Organic fertilizers	Kg			
Pesticides	Unit			232
Total material inputs				*36,387*
Seed bed	Hours	39.1	418	16,358
Land preparation	Hours	8.4	493	4,132
Transplanting	Hours	66.3	294	19,486
Irrigation	Hours	0.0	375	10
Crop Management	Hours	18.7	164	3,062
Harvest	Hours	69.2	221	15,263
Post-harvest	Hours	7.5	351	2,625
Total hired labor		*209.2*	*291*	*60,936*
Seed bed	Hours	10.5	416	4,374
Land preparation	Hours	22.1	493	10,886
Transplanting	Hours	5.7	294	1,683
Irrigation	Hours	0.6	333	186
Crop Management	Hours	4.1	164	678
Harvest	Hours	2.8	234	656
Post-harvest	Hours	5.4	356	1,910
Total own labor		*51.2*	*291*	*20,374*
Seed bed	Unit			2,528
Land preparation	Unit			5,209
Crop management	Unit			219
Harvest and postharvest	Unit			1,655
Fuel	Unit			2,944
Draught oxen	Unit			13,039
Other services	Unit			3,870
Total livestock, machinery and fuel				*29,463*
Working capital before interest	Unit			108,899
Interest on working capital				*2,450*
Total Costs	MMK/acre			**149,611**
Gross margin	MMK/acre			32,374
Gross margin	$/ha			**80**
Net margin	MMK/acre			12,000
Net margin	$/ha			**30**
Labor productivity	$/day			**3.84**
Total labor	Days/ha			80
Yield (dried paddy equivalent)	Kg/ha			**2,107**
Average cultivated area	Ha			2.48
Number of observations				124

TABLE 105: MONSOON RICE FARM BUDGET IN DRYLAND ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	926.9	231	214,100
Costs				
Seeds	Kg	49.0	301	14,741
Urea	Kg	45.3	542	24,565
NPK	Kg	49.8	441	21,997
T-Super	Kg	2.3	495	1,118
Other inorganic fertilizers	Kg			428
Organic fertilizers	Kg			
Pesticides	Unit			3,926
Total material inputs				*66,775*
Seed bed	Hours	50.4	379	19,104
Land preparation	Hours	9.6	345	3,306
Transplanting	Hours	103.0	272	28,064
Irrigation	Hours			
Crop Management	Hours	15.3	232	3,539
Harvest	Hours	38.9	299	11,623
Post-harvest	Hours	9.0	292	2,639
Total hired labor		*226.4*	*302*	*68,302*
Seed bed	Hours	11.4	384	4,399
Land preparation	Hours	9.9	332	3,302
Transplanting	Hours	3.6	281	1,025
Irrigation	Hours	13.7	310	4,227
Crop Management	Hours	22.6	232	5,247
Harvest	Hours	4.7	295	1,381
Post-harvest	Hours	6.2	286	1,765
Total own labor		*72.1*	*302*	*21,345*
Seed bed	Unit			6,752
Land preparation	Unit			6,619
Crop management	Unit			
Harvest and postharvest	Unit			3,390
Fuel	Unit			6,603
Draught oxen	Unit			11,756
Other services	Unit			10,298
Total livestock, machinery and fuel				*45,728*
Working capital before interest	Unit			166,544
Interest on working capital				*3,747*
Total Costs	MMK/acre			**205,898**
Gross margin	MMK/acre			29,547
Gross margin	$/ha			**73**
Net margin	MMK/acre			8,202
Net margin	$/ha			**21**
Labor productivity	$/day			**3.85**
Total labor	Days/ha			92
Yield (dried paddy equivalent)	Kg/ha			**1,824**
Average cultivated area	Ha			1.24
Number of observations				102

TABLE 106: MONSOON RICE FARM BUDGET IN IRRIGATED TRACT ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,006.0	189	190,268
Costs				
Seeds	Kg	43.2	323	13,945
Urea	Kg	45.8	529	24,252
NPK	Kg	57.9	503	29,142
T-Super	Kg	5.1	513	2,618
Other inorganic fertilizers	Kg			1,066
Organic fertilizers	Kg			
Pesticides	Unit			5,766
Total material inputs				*76,791*
Seed bed	Hours	42.3	435	18,378
Land preparation	Hours	6.6	505	3,335
Transplanting	Hours	77.6	318	24,691
Irrigation	Hours	1.0	229	225
Crop Management	Hours	26.7	177	4,709
Harvest	Hours	34.7	283	9,813
Post-harvest	Hours	12.3	313	3,837
Total hired labor		*201.1*	*323*	*64,988*
Seed bed	Hours	11.6	424	4,915
Land preparation	Hours	11.8	536	6,326
Transplanting	Hours	2.2	311	696
Irrigation	Hours	11.9	236	2,799
Crop Management	Hours	18.1	178	3,223
Harvest	Hours	0.7	306	220
Post-harvest	Hours	6.5	311	2,019
Total own labor		*78.3*	*323*	*20,198*
Seed bed	Unit			5,690
Land preparation	Unit			8,316
Crop management	Unit			202
Harvest and postharvest	Unit			2,058
Fuel	Unit			6,641
Draught oxen	Unit			9,048
Other services	Unit			9,512
Total livestock, machinery and fuel				*41,787*
Working capital before interest	Unit			169,916
Interest on working capital				*3,823*
Total Costs	MMK/acre			**207,587**
Gross margin	MMK/acre			2,879
Gross margin	$/ha			**7**
Net margin	MMK/acre			-17,319
Net margin	$/ha			**-44**
Labor productivity	$/day			**3.13**
Total labor	Days/ha			86
Yield (dried paddy equivalent)	Kg/ha			**1,979**
Average cultivated area	Ha			1.00
Number of observations				160

TABLE 107: MONSOON RICE FARM BUDGET IN RIVER AREA ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,538.3	139	213,761
Costs				
Seeds	Kg	32.7	237	7,767
Urea	Kg	5.6	497	2,805
NPK	Kg			
T-Super	Kg			
Other inorganic fertilizers	Kg			993
Organic fertilizers	Kg			
Pesticides	Unit			
Total material inputs				*11,565*
Seed bed	Hours	1.4	817	1,141
Land preparation	Hours	4.2	489	2,048
Transplanting	Hours	63.3	292	18,492
Irrigation	Hours	0.1	1,060	150
Crop Management	Hours	2.8	38	104
Harvest	Hours	51.7	235	12,173
Post-harvest	Hours	12.2	427	5,215
Total hired labor		*135.7*	*290*	*39,323*
Seed bed	Hours	26.3	289	7,602
Land preparation	Hours	19.1	486	9,281
Transplanting	Hours	36.5	292	10,656
Irrigation	Hours	19.9	279	5,542
Crop Management	Hours	8.0	288	2,314
Harvest	Hours	12.6	238	3,009
Post-harvest	Hours	26.4	427	11,265
Total own labor		*148.8*	*290*	*49,669*
Seed bed	Unit			2,766
Land preparation	Unit			24,481
Crop management	Unit			2,811
Harvest and postharvest	Unit			12,656
Fuel	Unit			19,564
Draught oxen	Unit			11,943
Other services	Unit			8,237
Total livestock, machinery and fuel				*82,460*
Working capital before interest	Unit			115,960
Interest on working capital				*2,505*
Total Costs	MMK/acre			**185,521**
Gross margin	MMK/acre			77,908
Gross margin	$/ha			**192**
Net margin	MMK/acre			28,239
Net margin	$/ha			**71**
Labor productivity	$/day			**5.24**
Total labor	Days/ha			88
Yield (dried paddy equivalent)	Kg/ha			**3,027**
Average cultivated area	Ha			0.26
Number of observations				83

TABLE 108: MONSOON RICE FARM BUDGET IN BORDER AREA ECOREGION, SHAN STATE

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,957.9	271	529,923
Costs				
Seeds	Kg	16.1	3,254	52,406
Urea	Kg	139.3	368	51,216
NPK	Kg	45.0	272	12,238
T-Super	Kg	57.4	247	14,219
Other inorganic fertilizers	Kg			191
Organic fertilizers	Kg			
Pesticides	Unit			1,144
Total material inputs				*131,413*
Seed bed	Hours	3.7	597	2,183
Land preparation	Hours	4.1	665	2,701
Transplanting	Hours	103.7	572	59,303
Irrigation	Hours	0.1	583	65
Crop Management	Hours	7.3	393	2,877
Harvest	Hours	22.9	537	12,306
Post-harvest	Hours	18.0	679	12,196
Total hired labor		*159.8*	*574*	*91,631*
Seed bed	Hours	29.2	595	17,363
Land preparation	Hours	24.6	668	16,431
Transplanting	Hours	25.4	578	14,651
Irrigation	Hours	10.9	574	6,251
Crop Management	Hours	16.3	512	8,369
Harvest	Hours	9.2	540	4,984
Post-harvest	Hours	14.2	679	9,647
Total own labor		*129.8*	*574*	*77,696*
Seed bed	Unit			676
Land preparation	Unit			16,553
Crop management	Unit			97
Harvest and postharvest	Unit			17,234
Fuel	Unit			30,059
Draught oxen	Unit			4,925
Other services	Unit			13,413
Total livestock, machinery and fuel				*82,957*
Working capital before interest	Unit			281,499
Interest on working capital				*4,222*
Total Costs	MMK/acre			**387,920**
Gross margin	MMK/acre			219,699
Gross margin	$/ha			**541**
Net margin	MMK/acre			142,003
Net margin	$/ha			**358**
Labor productivity	$/day			**10.40**
Total labor	Days/ha			89
Yield (dried paddy equivalent)	Kg/ha			**3,852**
Average cultivated area	Ha			0.74
Number of observations				117

TABLE 109: MONSOON RICE FARM BUDGET IN NORTHERN INTERIOR ECOREGION, SHAN STATE

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,377.2	293	402,984
Costs				
Seeds	Kg	25.8	836	21,578
Urea	Kg	98.4	389	38,223
NPK	Kg	61.5	292	17,975
T-Super	Kg	51.5	312	16,067
Other inorganic fertilizers	Kg			
Organic fertilizers	Kg			43
Pesticides	Unit			2,466
Total material inputs				*96,351*
Seed bed	Hours	1.2	422	510
Land preparation	Hours	0.2	375	57
Transplanting	Hours	81.6	528	43,139
Irrigation	Hours			
Crop Management	Hours	8.1	244	1,986
Harvest	Hours	45.5	480	21,849
Post-harvest	Hours	12.7	617	7,854
Total hired labor		*149.4*	*505*	*75,395*
Seed bed	Hours	20.2	366	7,385
Land preparation	Hours	25.2	307	7,746
Transplanting	Hours	26.2	520	13,642
Irrigation	Hours	5.7	503	2,851
Crop Management	Hours	11.9	263	3,132
Harvest	Hours	11.1	484	5,364
Post-harvest	Hours	14.2	618	8,793
Total own labor		*114.5*	*437*	*48,913*
Seed bed	Unit			5,376
Land preparation	Unit			16,563
Crop management	Unit			
Harvest and postharvest	Unit			17,800
Fuel	Unit			14,907
Draught oxen	Unit			7,443
Other services	Unit			11,179
Total livestock, machinery and fuel				*73,268*
Working capital before interest	Unit			215,312
Interest on working capital				*4,845*
Total Costs	MMK/acre			**298,772**
Gross margin	MMK/acre			153,125
Gross margin	$/ha			**377**
Net margin	MMK/acre			104,212
Net margin	$/ha			**263**
Labor productivity	$/day			**9.03**
Total labor	Days/ha			82
Yield (dried paddy equivalent)	Kg/ha			**2,710**
Average cultivated area	Ha			1.19
Number of observations				35

TABLE 110: MONSOON RICE FARM BUDGET IN SOUTHERN INTERIOR ECOREGION, SHAN STATE

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,017.7	352	358,146
Costs				
Seeds	Kg	36.5	488	17,831
Urea	Kg	91.7	442	40,534
NPK	Kg	8.9	335	2,983
T-Super	Kg	23.4	318	7,457
Other inorganic fertilizers	Kg			
Organic fertilizers	Kg			281
Pesticides	Unit			606
Total material inputs				*69,692*
Seed bed	Hours	8.0	216	1,736
Land preparation	Hours	9.6	371	3,578
Transplanting	Hours	70.3	380	26,715
Irrigation	Hours	0.0		23
Crop Management	Hours	26.5	233	6,166
Harvest	Hours	84.1	197	16,584
Post-harvest	Hours	40.3	371	14,965
Total hired labor		*238.8*	*292*	*69,768*
Seed bed	Hours	11.1	259	2,867
Land preparation	Hours	25.5	351	8,945
Transplanting	Hours	15.7	405	6,354
Irrigation	Hours	4.8	293	1,402
Crop Management	Hours	17.7	225	3,977
Harvest	Hours	12.2	190	2,318
Post-harvest	Hours	4.3	365	1,576
Total own labor		*91.2*	*292*	*27,438*
Seed bed	Unit			1,455
Land preparation	Unit			12,970
Crop management	Unit			455
Harvest and postharvest	Unit			7,141
Fuel	Unit			14,672
Draught oxen	Unit			4,801
Other services	Unit			12,661
Total livestock, machinery and fuel				*54,154*
Working capital before interest	Unit			162,064
Interest on working capital				*3,501*
Total Costs	MMK/acre			**224,552**
Gross margin	MMK/acre			161,033
Gross margin	$/ha			**397**
Net margin	MMK/acre			133,595
Net margin	$/ha			**337**
Labor productivity	$/day			**6.78**
Total labor	Days/ha			102
Yield (dried paddy equivalent)	Kg/ha			**2,002**
Average cultivated area	Ha			2.00
Number of observations				22

TABLE 111: MONSOON RICE FARM BUDGET BY CROP ESTABLISHMENT

		Transplanting			Direct Seeding		
	Unit	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,290.1	191	246,753	957.8	174	166,665
Costs							
Seeds	Kg	45.5	293	13,343	48.9	230	11,246
Urea	Kg	44.5	492	21,859	31.5	464	14,632
NPK	Kg	18.6	472	8,785	8.9	501	4,463
T-Super	Kg	9.5	374	3,546	8.3	443	3,673
Other inorganic fertilizers	Kg			1,292			709
Organic fertilizers	Kg			7			
Pesticides	Unit			1,254			955
Total material inputs				*50,085*			*35,678*
Seed bed	Hours	28.8	405	11,681	20.6	376	7,759
Land preparation	Hours	6.4	357	2,298	7.2	413	2,968
Transplanting	Hours	116.5	261	30,443			
Irrigation	Hours	0.1	269	28	0.02	167	3
Crop Management	Hours	18.5	169	3,121	8.7	136	1,182
Harvest	Hours	54.5	266	14,519	63.0	202	12,726
Post-harvest	Hours	14.5	330	4,781	17.9	301	5,366
Total hired labor		*239.4*	*279*	*66,873*	*138.4*	*250*	*34,543*
Seed bed	Hours	15.8	405	6,392	4.7	376	1,760
Land preparation	Hours	34.3	357	12,234	43.0	413	17,780
Transplanting	Hours	13.4	261	3,514			
Irrigation	Hours	3.3	269	874	1.2	167	196
Crop Management	Hours	33.0	169	5,569	51.9	136	7,065
Harvest	Hours	3.7	266	990	4.4	202	890
Post-harvest	Hours	12.7	330	4,181	18.5	301	5,552
Total own labor		*116.2*	*294*	*33,754*	*136.1*	*266*	*33,243*
Seed bed	Unit			2,603			1,339
Land preparation	Unit			3,639			3,776
Crop management	Unit			112			
Harvest and postharvest	Unit			5,360			3,894
Fuel	Unit			8,731			7,016
Draught oxen	Unit			4,098			1,878
Other services	Unit			8,059			7,359
Total livestock, machinery and fuel				*32,612*			*25,262*
Working capital before interest	Unit			130,271			77,391
Interest on working capital				*2,814*			*1,672*
Total Costs	MMK/acre			186,138			**130,398**
Gross margin	MMK/acre			94,369			69,510
Gross margin	$/ha			232			**171**
Net margin	MMK/acre			60,615			36,266
Net margin	$/ha			153			**92**
Labor productivity	$/day			4.32			**3.69**
Total labor	Days/ha			110			85
Yield (dried paddy equivalent)	Kg/ha			2,538			**1,885**
Average cultivated area	Ha			1.58			2.34
Number of observations				1,180			193

TABLE 112: MONSOON RICE FARM BUDGET BY TYPE OF SEEDS USED

		Hybrid			Certified			Other		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,767.8	273	482,535	1,391.6	178	265,798	1,181.1	182	225,598
Costs										
Seeds	Kg	18.2	2,498	45,440	47.5	282	13,370	47.7	231	11,020
Urea	Kg	130.0	375	48,762	38.6	549	21,200	37.1	506	18,756
NPK	Kg	43.1	276	11,913	21.0	517	10,845	14.8	504	7,488
T-Super	Kg	57.0	267	15,204	6.6	373	2,449	6.7	445	2,985
Other inorganic fertilizers	Kg			140			1,747			1,194
Organic fertilizers	Kg			13						6
Pesticides	Unit			1,306			521			1,242
Total material inputs				*122,779*			*50,132*			*42,690*
Seedbed		3.5	546	1,885	24.6	426	10,491	28.8	398	11,475
Land preparation	Hours	3.1	661	2,034	10.8	316	3,420	6.5	368	2,373
Transplanting	Hours	98.9	539	53,349	101.0	232	23,442	93.0	247	22,939
Irrigation	Hours	0.1	583	48	0.1	380	44	0.1	235	20
Crop Management	Hours	8.9	324	2,900	15.4	181	2,795	17.1	160	2,731
Harvest	Hours	29.7	475	14,107	64.5	270	17,423	57.1	244	13,919
Post-harvest	Hours	18.0	631	11,373	21.7	376	8,156	14.5	295	4,264
Total hired labor		*162.2*	*528*	*85,695*	*241.1*	*276*	*66,451*	*221.4*	*265*	*58,673*
Seedbed		27.4	546	14,950	14.2	426	6,042	12.8	398	5,088
Land preparation	Hours	23.8	661	15,749	27.9	316	8,808	37.3	368	13,722
Transplanting	Hours	30.2	539	16,304	8.9	232	2,061	9.9	247	2,433
Irrigation	Hours	9.5	583	5,548	2.7	380	1,031	2.5	235	581
Crop Management	Hours	16.9	324	5,478	53.8	181	9,748	36.5	160	5,820
Harvest	Hours	12.4	475	5,884	4.0	270	1,090	3.3	244	815
Post-harvest	Hours	13.6	631	8,593	13.1	376	4,921	13.9	295	4,088
Total own labor		*133.9*	*537*	*72,506*	*125.9*	*312*	*33,701*	*118.8*	*278*	*32,546*
Seedbed				841			2,484			2,435
Land preparation	Unit			3,708			3,844			3,649
Crop management	Unit			171			53			89
Harvest and postharvest	Unit			19,599			3,782			4,335
Fuel	Unit			30,335			7,255			7,217
Draught oxen	Unit			3,245			5,739			3,528
Other services	Unit			15,808			9,967			7,306
Total livestock, machinery and fuel				*73,708*			*33,124*			*28,569*
Working capital before interest	Unit			256,703			124,128			111,750
Interest on working capital				*5,545*			*2,681*			*2,414*
Total Costs	MMK/acre			**360,233**			**186,090**			**164,893**
Gross margin	MMK/acre			194,882			95,318			82,620
Gross margin	$/ha			**480**			**235**			**203**
Net margin	MMK/acre			122,376			61,617			50,074
Net margin	$/ha			**309**			**156**			**126**
Labor productivity	$/day			**9.09**			**4.24**			**3.96**
Total labor	Days/ha			91			113			105
Yield	Kg/ha			**3,478**			**2,738**			**2,234**
Average cultivated area	Ha			0.84			1.95			1.77
Number of observations				140			82			1,151

