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Changes in Input Costs and Returns in Paddy Production

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ගොවීන් වී වගාවට ආකර්ෂණය කර ගැනීම සහ වී වගාවේ රදවා තබා ගැනීම සඳහා වී වගාව ලාභදායී විය යුතුය. වී වගාව ලාභදායක ව්‍යාපාරයක් කිරීම සඳහා කළයුතු දේ හඳුනා ගැනීම සඳහා වී වගාවේ ලාභය හා වියදම් පිළිබඳ වූ කාලශ්‍රේණි දත්ත විශ්ලේෂණය කළ හැකියි. මෙම අධ්‍යයනය 1979 සිට 2010 කාලය තුළ වී වගාවේ ලාභය හා නිෂ්පාදන වියදම් දත්ත විශ්ලේෂණය කරන ලදී. අධ්‍යයනයේ ප්‍රතිඵලවලට අනුව වී වගා කරන ගොවීන් වී වගාවේ අවධානම අඩු අවස්ථා වලදී විචල්‍ය නිෂ්පාදන සාදක සඳහා වැඩිපුර ආයෝජනය කරන බව පෙනී යයි. සුළු පරිමාණ වී වගාකරුවන් අවධානමක් බාර ගැනීමට අකමැති නිසා වාරි මාර්ග පහසුකම් සැපයීම වැනි කටයුතු මගින් රජයට වී වගාවේ අවධානම අඩුකළ හැක. යෙදවුම් මිළ සලකා බලන ලද කාලය තුල ඉහළගොස් ඇති අතර එහි උච්චාවචනයන් ද සිදුවී ඇත. මෙවැනි තත්වයක් යටතේ නිෂ්පාදන වියදම අඩුකිරීම සඳහා සම්පත් භාවිත කිරීමේ කාර්යක්ෂමතාවය වැඩිකල යුතුය. මේ සඳහා කාර්යක්ෂම කෘෂිකාර්මික ව්‍යාප්ති සේවයක් අත්‍යවශ්‍ය වන හෙයින් පවතින ව්‍යාප්ති සේවාවෙහි ඵලදායීතාව නැංවීමට පියවර ගත යුතුය. ඉහත නිෂ්පාදන විභවයක් සහිත ප්‍රදේශවලද මෙම කාලය තුලදී අස්වැන්න උච්ඡාවචනය වී ඇති හෙයින් ඒ සඳහා බලපා ඇති සාධක හඳුනා ගැනීම සඳහා අධ්‍යයනයක් කළයුතුය. යටිතල පහසුකම් වර්ධනය වී ගමනාගමන පහසුකම් සහිත ප්‍රදේශවල පවා වී මිල උච්චාවචනය වී ඇති හෙයින් ඒ සඳහා බලපා ඇති කරුණු සෙවීම සඳහා ද අධ්‍යයනයක් කලයුතුය. කාලයත් සමග නිෂ්පාදන වියදම්, අස්වැන්න වැඩිවී ඇති අතර ලාභය අඩුවී ඇත.

යොමු වචන : වී නිෂ්පාදනය, නිෂ්පාදන වියදම්, නිෂ්පාදන සාදක, අවධානම, සම්පත් භාවිත කාර්යක්ෂමතාව

Introduction

Sri Lanka has been investing huge amounts of scarce resources to promote paddy production as rice is the staple food in Sri Lanka. The construction of inland reservoirs and irrigation infrastructures; investment in agricultural

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research,development, extension services; provision of subsidized inputs and guaranteed price schemes are some of such investments. Approximately 70 percent of the population is living in rural areas where paddy production has become one of the major livelihood activities. Nearly 1.8 million households are engaged in paddy production and approximately 25 percent of the country's land mass is located in rural areas. These are factors that have compelled the government to invest in paddy production (Ranaweera et. al, 2009 and CBSL, 2007).

At present, paddy production is not financially attractive despite of its national importance. In order to make it a financially attractive venture it is necessary to raise productivity through the enhancement of resource use efficiency. The creation of favorable production and marketing environments is a pre-requisite in achieving this objective. The introduction of fertilizer subsidy in one step taken by the government and its history goes back to 1950s. Empirical evidence shows that fertilizer subsidy has made a significant impact on paddy production but a marginal impact on cost of production. Mere supply of subsidized inputs will not enhance productivity and the profit margin unless it is supported by an effective agricultural extension program (Wickramasinghe et al., 2009, Darmpel, 1975, Henegedara, 2002, Niyarepola et. al., 2009, Nanthakumara and Palanisamy, 2010).

