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Cost and benefit of summer paddy cultivation in Myaungmya township: case study on three different farming practices

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Abstract: This paper tries to present difference farming practices and their returns in summer paddy cultivation in Myaungmya Township. Nearly ninety percent of monsoon paddy cultivated areas are occupied by summer paddy due to having access to irrigation sources, higher return and less risk. In summer paddy cultivation, three different farming practices are found and these are different in investment, knowledge on paddy cultivation and farmers' interest on paddy cultivation. Some farmers cultivate paddy by using agriculture machineries and chemical inputs and other use farm machineries but farm mechanization is still in its incipient stage. The cost of machinery use and chemical fertilizer increased the investment in paddy cultivation but farmers get high yield. Seed producers cultivate paddy systematically to get quality seeds. They use sufficient amount of chemical fertilizers and pesticides systematically. Smallholders do not use sufficient amount of chemical fertilizer due to less investment. Smallholder farmers mainly cultivate summer paddy to get food for household consumption and to sell small amount of surplus. Labour cost is highest in the cost of paddy cultivation due to labour shortage and labour intensive work. At present, the amount of loan from Myanmar Agriculture Bank has been raised but it is still insufficient for actual cost of paddy cultivation due to high labour cost and high price of chemical fertilizers, pesticides and others. Productivity and returns of the intensive farmers and seed producers differ from those of smallholders. Cost-benefit analysis and benefit-cost ratio were done to explain the findings.

Key words: Different practices, inputs, productivity, cost-benefit analysis.

Introduction

Rice is the most important cereal crop of Myanmar and it remains as a strategic sector in terms of its continuing significant contribution to Gross Domestic Product (GDP), income and employment generation. Total population of Myanmar was recorded as 51.4 million in 2014, an increase of 148% from 21.5 million in 1960 (World Bank, 2014). To meet the basic food need, paddy cultivated areas were extended and paddy is cultivated not only in monsoon period but also in cool and hot dry period.

Farmers have become aware that summer paddy gives high yield because of high sunshine intensity and summer paddy cultivation is of less risk. The cultivation period is free from untimely rain and it is cultivated in dry period with the help of irrigation. One of the most important requirements related to paddy cultivation is irrigation (Panuju *et al.*, 2012). Because part of the Deltaic area, there are many streams and the existing streams networks are an advantage for summer paddy cultivation in the area. Ayeyarwady region is known as rice granary of Myanmar and Myaungmya Township is one of the townships in Ayeyarwady region. Summer paddy cultivated area occupied 90 percent of the total rain fed paddy cultivated area, yield per unit area of summer paddy is higher than that of monsoon paddy and risk is lesser than that of monsoon paddy. Farmers extensively cultivate summer paddy but farming practices differ from one another. Three farming practices in summer paddy cultivation are found and their returns are also different.

Ramachandra and Nagarathna (2000) said that agriculture requires three major resources, land, water and energy. Land, being a resource, agricultural productivity could be linked directly to the availability of water (rain or irrigation) and energy inputs. The capital requirement in agricultural production depends on many factors in which type of product produced, the production level, technology used, geographical condition, input used, the demographical characteristics of the farmer, and etc. Input used in paddy cultivation is directly related to paddy productivity. The farmers who systematically used sufficient amount of chemical inputs get high yield. In the

area, intensive farmers and seed producers use higher capital investment than the smallholder farmers.

Availability of quality seed is one of the major constraints in increasing the productivity of agricultural crops (Hoque and Haque, 2014). Use of quality seed can increase productivity of paddy. In the study area, it is difficult to get quality seed for farmers and seeds are produced by the local farmers under the guidance of staff of agriculture department. The farmers are interested in paddy cultivation and they cultivate paddy systematically to get qualified seeds. They use sufficient inputs which cost high investment. But, the seed producers get higher return due to higher price of quality seeds for cultivation.

All farmers do not operate at the same efficiency level. Investment and interest of farmers differ from one another in adapting and using the knowledge and technologies to their own farms to get high return. FAO (1981) stated that increased agricultural productivity usually come as a result of effective adoption of improved technologies. Wortman and Cumming (1978) also expressed that one of the requirements that increase the productivity is input. Fertilizer use and fertilizer price became more important issue in Agriculture especially paddy cultivation. In developing countries, actual application rates of fertilizer are low, and it is well below those recommended in some countries in Asia (FFTC, 2008). Intensive farmers and seed producers are more interested in paddy cultivation to get high yield.