TABLE 113: MONSOON RICE FARM BUDGET BY LEVEL OF FERTILIZER USE

		Low Use			Medium Use			High Use		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,107.5	178	197,141	1,266.8	176	222,959	1,326.5	217	287,843
Costs										
Seeds	Kg	45.8	220	10,048	48.1	243	11,665	44.1	419	18,503
Urea	Kg	10.2	612	6,246	38.4	500	19,216	88.9	462	41,047
NPK	Kg	1.6	676	1,105	11.7	540	6,326	43.6	442	19,247
T-Super	Kg	0.6	537	335	5.4	458	2,450	26.1	361	9,399
Other inorganic fertilizers	Kg			1,314			1,086			1,124
Organic fertilizers	Kg						14			2
Pesticides	Unit			239			1,380			2,219
Total material inputs				*19,286*			*42,137*			*91,541*
Seedbed		30.3	405	12,284	24.5	400	9,810	26.9	395	10,608
Land preparation	Hours	6.1	349	2,118	6.3	373	2,338	7.7	384	2,964
Transplanting	Hours	86.7	244	21,154	99.0	238	23,591	96.4	314	30,272
Irrigation	Hours	0.0	408	7	0.0	313	14	0.2	237	55
Crop Management	Hours	16.8	166	2,794	17.7	144	2,555	14.8	198	2,935
Harvest	Hours	58.7	233	13,674	57.8	257	14,835	50.6	275	13,929
Post-harvest	Hours	10.3	331	3,413	16.4	291	4,771	19.9	353	7,033
Total hired labor		*213.0*	*264*	*56,283*	*226.8*	*260*	*58,976*	*219.1*	*313*	*68,500*
Seedbed		11.8	405	4,781	12.9	400	5,154	17.1	395	6,737
Land preparation	Hours	33.6	349	11,738	41.4	373	15,456	31.8	384	12,220
Transplanting	Hours	9.3	244	2,267	12.5	238	2,970	10.7	314	3,351
Irrigation	Hours	1.2	408	471	2.6	313	818	5.4	237	1,286
Crop Management	Hours	26.3	166	4,372	41.3	144	5,966	44.2	198	8,766
Harvest	Hours	3.1	233	721	4.4	257	1,131	4.1	275	1,128
Post-harvest	Hours	10.7	331	3,551	14.8	291	4,303	16.6	353	5,857
Total own labor		*98.5*	*305*	*27,902*	*132.5*	*288*	*35,799*	*131.8*	*308*	*39,346*
Seedbed				1,864			2,763			2,463
Land preparation	Unit			3,412			3,790			3,835
Crop management	Unit			123			61			86
Harvest and postharvest	Unit			3,897			4,733			7,107
Fuel	Unit			5,516			7,102			13,993
Draught oxen	Unit			4,559			3,289			2,989
Other services	Unit			5,927			7,839			10,694
Total livestock, machinery and fuel				*25,297*			*29,589*			*41,183*
Working capital before interest	Unit			83,779			111,096			180,263
Interest on working capital				*1,810*			*2,400*			*3,894*
Total Costs	MMK/acre			**130,578**			**168,901**			**244,464**
Gross margin	MMK/acre			94,465			89,857			82,725
Gross margin	$/ha			**233**			**221**			**204**
Net margin	MMK/acre			66,563			54,059			43,380
Net margin	$/ha			**168**			**136**			**109**
Labor productivity	$/day			**4.52**			**3.95**			**4.24**
Total labor	Days/ha			96			111			108
Yield	Kg/ha			**2,179**			**2,492**			**2,610**
Average cultivated area	Ha			1.83			1.87			1.38
Number of observations				458			458			457

TABLE 114: MONSOON RICE FARM BUDGET BY TYPES OF FERTILIZER USED

		No Use of Urea			Urea only			Urea + NPK		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	874.9	177	154,862	1,274.4	180	224,526	1,285.3	197	253,210
Costs										
Seeds	Kg	42.4	239	10,148	49.2	239	11,793	44.6	323	14,426
Urea	Kg				44.0	519	22,820	49.5	467	23,100
NPK	Kg	13.1	539	7,054	0.0			30.4	470	14,269
T-Super	Kg	2.5	400	1,004	0.1			17.8	387	6,886
Other inorganic fertilizers	Kg			570			2,150			562
Organic fertilizers	Kg						13			1
Pesticides	Unit			687			261			2,028
Total material inputs				*19,463*			*37,038*			*61,272*
Seedbed		26.0	369	9,601	27.1	400	10,858	27.6	408	11,253
Land preparation	Hours	9.0	366	3,299	5.3	394	2,090	7.0	355	2,499
Transplanting	Hours	53.9	257	13,859	98.9	246	24,288	98.7	274	27,036
Irrigation	Hours	0.0	417	8	0.0	245	12	0.1	266	35
Crop Management	Hours	8.0	132	1,056	18.6	174	3,239	16.9	162	2,732
Harvest	Hours	51.2	234	11,982	62.2	244	15,189	52.6	263	13,863
Post-harvest	Hours	10.0	320	3,213	14.0	321	4,481	17.2	325	5,581
Total hired labor		*163.8*	*272*	*44,512*	*231.3*	*264*	*61,064*	*223.2*	*286*	*63,732*
Seedbed		10.2	369	3,756	15.0	400	6,014	13.3	408	5,420
Land preparation	Hours	37.2	366	13,613	37.9	394	14,943	34.2	355	12,145
Transplanting	Hours	14.1	257	3,633	12.5	246	3,060	8.9	274	2,427
Irrigation	Hours	2.1	417	869	1.6	245	384	4.0	266	1,065
Crop Management	Hours	23.1	132	3,053	38.1	174	6,635	38.5	162	6,226
Harvest	Hours	4.9	234	1,147	4.4	244	1,085	3.2	263	834
Post-harvest	Hours	16.5	320	5,282	12.9	321	4,140	13.9	325	4,518
Total own labor		*110.9*	*299*	*31,353*	*125.2*	*289*	*36,260*	*118.0*	*293*	*32,634*
Seedbed				2,853			2,015			2,513
Land preparation	Unit			3,596			3,761			3,607
Crop management	Unit			326			39			78
Harvest and postharvest	Unit			4,526			4,456			5,672
Fuel	Unit			6,572			6,908			9,946
Draught oxen	Unit			4,086			4,648			2,817
Other services	Unit			5,709			7,454			8,769
Total livestock, machinery and fuel				*27,690*			*29,281*			*33,414*
Working capital before interest	Unit			76,470			107,713			138,974
Interest on working capital				*1,652*			*2,327*			*3,002*
Total Costs	MMK/acre			**124,670**			**165,970**			**194,053**
Gross margin	MMK/acre			61,546			94,817			91,791
Gross margin	$/ha			**152**			**233**			**226**
Net margin	MMK/acre			30,193			58,556			59,157
Net margin	$/ha			**76**			**148**			**149**
Labor productivity	$/day			**3.83**			**4.14**			**4.36**
Total labor	Days/ha			85			110			105
Yield	Kg/ha			**1,721**			**2,454**			**2,529**
Average cultivated area	Ha			1.39			1.83			1.67
Number of observations				184			492			697

TABLE 115: MONSOON RICE BUDGET BY FARM SIZE IN BRACKISH WATER ECOREGION, AYEYARWADY

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,533.1	165	253,075	1,466.9	163	238,423	1,478.8	177	261,986
Costs										
Seeds	Kg	47.1	214	10,094	49.2	210	10,353	48.7	205	9,980
Urea	Kg	53.2	431	22,908	54.8	417	22,881	51.9	415	21,525
NPK	Kg	12.4	526	6,541	19.9	471	9,391	16.9	499	8,444
T-Super	Kg	9.3	388	3,591	4.8	370	1,782	8.9	392	3,502
Other inorganic fertilizers	Kg			1,774			2,126			1,929
Organic fertilizers	Kg									
Pesticides	Unit			2,183			262			624
Total material inputs				*47,090*			*46,796*			*46,005*
Seedbed		8.3	268	2,234	10.4	452	4,684	8.3	281	2,336
Land preparation	Hours	11.2	251	2,820	9.6	288	2,756	9.7	272	2,626
Transplanting	Hours	129.2	197	25,427	115.5	202	23,388	113.4	183	20,789
Irrigation	Hours	0.2	167	25						
Crop Management	Hours	14.4	206	2,972	8.5	205	1,734	2.4	190	451
Harvest	Hours	72.3	290	20,953	63.3	285	18,030	73.9	228	16,822
Post-harvest	Hours	30.0	244	7,305	27.4	257	7,042	22.6	251	5,652
Total hired labor		*276.1*	*230*	*63,519*	*236.6*	*245*	*58,058*	*235.1*	*211*	*49,696*
Seedbed		12.8	268	3,420	11.5	452	5,182	8.8	281	2,472
Land preparation	Hours	40.4	251	10,153	41.4	288	11,916	39.8	272	10,807
Transplanting	Hours	10.7	197	2,096	8.2	202	1,662	7.4	183	1,358
Irrigation	Hours	1.7	167	287	0.2	245	55	0.7	211	147
Crop Management	Hours	133.0	206	27,382	93.3	205	19,150	81.4	190	15,489
Harvest	Hours	2.3	290	680	3.2	285	907	3.5	228	807
Post-harvest	Hours	20.3	244	4,940	23.1	257	5,928	17.2	251	4,305
Total own labor		*225.3*	*232*	*48,958*	*183.3*	*276*	*44,799*	*162.7*	*231*	*35,386*
Seedbed				659			712			1,108
Land preparation	Unit			5,425			3,885			1,482
Crop management	Unit									
Harvest and postharvest	Unit			6,740			6,010			8,152
Fuel	Unit			5,527			6,398			8,453
Draught oxen	Unit			7,768			1,462			323
Other services	Unit			9,986			7,822			8,113
Total livestock, machinery and fuel				*36,105*			*26,288*			*27,631*
Working capital before interest	Unit			146,714			131,142			123,332
Interest on working capital				*3,169*			*2,833*			*2,664*
Total Costs	MMK/acre			**198,814**			**178,774**			**161,382**
Gross margin	MMK/acre			103,192			104,448			135,990
Gross margin	$/ha			**254**			**257**			**335**
Net margin	MMK/acre			54,235			59,649			100,604
Net margin	$/ha			**137**			**151**			**254**
Labor productivity	$/day			**3.27**			**3.60**			**4.26**
Total labor	Days/ha			155			130			123
Yield	Kg/ha			**3,016**			**2,886**			**2,910**
Average cultivated area	Ha			0.94			1.76			2.73
Number of observations				51			50			58

TABLE 116: MONSOON RICE BUDGET BY FARM SIZE IN FRESHWATER ECOREGION, AYEYARWADY

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,254	172	215,239	1,301	164	213,073	1,316	151	199,112
Costs										
Seeds	Kg	56.4	212	11,966	55.5	209	11,606	54.1	206	11,165
Urea	Kg	33.7	435	14,670	42.3	446	18,839	38.1	441	16,796
NPK	Kg	7.7	426	3,260	11.3	446	5,056	11.1	419	4,661
T-Super	Kg	1.7	297	500	3.3	409	1,362	7.3	353	2,581
Other inorganic fertilizers	Kg			493			597			
Organic fertilizers	Kg									
Pesticides	Unit			251			405			433
Total material inputs				*31,140*			*37,865*			*35,636*
Seedbed		9.8	267	2,611	3.0	296	878	9.0	360	3,244
Land preparation	Hours	12.9	272	3,508	6.1	282	1,723	4.6	255	1,173
Transplanting	Hours	148.8	188	27,943	124.0	195	24,239	90.5	188	17,053
Irrigation	Hours	0.2	295	51						
Crop Management	Hours	8.7	237	2,073	15.1	94	1,411	20.4	70	1,426
Harvest	Hours	59.7	292	17,411	65.5	290	18,978	65.1	239	15,556
Post-harvest	Hours	25.5	308	7,856	21.5	247	5,318	16.8	457	7,663
Total hired labor		*267.9*	*231*	*61,890*	*239.3*	*223*	*53,307*	*215.2*	*222*	*47,720*
Seedbed		16.0	267	4,264	14.6	296	4,321	6.9	360	2,499
Land preparation	Hours	36.1	272	9,829	47.5	282	13,415	35.6	255	9,089
Transplanting	Hours	13.0	188	2,447	15.9	195	3,108	10.2	188	1,925
Irrigation	Hours	2.8	295	831	0.5	223	105	1.0	222	228
Crop Management	Hours	131.5	237	31,170	104.8	94	9,804	68.7	70	4,804
Harvest	Hours	4.3	292	1,255	3.5	290	1,007	1.1	239	261
Post-harvest	Hours	30.8	308	9,498	34.4	247	8,509	25.3	457	11,561
Total own labor		*235.0*	*266*	*59,294*	*222.5*	*233*	*40,268*	*151.3*	*256*	*30,367*
Seedbed				1,726			811			31
Land preparation	Unit			8,760			4,391			1,176
Crop management	Unit			47						
Harvest and postharvest	Unit			6,606			4,072			1,655
Fuel	Unit			9,940			10,275			7,127
Draught oxen	Unit			5,526			1,224			719
Other services	Unit			8,909			9,293			11,803
Total livestock, machinery and fuel				*41,514*			*30,066*			*22,511*
Working capital before interest	Unit			134,543			121,238			105,868
Interest on working capital				*2,906*			*2,619*			*2,287*
Total Costs	MMK/acre			**196,473**			**164,124**			**138,522**
Gross margin	MMK/acre			77,790			89,217			90,957
Gross margin	$/ha			**192**			**220**			**224**
Net margin	MMK/acre			18,496			48,949			60,590
Net margin	$/ha			47			124			153
Labor productivity	$/day			**2.83**			**2.92**			**3.49**
Total labor	Days/ha			155			143			113
Yield	Kg/ha			**2,469**			**2,561**			**2,591**
Average cultivated area	Ha			0.89			1.75			3.34
Number of observations				58			62			39

TABLE 117: MONSOON RICE BUDGET BY FARM SIZE IN SALTWATER ECOREGION, AYEYARWADY

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	954.4	193	184,016	922.7	204	188,506	1,018.3	203	207,116
Costs										
Seeds	Kg	65.4	229	14,950	50.8	229	11,647	49.9	246	12,264
Urea	Kg	29.0	432	12,518	49.4	437	21,595	42.1	432	18,193
NPK	Kg							0.7	470	318
T-Super	Kg	10.9	428	4,653	16.9	484	8,183	19.8	480	9,506
Other inorganic fertilizers	Kg			631			129			105
Organic fertilizers	Kg									
Pesticides	Unit			1,091			707			1,758
Total material inputs				*33,844*			*42,261*			*42,144*
Seedbed		24.3	321	7,777	38.2	299	11,404	28.0	350	9,795
Land preparation	Hours	26.5	317	8,408	11.1	286	3,176	5.1	326	1,674
Transplanting	Hours	39.0	186	7,242	79.1	190	15,042	95.3	199	18,957
Irrigation	Hours									
Crop Management	Hours	2.5	430	1,085	0.5	539	248	1.0	314	303
Harvest	Hours	50.6	220	11,138	51.3	252	12,935	53.0	162	8,580
Post-harvest	Hours	35.3	290	10,224	25.5	296	7,551	19.9	255	5,089
Total hired labor		*199.7*	*250*	*49,847*	*217.2*	*249*	*54,155*	*213.2*	*217*	*46,251*
Seedbed		9.6	321	3,073	17.2	299	5,126	25.2	350	8,811
Land preparation	Hours	70.3	317	22,310	57.2	286	16,367	78.2	326	25,481
Transplanting	Hours	10.2	186	1,886	16.4	190	3,111	20.8	199	4,135
Irrigation	Hours	2.0	250	510	1.9	249	481	0.9	217	204
Crop Management	Hours	81.5	430	35,046	77.2	539	41,630	29.3	314	9,207
Harvest	Hours	16.8	220	3,693	4.9	252	1,233	6.9	162	1,119
Post-harvest	Hours	34.2	290	9,892	29.0	296	8,582	22.1	255	5,632
Total own labor		*266.5*	*288*	*76,410*	*210.9*	*302*	*76,530*	*190.4*	*260*	*54,588*
Seedbed				4,724			4,925			2,865
Land preparation	Unit			4,738			5,435			1,593
Crop management	Unit									
Harvest and postharvest	Unit			11,738			9,102			3,113
Fuel	Unit			10,170			12,418			8,957
Draught oxen	Unit			5,491			744			331
Other services	Unit			10,529			14,842			9,670
Total livestock, machinery and fuel				*47,390*			*47,466*			*26,530*
Working capital before interest	Unit			131,081			143,882			114,926
Interest on working capital				*2,831*			*3,108*			*2,482*
Total Costs	MMK/acre			**210,332**			**223,520**			**171,996**
Gross margin	MMK/acre			50,103			41,516			89,708
Gross margin	$/ha			**123**			**102**			**221**
Net margin	MMK/acre			-26,306			-35,014			89,708
Net margin	$/ha			**-66**			**-88**			**89**
Labor productivity	$/day			**2.45**			**2.55**			**3.16**
Total labor	Days/ha			144			132			125
Yield	Kg/ha			**1,878**			**1,815**			**2,003**
Average cultivated area	Ha			1.02			1.83			3.53
Number of observations				18			49			89

TABLE 118: MONSOON RICE BUDGET BY FARM SIZE IN EAST ALLUVIAL ECOREGION, BAGO

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,402.3	181	254,199	1,360.2	180	244,892	1,349.5	181	243,681
Costs										
Seeds	Kg	47.7	196	9,356	44.3	196	8,672	44.3	188	8,328
Urea	Kg	33.0	656	21,631	16.3	689	11,199	12.7	649	8,274
NPK	Kg	8.4	741	6,192	5.2	718	3,730	9.2	689	6,321
T-Super	Kg	0.6	700	412	0.3	708	178	0.1	894	85
Other inorganic fertilizers	Kg			519			677			2,722
Organic fertilizers	Kg									
Pesticides	Unit						81			185
Total material inputs				*38,110*			*24,539*			*25,915*
Seedbed		45.0	439	19,767	45.0	412	18,518	38.4	467	17,920
Land preparation	Hours	5.2	420	2,175	3.4	462	1,591	3.6	433	1,552
Transplanting	Hours	79.6	346	27,521	77.1	320	24,656	138.3	261	36,045
Irrigation	Hours									
Crop Management	Hours	26.7	188	5,011	31.2	137	4,282	31.3	164	5,138
Harvest	Hours	46.5	377	17,515	63.2	260	16,394	59.6	200	11,914
Post-harvest	Hours	6.4	395	2,528	3.1	308	957	3.2	308	975
Total hired labor		*209.3*	*356*	*74,517*	*223.0*	*298*	*66,399*	*274.2*	*268*	*73,543*
Seedbed		11.4	439	5,001	7.6	412	3,123	6.6	467	3,063
Land preparation	Hours	29.9	420	12,558	20.8	462	9,599	16.7	433	7,254
Transplanting	Hours	6.7	346	2,327	4.2	320	1,332	5.7	261	1,479
Irrigation	Hours	0.3	356	100	0.2	298	49	0.1	268	37
Crop Management	Hours	9.1	188	1,703	2.5	137	338	4.7	164	768
Harvest	Hours	0.9	377	323	1.0	260	257	1.1	200	219
Post-harvest	Hours	3.1	395	1,213	2.4	308	732	1.7	308	530
Total own labor		*61.3*	*360*	*23,226*	*38.5*	*314*	*15,431*	*36.6*	*300*	*13,350*
Seedbed				2,360			1,222			2,590
Land preparation	Unit			1,903			1,605			5,298
Crop management	Unit						85			-
Harvest and postharvest	Unit			235			2,364			5,754
Fuel	Unit			1,429			2,152			6,349
Draught oxen	Unit			16,422			2,905			2,701
Other services	Unit			8,091			3,390			3,037
Total livestock, machinery and fuel				*30,439*			*13,724*			*25,730*
Working capital before interest	Unit			143,066			104,661			125,188
Interest on working capital				*3,090*			*2,261*			*2,704*
Total Costs	MMK/acre			**169,383**			**122,353**			**141,242**
Gross margin	MMK/acre			108,043			137,970			115,789
Gross margin	$/ha			**266**			**340**			**285**
Net margin	MMK/acre			84,817			122,539			102,439
Net margin	$/ha			**214**			**309**			**259**
Labor productivity	$/day			**6.48**			**6.82**			**5.56**
Total labor	Days/ha			84			81			96
Yield	Kg/ha			**2,759**			**2,676**			**2,655**
Average cultivated area	Ha			1.01			1.90			3.67
Number of observations				34			45			32

TABLE 119: MONSOON RICE BUDGET BY FARM SIZE IN WEST ALLUVIAL ECOREGION, BAGO

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,192.8	186	221,904	1,259.4	184	231,620	1,305.9	179	233,960
Costs										
Seeds	Kg	41.4	233	9,643	44.2	223	9,862	40.8	231	9,424
Urea	Kg	35.2	730	25,665	27.2	724	19,706	29.1	726	21,112
NPK	Kg	3.6	568	2,065	11.7	652	7,619	13.6	701	9,558
T-Super	Kg	0.8	402	341	0.5	627	317	1.3	627	809
Other inorganic fertilizers	Kg			180			2,458			1,175
Organic fertilizers	Kg									
Pesticides	Unit			6						
Total material inputs				*37,901*			*39,961*			*42,078*
Seedbed		26.2	395	10,343	35.3	359	12,667	35.9	448	16,089
Land preparation	Hours	4.3	401	1,733	3.0	369	1,123	1.3	478	636
Transplanting	Hours	77.3	278	21,462	73.0	351	25,637	81.2	288	23,355
Irrigation	Hours	0.0	750	19	-	-	-	-	-	-
Crop Management	Hours	30.6	159	4,850	36.2	162	5,882	39.4	128	5,047
Harvest	Hours	42.9	376	16,143	51.8	343	17,752	47.1	369	17,366
Post-harvest	Hours	9.9	389	3,849	12.2	295	3,601	9.6	425	4,072
Total hired labor		*191.2*	*306*	*58,399*	*211.6*	*315*	*66,661*	*214.4*	*310*	*66,564*
Seedbed		11.4	395	4,492	11.2	359	4,023	12.3	448	5,487
Land preparation	Hours	40.5	401	16,242	40.6	369	14,998	39.0	478	18,635
Transplanting	Hours	12.1	278	3,369	7.4	351	2,606	13.2	288	3,797
Irrigation	Hours	0.7	750	553	0.5	315	158	0.2	310	75
Crop Management	Hours	18.7	159	2,974	8.6	162	1,404	4.7	128	604
Harvest	Hours	4.6	376	1,712	0.8	343	263	2.2	369	801
Post-harvest	Hours	6.8	389	2,629	4.3	295	1,255	4.4	425	1,866
Total own labor		*94.8*	*393*	*31,970*	*73.4*	*313*	*24,707*	*75.9*	*349*	*31,266*
Seedbed				1,504			1,737			2,708
Land preparation	Unit			259			4,007			1,094
Crop management	Unit									
Harvest and postharvest	Unit			2,876			2,283			4,036
Fuel	Unit			3,056			1,947			4,531
Draught oxen	Unit			19,260			9,613			3,883
Other services	Unit			4,145			3,642			4,183
Total livestock, machinery and fuel				*31,100*			*23,229*			*20,435*
Working capital before interest	Unit			127,400			129,851			129,077
Interest on working capital				*2,752*			*2,805*			*2,788*
Total Costs	MMK/acre			**162,121**			**157,363**			**163,130**
Gross margin	MMK/acre			91,752			98,963			102,096
Gross margin	$/ha			**226**			**244**			**251**
Net margin	MMK/acre			59,782			74,256			70,830
Net margin	$/ha			**151**			**187**			**179**
Labor productivity	$/day			**5.17**			**5.44**			**5.27**
Total labor	Days/ha			88			88			90
Yield	Kg/ha			**2,347**			**2,478**			**2,569**
Average cultivated area	Ha			0.98			1.70			2.38
Number of observations				32			47			49