World Bank (1996) stressed that Sri Lanka is facing some macroeconomic imbalances and prices of production inputs tend to increase. When agricultural input prices are increasing disproportionately to increases in output prices farmers cannot exploit even the existing technology to its maximum potential. As a result, profit margin in paddy production will shrink over time discouraging farmers to continue. Therefore, this study attempts to analyze input costs, yield and profits in paddy production during the period from 1979 to 2010.

Methodology

Paddy production data of Kurunegala, Kalawewa, Anuradapura and Polonnaruwa districts during the period from 1979 to 2010 were expected to analyze during this study. However, the district of Ampara was excluded from analysis due to unavailability of a complete set of data pertaining to the focus period of the study irrespective of the district's importance to paddy production. Relevant data were extracted from the cost of cultivation surveys conducted by the Socio Economics and Planning Center of the Department of Agriculture.

Where paddy production was reported in Kg per acre it was divided by 20 to convert that to bushels per acre. Data were analyzed using descriptive methods. Objectives of the study were to analyze the changes occurred in input use, cost of production and the profitability.

Results and Discussion

Labor used

During the period considered in the analysis, the average amount of labor used per acre has ranged between 40 man days in Anuradapura to 52 man days in Kurunegala during *Maha* seasons. All districts except, Kurunegala have used an average amount of labor less than 50 man days to cultivate an acre of paddy during *Maha* season. The average amount of labor used during the period considered has ranged from 39 man days in *Yala* season in Polonnaruwa to 49 man days in Kurunegala. In general, areas with assured irrigation water have utilized lesser amounts of labor to cultivate an acre of paddy than the areas with less assured irrigation water (table 1). This could be because farmers in major irrigation schemes have to complete cultivation practices according to a time table announced by the irrigation authorities and as a result, they might have used more machinery in cultivating paddy.

When the wage rate during the period from 1979 to 2010was considered the highest wage rate during *Yala* season was reported in Polonnaruwa while the lowest rate was reported in Kurunegala. The highest wage rate during *Maha* was reported in Kalawewa while the lowest rate was reported in Kurunegala. In general, wage rate reported during *Maha* was lower than that reported during *Yala* in all districts (Table 1). At the same time it is evident that the wage rage reported in areas with assured water supply was higher than that was reported in areas without assured water supply. That is obvious because in areas with assured water supply (major irrigation schemes) the average size of the paddy holding is comparatively large and farmers do cultivate the maximum possible extent with available water. As a result, there is high seasonal demand for agricultural labor. It was observed that that was relatively in Kurunegala has fluctuated in a narrow range during both seasons (Table 1). This also indicates the fact that there has been a high demand for labor in areas with assured water supply during both seasons.

When the whole period was considered, the per acre average labor cost has ranged from Rs. 6,066.00 in Kurunegala to Rs. 6,917.00 in Polonnaruwa during *Yala* while the same has ranged between Rs. 5,169.00 in Polonnaruwa and Rs.

Rs. 6,381.00 in Kalawewa during *Maha*. The largest gap between per acre labor cost between two seasons was reported in Polonnaruwa. When districts were ranked according to the ascending order of per acre labor cost incurred in *Yala* seasons they are in the order of Kurunegala, Anuradapura, Kalawewa and Polonnaruwa while the districts were ranked according to the ascending order of per acre labor cost incurred in *Maha* season they are in the order of Polonnaruwa, Anuradapura, Kalawewa and Kurunegala (Table 1). The district of Kurunegala has reported the lowest labor cost during *Yala* and it is not a surprise because part of the paddy lands in the district are rain fed and *Yala* season carries less amount of rains to this area and so the risk associated with paddy production is relatively high.