In the area, some farmers are poor and they do not have sufficient investment to cultivate paddy systematically. Since the government stopped selling these chemical fertilizers at reasonable prices to the farmers since 1994, the farmers cannot apply the necessary amount because of high prices at private shops (Lwin, 2014). They use chemical fertilizer below the recommended level.

Tun (2014) stated that most of agricultural lands are currently cultivated by small scale farmers and the cost of land preparation and cultivation is rather high and productivity is low. In the area, more than half of the farmers are smallholders and their capital investment for

paddy cultivation is low. Therefore, productivity is low and they get low return.

The objectives of the paper are to understand the reasons that cause different cultivation practices, to explore different farming techniques, and to find out different returns from summer paddy cultivation and to forecast the future prospects of summer paddy cultivation in the area.

Materials and Methods

To present this paper, primary and secondary data were applied. To get primary data, 9 village tracts among the 98 village tracts were selected as sample villages and field surveys were done during summer paddy cultivation period between December and April in 2015. Three farmers from each village tract were interviewed to get thorough understanding on summer paddy cultivation. Primary data such as inputs, capital investment and labour use, price, returns, etc were collected by using questionnaires. To present net return of summer paddy cultivation, cost benefit analysis, benefit-cost ratio were applied. Secondary data were also applied to present spatial distribution of summer paddy cultivated area and they are obtained from departments concerned.

Results and Findings

Factors Supporting Summer Paddy Cultivation: Basic geographic factors such as location, topography, drainage, climate and soils support summer paddy cultivation in Myaungmya Township. Moreover, farming methods, inputs and irrigation have significant influence on the productivity of summer paddy.

Physical Factors: Physical factors such as relief, drainage, climate and soils directly or indirectly influence summer paddy cultivation of any area.

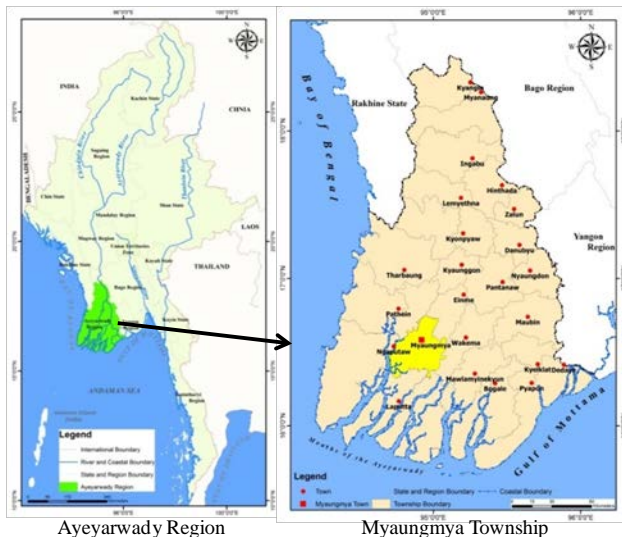


Fig. 1. Study area (Ayeyarwady Region and Myaungmya Township) in Myanmar; Source: Agriculture Atlas (2002)

Location: Myaungmya Township is located in the southwestern part of Ayeyarwady Region and it lies between North latitudes 16°19' and 16°44' and also between East longitudes 94°40' and 95°05' (Fig. 1). Bay of Bengal is about 69.19 km (43 miles) in the west and Kappali (Andaman) Sea is about 104.59 km (65 miles) in

the south (Myint Myint Win, 2014). The area of Myaungmya Township is 1,152.23 sq.km (444.88 sq-miles) or 3.28 per cent of Ayeyarwady Region. The township comprises 12 wards (urban) and 98 village tracts.

Relief and Drainage: The study area is located on the Ayeyarwady deltaic region built up with alluvium. The lowland region is composed of alluvium with an elevation of less than 7.62 m (25 ft) above the mean sea level. It is almost a flat plain (Fig. 2). The most significant feature of the landscape is the braiding network of river and streams. The widest plain is found along the Ywe River and the area is very suitable for summer paddy cultivation.