TABLE 120: MONSOON RICE BUDGET BY FARM SIZE IN RIVER AREA ECOREGION, BAGO

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,262.4	161	203,837	1,551.6	128	189,920	875.9	160	140,447
Costs										
Seeds	Kg	50.5	221	11,143	49.9	218	10,878	47.0	225	10,591
Urea	Kg	28.9	609	17,616	23.8	662	15,782	23.3	733	17,082
NPK	Kg	8.3	508	4,201	10.7	510	5,478	9.8	589	5,746
T-Super	Kg				3.2	394	1,279	0.0	460	9
Other inorganic fertilizers	Kg			2,907			3,545			2,580
Organic fertilizers	Kg									
Pesticides	Unit						43			276
Total material inputs				*35,866*			*37,006*			*36,284*
Seedbed		36.8	369	13,586	38.7	405	15,689	39.5	434	17,151
Land preparation	Hours	14.2	792	11,233	8.6	367	3,138	6.9	466	3,219
Transplanting	Hours	71.8	260	18,709	78.9	319	25,194	53.3	283	15,084
Irrigation	Hours							0.1	375	18
Crop Management	Hours	21.4	257	5,496	21.3	188	4,020	17.8	139	2,468
Harvest	Hours	66.5	306	20,346	67.3	305	20,538	70.0	173	12,078
Post-harvest	Hours	7.5	338	2,519	5.2	506	2,617	7.4	318	2,340
Total hired labor		*223.0*	*329*	*73,423*	*224.8*	*322*	*72,459*	*198.9*	*270*	*53,721*
Seedbed		11.1	369	4,083	9.7	405	3,935	10.5	434	4,536
Land preparation	Hours	21.1	792	16,748	26.1	367	9,577	19.0	466	8,861
Transplanting	Hours	6.1	260	1,598	3.1	319	987	4.4	283	1,255
Irrigation	Hours	0.2	329	59	0.5	322	170	0.6	375	227
Crop Management	Hours	9.1	257	2,327	5.1	188	964	3.0	139	412
Harvest	Hours	3.5	306	1,059	1.7	305	508	2.8	173	490
Post-harvest	Hours	4.6	338	1,549	4.7	506	2,356	5.2	318	1,671
Total own labor		*56.6*	*379*	*27,422*	*52.3*	*345*	*18,498*	*47.1*	*312*	*17,452*
Seedbed				4,974			1,982			1,651
Land preparation	Unit			3,284			5,129			4,544
Crop management	Unit						135			156
Harvest and postharvest	Unit			3,588			1,347			2,894
Fuel	Unit			4,776			2,768			3,410
Draught oxen	Unit			18,827			5,393			3,667
Other services	Unit			5,977			3,890			2,776
Total livestock, machinery and fuel				*41,426*			*20,645*			*19,098*
Working capital before interest	Unit			150,716			130,109			109,103
Interest on working capital				*3,255*			*2,810*			*2,357*
Total Costs	MMK/acre			**181,394**			**151,418**			**128,911**
Gross margin	MMK/acre			49,866			66,000			28,988
Gross margin	$/ha			**123**			**163**			**71**
Net margin	MMK/acre			22,443			47,502			11,536
Net margin	$/ha			**57**			**120**			**29**
Labor productivity	$/day			**4.77**			**4.69**			**3.35**
Total labor	Days/ha			86			86			76
Yield	Kg/ha			**2,484**			**3,053**			**1,723**
Average cultivated area	Ha			0.96			1.88			3.66
Number of observations				28			40			56

TABLE 121: MONSOON RICE BUDGET BY FARM SIZE IN DRYLAND ECOREGION, SAGAING

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	920.5	229	210,573	1,006.2	229	230,749	882.4	234	206,375
Costs										
Seeds	Kg	46.9	287	13,455	52.9	316	16,743	46.0	295	13,563
Urea	Kg	36.7	549	20,145	42.0	539	22,656	50.8	545	27,683
NPK	Kg	46.9	466	21,825	49.6	445	22,090	53.8	431	23,170
T-Super	Kg				1.4	347	470	3.8	546	2,093
Other inorganic fertilizers	Kg						199			525
Organic fertilizers	Kg									
Pesticides	Unit			2,648			4,444			4,201
Total material inputs				*58,074*			*66,601*			*71,233*
Seedbed		59.2	432	25,587	44.0	336	14,768	51.7	402	20,793
Land preparation	Hours	11.7	330	3,877	12.6	340	4,295	6.6	377	2,468
Transplanting	Hours	131.1	279	36,525	124.1	255	31,629	75.4	310	23,368
Irrigation	Hours									
Crop Management	Hours	16.5	249	4,105	11.0	296	3,257	17.9	201	3,598
Harvest	Hours	55.5	282	15,621	41.3	334	13,819	32.0	271	8,689
Post-harvest	Hours	8.1	280	2,258	9.4	259	2,436	8.7	332	2,895
Total hired labor		*282.6*	*312*	*88,075*	*242.6*	*290*	*70,271*	*195.7*	*319*	*62,377*
Seedbed		10.6	432	4,573	13.0	336	4,375	10.9	402	4,373
Land preparation	Hours	2.4	330	798	8.9	340	3,016	11.1	377	4,187
Transplanting	Hours	2.0	279	565	2.9	255	741	4.4	310	1,376
Irrigation	Hours	19.4	312	6,057	10.6	290	3,059	15.3	319	4,884
Crop Management	Hours	19.1	249	4,759	17.2	296	5,105	28.2	201	5,666
Harvest	Hours				5.5	334	1,842	6.0	271	1,626
Post-harvest	Hours	3.7	280	1,040	5.9	259	1,525	6.4	332	2,139
Total own labor		*57.5*	*314*	*17,791*	*64.0*	*301*	*19,664*	*82.7*	*316*	*24,251*
Seedbed				5,708			7,348			4,004
Land preparation	Unit			7,263			6,023			3,510
Crop management	Unit									
Harvest and postharvest	Unit			3,763			4,756			2,121
Fuel	Unit			7,117			6,421			8,091
Draught oxen	Unit			16,294			9,157			1,258
Other services	Unit			6,746			9,175			9,371
Total livestock, machinery and fuel				*47,211*			*42,980*			*28,354*
Working capital before interest	Unit			193,360			179,853			161,964
Interest on working capital				*4,177*			*3,885*			*3,498*
Total Costs	MMK/acre			**215,328**			**203,401**			**189,714**
Gross margin	MMK/acre			13,037			47,012			40,912
Gross margin	$/ha			**32**			**116**			**101**
Net margin	MMK/acre			-4,755			27,348			16,660
Net margin	$/ha			**-12**			**69**			**42**
Labor productivity	$/day			**3.49**			**4.20**			**3.73**
Total labor	Days/ha			105			95			86
Yield	Kg/ha			**1,811**			**1,980**			**1,736**
Average cultivated area	Ha			0.99			1.21			1.36
Number of observations				18			37			47

TABLE 122: MONSOON FARM BUDGET BY FARM SIZE IN IRRIGATED TRACT ECOREGION, SAGAING

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	995.2	192	191,172	894.5	182	162,502	1,080.0	194	209,331
Costs										
Seeds	Kg	41.9	338	14,155	39.6	317	12,577	45.3	330	14,964
Urea	Kg	34.6	526	18,217	47.2	538	25,374	47.0	526	24,730
NPK	Kg	50.7	525	26,624	64.4	488	31,448	52.9	513	27,160
T-Super	Kg	6.0	604	3,597	8.2	513	4,197	2.7	309	822
Other inorganic fertilizers	Kg			944			1,200			895
Organic fertilizers	Kg									
Pesticides	Unit			5,623			9,063			3,555
Total material inputs				*69,159*			*83,860*			*72,125*
Seedbed		44.5	412	18,329	38.9	474	18,413	41.5	445	18,456
Land preparation	Hours	7.6	487	3,680	6.1	549	3,356	6.7	468	3,149
Transplanting	Hours	79.0	355	28,087	82.6	327	26,969	75.2	295	22,193
Irrigation	Hours	1.8	61	109	0.7	314	210	0.9	330	281
Crop Management	Hours	16.4	228	3,749	22.9	204	4,657	30.3	161	4,863
Harvest	Hours	20.6	312	6,433	34.5	190	6,550	41.1	325	13,352
Post-harvest	Hours	13.7	332	4,564	9.1	247	2,263	13.1	348	4,543
Total hired labor		*183.7*	*354*	*64,951*	*194.7*	*321*	*62,416*	*208.7*	*320*	*66,836*
Seedbed		11.8	412	4,866	10.3	474	4,882	11.0	445	4,885
Land preparation	Hours	8.9	487	4,326	12.3	549	6,732	9.3	468	4,332
Transplanting	Hours	2.4	355	854	3.1	327	1,002	0.9	295	277
Irrigation	Hours	12.9	61	791	9.5	314	2,987	12.2	330	4,016
Crop Management	Hours	19.8	228	4,516	15.2	204	3,091	16.9	161	2,709
Harvest	Hours	0.7	312	207	1.0	190	196	0.3	325	98
Post-harvest	Hours	5.4	332	1,805	6.5	247	1,621	6.1	348	2,115
Total own labor		*61.9*	*313*	*17,364*	*57.9*	*329*	*20,512*	*56.6*	*339*	*18,433*
Seedbed				6,192			5,607			5,992
Land preparation	Unit			10,983			5,852			4,553
Crop management	Unit			296			462			
Harvest and postharvest	Unit			1,462			3,128			1,636
Fuel	Unit			8,822			8,470			6,977
Draught oxen	Unit			12,266			6,346			1,586
Other services	Unit			8,441			9,094			9,336
Total livestock, machinery and fuel				*48,757*			*38,958*			*30,081*
Working capital before interest	Unit			182,868			185,235			169,042
Interest on working capital				*3,950*			*4,001*			*3,651*
Total Costs	MMK/acre			**204,181**			**209,747**			**191,126**
Gross margin	MMK/acre			4,355			-26,734			36,639
Gross margin	$/ha			**11**			**-66**			**90**
Net margin	MMK/acre			-13,009			-4,882			18,206
Net margin	$/ha			**-33**			**-119**			**46**
Labor productivity	$/day			**3.77**			**2.27**			**4.01**
Total labor	Days/ha			76			78			82
Yield	Kg/ha			**1,958**			**1,760**			**2,125**
Average cultivated area	Ha			0.71			0.97			1.29
Number of observations				48			59			53

TABLE 123: MONSOON RICE BUDGET BY FARM SIZE IN RIVER AREA ECOREGION, SAGAING

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,611.4	143	230,789	1,543.4	148	228,633	1,669.0	163	271,739
Costs										
Seeds	Kg	27.9	275	7,659	38.4	228	8,756	24.3	216	5,250
Urea	Kg	5.7	621	3,567	5.8	435	2,523			
NPK	Kg									
T-Super	Kg									
Other inorganic fertilizers	Kg						1,779			
Organic fertilizers	Kg									
Pesticides	Unit									
Total material inputs				*11,227*			*13,058*			*5,250*
Seedbed		5.5		6,324	8.8	421	3,712			
Land preparation	Hours	9.3	570	5,312	15.2	380	5,754			
Transplanting	Hours	64.2	322	20,639	44.9	367	16,504	40.0	533	21,333
Irrigation	Hours	0.1		89	1.1	429	464			
Crop Management	Hours	1.9		71						
Harvest	Hours	37.5	313	11,711	56.6	200	11,334	24.0	583	14,000
Post-harvest	Hours	9.0	460	4,137	21.3	367	7,804			
Total hired labor		*127.5*	*379*	*48,284*	*147.9*	*308*	*45,572*	*64.0*	*552*	*35,333*
Seedbed		26.5	379	10,040	19.6	421	8,239	29.3	552	16,194
Land preparation	Hours	23.6	570	13,434	30.6	380	11,620	47.3	552	26,132
Transplanting	Hours	30.4	322	9,779	41.6	367	15,269	65.3	533	34,844
Irrigation	Hours	15.3	379	5,776	6.1	429	2,602	6.7	552	3,681
Crop Management	Hours	7.4	379	2,801	7.6	308	2,348		552	
Harvest	Hours	11.2	313	3,507	14.4	200	2,888	31.3	583	18,278
Post-harvest	Hours	28.0	460	12,890	29.7	367	10,911	24.0	552	13,250
Total own labor		*142.3*	*400*	*58,226*	*149.6*	*353*	*53,875*	*204.0*	*554*	*112,379*
Seedbed				1,689			1,547			20,000
Land preparation	Unit			9,425			1,392			13,333
Crop management	Unit			3,140			8,507			13,333
Harvest and postharvest	Unit			7,677			9,080			27,333
Fuel	Unit			12,369			16,145			50,667
Draught oxen	Unit			6,476			6,463			
Other services	Unit			4,096			5,712			4,293
Total livestock, machinery and fuel				*44,873*			*48,846*			*128,960*
Working capital before interest	Unit			104,384			107,476			169,543
Interest on working capital				*2,255*			*2,321*			*3,662*
Total Costs	MMK/acre			**164,864**			**163,673**			**285,585**
Gross margin	MMK/acre			124,151			118,835			98,534
Gross margin	$/ha			**306**			**293**			**243**
Net margin	MMK/acre			65,925			64,960			-13,845
Net margin	$/ha			**166**			**164**			**-35**
Labor productivity	$/day			**6.27**			**5.48**			**6.58**
Total labor	Days/ha			83			92			83
Yield	Kg/ha			**3,170**			**3,037**			**3,284**
Average cultivated area	Ha			0.22			0.26			0.15
Number of observations				61			20			2

TABLE 124: MONSOON RICE BUDGET BY FARM SIZE IN BORDER AREA ECOREGION, SHAN STATE

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,953.3	271	529,360	2,120.1	265	562,558			
Costs										
Seeds	Kg	16.2	3,248	52,494	15.8	3,227	50,863			
Urea	Kg	138.4	368	50,949	145.7	364	53,071			
NPK	Kg	41.8	274	11,481	70.5	258	18,211			
T-Super	Kg	62.6	247	15,456	16.3	268	4,366			
Other inorganic fertilizers	Kg			215						
Organic fertilizers	Kg									
Pesticides	Unit			1,056			1,801			
Total material inputs				*131,651*			*128,312*			
Seedbed		3.9	548	2,120	2.0	1,327	2,649			
Land preparation	Hours	4.4	664	2,896	2.0	625	1,222			
Transplanting	Hours	103.5	566	58,549	107.6	611	65,750			
Irrigation	Hours	0.1	583	73						
Crop Management	Hours	7.5	411	3,067	7.3	194	1,426			
Harvest	Hours	22.0	559	12,280	31.0	411	12,721			
Post-harvest	Hours	15.8	770	12,129	35.1	364	12,768			
Total hired labor		*157.1*	*580*	*91,114*	*185.0*	*522*	*96,536*			
Seedbed		28.2	548	15,443	37.2	1,327	49,353			
Land preparation	Hours	26.4	664	17,563	11.2	625	7,004			
Transplanting	Hours	23.9	566	13,531	36.7	611	22,406			
Irrigation	Hours	11.5	583	6,682	6.6	522	3,467			
Crop Management	Hours	16.3	411	6,698	16.7	194	3,249			
Harvest	Hours	9.4	559	5,259	7.8	411	3,214			
Post-harvest	Hours	13.9	770	10,733	16.2	364	5,913			
Total own labor		*129.6*	*586*	*75,908*	*132.5*	*579*	*94,605*			
Seedbed				214						
Land preparation	Unit			2,684						
Crop management	Unit			262						
Harvest and postharvest	Unit			20,044			12,001			
Fuel	Unit			36,710			24,332			
Draught oxen	Unit			2,612						
Other services	Unit			18,110			10,738			
Total livestock, machinery and fuel				*80,636*			*47,070*			
Working capital before interest	Unit			303,401			271,918			
Interest on working capital				*6,553*			*5,873*			
Total Costs	MMK/acre			**385,863**			**372,397**			
Gross margin	MMK/acre			91,114			284,766			
Gross margin	$/ha			**530**			**701**			
Net margin	MMK/acre			139,498			190,161			
Net margin	$/ha			**352**			**480**			
Labor productivity	$/day			**10.18**			**10.55**			
Total labor	Days/ha			89			98			
Yield	Kg/ha			**3,808**			**4,171**			
Average cultivated area	Ha			0.70			1.42			
Number of observations				110			7			

TABLE 125: MONSOON RICE BUDGET BY FARM SIZE IN NORTHERN INTERIOR ECOREGION, SHAN STATE

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,515.8	296	449,117	1,190.5	284	337,729			
Costs										
Seeds	Kg	26.2	875	22,939	25.4	802	20,365			
Urea	Kg	96.8	393	38,053	103.3	382	39,473			
NPK	Kg	65.8	287	18,913	55.3	301	16,645			
T-Super	Kg	43.5	314	13,670	64.9	310	20,144			
Other inorganic fertilizers	Kg									
Organic fertilizers	Kg			61						
Pesticides	Unit			2,125			3,073			
Total material inputs				*95,761*			*99,700*			
Seedbed		0.5	562	295	2.3	375	866			
Land preparation	Hours	0.3	375	98						
Transplanting	Hours	94.1	563	52,972	65.3	459	29,959			
Irrigation	Hours									
Crop Management	Hours	6.2	232	1,428	11.7	253	2,957			
Harvest	Hours	59.7	462	27,608	25.1	540	13,561			
Post-harvest	Hours	14.1	649	9,170	10.4	573	5,939			
Total hired labor		*174.9*	*524*	*91,570*	*114.8*	*464*	*53,282*			
Seedbed		22.6	562	12,716	17.0	375	6,366			
Land preparation	Hours	21.6	375	8,118	30.3	464	14,088			
Transplanting	Hours	21.2	563	11,939	32.5	459	14,924			
Irrigation	Hours	8.4	524	4,415	1.5	464	703			
Crop Management	Hours	13.0	232	3,008	10.8	253	2,738			
Harvest	Hours	9.8	462	4,533	12.3	540	6,625			
Post-harvest	Hours	13.3	649	8,617	15.3	573	8,764			
Total own labor		*109.9*	*481*	*53,346*	*119.7*	*447*	*54,208*			
Seedbed				2,845			842			
Land preparation	Unit			7,966			3,246			
Crop management	Unit			147						
Harvest and postharvest	Unit			23,634			19,546			
Fuel	Unit			26,437			23,385			
Draught oxen	Unit			6,714			5,771			
Other services	Unit			8,539			16,105			
Total livestock, machinery and fuel				*76,282*			*68,894*			
Working capital before interest	Unit			263,613			221,876			
Interest on working capital				*5,694*			*4,793*			
Total Costs	MMK/acre			**322,653**			**280,876**			
Gross margin	MMK/acre			179,810			111,061			
Gross margin	$/ha			**443**			**273**			
Net margin	MMK/acre			126,464			58,853			
Net margin	$/ha			**319**			**144**			
Labor productivity	$/day			**9.38**			**7.48**			
Total labor	Days/ha			88			72			
Yield	Kg/ha			**2,982**			**2,342**			
Average cultivated area	Ha			0.99			1.68			
Number of observations				25			10			

TABLE 126: MONSOON RICE BUDGET BY FARM SIZE IN SOUTHERN INTERIOR ECOREGION, SHAN STATE

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg				942.1	312	293,744	1,055.0	361	381,123
Costs										
Seeds	Kg				39.2	494	19,400	36.1	485	17,523
Urea	Kg				88.0	444	39,092	95.5	442	42,195
NPK	Kg				14.0	310	4,340	7.2	350	2,513
T-Super	Kg				24.0	318	7,620	22.7	319	7,248
Other inorganic fertilizers	Kg									
Organic fertilizers	Kg									359
Pesticides	Unit						560			612
Total material inputs							*71,012*			*70,451*
Seedbed					3.7	380	1,400	9.2	198	1,825
Land preparation	Hours				6.7	494	3,320	10.3	347	3,578
Transplanting	Hours				92.8	242	22,480	64.7	434	28,070
Irrigation	Hours							0.0	2,500	30
Crop Management	Hours				24.2	317	7,660	27.4	213	5,822
Harvest	Hours				81.0	258	20,880	85.6	182	15,540
Post-harvest	Hours				46.2	429	19,820	38.8	346	13,445
Total hired labor					*254.6*	*297*	*75,560*	*236.0*	*289*	*68,310*
Seedbed					12.9	380	4,915	10.6	198	2,096
Land preparation	Hours				26.8	494	13,260	25.5	347	8,858
Transplanting	Hours				9.1	242	2,208	17.3	434	7,521
Irrigation	Hours				3.8	297	1,140	5.1	2,500	12,715
Crop Management	Hours				15.4	317	4,884	18.0	213	3,836
Harvest	Hours				12.5	258	3,219	11.8	182	2,152
Post-harvest	Hours				4.4	429	1,888	4.4	346	1,508
Total own labor					*85.0*	*345*	*31,514*	*92.8*	*603*	*38,686*
Seedbed										1,388
Land preparation	Unit						8,240			4,955
Crop management	Unit									180
Harvest and postharvest	Unit						7,480			8,020
Fuel	Unit						17,996			20,332
Draught oxen	Unit						3,120			2,764
Other services	Unit						10,384			16,500
Total livestock, machinery and fuel							*47,220*			*54,138*
Working capital before interest	Unit						193,792			192,899
Interest on working capital							*4,186*			*4,167*
Total Costs	MMK/acre						**229,492**			**235,752**
Gross margin	MMK/acre						95,796			184,057
Gross margin	$/ha						**236**			**453**
Net margin	MMK/acre						64,282			145,371
Net margin	$/ha						**162**			**367**
Labor productivity	$/day						**4.93**			**7.22**
Total labor	Days/ha						105			102
Yield	Kg/ha						**1,854**			**2,076**
Average cultivated area	Ha						1.69			2.11
Number of observations							6			16