Table 1. Labor Use, Wage Rate and Labor Cost

District	**Season**	**Labor use (Md)**	**Wage rate (Rs/Md)**	**Labor cost**
Kurunegala	*Maha*	52	111.21 (10.00-262.00)	6,198.98 (816.76-13,986.02)
	Yala	49	123.80 (13.00-667.00)	6,066.20 (386.01-19,729.00)
Kalawewa	*Maha*	43	148.39 (9.90-539.00)	6,381.42 (1,217.43-16,573.00)
	Yala	45	150.00 (26.00-652.00)	6,750.07 (1,419.66-19,987.00)
Anuradapura	*Maha*	40	129.23 (12.00-601.00)	5,168.77 (816.76-13,968.00)
	Yala	43	160.86 (13.00-660.00)	6,916.72 (393.79-19,773.00)
Polonnaruwa	*Maha*	44	140.39 (12.00-629.00)	6,176.72 (867.56-18,424.00)
	Yala	39	163.10 (16.00-676.00	6,360.82 (685.11-19,380.00)

***Note: Values in parentheses are the minimum and maximum values, all financial values are in nominal terms and the averages reported are the arithmetic means of corresponding values.**Source:Adopted from SEPC (2013)

Under these circumstances resource poor farmers who are risk averters in nature do not invest large amounts in paddy production as the production risk is high. Situation during *Maha* is quiet different because the district receives the highest rains during *Maha* and farmers do cultivate the maximum possible extent to paddy during this season and invest more on production inputs such as labor.

Based on this information it is reasonable to conclude that farmers have employed more labor in cultivating paddy when the availability of irrigation water is assured. In other words, farmers do invest more on production inputs when the risk associated with paddy production is low because farmers are, in general, risk averters.

Cost of Farm Power

During this analysis an overall average value of farm power for the period from 1979 to 2010 was computed. Cost of farm power is the payments made for the hired machinery used in land preparation, harvesting, threshing and transportation. Per acre average cost of farm power reported during *Maha* has ranged from Rs. 2,344.00 in Polonnaruwa to Rs. 2,910.00 in Anuradapura. When the range in power cost was considered Anuradapura and Polonnaruwa are the districts that have reported the highest fluctuations in cost of farm power during *Maha* and *Yala* respectively

Table 2. Per Acre Input Cost

District	Season	Cost of Farm Power (Rs/Ac)	Cost of Material inputs (Rs/Ac)	Total cost Rs/Ac)
Kurunegala	*Maha*	2,616.00 (289.00-8515.00)	2616.00 (491.00-6,494.00)	11,432.00 (1,285.00-33,333.00)
	Yala	2,552.00 (245.00-8245.00)	3,000.00 (64.00-382.00)	11,618.00 (1,135.00-34,392.00)
Kalawewa	*Maha*	2,899.00 (656.00-7,750.00)	3,150.00 (626.00-6,774.00)	12,430.00 (2,685.00-31,037.00)
	Yala	2,859.00 (680.00-8,691.00)	3,250.00 (456.00-7,450.00)	12,859.00 (2,525.00-35,540.00)
Anuradapura	*Maha*	2,910.00 (293.00-8,681.00)	2,300.00 (332.00-4,861.00)	10,379.00 (1,291.00- 34,644.00)
	Yala	3,118.00 (507.00-8,811.00)	3,400.00 (305.00-7,292.00)	13,435.00 (1206.00- 35,750.00)
Polonnaruwa	*Maha*	2,344.00 (427.00-8,681.00)	3,200.00 (293.00-6,695.00)	11,721.00 (1,693.00-35,022.00)
	Yala	3,297.00 (394.00-9,678.00)	3,300.00 (444.00-6,693.00)	11,055.00 (1,2958.00-35,198.00)

***Note: Figures in parentheses are ranges, all financial values are in nominal terms and the averages reported are the arithmetic means Of corresponding values.** Source: Adopted from SEPC(2013)

In general, the average amount spent on farm power is high in districts where the availability of irrigation water is assured (Table 2).

Input Cost

Material inputs include seed, fertilizers, agrochemicals etc and this cost also has been fluctuating over time. When the period of analysis was considered, per acre cost of inputs has ranged from Rs. 2,344.00 in Polonnaruwa to Rs. 2,910.00 in Anuradapura during *Maha* seasons while that has ranged between Rs.2,552.00 in Kurunegala and Rs.3,299.00 in Polonnaruwa during *Yala* seasons. This cost is comparatively smaller than the labor cost and the power cost (Table 2). One reason for the prevalence of low input cost could be the fertilizer subsidy.