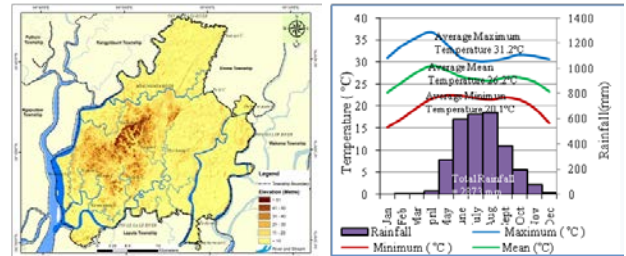


Fig. 2. Relief and Drainage of Myaungmya Township Source: Digital Elevation Model

Fig. 3. Climograph of Myaungmya Station (1981 to 2010) Data Source: Meteorology and Hydrology Department, Myaungmya

The major rivers are Panmawady, Myaungmya, Pyamalaw, Ywe, Pinlegalay and Pathein (Ngawun). Panmawady, Pyamalaw, Ywe and Pathein rivers are distributaries of Ayeyarwady River and flow from north to south. Pya Creek flows through the northern part of the township, Kyonton, Kangyi and Pulu creeks through the northeastern part of the township. Except the rivers located in the southernmost part of the area, most streams support irrigation water for summer paddy cultivation.

Climate: According to Koppen's climatic classification, with more than 18° C (64.4°F) of the coolest month temperature and an annual rainfall of over 2,800 mm (112 inches), the climate type of the study area is Tropical Monsoon (Amwg).

Climate directly controls agriculture including summer paddy cultivation. The annual mean temperature is 26.2° C (79.61°F). The hottest month is April with a mean monthly temperature of 29.2° C (84.56° F) and January the coolest month with 23.1° C (73.58° F). The mean monthly maximum temperature is highest in April with 36.8° C (98.24° F) and lowest in July and August in 30.2° C (84.36° F) due to cloudiness of the sky and it slightly decreases in the cool dry period from November to January and rises up to 35° C (95.9° F) in the hot dry season from March to third week of May. Paddy is extensively grown in the area because the optimum temperature for rice cultivation is between 25°C and 35°C (Ghadirnezhad and Fallahads, 2014).

Rainfall is highly seasonal with a considerably long dry period from November to the end of May (Fig. 3). Water requirement is high for summer paddy cultivation because of high temperature and scarce rainfall in the hot dry period. Summer paddy is grown with the help of irrigation.

Water Balance: In the area, ground water recharge is found until November and December. Then, from January to April, water deficit occurs (Fig. 4). Therefore, it is difficult to grow paddy in dry season without irrigation. Myaungmya Township possesses several rivers which support irrigation water for summer paddy. Therefore,

Department. But, they practice broadcasting method in summer paddy cultivation because of labour shortage.

Table 1. Cost-benefit in Summer Paddy Cultivation (Intensive Farmers)

Items	Cost/acre (ks)	%
Tillage (machine)	15000	4.8
seed (8000 ks ×3.5 baskets)	28000	9.1
Shwenagar weedicide	18500	6.0
Urea 2 bags	40000	13.1
T super 2 bags	30000	9.8
labour cost	100000	32.7
Diesel cost	15000	4.9
Others	20000	6.5
Harvesting	40000	13.1
Total cost	306500	100
Return (100 baskets ×6000 ks)	600000	
Net benefit	293500	

Source: interview (2015)

They use agriculture machinery in plowing. They mainly use hand-pushed tractors which are made in China. The value of it is about 2,000,000 kyats (more than 1500 US\$) and some farmers hire agriculture machinery from the Richs and agricultural company. A hand-pushed tractor takes only 8 hours to plough a farm with an area of a hectare. Rental cost is 20000 ks per day (more than 15 US\$ per day). Diesel cost is 5000 ks per acre (nearly 4 US\$ per ha). To drive it, labour cost is 5000 ks per day (about 4 US\$ per day). Therefore, the total cost of plowing is about 15,000ks (nearly 13 US\$ per acre). They usually till their land twice to get high yield in paddy cultivation.

They cultivate high yield varieties because they have sufficient investment and they intend to get higher yield per unit area. Quality seeds are more expensive and the price is 8500 kyats per basket (185 kyats per lb). For a hectare of paddy field, 3.5 baskets are needed to apply. Generally, more seeds are needed in broadcasting method. Most farmers use 2.5 baskets per hectare but intensive farmers use larger amount to get more productivity. Chemical inputs used differ from one farmer to another. At the stage of tilling, they use weedicide to kill weeds. Shwenagar brand weedicide is most popular in that area and they use 2.5 bags per ha (one bag per acre) to protect the field from weeds. Price of a bag of Shwenagar weedicide is 18500 kyats. They also apply chemical fertilizers according to guidance of the agriculture staff. They use 2 bags of Urea and 2 bags of T super per acre in summer paddy cultivation.