TABLE 127: MONSOON RICE BUDGET BY MECHANIZATION

		Mechanized Farms			Non-Mechanized Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,241.1	191	237,297	1,196.1	184	219,567
Costs							
Seeds	Kg	45.5	308	14,025	47.4	229	10,873
Urea	Kg	44.4	469	20,805	37.3	530	19,788
NPK	Kg	19.3	471	9,068	11.9	490	5,819
T-Super	Kg	10.7	357	3,807	6.6	473	3,122
Other inorganic fertilizers	Kg			1,240			1,062
Organic fertilizers	Kg			8			2
Pesticides	Unit			1,327			946
Total material inputs				*50,281*			*41,612*
Seed bed	Hours	23.2	420	9,763	34.8	376	13,015
Land preparation	Hours	6.6	355	2,334	6.6	394	2,607
Transplanting	Hours	96.87	270	26,125	100.0	240	24,039
Irrigation	Hours	0.1	258	27	0.1	290	16
Crop Management	Hours	15.6	169	2,637	18.4	160	2,947
Harvest	Hours	54.7	249	13,625	59.0	258	15,202
Post-harvest	Hours	15.4	335	5,170	14.6	299	4,372
Total hired labor		*212.5*	*281*	*59,685*	*233.5*	*267*	*62,290*
Seed bed	Hours	11.6	420	4884	17.4	376	6548
Land preparation	Hours	29.8	355	10593	47.7	394	18788
Transplanting	Hours	12.8	270	3458	14.1	240	3377
Irrigation	Hours	3.3	258	941	1.9	290	551
Crop Management	Hours	38.8	169	6561	32.6	160	5210
Harvest	Hours	4.0	249	996	3.6	258	921
Post-harvest	Hours	14.5	335	4852	12.5	299	3746
Total own labor		*114.9*	*281*	*32,286*	*129.7*	*267*	*39,141*
Seed bed	Unit			4,683			2,314
Land preparation	Unit			11,979			115
Crop management	Unit			78			86
Harvest and postharvest	Unit			6,415			3,689
Fuel	Unit			8,746			2,358
Draught oxen	Unit			4,314			21,762
Other services	Unit			7,828			6,270
Total livestock, machinery and fuel				*44,042*			*36,676*
Working capital before interest	Unit			135,213			121,004
Interest on working capital				*2,921*			*2,893*
Total Costs	MMK/acre			**189,214**			**182,334**
Gross margin	MMK/acre			80,368			76,374
Gross margin	$/ha			**198**			**188**
Net margin	MMK/acre			48,083			37,233
Net margin	$/ha			**121**			**94**
Labor productivity	$/day			**4.45**			**3.95**
Total labor	Days/ha			101			112
Yield (dried paddy equivalent)	Kg/ha			**2,442**			**2,353**
Average cultivated area	Ha			1.77			1.55
Number of observations				856			517

TABLE 128: MONSOON RICE BUDGET BY GENDER OF HOUSEHOLD HEAD

		Men			Women		
	Unit	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,218.8	188	229,133	1,283.7	198	254,180
Costs							
Seeds	Kg	48.0	268	12,897	48.9	271	13,269
Urea	Kg	41.2	490	20,169	48.7	471	22,918
NPK	Kg	16.2	467	7,558	21.2	532	11,290
T-Super	Kg	8.8	389	3,423	13.2	367	4,848
Other inorganic fertilizers	Kg			1,184			1,130
Organic fertilizers	Kg			7			
Pesticides	Unit			1,157			1,532
Total material inputs				*46,393*			*54,986*
Seed bed	Hours	27.1	402	10,905	28.0	394	11,037
Land preparation	Hours	6.2	371	2,315	9.6	354	3,404
Transplanting	Hours	92.3	262	24,204	107.7	253	27,281
Irrigation	Hours	0.1	296	15	0.4	229	89
Crop Management	Hours	16.2	170	2,755	19.7	135	2,656
Harvest	Hours	56.0	251	14,068	58.0	260	15,051
Post-harvest	Hours	14.7	329	4,847	18.6	285	5,303
Total hired labor		*217.0*	*277*	*60,051*	*243.7*	*268*	*65,213*
Seed bed	Hours	13.9	402	5,589	11.1	394	4,364
Land preparation	Hours	36.8	371	13,651	29.3	354	10,390
Transplanting	Hours	10.9	262	2,850	10.6	253	2,680
Irrigation	Hours	2.9	296	852	2.6	229	590
Crop Management	Hours	36.2	170	6,140	41.1	135	5,534
Harvest	Hours	3.8	251	948	4.6	260	1,183
Post-harvest	Hours	13.9	329	4,586	12.5	285	3,569
Total own labor		*120.9*	*297*	*34,614*	*112.7*	*273*	*28,310*
Seed bed	Unit			2,326			2,628
Land preparation	Unit			3,565			4,533
Crop management	Unit			88			108
Harvest and postharvest	Unit			4,987			5,833
Fuel	Unit			8,354			8,774
Draught oxen	Unit			3,387			6,079
Other services	Unit			7,977			7,455
Total livestock, machinery and fuel				*30,692*			*35,433*
Working capital before interest	Unit			118,220			135,280
Interest on working capital				*2,554*			*2,922*
Total Costs	MMK/acre			**174,304**			**186,865**
Gross margin	MMK/acre			89,443			95,625
Gross margin	$/ha			**220**			**235**
Net margin	MMK/acre			54,829			67,315
Net margin	$/ha			**138**			**170**
Labor productivity	$/day			**4.31**			**4.16**
Total labor	Days/ha			104			110
Yield (dried paddy equivalent)	Kg/ha			**2,398**			**2,526**
Average cultivated area	Ha			1.72			1.48
Number of observations				1,211			162

ANNEX 9: DRY SEASON RICE PRODUCTION

TABLE 129: DRY SEASON RICE FARM BUDGET IN SALTWATER ECOREGION, AYEYARWADY

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,729.0	182	315,118
Costs				
Seeds	Kg	86.3	253	21,810
Urea	Kg	119.1	296	35,227
NPK	Kg	6.5	229	1,495
T-Super	Kg	70.5	297	20,938
Other inorganic fertilizers	Kg			151
Organic fertilizers	Kg			20
Pesticides	Unit			3,939
Total material inputs				*83,581*
Seed bed	Hours			
Land preparation	Hours	7.8	332	2,585
Transplanting	Hours	2.3	355	810
Irrigation	Hours	3.2	349	1,129
Crop Management	Hours	6.3	403	2,548
Harvest	Hours	46.0	368	16,957
Post-harvest	Hours	33.5	404	13,531
Total hired labor		*99.1*	*379*	*37,560*
Seed bed	Hours			
Land preparation	Hours	11.3	332	3,557
Transplanting	Hours	5.1	355	1,611
Irrigation	Hours	10.8	349	3,634
Crop Management	Hours	22.3	403	8,722
Harvest	Hours	2.4	368	884
Post-harvest	Hours	15.3	404	6,189
Total own labor		*67.1*	*369*	*24,597*
Seed bed	Unit			
Land preparation	Unit			11,620
Crop management	Unit			2,482
Harvest and postharvest	Unit			6,505
Fuel	Unit			24,814
Draught oxen	Unit			3,096
Other services	Unit			7,310
Total livestock, machinery and fuel				*55,826*
Working capital before interest	Unit			146,479
Interest on working capital				*3,164*
Total Costs	MMK/acre			**204,729**
Gross margin	MMK/acre			134,987
Gross margin	$/ha			**332**
Net margin	MMK/acre			110,390
Net margin	$/ha			**279**
Labor productivity	$/day			**10.16**
Total labor	Days/ha			51
Yield (dried paddy equivalent)	Kg/ha			**3,402**
Average cultivated area	Ha			3.27
Number of observations				151

TABLE 130: DRY SEASON RICE FARM BUDGET IN DRYLAND ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,298.3	207	268,354
Costs				
Seeds	Kg	53.4	413	22,044
Urea	Kg	76.2	414	31,510
NPK	Kg	73.3	456	33,470
T-Super	Kg	18.0	295	5,291
Other inorganic fertilizers	Kg			2,194
Organic fertilizers	Kg			
Pesticides	Unit			8,718
Total material inputs				*103,227*
Seed bed	Hours	0.3	511	171
Land preparation	Hours	4.5	436	1,972
Transplanting	Hours	31.7	415	13,155
Irrigation	Hours			
Crop Management	Hours	16.1	308	4,960
Harvest	Hours	64.6	480	31,013
Post-harvest	Hours	42.9	440	18,892
Total hired labor		*160.2*	*438*	*70,163*
Seed bed	Hours	2.9	511	1,523
Land preparation	Hours	9.6	436	4,207
Transplanting	Hours	3.3	415	1,349
Irrigation	Hours	20.6	438	9,020
Crop Management	Hours	12.5	308	3,844
Harvest	Hours	0.8	480	374
Post-harvest	Hours	19.8	440	8,741
Total own labor		*69.5*	*433*	*29,060*
Seed bed	Unit			583
Land preparation	Unit			4,894
Crop management	Unit			232
Harvest and postharvest	Unit			11,509
Fuel	Unit			8,471
Draught oxen	Unit			4,700
Other services	Unit			6,726
Total livestock, machinery and fuel				*37,115*
Working capital before interest	Unit			160,601
Interest on working capital				*3,614*
Total Costs	MMK/acre			**243,179**
Gross margin	MMK/acre			54,235
Gross margin	$/ha			**134**
Net margin	MMK/acre			25,175
Net margin	$/ha			**64**
Labor productivity	$/day			**5.57**
Total labor	Days/ha			71
Yield (dried paddy equivalent)	Kg/ha			**2,554**
Average cultivated area	Ha			1.66
Number of observations				79

TABLE 131: DRY SEASON RICE FARM BUDGET IN IRRIGATED TRACT ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	1,553.4	209	325,259
Costs				
Seeds	Kg	60.0	325	19,492
Urea	Kg	62.4	422	26,320
NPK	Kg	48.1	434	20,901
T-Super	Kg	8.8	367	3,217
Other inorganic fertilizers	Kg			2,679
Organic fertilizers	Kg			600
Pesticides	Unit			12,086
Total material inputs				*85,295*
Seed bed	Hours	0.3	418	132
Land preparation	Hours	5.8	532	3,099
Transplanting	Hours	35.0	324	11,336
Irrigation	Hours	0.8	378	297
Crop Management	Hours	13.2	309	4,075
Harvest	Hours	53.4	452	24,152
Post-harvest	Hours	29.0	486	14,088
Total hired labor		*137.6*	*416*	*57,179*
Seed bed	Hours	3.6	418	1,506
Land preparation	Hours	6.3	532	3,279
Transplanting	Hours	3.2	324	1,047
Irrigation	Hours	17.7	378	6,887
Crop Management	Hours	11.4	309	3,487
Harvest	Hours	1.3	452	563
Post-harvest	Hours	14.4	486	6,661
Total own labor		*57.8*	*414*	*23,428*
Seed bed	Unit			127
Land preparation	Unit			7,748
Crop management	Unit			51
Harvest and postharvest	Unit			12,445
Fuel	Unit			9,539
Draught oxen	Unit			4,887
Other services	Unit			7,033
Total livestock, machinery and fuel				*41,829*
Working capital before interest	Unit			146,064
Interest on working capital				*3,286*
Total Costs	MMK/acre			**211,018**
Gross margin	MMK/acre			137,669
Gross margin	$/ha			**339**
Net margin	MMK/acre			114,241
Net margin	$/ha			**288**
Labor productivity	$/day			**9.64**
Total labor	Days/ha			60
Yield (dried paddy equivalent)	Kg/ha			**3,056**
Average cultivated area	Ha			1.26
Number of observations				71

TABLE 132: DRY SEASON RICE FARM BUDGET IN BORDER AREA ECOREGION, SHAN STATE

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	2,648.7	243	690,874
Costs				
Seeds	Kg	17.5	2,289	40,045
Urea	Kg	162.2	302	49,028
NPK	Kg	44.8	344	15,403
T-Super	Kg	99.4	208	20,659
Other inorganic fertilizers	Kg			542
Organic fertilizers	Kg			
Pesticides	Unit			4,713
Total material inputs				*130,390*
Seed bed	Hours	4.2	626	2,656
Land preparation	Hours	1.8	752	1,367
Transplanting	Hours	129.8	610	79,193
Irrigation	Hours	2.8	662	1,843
Crop Management	Hours	3.6	664	2,365
Harvest	Hours	8.1	854	6,929
Post-harvest	Hours	12.4	1,121	13,920
Total hired labor		*162.8*	*665*	*108,273*
Seed bed	Hours	30.8	626	20,980
Land preparation	Hours	15.1	752	10,802
Transplanting	Hours	10.7	610	6,542
Irrigation	Hours	43.1	662	29,312
Crop Management	Hours	30.1	664	19,501
Harvest	Hours	6.6	854	5,632
Post-harvest	Hours	19.4	1,121	21,857
Total own labor		*155.8*	*756*	*114,625*
Seed bed	Unit			6,180
Land preparation	Unit			17,237
Crop management	Unit			7,886
Harvest and postharvest	Unit			34,331
Fuel	Unit			77,582
Draught oxen	Unit			
Other services	Unit			19,671
Total livestock, machinery and fuel				*162,887*
Working capital before interest	Unit			380,701
Interest on working capital				*5,711*
Total Costs	MMK/acre			**521,886**
Gross margin	MMK/acre			283,614
Gross margin	$/ha			**698**
Net margin	MMK/acre			168,988
Net margin	$/ha			**427**
Labor productivity	$/day			**12.39**
Total labor	Days/ha			98
Yield (dried paddy equivalent)	Kg/ha			**5,601**
Average cultivated area	Ha			0.79
Number of observations				35

TABLE 133: DRY SEASON RICE FARM BUDGET BY METHOD OF PLANTATION

		Transplanting			Direct Seeding		
	Unit	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,915.0	192	365,762	1,632.6	191	311,822
Costs							
Seeds	Kg	38.3	633	24,236	80.9	272	21,978
Urea	Kg	88.0	360	31,697	109.6	316	34,642
NPK	Kg	54.5	447	24,347	19.9	380	7,554
T-Super	Kg	32.6	237	7,750	58.4	299	17,472
Other inorganic fertilizers	Kg			2,169			582
Organic fertilizers	Kg			104			88
Pesticides	Unit			5,634			5,830
Total material inputs				*95,937*			*88,145*
Seedbed		1.9	562	1,043			
Land preparation	Hours	3.5	438	1,528	7.2	362	2,606
Transplanting	Hours	102.4	451	46,165	2.0	362	724
Irrigation	Hours	0.7	663	471	2.6	348	899
Crop Management	Hours	17.1	305	5,224	7.4	378	2,781
Harvest	Hours	45.1	535	24,129	49.1	391	19,202
Post-harvest	Hours	26.4	628	16,561	35.1	406	14,259
Total hired labor		*197.0*	*483*	*95,121*	*103.3*	*392*	*40,471*
Seedbed		14.6	562	8,231			
Land preparation	Hours	9.9	438	4,320	10.8	362	3,895
Transplanting	Hours	5.7	451	2,551	4.7	362	1,690
Irrigation	Hours	25.2	663	16,724	12.9	348	4,476
Crop Management	Hours	16.7	305	5,110	20.3	378	7,670
Harvest	Hours	2.4	535	1,300	2.1	391	820
Post-harvest	Hours	18.6	628	11,665	15.8	406	6,424
Total own labor		*93.1*	*512*	*49,901*	*66.5*	*374*	*24,974*
Seedbed				789			
Land preparation	Unit			4,436			5,090
Crop management	Unit			461			733
Harvest and postharvest	Unit			20,313			7,039
Fuel	Unit			25,630			22,696
Draught oxen	Unit			1,839			576
Other services	Unit			9,419			7,363
Total livestock, machinery and fuel				*62,886*			*43,496*
Working capital before interest	Unit			213,254			138,652
Interest on working capital				*4,604*			*2,995*
Total Costs	MMK/acre			**308,451**			**200,081**
Gross margin	MMK/acre			107,212			136,741
Gross margin	$/ha			**264**			**337**
Net margin	MMK/acre			57,311			111,741
Net margin	$/ha			**145**			**282**
Labor productivity	$/day			**8.66**			**9.30**
Total labor	Days/ha			90			52
Yield	Kg/ha			**3,768**			**3,212**
Average cultivated area	Ha			1.23			2.54
Number of observations				85			251

TABLE 134: DRY SEASON RICE FARM BUDGET BY LEVEL OF FERTILIZER USED

		Low Use			Medium Use			High Use		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,668.5	191	319,193	1,693.6	193	326,871	1,653.5	193	319,116
Costs										
Seeds	Kg	73.6	298	21,901	78.2	293	22,936	73.1	303	22,167
Urea	Kg	61.1	370	22,586	105.8	293	30,955	179.5	315	56,587
NPK	Kg	12.2	471	5,773	14.2	391	5,566	57.0	380	21,660
T-Super	Kg	25.4	353	8,979	60.6	238	14,423	94.4	311	29,399
Other inorganic fertilizers	Kg			688			759			1,048
Organic fertilizers	Kg			180						54
Pesticides	Unit			5,194			5,010			7,705
Total material inputs				*65,300*			*79,648*			*138,620*
Seedbed		0.2	566	138	0.3	454	130	0.3	695	183
Land preparation	Hours	8.4	328	2,743	5.4	449	2,442	5.5	366	2,008
Transplanting	Hours	18.8	422	7,949	13.1	508	6,654	15.5	413	6,401
Irrigation	Hours	2.3	344	806	1.1	444	501	3.7	350	1,291
Crop Management	Hours	10.4	389	4,058	6.7	293	1,972	8.4	358	3,007
Harvest	Hours	46.2	474	21,887	50.0	358	17,891	50.5	378	19,103
Post-harvest	Hours	35.9	457	16,397	29.5	392	11,587	35.8	426	15,242
Total hired labor		*122.3*	*441*	*53,978*	*106.2*	*388*	*41,176*	*119.7*	*395*	*47,235*
Seedbed		2.3	566	1,319	2.0	454	888	1.8	695	1,231
Land preparation	Hours	12.0	328	3,923	8.6	449	3,870	11.0	366	4,007
Transplanting	Hours	5.0	422	2,118	3.9	508	1,976	5.6	413	2,297
Irrigation	Hours	12.2	344	4,176	15.6	444	6,941	17.3	350	6,053
Crop Management	Hours	17.9	389	6,956	17.7	293	5,174	25.3	358	9,067
Harvest	Hours	2.1	474	993	1.5	358	533	3.0	378	1,132
Post-harvest	Hours	15.8	457	7,212	15.3	392	5,986	18.0	426	7,662
Total own labor		*67.2*	*426*	*26,697*	*64.5*	*414*	*25,368*	*81.9*	*427*	*31,449*
Seedbed				62			144			151
Land preparation	Unit			5,348			4,119			5,477
Crop management	Unit			935			184			915
Harvest and postharvest	Unit			8,883			8,960			8,897
Fuel	Unit			18,608			26,700			26,023
Draught oxen	Unit			956			510			721
Other services	Unit			8,205			6,584			8,038
Total livestock, machinery and fuel				*42,997*			*47,201*			*50,221*
Working capital before interest	Unit			123,991			138,548			201,732
Interest on working capital				*2,678*			*2,993*			*4,357*
Total Costs	MMK/acre			**191,650**			**196,386**			**271,883**
Gross margin	MMK/acre			154,239			155,853			78,862
Gross margin	$/ha			**380**			**384**			**194**
Net margin	MMK/acre			127,542			130,485			47,223
Net margin	$/ha			**322**			**329**			**119**
Labor productivity	$/day			**10.15**			**10.56**			**6.26**
Total labor	Days/ha			59			53			62
Yield	Kg/ha			**3,283**			**3,332**			**3,253**
Average cultivated area	Ha			2.43			2.17			1.97
Number of observations				129			107			100

TABLE 135: DRY SEASON RICE FARM BUDGET BY TYPE OF FERTILIZER USED

		No Urea			Urea only			Urea + NPK		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,520.9	193	293,529	1,782.2	187	323,179	1,550.5	207	320,948
Costs										
Seeds	Kg	72.9	316	23,056	82.1	274	22,474	56.9	382	21,746
Urea	Kg				122.9	300	36,828	78.8	407	32,072
NPK	Kg	50.5	474	23,985				84.2	395	33,265
T-Super	Kg	15.4	226	3,477	72.4	291	21,087	15.1	336	5,095
Other inorganic fertilizers	Kg			4,669			143			1,985
Organic fertilizers	Kg			415			21			224
Pesticides	Unit			5,162			4,226			9,883
Total material inputs				*60,764*			*84,779*			*104,270*
Seedbed		0.4	607	262	0.2	578	114	0.4	537	216
Land preparation	Hours	10.3	217	2,238	7.2	344	2,473	5.0	491	2,433
Transplanting	Hours	31.2	241	7,531	8.4	531	4,481	33.8	409	13,807
Irrigation	Hours	0.4	400	154	2.8	370	1,021	1.5	321	467
Crop Management	Hours	3.4	329	1,108	5.9	388	2,297	16.6	332	5,489
Harvest	Hours	56.0	467	26,177	44.9	374	16,792	56.8	475	26,956
Post-harvest	Hours	40.0	499	19,946	32.0	417	13,331	37.9	450	17,065
Total hired labor		*141.7*	*405*	*57,415*	*101.4*	*400*	*40,509*	*151.8*	*438*	*66,433*
Seedbed		2.0	607	1,214	1.6	578	896	3.4	537	1,811
Land preparation	Hours	11.5	217	2,509	11.5	344	3,948	8.5	491	4,151
Transplanting	Hours	4.2	241	1,024	5.4	531	2,882	3.3	409	1,352
Irrigation	Hours	13.8	400	5,520	13.5	370	4,985	17.6	321	5,633
Crop Management	Hours	9.4	329	3,106	20.9	388	8,091	18.4	332	6,096
Harvest	Hours	0.5	467	230	2.3	374	862	2.0	475	928
Post-harvest	Hours	15.3	499	7,654	16.0	417	6,658	16.9	450	7,616
Total own labor		*56.9*	*405*	*21,258*	*71.1*	*400*	*28,323*	*69.9*	*438*	*27,587*
Seedbed				111			49			269
Land preparation	Unit			5,248			5,169			4,528
Crop management	Unit			738			771			496
Harvest and postharvest	Unit			8,949			8,295			10,469
Fuel	Unit			13,098			27,321			13,729
Draught oxen	Unit			1,462			408			1,540
Other services	Unit			9,423			7,629			7,482
Total livestock, machinery and fuel				*39,029*			*49,642*			*38,513*
Working capital before interest	Unit			118,086			144,806			165,195
Interest on working capital				*2,399*			*3,128*			*3,568*
Total Costs	MMK/acre			**180,867**			**206,380**			**240,372**
Gross margin	MMK/acre			133,921			145,112			108,163
Gross margin	$/ha			**330**			**357**			**266**
Net margin	MMK/acre			112,663			116,799			80,576
Net margin	$/ha			**284**			**295**			**203**
Labor productivity	$/day			**9.04**			**10.00**			**7.48**
Total labor	Days/ha			61			53			68
Yield	Kg/ha			**2,992**			**3,400**			**3,051**
Average cultivated area	Ha			1.88			2.58			1.65
Number of observations				14			199			123

TABLE 136: DRY SEASON RICE BUDGET BY FARM SIZE IN SALTWATER ECOREGION, AYEYARWADY

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,611.0	184	295,985	1,700.6	182	308,701	1,754.1	182	319,860
Costs										
Seeds	Kg	80.4	259	20,825	87.9	254	22,278	86.7	252	21,849
Urea	Kg	91.1	405	36,902	112.0	355	39,775	126.5	267	33,842
NPK	Kg	5.5	66	366	5.5	529	2,905	7.3	150	1,104
T-Super	Kg	74.4	425	31,667	68.6	332	22,764	70.7	269	19,026
Other inorganic fertilizers	Kg			72			427			35
Organic fertilizers	Kg									33
Pesticides	Unit			5,684			4,760			3,409
Total material inputs				*95,516*			*92,909*			*79,297*
Seedbed										
Land preparation	Hours	11.2	313	3,523	8.8	333	2,944	6.8	332	2,241
Transplanting	Hours	3.1	398	1,229	2.2	383	835	2.1	329	706
Irrigation	Hours	5.9	424	2,501	3.4	270	919	2.8	363	1,006
Crop Management	Hours	7.2	445	3,195	4.9	392	1,936	6.8	396	2,677
Harvest	Hours	44.9	360	16,161	47.9	404	19,352	44.9	356	15,978
Post-harvest	Hours	42.8	375	16,056	36.9	437	16,122	31.0	396	12,257
Total hired labor		*115.1*	*371*	*42,665*	*104.2*	*404*	*42,108*	*94.3*	*370*	*34,865*
Seedbed										
Land preparation	Hours	12.0	313	3,755	12.9	333	4,306	10.8	332	3,578
Transplanting	Hours	4.1	398	1,647	4.4	383	1,668	5.6	329	1,851
Irrigation	Hours	18.4	424	7,809	11.9	270	3,222	9.6	363	3,470
Crop Management	Hours	33.3	445	14,804	28.3	392	11,094	19.1	396	7,571
Harvest	Hours	4.5	360	1,615	1.9	404	760	2.4	356	840
Post-harvest	Hours	20.5	375	7,697	17.1	437	7,486	13.9	396	5,512
Total own labor		*92.8*	*386*	*37,328*	*76.5*	*370*	*28,536*	*61.4*	*362*	*22,822*
Seedbed										
Land preparation	Unit			9,695			8,253			3,289
Crop management	Unit			4,157			851			385
Harvest and postharvest	Unit			11,126			7,941			5,803
Fuel	Unit			22,690			24,352			27,964
Draught oxen	Unit			236			110			238
Other services	Unit			10,173			9,353			6,739
Total livestock, machinery and fuel				*58,077*			*50,860*			*44,417*
Working capital before interest	Unit			160,040			150,402			130,343
Interest on working capital				*3,534*			*3,249*			*2,815*
Total Costs	MMK/acre			**237,329**			**217,660**			**184,216**
Gross margin	MMK/acre			96,184			119,576			158,466
Gross margin	$/ha			**237**			**294**			**390**
Net margin	MMK/acre			58,856			91,041			135,644
Net margin	$/ha			**149**			**230**			**342**
Labor productivity	$/day			**6.99**			**8.66**			**11.16**
Total labor	Days/ha			64			56			48
Yield	Kg/ha			**3,170**			**3,346**			**3,451**
Average cultivated area	Ha			1.40			2.58			4.56
Number of observations				30			50			71

TABLE 137: DRY SEASON RICE BUDGET BY FARM SIZE IN DRYLAND ECOREGION, SAGAING

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,292.9	205	264,757	1,191.0	204	243,310	1,371.6	207	284,599
Costs										
Seeds	Kg	55.6	422	23,455	52.6	398	20,962	53.1	416	22,093
Urea	Kg	68.1	420	28,629	92.9	461	42,772	67.6	368	24,878
NPK	Kg	72.9	397	28,943	92.6	479	44,402	59.7	463	27,661
T-Super	Kg	13.5	323	4,352	29.6	243	7,202	11.5	370	4,257
Other inorganic fertilizers	Kg			1,189			2,743			2,110
Organic fertilizers	Kg									
Pesticides	Unit			8,204			11,899			6,778
Total material inputs				*94,773*			*129,980*			*87,777*
Seedbed		0.6	560	351	0.2	429	87	0.3	500	148
Land preparation	Hours	6.5	475	3,103	3.9	423	1,655	4.0	418	1,690
Transplanting	Hours	28.2	385	10,872	26.4	356	9,374	36.3	451	16,398
Irrigation	Hours									
Crop Management	Hours	15.0	290	4,337	8.1	408	3,287	21.7	288	6,266
Harvest	Hours	58.6	497	29,105	69.4	405	28,065	63.8	531	33,885
Post-harvest	Hours	48.4	450	21,776	45.2	474	21,423	39.2	407	15,938
Total hired labor		*157.3*	*442*	*69,544*	*153.1*	*417*	*63,891*	*165.4*	*449*	*74,324*
Seedbed		1.9	560	1,079	3.5	429	1,501	2.8	500	1,381
Land preparation	Hours	5.9	475	2,798	10.4	423	4,377	10.8	418	4,529
Transplanting	Hours	2.6	385	1,007	3.0	356	1,061	3.9	451	1,745
Irrigation	Hours	25.6	442	11,331	20.6	417	8,580	18.2	449	8,179
Crop Management	Hours	8.2	290	2,366	14.2	408	5,788	13.0	288	3,753
Harvest	Hours	1.3	497	654	0.4	405	156	0.8	531	432
Post-harvest	Hours	21.0	450	9,467	18.8	474	8,934	19.8	407	8,048
Total own labor		*66.6*	*443*	*28,701*	*70.8*	*416*	*30,397*	*69.3*	*435*	*28,066*
Seedbed				449			164			400
Land preparation	Unit			6,632			4,120			2,841
Crop management	Unit			351			286			682
Harvest and postharvest	Unit			10,018			8,210			7,977
Fuel	Unit			8,271			9,569			9,321
Draught oxen	Unit			4,703			1,314			607
Other services	Unit			5,339			5,708			7,628
Total livestock, machinery and fuel				*35,763*			*29,370*			*29,456*
Working capital before interest	Unit			141,199			173,752			141,734
Interest on working capital				*3,223*			*3,753*			*3,061*
Total Costs	MMK/acre			**232,003**			**257,390**			**222,685**
Gross margin	MMK/acre			61,455			16,317			89,980
Gross margin	$/ha			**151**			**40**			**222**
Net margin	MMK/acre			32,754			-14,080			61,914
Net margin	$/ha			**83**			**-36**			**156**
Labor productivity	$/day			**5.90**			**3.79**			**6.53**
Total labor	Days/ha			69			69			72
Yield	Kg/ha			**2,544**			**2,343**			**2,699**
Average cultivated area	Ha			1.13			1.56			2.20
Number of observations				24			27			28

TABLE 138: DRY SEASON RICE BUDGET BY FARM SIZE IN IRRIGATED TRACT ECOREGION, SAGAING

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,452.3	211	306,653	1,583.3	205	324,559	1,687.7	214	361,687
Costs										
Seeds	Kg	60.9	344	20,941	65.0	297	19,317	46.8	364	17,023
Urea	Kg	71.0	429	30,444	60.7	410	24,852	44.3	440	19,496
NPK	Kg	62.5	420	26,241	41.8	430	17,969	27.1	505	13,681
T-Super	Kg	11.0	367	4,046	6.1	317	1,932	10.8	418	4,530
Other inorganic fertilizers	Kg			4,281			1,867			882
Organic fertilizers	Kg						287			2,699
Pesticides	Unit			9,674			17,414			4,994
Total material inputs				*95,628*			*83,639*			*63,305*
Seedbed		0.2	350	81	0.1	875	74	1.1	364	386
Land preparation	Hours	7.0	641	4,491	6.4	421	2,707	1.9	406	783
Transplanting	Hours	31.2	357	11,142	28.0	270	7,542	63.9	340	21,735
Irrigation	Hours	1.9	379	709	-	-	-	-	-	-
Crop Management	Hours	11.1	318	3,532	13.2	310	4,106	17.2	292	5,024
Harvest	Hours	56.9	383	21,762	54.3	463	25,147	44.3	631	27,960
Post-harvest	Hours	25.9	517	13,381	30.3	500	15,175	32.1	387	12,439
Total hired labor		*134.2*	*411*	*55,098*	*132.3*	*414*	*54,751*	*160.6*	*426*	*68,327*
Seedbed		3.3	350	1,171	3.5	875	3,053	4.5	364	1,630
Land preparation	Hours	6.5	641	4,185	5.9	421	2,483	7.1	406	2,898
Transplanting	Hours	3.0	357	1,087	3.8	270	1,024	2.1	340	721
Irrigation	Hours	20.8	379	7,884	14.8	414	6,127	16.4	426	6,972
Crop Management	Hours	13.6	318	4,311	10.9	310	3,396	9.0	292	2,628
Harvest	Hours	2.4	383	907	0.8	463	384	-	631	-
Post-harvest	Hours	12.3	517	6,342	17.2	500	8,609	14.6	387	5,636
Total own labor		*61.9*	*421*	*25,888*	*57.0*	*465*	*25,077*	*53.7*	*406*	*20,485*
Seedbed				142			53			96
Land preparation	Unit			8,287			4,304			3,692
Crop management	Unit			28						133
Harvest and postharvest	Unit			12,099			13,630			13,651
Fuel	Unit			10,593			10,056			8,236
Draught oxen	Unit			2,632			3,154			1,627
Other services	Unit			7,368			5,861			6,607
Total livestock, machinery and fuel				*41,150*			*37,058*			*34,041*
Working capital before interest	Unit			156,733			135,127			125,274
Interest on working capital				*3,385*			*2,919*			*2,706*
Total Costs	MMK/acre			**221,149**			**203,445**			**188,864**
Gross margin	MMK/acre			111,392			146,191			193,308
Gross margin	$/ha			**274**			**360**			**476**
Net margin	MMK/acre			85,504			121,114			172,823
Net margin	$/ha			**216**			**306**			**436**
Labor productivity	$/day			**8.35**			**9.97**			**11.07**
Total labor	Days/ha			61			58			66
Yield	Kg/ha			**2,857**			**3,115**			**3.320**
Average cultivated area	Ha			1.00			1.41			1.87
Number of observations				35			27			9

TABLE 139: DRY SEASON RICE BUDGET BY FARM SIZE IN BORDER AREA ECOREGION, SHAN

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	2,839.3	244	692,354						
Costs										
Seeds	Kg	18.0	2,234	40,146						
Urea	Kg	160.6	303	48,689						
NPK	Kg	46.4	340	15,792						
T-Super	Kg	97.7	208	20,315						
Other inorganic fertilizers	Kg			591						
Organic fertilizers	Kg									
Pesticides	Unit			4,685						
Total material inputs				*130,218*						
Seedbed		4.4	617	2,699						
Land preparation	Hours	1.9	758	1,415						
Transplanting	Hours	128.2	610	78,239						
Irrigation	Hours	2.7	663	1,780						
Crop Management	Hours	3.6	668	2,378						
Harvest	Hours	8.1	851	6,888						
Post-harvest	Hours	12.4	1,124	13,933						
Total hired labor		*161.2*	*666*	*107,333*						
Seedbed		30.2	617	18,633						
Land preparation	Hours	14.7	758	11,167						
Transplanting	Hours	10.6	610	6,454						
Irrigation	Hours	43.1	663	28,596						
Crop Management	Hours	29.3	668	19,561						
Harvest	Hours	6.6	851	5,572						
Post-harvest	Hours	19.6	1,124	21,982						
Total own labor		*154.1*	*756*	*111,966*						
Seedbed				1,092						
Land preparation	Unit			4,812						
Crop management	Unit			1,456						
Harvest and postharvest	Unit			35,026						
Fuel	Unit			69,655						
Draught oxen	Unit									
Other services	Unit			15,293						
Total livestock, machinery and fuel				*127,335*						
Working capital before interest	Unit			344,065						
Interest on working capital				*7,432*						
Total Costs	MMK/acre			**484,284**						
Gross margin	MMK/acre			320,036						
Gross margin	$/ha			**788**						
Net margin	MMK/acre			208,070						
Net margin	$/ha			**525**						
Labor productivity	$/day			**12.76**						
Total labor	Days/ha			97						
Yield	Kg/ha			**5,572**						
Average cultivated area	Ha			0.79						
Number of observations				35						

TABLE 140: DRY SEASON RICE FARM BUDGET BY GENDER OF HOUSEHOLD HEAD

		Men			Women		
	Unit	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,691.5	192	324,759	1,479.9	195	288,587
Costs							
Seeds	Kg	75.0	297	22,322	73.5	300	22,038
Urea	Kg	106.3	319	33,865	108.7	348	37,882
NPK	Kg	24.7	401	9,918	25.0	398	9,966
T-Super	Kg	55.3	287	15,833	49.6	379	18,807
Other inorganic fertilizers	Kg			669			2,191
Organic fertilizers	Kg			16			841
Pesticides	Unit			5,830			5,521
Total material inputs				*88,452*			*97,245*
Seedbed		0.3	551	141	0.3	654	206
Land preparation	Hours	6.7	372	2,483	6.7	323	2,157
Transplanting	Hours	16.3	446	7,248	15.1	395	5,971
Irrigation	Hours	2.3	355	801	2.9	415	1,222
Crop Management	Hours	8.8	357	3,125	8.4	372	3,137
Harvest	Hours	49.2	406	19,961	42.3	455	19,241
Post-harvest	Hours	34.0	428	14,540	32.7	460	15,020
Total hired labor		*117.4*	*412*	*48,300*	*108.5*	*433*	*46,954*
Seedbed		2.1	551	1,154	1.8	654	1,159
Land preparation	Hours	11.0	372	4,080	7.3	323	2,344
Transplanting	Hours	4.9	446	2,206	3.4	395	1,339
Irrigation	Hours	14.6	355	5,164	15.1	415	6,259
Crop Management	Hours	20.4	357	7,278	13.5	372	5,023
Harvest	Hours	2.3	406	931	0.6	455	294
Post-harvest	Hours	16.6	428	7,116	11.9	460	5,455
Total own labor		*71.9*	*412*	*27,928*	*53.5*	*433*	*21,873*
Seedbed				113			90
Land preparation	Unit			4,973			5,244
Crop management	Unit			660			1,047
Harvest and postharvest	Unit			8,641			11,630
Fuel	Unit			23,087			23,344
Draught oxen	Unit			580			2,514
Other services	Unit			7,839			5,772
Total livestock, machinery and fuel				*45,893*			*49,641*
Working capital before interest	Unit			148,143			159,578
Interest on working capital				*3,200*			*3,447*
Total Costs	MMK/acre			213,773			219,159
Gross margin	MMK/acre			138,915			91,300
Gross margin	$/ha			342			225
Net margin	MMK/acre			110,986			69,427
Net margin	$/ha			**280**			**175**
Labor productivity	$/day			**9.21**			**8.48**
Total labor	Days/ha			58			50
Yield	Kg/ha			**3,328**			**2,912**
Average cultivated area	Ha			2.27			1.76
Number of observations				298			38

ANNEX 10: PULSE PRODUCTION

TABLE 141: PULSE PRODUCTION: CHARACTERISTICS OF PULSE FARMS

	N	Farm size (acre)	Cultivated area (Acre)	% land under pulses
BLACK GRAM				
By Ecoregion				
Brackish water, Ayeyarwady	135	9.9	6.6	77.2
Freshwater, Ayeyarwady	144	7.0	4.7	73.9
East alluvial, Bago	113	9.2	5.7	71.6
West alluvial, Bago	105	7.8	4.5	63.3
River area, Bago	61	9.0	4.9	62.9
By Farm Size				
Small		3.4	2.8	84.7
Medium		7.9	5.4	68.4
Large		17.7	9.2	53.9
By Gender				
Men		8.5	5.3	70.6
Women		8.4	5.4	74.4
GREEN GRAM				
Brackish water, Ayeyarwady	19	10.2	5.4	62.0
East alluvial, Bago	15	6.3	4.6	75.1
Irrigated tract, Sagaing	22	7.1	2.9	47.9
River area, Sagaing	57	9.8	6.5	70.7
By Farm Size				
Small		3.8	2.8	76.9
Medium		7.7	4.8	61.5
Large		15.7	8.7	57.0
By Gender				
Men		9.2	5.6	66.1
Women		5.7	2.3	57.2
CHICKPEAS				
Dryland, Sagaing	63	11.7	3.6	37.3
Irrigated tract, Sagaing	43	10.0	5.2	56.8
River area, Sagaing	10	11.4	2.0	19.9
By Farm Size				
Small		3.4	1.9	60.0
Medium		8.0	3.6	45.2
Large		18.6	5.7	31.5
By Gender				
Men		11.0	4.0	41.6
Women		11.1	4.1	49.0

Note: Land under pulses refers to the size of the main plot on which pulses are produced.

TABLE 142: PULSE PRODUCTION, SALES, AND YIELDS

	Production (kg)*	Yield kg/acre	Yield kg/ha	% of sellers	% of product sold
BLACK GRAM					
By Ecoregion					
Brackish water, Ayeyarwady	2,262	343	847	94.8	84.0
Freshwater, Ayeyarwady	1,365	290	718	98.6	87.0
East alluvial, Bago	1,795	315	778	98.2	87.1
West alluvial, Bago	1,350	300	741	100.0	89.4
River area, Bago	1,681	343	848	91.8	89.9
By Farm Size					
Small	881	315	777	97.6	89.8
Medium	1,627	301	745	98.7	86.8
Large	2,835	308	761	93.8	83.2
By Gender					
Men	1,628	307	759	97.2	87.3
Women	1,692	313	774	96.6	84.8
GREEN GRAM					
Brackish water, Ayeyarwady	2,347	435	1,074	89.5	79.4
East alluvial, Bago	1,340	291	720	93.3	84.0
Irrigated tract, Sagaing	1,331	459	1,134	95.5	91.4
River area, Sagaing	2,275	350	865	100.0	89.6
By Farm Size					
Small	829	296	732	97.4	90.2
Medium	1,664	347	857	94.7	84.3
Large	2,861	329	813	97.2	87.9
By Gender					
Men	1,849	330	816	96.2	87.2
Women	693	301	745	100.0	91.3
CHICKPEAS					
Dryland, Sagaing	1,193	331	819	85.7	70.3
Irrigated tract, Sagaing	2,076	399	987	100.0	88.1
River area, Sagaing	688	344	850	100.0	92.7
By Farm Size					
Small	696	366	905	91.7	83.9
Medium	1,150	319	789	93.8	82.6
Large	2,259	396	979	90.9	71.9
By Gender					
Men	1,456	364	958	93.6	80.7
Women	1,296	316	700	86.4	70.9

Note: Production refers to the production from main plot, not total area devoted to specific crop.