Labour cost includes costs of plowing, harvesting, pumping water and spraying pesticides. Although machineries are extensively used in plowing, manual labour is still mainly used in harvesting, pumping water and spraying pesticides. In harvesting, human labour is mainly applied due to tall paddy plants. Average labour cost is 4000 kyats per day and total labour cost is round about 100,000 kyats per acre.

Pumping cost varies from one place from another because of different soils. In some places, soils are sandy and such soils need more water. Generally, water is irrigated three times before harvesting. They irrigate 5 or 6 times depending on the soils. The cost of diesel is about 5,000 kyats per acre (nearly 4 US\$) at the first time. The cost for

first time irrigation is higher because water requirement is higher at the first time. Therefore, total diesel cost is 15,000 kyats per acre. Diesel cost differs from one farmer to another because of existing soils. It is necessary to irrigate water at least 5 times on loamy soil but 7 times on sandy soils. Among the cost of cultivation, labour and input costs are higher and they are the chief causes that produce high yield.

The total cost is 306500 ks per acre and productivity of paddy is 100 baskets per acres. In 2015, price of paddy was about 6000 ks per baskets. Therefore, farmers get high benefit and they get 293500 kyats per acre due to high productivity which is resulted from high investment.

In the second type, the farmers cultivate summer paddy for selling seeds to the farmers in the area and to other areas (Table 2). They follow guidance of the staff of agricultural department exactly to produce quality seed. They are very interested in paddy cultivation.

Table 2. Cost-benefit in Summer Paddy Cultivation (Seed producers)

Items	Cost/acre (ks)	%
Tillage (machine)	15000	3.7
seeds (10000 ks ×2 baskets)	20000	4.8
Fungicide & Pesticide	20000	4.8
Potash 0.5 bags	13000	3.1
Urea 1.5 bags	30000	7.3
T super 1 bags	20000	4.8
Harvesting	60000	14.5
labour cost	200000	48.4
Pumping cost	15000	3.6
Others	20000	4.8
Total cost	413000	100.0
return (90 baskets × 9000 Ks)	810000	
Net benefit	397000	

Source: interview (2015)

Cost of cultivation is larger than that in the first group. To produce quality seed, farmers till the land thoroughly and the cost is also high. Therefore, cost of labour, rental cost of agriculture machinery and diesels costs are higher in land preparing stage.

Fertilization cost ranks as the third highest cost after labor and mechanization costs. In fact, input costs represent 22.37 percent of the total cost. Farmers mainly use Urea, Potash and T-Super. Farmers usually apply the macro-nutrients as granular fertilizers, and the micro-nutrients as liquid are applied together with the pesticides. They use chemical fertilizer two times: first time is at 21 days and second time at 50 days after cultivation. With granular fertilizers, nitrogen is the most important nutrient for rice production and the urea is the most used fertilizer because it is composed of 46 percent of nitrogen although the portion of urea actually used by rice plants is very low (Vargas, 2012). Farmers in this group have large amount of capital investment and they know systematic seed producing technology and use farms inputs. But the users vary one farmer to another depending on their drainage and soils. They use more inputs to get higher seed production.

They cultivate high yield quality seed to get high quality seeds. They need nearly 2 baskets per acre. Amount of seeds used is lower than that used in first group. They practice transplanting method in which systematic method

(6 inches × 8 inches apart) is applied. Although the number of plants in an area is lower, the production and seed quality is higher due to sufficient nutrients and systematic planting. Price of seeds for cultivation is higher than seeds for consumption because of high quality seeds. Price of seeds is about 10000 kyats per basket.

Labour cost is much higher than that of intensive farming because of systematic cultivation. Systematic cultivation method needs much amount of labour and it takes more time in cultivation. They cultivate paddy plant along the string line to be systematic. It costs much because of high labour requirement cost and the small holders cannot practice the method due to high labour cost. They cost more on planting and harvesting. One permanent laborer is hired for year round to be engaged in not only for on-field activities but also for supplementary work in the farm enterprise such as farmland plot maintenance, water management, storing and others. Total labour cost for one acre is about 200,000 kyats for the production of summer paddy seeds. The labour cost is high because it is necessary to care the paddy field continuously. Threshing machines are widely utilized in the village for paddy and pulses to save the time and reduce post-harvest loss. However, harvesting is done manually.

The productivity is 90 baskets per acre. The price of seeds for cultivation is usually higher and it was about 9000 kyats per basket in 2015. Although the seed producers cost much investment, they get higher price and higher net income. Therefore, farmers get high benefit and their average net return is 397000 kyats per acre due to high productivity which is resulted from high investment and price.