TABLE 143: PULSE PRODUCTION: SOURCE OF SEEDS PROCUREMENT

	Source of Seeds for Pulses			Application rate and Costs of seeds		
	Trader/Local market	Relative/ Friends	Own seeds	Kg of seed/ha	Unit price of seeds in $/kg	Costs of seeds in $/ha
BLACK GRAM						
By Ecoregion						
Brackish water, Ayeyarwady	17.0	0.7	82.2	76.4	0.80	60.2
Freshwater, Ayeyarwady	7.6	11.1	81.3	82.9	0.64	53.3
East alluvial, Bago	5.3	6.2	88.5	80.8	0.72	58.4
West alluvial, Bago	16.2	6.7	77.1	77.9	0.68	52.7
River area, Bago	8.2	1.6	90.2	85.0	0.80	68.6
By Farm Size						
Small	14.6	7.8	77.6	80.2	0.68	54.4
Medium	10.3	4.5	85.2	81.1	0.76	59.9
Large	6.9	4.6	88.5	78.7	0.74	58.4
By Gender						
Men	10.8	5.8	83.4	80.6	0.71	57.0
Women	13.6	5.1	81.4	76.5	0.85	61.9
GREEN GRAM						
Brackish water, Ayeyarwady	15.8	5.3	78.9	60.0	1.23	73.9
East alluvial, Bago	26.7	13.3	60.0	83.0	1.04	85.0
Irrigated tract, Sagaing	40.9	31.8	27.3	33.6	2.04	67.6
River area, Sagaing	15.8		84.2	65.3	1.21	79.4
By Farm Size						
Small	23.1	15.4	61.5	64.0	1.33	79.5
Medium	21.1	7.9	71.1	57.2	1.43	75.0
Large	22.2	2.8	75.0	60.5	1.31	76.1
By Gender						
Men	20.2	8.7	71.2	60.9	1.33	76.7
Women	44.4	11.1	44.4	57.6	1.58	79.0
CHICKPEAS						
Dryland, Sagaing	23.8	4.8	71.4	99.7	0.54	55.1
Irrigated tract, Sagaing	25.6	16.3	58.1	145.1	0.59	85.7
River area, Sagaing	10.0		90.0	136.6	0.58	79.0
By Farm Size						
Small	29.2	25.0	45.8	141.1	0.55	77.8
Medium	31.3	4.2	64.6	121.0	0.57	71.3
Large	11.4	4.5	84.1	106.6	0.56	60.4
By Gender						
Men	22.3	7.4	70.2	124.6	0.57	71.6
Women	27.3	13.6	59.1	98.9	0.55	55.2

TABLE 144: PULSE PRODUCTION: USERS OF FERTILIZERS

Percentage of fertilizer users

	Urea	NPK	T-Super
BLACK GRAM			
By Ecoregion			
Brackish water, Ayeyarwady	3.0	0.7	
Freshwater, Ayeyarwady	4.9		
East alluvial, Bago	2.7	0.9	0.9
West alluvial, Bago	2.9		
River area, Bago	4.9		
By Farm Size			
Small	3.4		
Medium	4.0	0.4	
Large	3.1	0.8	0.8
By Gender			
Men	3.8	0.4	0.2
Women	1.7		
GREEN GRAM			
Brackish water, Ayeyarwady	5.3		
East alluvial, Bago	13.3		
Irrigated tract, Sagaing		4.5	
River area, Sagaing	19.3	5.3	21.1
By Farm Size			
Small	15.4		7.7
Medium	13.2	10.5	15.8
Large	8.3		8.3
By Gender			
Men	12.5	3.8	10.6
Women	11.1		11.1
CHICKPEAS			
Dryland, Sagaing	49.2	54.0	1.6
Irrigated tract, Sagaing	30.2	53.5	11.6
River area, Sagaing	10.0		
By Farm Size			
Small	41.7	45.8	
Medium	37.5	39.6	2.1
Large	38.6	61.4	11.4
By Gender			
Men	36.2	48.9	6.4
Women	50.0	50.0	

TABLE 145: PULSE PRODUCTION: CONSUMPTION AND APPLICATION RATE OF FERTILIZERS

	Average Consumption (kg/ha)			Application Rate (kg/ha)		
	Urea	NPK	T-Super	Urea	NPK	T-Super
BLACK GRAM						
By Ecoregion						
Brackish water, Ayeyarwady	1.7	0.3		57.5	35.3	
Freshwater, Ayeyarwady	2.0			41.7		
East alluvial, Bago	0.9	0.3	0.1	35.5	30.9	13.7
West alluvial, Bago	2.4			84.4		
River area, Bago	3.8			78.2		
By Farm Size						
Small	1.2			35.1		
Medium	3.3	0.2		81.3	35.3	
Large	1.1	0.2	0.1	34.7	30.9	13.7
By Gender						
Men	2.1	0.1		55.5	33.1	13.7
Women	1.0			61.8		
GREEN GRAM						
Brackish water, Ayeyarwady	2.2			41.2		
East alluvial, Bago	8.2			61.5		
Irrigated tract, Sagaing		0.9			20.6	
River area, Sagaing	10.4	10.8	16.7	53.7	205.9	79.1
By Farm Size						
Small	9.1		3.4	59.1		44.6
Medium	6.9	16.8	14.8	52.3	159.6	94.0
Large	3.8		7.0	46.1		83.7
By Gender						
Men	6.9	6.1	8.7	54.9	159.6	82.6
Women	4.6		4.6	41.2		41.2
CHICKPEAS						
Dryland, Sagaing	29.5	37.8	0.7	59.9	70.1	41.2
Irrigated tract, Sagaing	20.4	58.9	11.9	67.4	110.2	102.5
River area, Sagaing	8.2			82.4		
By Farm Size						
Small	31.5	52.5		75.5	114.6	
Medium	25.9	30.9	1.8	69.1	77.9	86.5
Large	18.6	49.4	10.6	48.1	80.5	93.4
By Gender						
Men	23.9	42.3	5.9	66.2	86.4	92.2
Women	25.7	42.8		51.5	85.6	

TABLE 146: PULSE PRODUCTION: USE OF CHEMICALS

	% Users	Consumption MMK/acre	Application rate MMK/acre	Application rate $/ha
BLACK GRAM				
By Ecoregion				
Brackish water, Ayeyarwady	88.1	9,596	10,886	27.5
Freshwater, Ayeyarwady	45.8	3,013	6,574	16.6
East alluvial, Bago	46.9	3,390	7,227	18.2
West alluvial, Bago	52.4	2,796	5,339	13.5
River area, Bago	50.8	4,794	9,433	23.8
By Farm Size				
Small	54.6	5,782	10,583	26.7
Medium	59.2	4,333	7,321	18.5
Large	61.5	4,206	6,836	17.3
By Gender				
Men	58.3	4,659	7,989	20.2
Women	55.9	6,332	11,321	28.6
GREEN GRAM				
Brackish water, Ayeyarwady	78.9	20,131	25,499	64.4
East alluvial, Bago	33.3	2,342	7,026	17.7
Irrigated tract, Sagaing	100.0	16,340	16,340	41.2
River area, Sagaing	59.6	5,641	9,457	23.9
By Farm Size				
Small	64.1	14,163	22,094	55.8
Medium	68.4	6,727	9,832	24.8
Large	69.4	8,074	11,626	29.3
By Gender				
Men	67.3	8,949	13,296	33.6
Women	66.7	18,657	27,986	70.6
CHICKPEAS				
Dryland, Sagaing	30.2	2,103	6,974	17.6
Irrigated tract, Sagaing	90.7	5,646	6,225	15.7
River area, Sagaing	80.0	19,615	24,519	61.9
By Farm Size				
Small	54.2	6,365	11,751	29.7
Medium	54.2	5,345	9,867	24.9
Large	61.4	3,685	6,004	15.2
By Gender				
Men	59.6	5,055	8,485	21.4
Women	45.5	4,376	9,627	24.3

TABLE 147: PULSE PRODUCTION: BREAKDOWN OF TOTAL USE OF LABOR BY TYPE

	Total Labor Hours/Acre	% family	% permanent	% hired
BLACK GRAM				
By Ecoregion				
Brackish water, Ayeyarwady	186	29.8	0.9	69.3
Freshwater, Ayeyarwady	112	26.1	1.5	72.5
East alluvial, Bago	160	20.7	1.0	78.4
West alluvial, Bago	134	34.6	0.7	64.7
River area, Bago	143	24.8	2.1	73.1
By Farm Size				
Small	160	30.6	1.0	68.4
Medium	140	26.9	1.1	72.0
Large	145	23.0	1.5	75.4
By Gender				
Men	146	27.8	1.1	71.1
Women	160	23.4	1.4	75.2
GREEN GRAM				
Brackish water, Ayeyarwady	206	26.1	2.3	71.6
East alluvial, Bago	170	18.8	1.8	79.4
Irrigated tract, Sagaing		216	28.9	71.1
River area, Sagaing	129	25.0		75.0
By Farm Size				
Small	218	27.5	0.2	72.3
Medium	187	26.3		73.7
Large	173	19.9	1.8	78.3
By Gender				
Men	180	24.4	0.6	75.0
Women	347	28.0	0.9	71.1
CHICKPEAS				
Dryland, Sagaing	154	41.1		58.9
Irrigated tract, Sagaing	112	40.1		59.9
River area, Sagaing	150	52.7		47.3
By Farm Size				
Small	157	39.4		60.6
Medium	166	41.5		58.5
Large	139	43.1		56.9
By Gender				
Men	152	42.8		57.2
Women	161	36.8		63.2

TABLE 148: BLACK GRAM FARM BUDGET IN BRACKISH AREA ECOREGION, AYEYARWADY

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	343.0	610	209,243
Costs				
Seeds	Kg	31.2	791	24,714
Urea	Kg	0.7	285	192
NPK	Kg	0.1	429	24
T-Super	Kg			
Other inorganic fertilizers	Kg			4,317
Organic fertilizers	Kg			
Pesticides	Unit			8,134
Total material inputs				*37,382*
Land preparation	Hours	8.5	284	2,416
Seeding	Hours	2.2	276	612
Irrigation	Hours			
Crop Management	Hours	12.5	273	3,423
Harvest	Hours	80.0	303	24,232
Post-harvest	Hours	31.8	279	8,855
Total hired labor		*135.0*	*293*	*39,538*
Land preparation	Hours	4.9	284	1,400
Seeding	Hours	3.0	276	853
Irrigation	Hours			
Crop Management	Hours	24.9	273	7,263
Harvest	Hours	3.0	303	900
Post-harvest	Hours	14.7	279	4,097
Total own labor		*50.6*	*286*	*14,514*
Land preparation	Unit			3,139
Crop management	Unit			
Harvest and postharvest	Unit			2,240
Fuel	Unit			3,818
Draught oxen	Unit			5,201
Other services	Unit			6,647
Total livestock, machinery and fuel				*21,046*
Working capital before interest	Unit			64,880
Interest on working capital				*1,401*
Total Costs	MMK/acre			**113,882**
Gross margin	MMK/acre			109,875
Gross margin	$/ha			**277**
Net margin	MMK/acre			95,361
Net margin	$/ha			**241**
Labor productivity	$/day			**7.40**
Total labor	Days/ha			57
Yield	Kg/ha			**848**
Average cultivated area	Ha			1.08
Number of observations				135

TABLE 149: BLACK GRAM FARM BUDGET IN FRESHWATER ECOREGION, AYEYARWADY

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	290.1	604	175,227
Costs				
Seeds	Kg	33.0	630	20,763
Urea	Kg	0.6	349	224
NPK	Kg			
T-Super	Kg			
Other inorganic fertilizers	Kg			447
Organic fertilizers	Kg			
Pesticides	Unit			3,652
Total material inputs				*25,086*
Land preparation	Hours	5.0	386	1,923
Seeding	Hours	0.4	285	114
Irrigation	Hours			
Crop Management	Hours	1.1	270	292
Harvest	Hours	64.0	331	21,181
Post-harvest	Hours	14.7	313	4,593
Total hired labor		*85.1*	*330*	*28,102*
Land preparation	Hours	3.4	386	1,319
Seeding	Hours	4.2	285	1,163
Irrigation	Hours	0.3	330	49
Crop Management	Hours	4.2	270	1,113
Harvest	Hours	1.1	331	368
Post-harvest	Hours	14.2	313	4,443
Total own labor		*27.3*	*321*	*8,455*
Land preparation	Unit			1,610
Crop management	Unit			
Harvest and postharvest	Unit			970
Fuel	Unit			5,147
Draught oxen	Unit			1,819
Other services	Unit			799
Total livestock, machinery and fuel				*10,346*
Working capital before interest	Unit			37,760
Interest on working capital				*850*
Total Costs	MMK/acre			**72,838**
Gross margin	MMK/acre			110,844
Gross margin	$/ha			**280**
Net margin	MMK/acre			102,389
Net margin	$/ha			**258**
Labor productivity	$/day			**10.53**
Total labor	Days/ha			35
Yield	Kg/ha			**717**
Average cultivated area	Ha			0.76
Number of observations				144

TABLE 150: BLACK GRAM FARM BUDGET IN EAST ALLUVIAL ECOREGION, BAGO

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	315.1	643	202,655
Costs				
Seeds	Kg	32.7	706	23,070
Urea	Kg	0.3	389	120
NPK	Kg	0.1	520	38
T-Super	Kg	0.1	450	33
Other inorganic fertilizers	Kg			5,287
Organic fertilizers	Kg			
Pesticides	Unit			2,232
Total material inputs				*30,779*
Land preparation	Hours	3.5	367	1,273
Seeding	Hours	0.4	357	130
Irrigation	Hours			
Crop Management	Hours	1.6	327	511
Harvest	Hours	99.8	292	29,171
Post-harvest	Hours	23.5	301	7,083
Total hired labor		*128.7*	*297*	*38,168*
Land preparation	Hours	5.3	367	1,998
Seeding	Hours	4.8	357	1,717
Irrigation	Hours			
Crop Management	Hours	8.7	327	2,858
Harvest	Hours	0.7	292	196
Post-harvest	Hours	11.3	301	3,445
Total own labor		*31.2*	*320*	*10,212*
Land preparation	Unit			8,217
Crop management	Unit			
Harvest and postharvest	Unit			2,562
Fuel	Unit			5,236
Draught oxen	Unit			3,586
Other services	Unit			1,567
Total livestock, machinery and fuel				*21,167*
Working capital before interest	Unit			53,860
Interest on working capital				*1,212*
Total Costs	MMK/acre			**101,539**
Gross margin	MMK/acre			111,329
Gross margin	$/ha			**281**
Net margin	MMK/acre			101,116
Net margin	$/ha			**255**
Labor productivity	$/day			**8.52**
Total labor	Days/ha			49
Yield	Kg/ha			**778**
Average cultivated area	Ha			0.94
Number of observations				113

TABLE 151: BLACK GRAM FARM BUDGET IN WEST ALLUVIAL ECOREGION, BAGO

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	300.2	639	191,744
Costs				
Seeds	Kg	31.6	665	21,011
Urea	Kg	1.0	175	171
NPK	Kg			
T-Super	Kg			
Other inorganic fertilizers	Kg			7,626
Organic fertilizers	Kg			
Pesticides	Unit			2,257
Total material inputs				*31,065*
Land preparation	Hours	4.9	295	1,440
Seeding	Hours	0.1	313	37
Irrigation	Hours			
Crop Management	Hours	1.0	276	289
Harvest	Hours	70.3	231	16,275
Post-harvest	Hours	11.8	310	3,671
Total hired labor		*88.2*	*246*	*21,713*
Land preparation	Hours	15.6	295	4,692
Seeding	Hours	4.2	313	1,321
Irrigation	Hours			
Crop Management	Hours	11.7	276	3,368
Harvest	Hours	2.3	231	553
Post-harvest	Hours	12.0	310	3,659
Total own labor		*45.8*	*274*	*13,594*
Land preparation	Unit			5,775
Crop management	Unit			
Harvest and postharvest	Unit			2,350
Fuel	Unit			4,123
Draught oxen	Unit			5,126
Other services	Unit			1,015
Total livestock, machinery and fuel				*18,389*
Working capital before interest	Unit			51,221
Interest on working capital				*768*
Total Costs	MMK/acre			85,529
Gross margin	MMK/acre			119,800
Gross margin	$/ha			302
Net margin	MMK/acre			106,215
Net margin	$/ha			268
Labor productivity	$/day			9.55
Total labor	Days/ha			41
Yield	Kg/ha			741
Average cultivated area	Ha			0.73
Number of observations				105

TABLE 152: BLACK GRAM FARM BUDGET IN RIVER AREA ECOREGION, BAGO

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	343.2	707	242,560
Costs				
Seeds	Kg	34.4	850	29,271
Urea	Kg	1.5	268	415
NPK	Kg			
T-Super	Kg			
Other inorganic fertilizers	Kg			3,885
Organic fertilizers	Kg			
Pesticides	Unit			3,592
Total material inputs				*37,164*
Land preparation	Hours	6.6	393	2,579
Seeding	Hours	0.5	355	164
Irrigation	Hours			
Crop Management	Hours	1.6	262	413
Harvest	Hours	83.3	303	25,209
Post-harvest	Hours	17.4	329	5,715
Total hired labor		*109.2*	*312*	*34,080*
Land preparation	Hours	9.4	393	3,682
Seeding	Hours	4.7	355	1,690
Irrigation	Hours			
Crop Management	Hours	10.2	262	2,901
Harvest	Hours			
Post-harvest	Hours	9.7	329	3,181
Total own labor		*34.0*	*324*	*11,454*
Land preparation	Unit			2,422
Crop management	Unit			
Harvest and postharvest	Unit			4,415
Fuel	Unit			2,959
Draught oxen	Unit			3,742
Other services	Unit			1,975
Total livestock, machinery and fuel				*15,514*
Working capital before interest	Unit			55,834
Interest on working capital				*1,206*
Total Costs	MMK/acre			**99,419**
Gross margin	MMK/acre			154,596
Gross margin	$/ha			**390**
Net margin	MMK/acre			143,142
Net margin	$/ha			**361**
Labor productivity	$/day			**11.55**
Total labor	Days/ha			44
Yield	Kg/ha			**848**
Average cultivated area	Ha			0.80
Number of observations				61

TABLE 153: BLACK GRAM FARM BUDGET BY FARM SIZE

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	315.3	614	193,410	301.0	626	188,426	308.1	635	195,580
Costs										
Seeds	Kg	32.0	662	21,191	32.4	761	24,612	32.4	715	23,149
Urea	Kg	0.6	428	266	1.1	189	203	0.4	414	172
NPK	Kg				0.04	429	18	0.04	520	22
T-Super	Kg							0.04	450	19
Other inorganic fertilizers	Kg			5,190			3,684			4,085
Organic fertilizers	Kg									
Pesticides	Unit			5,426			4,460			3,991
Total material inputs				*32,073*			*32,976*			*31,438*
Land preparation	Hours	5.1	387	1,990	5.5	297	1,649	6.5	333	2,153
Seeding	Hours	0.5	305	151	0.9	288	247	1.1	286	322
Irrigation	Hours									
Crop Management	Hours	5.4	244	1,328	3.3	296	982	5.6	280	1,572
Harvest	Hours	76.5	287	21,909	77.3	305	23,598	83.2	289	24,026
Post-harvest	Hours	23.8	294	6,985	21.2	286	6,053	20.9	307	6,398
Total hired labor		*111.3*	*291*	*32,363*	*108.2*	*301*	*32,529*	*117.2*	*294*	*34,471*
Land preparation	Hours	5.9	387	2,297	7.8	297	2,310	6.2	333	2,058
Seeding	Hours	4.1	305	1,265	3.9	288	1,123	4.1	286	1,164
Irrigation	Hours	0.1	291	37	0.1	301	30	-	294	-
Crop Management	Hours	17.1	244	4,182	14.2	296	4,194	10.2	280	2,864
Harvest	Hours	2.7	287	787	1.9	305	575	0.8	289	236
Post-harvest	Hours	16.9	294	4,974	12.9	286	3,695	11.0	307	3,384
Total own labor		*47.0*	*301*	*13,542*	*40.7*	*296*	*11,927*	*32.3*	*298*	*9,705*
Land preparation	Unit			4,604			3,474			1,486
Crop management	Unit									
Harvest and postharvest	Unit			4,090			2,249			1,239
Fuel	Unit			4,644			5,367			5,618
Draught oxen	Unit			916			588			286
Other services	Unit			2,980			2,733			2,579
Total livestock, machinery and fuel				*17,234*			*14,412*			*11,209*
Working capital before interest	Unit			52,776			50,266			46,695
Interest on working capital				*1,140*			*1,086*			*1,009*
Total Costs	MMK/acre			**96,352**			**92,929**			**87,833**
Gross margin	MMK/acre			110,600			107,424			117,453
Gross margin	$/ha			**272**			**265**			**289**
Net margin	MMK/acre			97,058			95,497			107,747
Net margin	$/ha			**245**			**241**			**272**
Labor productivity	$/day			**8.09**			**8.23**			**8.66**
Total labor	Days/ha			49			46			46
Yield	Kg/ha			**778**			**744**			**761**
Average cultivated area	Ha			1.13			2.17			3.74
Number of observations				205			223			130

TABLE 154: BLACK GRAM FARM BUDGET BY GENDER OF HOUSEHOLD HEAD

		Men			Women		
	Unit	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	306.9	636	195,252	313.1	618	193,434
Costs							
Seeds	Kg	32.5	705	22,884	31.1	881	27,379
Urea	Kg	0.8	269	202	0.5	440	209
NPK	Kg	0.04	474	18			
T-Super	Kg	0.02	450	8			
Other inorganic fertilizers	Kg			4,062			4,753
Organic fertilizers	Kg						
Pesticides	Unit			4,173			6,832
Total material inputs				*31,347*			*39,174*
Land preparation	Hours	5.5	338	1,846	9.1	279	2,535
Seeding	Hours	0.8	296	222	2.1	267	564
Irrigation	Hours						
Crop Management	Hours	4.0	291	1,159	10.3	231	2,372
Harvest	Hours	80.2	292	23,453	73.8	317	23,394
Post-harvest	Hours	20.6	299	6,150	29.6	278	8,232
Total hired labor		*111.0*	*296*	*32,830*	*124.9*	*297*	*37,096*
Land preparation	Hours	6.7	338	2,258	7.6	279	2,121
Seeding	Hours	4.1	296	1,211	3.4	267	907
Irrigation	Hours	0.1	296	21		297	
Crop Management	Hours	12.9	291	3,756	15.0	231	3,467
Harvest	Hours	1.7	292	495	1.0	317	321
Post-harvest	Hours	12.8	299	3,837	13.6	278	3,792
Total own labor		*38.3*	*302*	*11,578*	*40.7*	*278*	*10,608*
Land preparation	Unit			2,849			3,196
Crop management	Unit						
Harvest and postharvest	Unit			2,195			2,191
Fuel	Unit			5,376			4,945
Draught oxen	Unit			468			1,040
Other services	Unit			2,590			3,797
Total livestock, machinery and fuel				*13,478*			*15,169*
Working capital before interest	Unit			48,052			59,813
Interest on working capital				*1,038*			*1,292*
Total Costs	MMK/acre			**90,270**			**103,339**
Gross margin	MMK/acre			116,559			100,703
Gross margin	$/ha			**287**			**248**
Net margin	MMK/acre			104,982			90,095
Net margin	$/ha			**265**			**227**
Labor productivity	$/day			**8.68**			**7.37**
Total labor	Days/ha			46			51
Yield	Kg/ha			**742**			**757**
Average cultivated area	Ha			2.15			2.17
Number of observations				499			59

TABLE 155: GREEN GRAM FARM BUDGET IN BRACKISH AREA ECOREGION, AYEYARWADY

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	435.1	901	391,754
Costs				
Seeds	Kg	23.2	1,181	27,360
Urea	Kg	0.3	400	105
NPK	Kg			
T-Super	Kg			
Other inorganic fertilizers	Kg			5,695
Organic fertilizers	Kg			
Pesticides	Unit			14,458
Total material inputs				*47,619*
Land preparation	Hours	18.1	276	4,988
Seeding	Hours	2.4	282	668
Irrigation	Hours			
Crop Management	Hours	11.6	281	3,261
Harvest	Hours	68.8	395	27,169
Post-harvest	Hours	35.6	314	11,190
Total hired labor		*136.5*	*346*	*47,277*
Land preparation	Hours	10.4	276	2,861
Seeding	Hours	2.3	282	644
Irrigation	Hours			
Crop Management	Hours	40.2	281	11,372
Harvest	Hours			
Post-harvest	Hours	16.4	314	5,160
Total own labor		*69.3*	*320*	*20,037*
Land preparation	Unit			2,694
Crop management	Unit			
Harvest and postharvest	Unit			
Fuel	Unit			6,806
Draught oxen	Unit			4,195
Other services	Unit			6,886
Total livestock, machinery and fuel				*20,581*
Working capital before interest	Unit			77,118
Interest on working capital				*1,666*
Total Costs	MMK/acre			**137,180**
Gross margin	MMK/acre			274,611
Gross margin	$/ha			**693**
Net margin	MMK/acre			254,574
Net margin	$/ha			**643**
Labor productivity	$/day			**13.39**
Total labor	Days/ha			64
Yield	Kg/ha			**1,075**
Average cultivated area	Ha			0.88
Number of observations				19

TABLE 156: GREEN GRAM FARM BUDGET IN EAST ALLUVIAL ECOREGION, BAGO

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	291.0	914	265,886
Costs				
Seeds	Kg	33.6	1,000	33,573
Urea	Kg	4.2	372	1,575
NPK	Kg			
T-Super	Kg			
Other inorganic fertilizers	Kg			17,139
Organic fertilizers	Kg			
Pesticides	Unit			1,658
Total material inputs				*53,944*
Land preparation	Hours	1.9	357	694
Seeding	Hours	0.3	333	111
Irrigation	Hours			
Crop Management	Hours			
Harvest	Hours	116.9	268	31,282
Post-harvest	Hours	20.7	302	6,254
Total hired labor		*139.9*	*274*	*38,341*
Land preparation	Hours	5.4	357	1,925
Seeding	Hours	3.4	333	790
Irrigation	Hours			
Crop Management	Hours	6.6	274	828
Harvest	Hours			
Post-harvest	Hours	14.7	302	4,506
Total own labor		*30.1*	*298*	*8,050*
Land preparation	Unit			12,964
Crop management	Unit			
Harvest and postharvest	Unit			7,593
Fuel	Unit			8,011
Draught oxen	Unit			1,067
Other services	Unit			1,458
Total livestock, machinery and fuel				*31,093*
Working capital before interest	Unit			85,842
Interest on working capital				*1,931*
Total Costs	MMK/acre			**133,360**
Gross margin	MMK/acre			140,575
Gross margin	$/ha			**355**
Net margin	MMK/acre			132,526
Net margin	$/ha			**335**
Labor productivity	$/day			**9.80**
Total labor	Days/ha			53
Yield	Kg/ha			**719**
Average cultivated area	Ha			0.76
Number of observations				15

TABLE 157: GREEN GRAM FARM BUDGET IN IRRIGATED TRACT ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	459.1	1,075	493,339
Costs				
Seeds	Kg	14.0	1,906	26,603
Urea	Kg			
NPK	Kg	0.3	760	247
T-Super	Kg			
Other inorganic fertilizers	Kg			1,693
Organic fertilizers	Kg			
Pesticides	Unit			14,322
Total material inputs				*42,864*
Land preparation	Hours	3.1	350	1,098
Seeding	Hours	0.6	424	242
Irrigation	Hours	4.0	185	739
Crop Management	Hours	5.9	368	2,187
Harvest	Hours	120.0	389	46,707
Post-harvest	Hours	5.4	351	1,887
Total hired labor		*139.1*	*344*	*52,860*
Land preparation	Hours	7.5	350	2,590
Seeding	Hours	3.3	424	1,415
Irrigation	Hours	13.7	185	1,922
Crop Management	Hours	19.0	368	7,727
Harvest	Hours	13.3	389	5,566
Post-harvest	Hours	20.7	351	7,355
Total own labor		*77.5*	*344*	*26,574*
Land preparation	Unit			5,545
Crop management	Unit			5,218
Harvest and postharvest	Unit			5,500
Fuel	Unit			24,906
Draught oxen	Unit			2,526
Other services	Unit			13,347
Total livestock, machinery and fuel				*57,041*
Working capital before interest	Unit			104,171
Interest on working capital				*2,344*
Total Costs	MMK/acre			**181,683**
Gross margin	MMK/acre			338,230
Gross margin	$/ha			**854**
Net margin	MMK/acre			311,656
Net margin	$/ha			**787**
Labor productivity	$/day			**16.06**
Total labor	Days/ha			67
Yield	Kg/ha			**1,134**
Average cultivated area	Ha			0.48
Number of observations				22

TABLE 158: GREEN GRAM FARM BUDGET IN RIVER AREA ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	350.1	984	344,269
Costs				
Seeds	Kg	25.7	1,210	31,168
Urea	Kg	4.0	411	1,662
NPK	Kg	3.6	452	1,616
T-Super	Kg	6.3	630	3,937
Other inorganic fertilizers	Kg			5,372
Organic fertilizers	Kg			
Pesticides	Unit			4,999
Total material inputs				*48,754*
Land preparation	Hours	5.0	529	2,664
Seeding	Hours	0.3	455	150
Irrigation	Hours			
Crop Management	Hours	2.1	483	994
Harvest	Hours	80.7	416	33,599
Post-harvest	Hours	7.9	469	3,719
Total hired labor		*96.1*	*428*	*41,126*
Land preparation	Hours	7.1	529	3,640
Seeding	Hours	3.6	455	1,629
Irrigation	Hours			
Crop Management	Hours	12.0	483	5,726
Harvest	Hours	0.9	416	379
Post-harvest	Hours	9.6	469	4,522
Total own labor		*33.2*	*470*	*15,896*
Land preparation	Unit			9,843
Crop management	Unit			
Harvest and postharvest	Unit			1,910
Fuel	Unit			5,873
Draught oxen	Unit			1,329
Other services	Unit			1,786
Total livestock, machinery and fuel				*20,740*
Working capital before interest	Unit			73,302
Interest on working capital				*1,649*
Total Costs	MMK/acre			**128,166**
Gross margin	MMK/acre			231,999
Gross margin	$/ha			**586**
Net margin	MMK/acre			216,103
Net margin	$/ha			**545**
Labor productivity	$/day			**18.32**
Total labor	Days/ha			40
Yield	Kg/ha			**865**
Average cultivated area	Ha			1.06
Number of observations				57

TABLE 159: GREEN GRAM FARM BUDGET BY FARM SIZE

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	296	982	290,672	347.1	984	341,448	329.0	982	323,078
Costs										
Seeds	Kg	25.5	1,187	30,235	25.0	1,231	30,795	24.5	1,224	29,996
Urea	Kg	4.6	405	1,862	3.6	459	1,639	1.6	415	662
NPK	Kg				7.8	458	3,586			
T-Super	Kg	1.8	367	676	7.4	729	5,406	2.9	540	1,551
Other inorganic fertilizers	Kg			6,839			7,129			6,003
Organic fertilizers	Kg									
Pesticides	Unit			12,773			6,031			6,045
Total material inputs				*52,386*			*54,586*			*44,257*
Land preparation	Hours	7.9	382	3,026	4.5	499	2,240	7.0	374	2,620
Seeding	Hours	0.7	319	235	0.5	347	187	0.8	362	279
Irrigation	Hours	0.9	344	304	0.4	234	82	0.3	31	10
Crop Management	Hours	4.9	342	1,662	3.5	341	1,186	3.7	387	1,432
Harvest	Hours	114.7	364	41,800	95.5	406	38,764	88.0	380	33,393
Post-harvest	Hours	11.9	366	4,364	12.2	355	4,328	14.9	378	5,635
Total hired labor		*141.0*	*353*	*51,390*	*116.5*	*364*	*46,787*	*114.7*	*3*	*43,370*
Land preparation	Hours	6.3	382	2,422	6.3	499	3,167	7.2	374	2,687
Seeding	Hours	3.4	319	1,093	3.2	347	1,108	3.3	362	1,176
Irrigation	Hours	4.6	344	1,593	1.3	234	310	0.3	31	8
Crop Management	Hours	20.0	342	6,833	22.2	341	7,574	12.2	387	4,723
Harvest	Hours	5.5	364	1,998	1.6	406	634	0.2	380	68
Post-harvest	Hours	17.9	366	6,570	11.3	355	3,991	10.9	378	4,108
Total own labor		*57.8*	*353*	*20,509*	*45.9*	*364*	*16,785*	*33.9*	*319*	*12,771*
Land preparation	Unit			6,728			6,100			5,763
Crop management	Unit			552			220			
Harvest and postharvest	Unit			4,186			2,995			1,516
Fuel	Unit			8,469			8,139			6,980
Draught oxen	Unit			1,803			429			1,092
Other services	Unit			4,239			3,604			3,609
Total livestock, machinery and fuel				*25,977*			*21,486*			*18,960*
Working capital before interest	Unit			83,588			79,767			67,558
Interest on working capital				*1,806*			*1,723*			*1,459*
Total Costs	MMK/acre			**152,067**			**141,367**			**120,817**
Gross margin	MMK/acre			159,114			216,866			215,032
Gross margin	$/ha			**392**			**534**			**530**
Net margin	MMK/acre			138,605			200,081			202,261
Net margin	$/ha			**350**			**505**			**511**
Labor productivity	$/day			**9.44**			**14.02**			**14.95**
Total labor	Days/ha			61			50			46
Yield	Kg/ha			**731**			**857**			**813**
Average cultivated area	Ha			1.13			1.94			3.52
Number of observations				39			38			36

TABLE 160: GREEN GRAM FARM BUDGET BY GENDER OF HOUSEHOLD HEAD

		Men			Women		
	Unit	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	333.0	982	324,060	301.0	982	295,582
Costs							
Seeds	Kg	24.8	1,218	30,217	25.2	1,268	32,012
Urea	Kg	2.7	415	1,139	2.4	880	2,097
NPK	Kg	2.4	458	1,119			
T-Super	Kg	4.1	624	2,568	2.4	920	2,193
Other inorganic fertilizers	Kg			6,267			12,762
Organic fertilizers	Kg						
Pesticides	Unit			6,978			14,847
Total material inputs				*48,289*			*63,912*
Land preparation	Hours	6.2	405	2,514	11.9	368	4,385
Seeding	Hours	0.7	349	241	0.8	382	310
Irrigation	Hours	0.3	300	82	4.6	31	143
Crop Management	Hours	3.6	364	1,319	9.9	367	3,622
Harvest	Hours	93.4	384	35,829	139.8	400	55,863
Post-harvest	Hours	13.4	370	4,954	18.5	359	6,649
Total hired labor		*117.6*	*362*	*44,939*	*185.5*	*318*	*70,972*
Land preparation	Hours	6.7	405	2,714	8.7	368	3,210
Seeding	Hours	3.3	349	1,136	3.5	382	1,330
Irrigation	Hours	1.2	300	345	7.3	31	229
Crop Management	Hours	16.0	364	5,837	32.8	367	12,040
Harvest	Hours	1.0	384	384	16.8	400	6,707
Post-harvest	Hours	12.0	370	4,426	20.8	359	7,453
Total own labor		*40.1*	*362*	*14,842*	*89.9*	*318*	*30,969*
Land preparation	Unit			5,897			9,959
Crop management	Unit			172			
Harvest and postharvest	Unit			2,095			12,095
Fuel	Unit			7,452			11,647
Draught oxen	Unit			985			2,002
Other services	Unit			3,556			8,317
Total livestock, machinery and fuel				*20,155*			*44,021*
Working capital before interest	Unit			72,601			116,393
Interest on working capital				*1,568*			*2,514*
Total Costs	MMK/acre			**129,794**			**212,388**
Gross margin	MMK/acre			209,109			114,163
Gross margin	$/ha			**515**			**281**
Net margin	MMK/acre			194,266			83,194
Net margin	$/ha			**490**			**210**
Labor productivity	$/day			**13.90**			**6.53**
Total labor	Days/ha			49			85
Yield	Kg/ha			**798**			**728**
Average cultivated area	Ha			2.27			0.94
Number of observations				104			9

TABLE 161: CHICKPEA FARM BUDGET IN DRYLAND ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	334.9	443	146,566
Costs				
Seeds	Kg	36.5	536	19,552
Urea	Kg	10.5	423	4,444
NPK	Kg	15.8	627	9,886
T-Super	Kg	0.2	700	161
Other inorganic fertilizers	Kg			950
Organic fertilizers	Kg			15
Pesticides	Unit			2,076
Total material inputs				*37,084*
Land preparation	Hours	12.4	294	3,646
Seeding	Hours	5.7	266	1,516
Irrigation	Hours	0.3	331	89
Crop Management	Hours	27.9	224	6,252
Harvest	Hours	43.9	249	10,947
Post-harvest	Hours	11.7	332	3,880
Total hired labor		*101.9*	*286*	*26,330*
Land preparation	Hours	11.3	294	485
Seeding	Hours	3.6	266	1,011
Irrigation	Hours	1.4	331	455
Crop Management	Hours	19.2	224	4,287
Harvest	Hours	6.0	249	1,556
Post-harvest	Hours	10.2	332	3,359
Total own labor		*51.6*	*283*	*11,153*
Land preparation	Unit			1,638
Crop management	Unit			220
Harvest and postharvest	Unit			3,449
Fuel	Unit			1,859
Draught oxen	Unit			8,747
Other services	Unit			7,079
Total livestock, machinery and fuel				*22,993*
Working capital before interest	Unit			71,580
Interest on working capital				*1,611*
Total Costs	MMK/acre			**99,170**
Gross margin	MMK/acre			58,548
Gross margin	$/ha			**148**
Net margin	MMK/acre			47,396
Net margin	$/ha			**120**
Labor productivity	$/day			**5.73**
Total labor	Days/ha			47
Yield	Kg/ha			**818**
Average cultivated area	Ha			0.59
Number of observations				63

TABLE 162: CHICKPEA FARM BUDGET IN IRRIGATED TRACT ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	399.1	460	183,439
Costs				
Seeds	Kg	58.9	587	34,630
Urea	Kg	6.6	429	2,817
NPK	Kg	23.1	549	12,690
T-Super	Kg	7.1	331	2,332
Other inorganic fertilizers	Kg			578
Organic fertilizers	Kg			
Pesticides	Unit			5,229
Total material inputs				*58,276*
Land preparation	Hours	3.2	360	1,138
Seeding	Hours	2.2	331	738
Irrigation	Hours	2.4	314	738
Crop Management	Hours	15.0	243	3,642
Harvest	Hours	42.5	271	11,518
Post-harvest	Hours	6.1	312	1,903
Total hired labor		*71.3*	*305*	*19,677*
Land preparation	Hours	8.3	360	2,982
Seeding	Hours	4.9	331	1,600
Irrigation	Hours	3.2	314	1,005
Crop Management	Hours	7.6	243	1,856
Harvest	Hours	4.0	271	1,087
Post-harvest	Hours	13.0	312	4,133
Total own labor		*40.9*	*305*	*11,657*
Land preparation	Unit			357
Crop management	Unit			2,888
Harvest and postharvest	Unit			2,553
Fuel	Unit			5,278
Draught oxen	Unit			3,670
Other services	Unit			4,525
Total livestock, machinery and fuel				*19,272*
Working capital before interest	Unit			83,805
Interest on working capital				*1,810*
Total Costs	MMK/acre			**111,698**
Gross margin	MMK/acre			84,403
Gross margin	$/ha			**213**
Net margin	MMK/acre			71,741
Net margin	$/ha			**181**
Labor productivity	$/day			**8.73**
Total labor	Days/ha			35
Yield (dried paddy equivalent)	Kg/ha			**986**
Average cultivated area	Ha			0.85
Number of observations				43

TABLE 163: CHICKPEA FARM BUDGET IN RIVER AREA ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	343.9	469	161,213
Costs				
Seeds	Kg	47.4	566	26,872
Urea	Kg	3.5	500	1,744
NPK	Kg			
T-Super	Kg			
Other inorganic fertilizers	Kg			5,125
Organic fertilizers	Kg			
Pesticides	Unit			17,443
Total material inputs				*51,184*
Land preparation	Hours	5.7	300	1,706
Seeding	Hours	5.4	251	1,345
Irrigation	Hours	0.7	500	349
Crop Management	Hours	6.0	221	1,326
Harvest	Hours	43.9	216	9,495
Post-harvest	Hours	14.4	340	4,912
Total hired labor		*76.1*	*252*	*19,132*
Land preparation	Hours	16.8	300	5,051
Seeding	Hours	6.0	251	1,510
Irrigation	Hours			
Crop Management	Hours	24.9	221	5,514
Harvest	Hours	2.5	216	546
Post-harvest	Hours	24.0	340	8,153
Total own labor		*74.2*	*266*	*20,773*
Land preparation	Unit			163
Crop management	Unit			1,367
Harvest and postharvest	Unit			6,144
Fuel	Unit			2,346
Draught oxen	Unit			6,398
Other services	Unit			10,078
Total livestock, machinery and fuel				*26,496*
Working capital before interest	Unit			82,405
Interest on working capital				*1,780*
Total Costs	MMK/acre			**119,365**
Gross margin	MMK/acre			62,621
Gross margin	$/ha			**158**
Net margin	MMK/acre			20,773
Net margin	$/ha			**106**
Labor productivity	$/day			**5.86**
Total labor	Days/ha			46
Yield	Kg/ha			**850**
Average cultivated area	Ha			0.29
Number of observations				10