In the third group, the farmers cultivate summer paddy for the purpose of getting household consumption and selling (Table 3). But, they do not have sufficient investment and they cannot afford to buy sufficient amount of inputs. They use less amount of input and get low yield.

Table 3. Cost-benefit in Summer Paddy Cultivation (Smallholder farmers)

Items	Cost/acre (ks)	%
Tillage (manual)	15000	6.7
seed (8000ks ×3.5 baskets)	28000	12.6
Pesticide	10000	4.5
Urea 1 bags	20000	9.0
T super 1 bags	20000	9.0
Harvesting	40000	17.9
labour cost	80000	35.9
Diesel cost	10000	4.5
Total Cost	223000	100.0
return (60 baskets ×6000ks)	360000	
Net return	137000	

Source: interview (2015)

Agriculture machinery is used in this group to till the land. They usually practice broadcasting method and only two labours are needed for seeds broadcasting. Therefore, labour cost is low in seed broadcasting period. Total labour cost is about 80,000 kyats. Most of the farm works are done by family members.

Agriculture bank has been disbursed the loan for paddy cultivation with the rate of 100,000 kyat per acre since 2011 and interest rate is 5 percent. But, the farmers who

own more than 10 acre get only 1,000,000 kyats. The loan is available during the period from April to August for monsoon paddy and from September to December for summer paddy. But, it is insufficient for paddy cultivation. Moreover, they use less input. Authorities concerned guide to use 2 bags of urea per acre, but most farmers in the group use 1.5 bags per acre of urea and 1 bag of t-super though the authorities instruct to use 2 bags of t-super per ha. They do not use sufficient amount of input to reduce the cost of input and capital investment. It affects yield per unit area and it gives low return.

Burma, Syria, Argentina, Kenya, Australia and India use less than 30 kg of nutrient per ha of arable land (FAO,1981). Farmers in the area try to produce quality seeds. But, now, amount of input use increased in paddy cultivation but it is still under recommended level due to low investment.

They do not use weedicide because they practice traditional method to reduce capital investment. Family members remove weeds for reducing labour cost. Diesel cost is about 10,000ks per acre. Their net benefit is 137000 kyats per acre.

Seed producer get highest productivity as they cultivate paddy systematically under the guidance of the agriculture staff and they use sufficient chemical input to get quality seed.

Benefit Cost Ratio: According to calculation proposed by Hussin *et al.*, (2008), the value of Benefit Cost Ratio (BCR) of intensive paddy cultivation, seed production and smallholder farmers' paddy cultivation are 0.95, 0.96 and 0.61 respectively. As more and more the value of Benefit Cost Ratio, more will be the net return and intensive farmers and seed producer get more return. It unfolds that the farmers who are interested in paddy cultivation, they use sufficient amount and have high investment and get higher return.

Conclusion

In Myaungmya Township, farmers know the effects of untimely rain and irregular rain at the end of monsoon period and they cultivate summer paddy extensively due to water availability from nearby streams and free from negative impacts of climatic irregularity. In the study area, three different farming practices are found and the intensive farmers and seed producers differ in cultivation method, input use, productivity, investment and interest of smallholder farmers. Depending on their farming practices and investment, they get different return. Labour and input cost are high among the cost of cultivation. The intensive farmers and seed producers use much amount of input by using large capital investment and they get high yield and high return. Smallholder farmers who do not have sufficient investment use fertilizer under recommended level and they get low yield.

Benefit Cost Ratio (BCR) also shows that smallholder farmers get low return. In the study area, nearly half of the farmers do not have sufficient capital investment and they are in vicious debt cycle because they have to borrow money for paddy cultivation from the money lenders with high interest rate.

Authority concerned needs to plan to offer sufficient loan for smallholders. It is also needed to distribute the new

knowledge and technologies to those who practice unsystematic paddy cultivation methods and persuade to practice systematic cultivation by supporting necessary aids such as agricultural machinery, investment and modern farming techniques. The intensive farmers and seed producers use chemical fertilizers which cause environmental deterioration and the fertilizer use will almost certainly rise in the future. Therefore, continuous farmer education is necessary to make them understand new paddy cultivations methods and input uses, to get high yield and to reduce environment impacts on paddy cultivation. It is necessary to do researches on price fluctuation, environmental impacts on paddy cultivation and soil deterioration to achieve sustainable development in summer paddy cultivation.

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