TABLE 164: CHICKPEA FARM BUDGET BY FARM SIZE

		Small Farms			Medium Farms			Large Farms		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	366.0	446	163,236	318.9	446	142,274	396.0	446	176,616
Costs										
Seeds	Kg	48.4	551	26,659	50.7	576	29,210	45.7	567	25,894
Urea	Kg	12.2	392	4,765	8.5	412	3,519	6.9	446	3,083
NPK	Kg	18.8	552	10,367	16.1	744	11,990	19.9	527	10,508
T-Super	Kg				2.1	400	820	5.2	326	1,684
Other inorganic fertilizers	Kg			422			685			1,130
Organic fertilizers	Kg									16
Pesticides	Unit			4,776			4,151			4,269
Total material inputs				*46,988*			*50,376*			*46,583*
Land preparation	Hours	14.8	318	4,708	7.9	288	2,268	6.0	323	1,955
Seeding	Hours	4.6	295	1,348	4.0	286	1,143	4.0	271	1,096
Irrigation	Hours	1.7	355	597	1.7	326	551	1.0	298	284
Crop Management	Hours	26.4	259	6,826	22.0	215	4,731	19.8	235	4,667
Harvest	Hours	40.8	278	11,343	45.8	244	11,153	42.7	264	11,263
Post-harvest	Hours	12.4	345	4,271	8.5	339	2,877	8.7	318	2,756
Total hired labor		*100.7*	*308*	*29,093*	*89.8*	*283*	*22,723*	*82.3*	*285*	*22,021*
Land preparation	Hours	9.6	318	3,064	11.3	288	3,245	9.3	323	2,995
Seeding	Hours	2.9	295	847	3.3	286	948	5.3	271	1,428
Irrigation	Hours	2.1	355	762	2.3	326	744	2.1	298	638
Crop Management	Hours	13.5	259	3,493	16.2	215	3,472	12.2	235	2,862
Harvest	Hours	6.8	278	1,879	4.4	244	1,066	4.7	264	1,233
Post-harvest	Hours	16.9	345	5,842	11.8	339	4,009	11.1	318	3,527
Total own labor		*51.9*	*308*	*15,886*	*49.2*	*283*	*13,485*	*44.6*	*285*	*12,683*
Land preparation	Unit			1,760			856			346
Crop management	Unit			506			2,031			1,169
Harvest and postharvest	Unit			4,583			3,226			2,595
Fuel	Unit			4,721			5,159			4,848
Draught oxen	Unit			9,262			4,219			2,261
Other services	Unit			8,369			7,233			6,265
Total livestock, machinery and fuel				*29,200*			*22,723*			*17,483*
Working capital before interest	Unit			89,667			81,792			72,068
Interest on working capital				*1,937*			*1,767*			*1,557*
Total Costs	MMK/acre			**123,104**			**111,073**			**100,328**
Gross margin	MMK/acre			56,018			44,686			88,972
Gross margin	$/ha			**138**			**110**			**219**
Net margin	MMK/acre			40,132			31,201			76,288
Net margin	$/ha			**101**			**79**			**193**
Labor productivity	$/day			**5.98**			**5.10**			**8.06**
Total labor	Days/ha			47			43			39
Yield	Kg/ha			**904**			**788**			**979**
Average cultivated area	Ha			0.76			1.44			2.32
Number of observations				24			48			44

TABLE 165: CHICKPEA FARM BUDGET BY GENDER OF HOUSEHOLD HEAD

		Men			Women		
	Unit	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	364.1	446	162,389	315.5	446	140,701
Costs							
Seeds	Kg	49.8	573	28,530	39.1	548	21,445
Urea	Kg	6.8	422	2,887	13.0	431	5,598
NPK	Kg	19.9	596	11,847	12.3	616	7,594
T-Super	Kg	4.4	342	1,490			
Other inorganic fertilizers	Kg			1,002			461
Organic fertilizers	Kg						45
Pesticides	Unit			4,350			3,959
Total material inputs				*50,106*			*39,101*
Land preparation	Hours	7.1	306	2,179	9.5	317	2,998
Seeding	Hours	4.0	273	1,090	4.4	303	1,339
Irrigation	Hours	1.5	319	482	0.4	313	112
Crop Management	Hours	20.4	224	4,575	24.9	251	6,274
Harvest	Hours	43.5	273	11,875	44.1	193	8,498
Post-harvest	Hours	9.4	316	2,980	7.0	403	2,808
Total hired labor		*86.0*	*285*	*23,181*	*90.3*	*297*	*22,030*
Land preparation	Hours	10.2	306	3,115	9.5	317	2,995
Seeding	Hours	4.8	273	1,298	2.5	303	748
Irrigation	Hours	2.5	319	800	0.9	313	266
Crop Management	Hours	12.0	224	2,703	21.0	251	5,274
Harvest	Hours	5.3	273	1,437	2.6	193	510
Post-harvest	Hours	12.8	316	4,057	8.0	403	3,242
Total own labor		*47.6*	*285*	*13,410*	*44.4*	*297*	*13,034*
Land preparation	Unit			419			1,726
Crop management	Unit			1,492			1,113
Harvest and postharvest	Unit			2,992			3,125
Fuel	Unit			4,483			6,925
Draught oxen	Unit			3,465			4,450
Other services	Unit			7,125			5,532
Total livestock, machinery and fuel				*19,977*			*22,871*
Working capital before interest	Unit			78,409			72,696
Interest on working capital				*1,694*			*1,570*
Total Costs	MMK/acre			**108,367**			**98,606**
Gross margin	MMK/acre			67,432			55,129
Gross margin	$/ha			**166**			**136**
Net margin	MMK/acre			54,022			42,095
Net margin	$/ha			**136**			**106**
Labor productivity	$/day			**6.59**			**5.74**
Total labor	Days/ha			41			42
Yield	Kg/ha			**880**			**763**
Average cultivated area	Ha			1.63			1.64
Number of observations				94			22

ANNEX 11: OILSEED AND MAIZE PRODUCTION

TABLE 166: CULTIVATED AREA, PRODUCTION, AND YIELDS OF OILSEEDS AND MAIZE

	N	Average area acre	Total production kg	Average yield kg/acre	Average yield kg/ha
BY ECOREGION					
Maize					
North interior	83	3.76	6,510	1,720	4,251
South interior	97	4.69	7,069	1,472	3,638
Groundnut (rain)					
River area	36	2.55	589	275	680
Sesame (early)					
Dryland	22	2.63	169	69	169
River area	28	3.37	247	84	208
Sunflower					
Dryland	17	3.72	1,000	295	730
BY GENDER					
Maize					
Male	156	4.23	6,819	1,597	3,947
Female	24	4.49	6,762	1,519	3,753
Groundnut (rain)					
Male	28	2.53	557	272	672
Female	8	2.63	699	287	710
Sesame (early)					
Male	37	3.11	228	84	208
Female	13	2.88	169	58	144
Sunflower					
Male	13	4.04	1,070	293	723
Female	4	2.69	773	304	752

TABLE 167: PRODUCTION AND SALES OF OILSEEDS AND MAIZE

	N	Total production kg	Ratio sellers	Quantity sold kg	Ratio quantity sold
BY ECOREGION					
Maize					
North interior	83	6,510	1.00	6,285	0.98
South interior	97	7,069	1.00	6,507	0.93
Groundnut (rain)					
River area	36	589	1.00	437	0.75
Sesame (early)					
Dryland	22	169	1.00	148	0.88
River area	28	247	1.00	232	0.91
Sunflower					
Dryland	17	1,000	1.00	700	0.66
BY GENDER					
Maize					
Male	156	6,819	1.00	6,375	0.94
Female	24	6,762	1.00	6,602	0.99
Groundnut (rain)					
Male	28	557	1.00	417	0.77
Female	8	699	1.00	508	0.68
Sesame (early)					
Male	37	228	1.00	212	0.91
Female	13	169	1.00	147	0.85
Sunflower					
Male	13	1,070	1.00	764	0.65
Female	4	773	1.00	490	0.67

TABLE 168: TYPE OF SEEDS USED FOR OILSEED AND MAIZE PRODUCTION

In percent to total seed use

		N	Hybrid	Cerified	Other
BY ECOREGION					
Maize					
North interior		83	100		
South interior		97	81	18	1
Groundnut (rain)					
River area		36	3		97
Sesame (early)					
Dryland		22		5	95
River area		28			100
Sunflower					
Dryland		17			100

TABLE 169: SOURCE OF SEEDS FOR OILSEEDS AND MAIZE

In percent to all sources

	N	Traders	Friends/ Relatives	Cooperatives, Commercial firms	Previous harvest
BY ECOREGION					
Maize					
North interior	83	98	1	1	
South interior	97	62	5	33	
Groundnut (rain)					
River area	36	14	8		78
Sesame (early)					
Dryland	22	27	18		55
River area	28	36	18		46
Sunflower					
Dryland	17		6		94

TABLE 170: CONSUMPTION OF FERTILIZERS FOR OILSEEDS AND MAIZE

In kg per acre

		N	Urea	NPK	T-super
BY ECOREGION					
Maize					
North interior		83	53.9	68.2	15.9
South interior		97	17.5	23.9	29.8
Groundnut (rain)					
River area		36	4.6	8.6	1.4
Sesame (early)					
Dryland		22	15.7	12.7	
River area		28	1.2	1.8	
Sunflower					
Dryland		17	12.2	18.5	
BY GENDER					
Maize					
Male		156	34.2	45.7	22.6
Female		24	34.5	35.1	28.2
Groundnut (rain)					
Male		28	5.7	7.8	1.8
Female		8	0.9	11.4	
Sesame (early)					
Male		37	7.3	6.2	
Female		13	8.4	7.5	
Sunflower					
Male		13	14.6	20.6	
Female		4	4.3	11.9	

TABLE 171: AVERAGE APPLICATION RATE OF FERTILIZERS FOR OILSEEDS AND MAIZE

	% of HH using urea	Application rate urea (kg/acre)	% of HH using NPK	Application rate NPK (kg/acre)	% of HH using t-super	Application rate t-super (kg/acre)
BY ECOREGION						
Maize						
North interior	94	57.36	73	92.78	22	73.31
South interior	39	44.61	36	66.20	57	52.48
Groundnut (rain)						
River area	11	41.37	28	30.81	3	50.00
Sesame (early)						
Dryland	55	28.74	45	27.88		
River area	18	6.86	4	50.00		
Sunflower						
Dryland	71	17.22	88	20.99		
BY GENDER						
Maize						
Male	66	51.85	53	85.96	40	56.01
Female	54	63.75	54	64.78	42	67.70
Groundnut (rain)						
Male	11	52.78	21	36.17	4	50.00
Female	13	7.14	50	22.78		
Sesame (early)						
Male	30	24.59	19	32.98		
Female	46	18.12	31	24.48		
Sunflower						
Male	77	18.97	92	22.28		
Female	50	8.51	75	15.83		

TABLE 172: PROPORTION OF USERS OF CHEMICALS AND APPLICATION RATE FOR OIL-SEEDS AND MAIZE

	N	% of HH using insecticide	Application rate insecticides ($/acre)	% of HH using herbicide	Application rate herbicide ($/acre)
BY ECOREGION					
Maize					
North interior	83	4	0.67		
South interior	97	1	7.56	0.01	18.16
Groundnut (rain)					
River area	36	86	12.78		
Sesame (early)					
Dryland	22	14	9.70	5	3.19
River area	28	61	4.60		
Sunflower					
Dryland	17				
BY GENDER					
Maize					
Male	156	2	0.67	1	18.16
Female	24	4	7.56		
Groundnut (rain)					
Male	28	82	12.24		
Female	8	100	14.35		
Sesame (early)					
Male	37	46	5.68		
Female	13	23	3.59	8	3.19
Sunflower					
Male	13				
Female	4				

TABLE 173: TOTAL LABOR USE AND RATIO BY TASKS AND TYPE OF LABOR

	Total hours/ acre	Land preparation %	Plantation %	Crop mang. %	Harvest %	Post-harvest %	Family labor %
BY ECOREGION							
Maize							
North interior	202.4	23	8	27	31	12	34
South interior	202.3	17	8	32	28	15	55
Groundnut(rain)							
River area	217.4	17	2	43	28	9	75
Sesame(early)							
Dryland	185.6	18	3	34	26	19	53
River area	118.7	19	2	29	33	17	53
Sunflower							
Dryland	98.0	16	4	42	23	14	41
BY GENDER							
Maize							
Male	200.3	20	8	28	29	14	43
Female	210.9	17	7	36	30	10	56
Groundnut (rain)							
Male	204.8	16	2	42	30	9	73
Female	232.6	21	3	46	21	8	83
Sesame (early)							
Male	167.4	18	2	31	29	21	51
Female	190.2	20	3	33	31	12	58
Sunflower							
Male	100.4	16	5	39	27	14	43
Female	97.7	16	4	54	12	15	35

TABLE 174: MAIZE FARM BUDGETS, SHAN STATE

		Northern Interior			Southern Interior			Average		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	1,729.7	293	506,991	1,507.5	299	451,359	1,598.0	297	474,100
Costs										
Seeds	Kg	5.0	4,195	21,084	4.9	4,092	20,238	5.0	4,134	20,583
Urea	Kg	48.6	398	19,350	15.5	440	6,826	29.0	411	11,926
NPK	Kg	67.4	304	20,487	17.1	456	7,787	37.6	345	12,958
T-Super	Kg	13.9	307	4,266	35.4	330	11,664	26.6	325	8,652
Other inorganic fertilizers	Kg			427			233			312
Organic fertilizers	Kg									
Pesticides	Unit			31			297			189
Total material inputs				*65,645*			*47,046*			*54,619*
Land preparation	Hours	5.0	497	2,467	10.1	328	3,303	8.0	371	2,963
Seeding	Hours	3.7	481	1,764	8.8	347	3,041	6.7	377	2,521
Irrigation	Hours				0.04	417	16	0.04	417	10
Crop Management	Hours	23.4	408	9,535	43.7	299	13,042	35.4	328	11,614
Harvest	Hours	36.9	407	15,019	47.1	237	11,143	42.9	296	12,721
Post-harvest	Hours	7.7	463	3,557	13.9	303	4,229	11.4	347	3,955
Total hired labor		*76.6*	*422*	*32,340*	*123.6*	*281*	*34,775*	*104.4*	*323*	*33,784*
Land preparation	Hours	43.3	497	21,561	30.1	328	9,875	36.1	371	13,391
Seeding	Hours	15.4	481	7,381	13.2	347	4,574	14.2	377	5,366
Irrigation	Hours	3.1	422	1,314				3.1	417	1,296
Crop Management	Hours	41.7	408	17,021	27.7	299	8,283	33.9	328	11,116
Harvest	Hours	39.1	407	15,936	27.0	237	6,399	32.5	296	9,637
Post-harvest	Hours	13.3	463	6,152	17.5	303	5,297	15.5	347	5,396
Total own labor		*125.1*	*446*	*69,365*	*78.1*	*303*	*34,427*	*97.2*	*356*	*46,203*
Land preparation	Unit			30,369			18,091			20,543
Crop management	Unit						251			149
Harvest and postharvest	Unit			10,652			9,845			10,174
Fuel	Unit			6,932			10,517			9,057
Draught oxen	Unit			2,833			1,473			2,027
Other services	Unit			7,480			7,115			7,264
Total livestock, machinery and fuel				*33,371*			*38,174*			*36,218*
Working capital before interest	Unit			112,781			104,622			107,944
Interest on working capital				*2,436*			*2,354*			*2,429*
Total Costs	MMK/acre			**203,157**			**156,776**			**173,252**
Gross margin	MMK/acre			373,199			329,010			346,961
Gross margin	$/ha			**919**			**810**			**854**
Net margin	MMK/acre			303,834			294,582			300,758
Net margin	$/ha			**767**			**744**			**759**
Labor productivity	$/day			**18.04**			**16.36**			**17.04**
Total labor	Days/ha			62			62			62
Yield	Kg/ha			**4,272**			**3,729**			**3,948**
Average cultivated area	Ha			0.62			0.77			0.70
Number of observations				83			97			180

TABLE 175: GROUNDNUT FARM BUDGET, RIVER AREA ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	230.7	1,279	295,082
Costs				
Seeds	Kg	37.2	1,626	60,456
Urea	Kg	3.8	431	1,644
NPK	Kg	6.3	609	3,854
T-Super	Kg	3.3	200	653
Other inorganic fertilizers	Kg			
Organic fertilizers	Kg			
Pesticides	Unit			11,461
Total material inputs				*78,068*
Land preparation	Hours	21.4	301	6,455
Seeding	Hours	2.2	265	588
Irrigation	Hours			
Crop Management	Hours	76.1	190	14,431
Harvest	Hours	61.3	402	24,636
Post-harvest	Hours	13.6	340	4,627
Total hired labor		*174.7*	*299*	*50,737*
Land preparation	Hours	18.6	301	5,611
Seeding	Hours	3.2	265	856
Irrigation	Hours			
Crop Management	Hours	25.6	190	4,860
Harvest	Hours	7.8	402	3,126
Post-harvest	Hours	5.9	340	2,012
Total own labor		*42.3*	*299*	*16,466*
Land preparation	Unit			
Crop management	Unit			
Harvest and postharvest	Unit			4,984
Fuel	Unit			1,425
Draught oxen	Unit			4,752
Other services	Unit			8,595
Total livestock, machinery and fuel				*19,755*
Working capital before interest	Unit			119,297
Interest on working capital				*1,789*
Total Costs	MMK/acre			**166,815**
Gross margin	MMK/acre			144,732
Gross margin	$/ha			**356**
Net margin	MMK/acre			128,266
Net margin	$/ha			**324**
Labor productivity	$/day			**8.32**
Total labor	Days/ha			65
Yield	Kg/ha			**558**
Average cultivated area	Ha			0.42
Number of observations				36

TABLE 176: SESAME FARM BUDGETS, SAGAING

		Dry Land			River Area			Average		
	Unit	Quantity	Price	Total	Quantity	Price	Total	Quantity	Price	Total
Gross Revenue	Kg	64.2	2,474	158,791	73.2	2,326	170,301	69.8	2,378	165,928
Costs										
Seeds	Kg	2.3	1,982	4,640	7.0	1,859	13,073	5.3	1,880	9,869
Urea	Kg	14.8	474	7,016	0.7	699	508	6.1	491	2,980
NPK	Kg	11.6	720	8,330	0.5	350	185	4.7	694	3,280
T-Super	Kg									
Other inorganic fertilizers	Kg									
Organic fertilizers	Kg									
Pesticides	Unit			1,235			2,604			2,084
Total material inputs				*21,220*			*16,370*			*18,213*
Land preparation	Hours	17.9	208	3,731	5.6	325	1,815	10.3	248	2,543
Seeding	Hours	3.6	257	933	0.5	267	127	1.7	259	433
Irrigation	Hours									
Crop Management	Hours	37.0	257	9,499	22.2	252	5,582	27.8	254	7,070
Harvest	Hours	34.2	294	10,062	34.9	246	8,578	34.7	264	9,142
Post-harvest	Hours	9.6	804	7,711	5.7	870	4,929	7.2	837	5,986
Total hired labor		*102.4*	*364*	*31,935*	*68.8*	*392*	*21,030*	*81.5*	*372*	*25,173*
Land preparation	Hours	19.1	208	3,973	21.5	325	6,990	20.6	248	5,111
Seeding	Hours	3.8	257	977	2.2	267	582	2.7	259	701
Irrigation	Hours									
Crop Management	Hours	39.0	257	10,013	13.1	252	3,307	22.3	254	5,671
Harvest	Hours	19.6	294	5,761	10.9	246	2,670	14.5	264	3,821
Post-harvest	Hours	26.9	804	21,672	14.8	870	12,907	19.5	837	16,359
Total own labor		*83.3*	*364*	*42,397*	*49.9*	*392*	*26,457*	*62.6*	*372*	*31,662*
Land preparation	Unit			12,500			1,533			3,842
Crop management	Unit									
Harvest and postharvest	Unit			138			48			82
Fuel	Unit			604			849			756
Draught oxen	Unit			5,415			2,350			3,515
Other services	Unit			5,934			4,661			5,145
Total livestock, machinery and fuel				*12,955*			*8,152*			*9,977*
Working capital before interest	Unit			48,338			32,046			38,236
Interest on working capital				*1,044*			*692*			*860*
Total Costs	MMK/acre			109,552			72,701			**85,885**
Gross margin	MMK/acre			91,637			124,057			111,705
Gross margin	$/ha			226			305			**275**
Net margin	MMK/acre			49,239			97,601			80,043
Net margin	$/ha			**124**			**246**			**202**
Labor productivity	$/day			**6.18**			**10.81**			**8.54**
Total labor	Days/ha			57			37			44
Yield	Kg/ha			129			148			**140**
Average cultivated area	Ha			0.43			0.55			0.50
Number of observations				22			28			50

TABLE 177: SUNFLOWER FARM BUDGET, DRYLAND ECOREGION, SAGAING

	Unit	Quantity	Price (Kyat)	Total
Gross Revenue	Kg	268.7	734	197,310
Costs				
Seeds	Kg	6.0	650	3,878
Urea	Kg	10.1	400	4,043
NPK	Kg	16.5	360	5,924
T-Super	Kg			
Other inorganic fertilizers	Kg			
Organic fertilizers	Kg			
Pesticides	Unit			
Total material inputs				*13,845*
Land preparation	Hours	5.1	297	1,514
Seeding	Hours	2.2	209	466
Irrigation	Hours	0.3	250	63
Crop Management	Hours	14.2	171	2,426
Harvest	Hours	26.8	163	4,355
Post-harvest	Hours	5.8	217	1,224
Total hired labor		*54.3*	*185*	*10,048*
Land preparation	Hours	10.6	297	3,155
Seeding	Hours	3.7	209	775
Irrigation	Hours	5.9	250	1,466
Crop Management	Hours	19.5	171	3,347
Harvest	Hours	8.4	163	1,371
Post-harvest	Hours	5.9	211	1,240
Total own labor		*43.5*	*217*	*11,354*
Land preparation	Unit			
Crop management	Unit			
Harvest and postharvest	Unit			2,842
Fuel	Unit			518
Draught oxen	Unit			2,268
Other services	Unit			6,342
Total livestock, machinery and fuel				*11,971*
Working capital before interest	Unit			30,284
Interest on working capital				*681*
Total Costs	MMK/acre			**47,899**
Gross margin	MMK/acre			160,765
Gross margin	$/ha			**396**
Net margin	MMK/acre			149,411
Net margin	$/ha			**377**
Labor productivity	$/day			**15.68**
Total labor	Days/ha			30
Yield	Kg/ha			**542**
Average cultivated area	Ha			0.61
Number of observations				17

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