Total Cost of Production

When per acre total cost incurred in cultivating an acre of paddy during the period from 1979 to 2010 was considered that cost has ranged from Rs. 10,379.00 in Anuradapura to Rs. 12,430.00 in Kalawewa during *Maha* seasons and from Rs. 11,618.00 in Kurunegala to Rs. 13,435.00 in Anuradapura during *Yala* seasons. Kurunegala district has reported the lowest cost during both seasons (Table 2).

As different cost components have behaved in different ways it was attempted to identify whether there is a linear association between different components of the cost of production and results are presented in Table 3. When the overall situation was considered labor cost and input cost are not linearly associated and similarly these two costs of individual seasons are also not linear associated. Labor cost and power cost are always positively related and this linear association is very strong. That is when farmers invest more on farm power they also invest more on labor. Farmers have to invest on farm power for land preparation and harvesting and threshing. If the season is a successful one farmers have to pay high amounts for harvesting and threshing. At the same time farmers use more labor throughout the season when the season is a successful one. In addition to that they have to employ more labor for harvesting and post harvest handling when the season is a successful one. Therefore a linear association of this nature could be expected. A similar relationship between labor cost and total cost could also be expected (Table 3).

There is no strong linear association between input cost and power cost when, all seasons as well as *Maha* season were considered. However, there is a strong linear association between input cost and power cost during *Yala* season. That indicates that during *Yala* season if farmers invested more on material input they also invest more on farm power. Farmers use high amounts of material

inputs during *Yala* season only if the availability of irrigation water is assured, or in other words, if the season is a successful one. At the same time, farm power is used for land preparation at the commencement of the cultivation season and at the end of the season to perform harvesting and post harvest operations. Therefore, the linear association prevailing between these two cost components is realistic.

In general, input cost and total cost are linearly related and that relationship is very strong in *Yala* seasons. This is not a surprise because during *Yala* seasons, due to uncertain availability of irrigation water farmers use material inputs cautiously. So, if they have used more material inputs they use other inputs too in required quantities and hence, total cost will be high.

There is a very strong linear association between power cost and total cost regardless the cultivation season (Table 3). This is realistic because farmers have to use more farm power for harvesting and post harvest operations when the season is a success. Based on this information it is possible to conclude that if farmers invest more on labor they will invest more on material inputs and farm power as well.

Per Acre Yield and Profit

It is clear that average yield of *Maha* season was higher than that of the *Yala* season. And that is the expected outcome because during *Yala* season availability of irrigation water is relatively low. However, yield difference between two seasons was high in Kalawewa (Table 4). Because Kalawewa is an area with relatively well developed infrastructure and an assured supply of irrigation water causal factors for the observed high yield gap should be studied.

Table 3. Linear Correlation Coefficients of Cost Components

Cost component	Both Yala & Maha	Maha	Yala
Labor & Input	0.244	- 0.403	0.459
Labor & Power	0.864	0.817	0.834
Labor & Total cost	0.929	0.934	0.872
Input & Power	0.246	- 0.462	0.860
Input & Total cost	0.5322	- 0.180	0.834
Power & total cost	0.911	0.891	0.997

Source: Researcher developed (2013)

When yield fluctuations over time were examined it is clear that the highest yield fluctuation was reported in Kalawewa during *Maha* seasons and in

Anuradapura during *Yala* seasons. This is an unfavorable situation causes for the observed yield ranges in areas with assured water supply should be investigated with immediate effect because these are areas with high production potentials.

Even though average paddy prices are not highly different among different districts their fluctuations are different. The highest fluctuation in paddy prices during *Maha* seasons was observed in Kurunegala district. Price fluctuations during *Yala* seasons were high in all districts considered and the highest was reported in Anuradapura. When per acre profit was considered the highest and the lowest profits were reported in Anuradapura and Kurunegala respectively (Table 4).

Time Trends in Costs and Returns

When the total period was considered labor use during *Maha* seasons has increased by an average number of 43.88, 66.60, 53.41 and 62.99 in Kurunegala, Kalawewa, Anuradapura and Polonnaruwa respectively. The time trend in labor use during *Yala* seasons are 58.10, 27.89, 53.90 and 49.10 respectively in Kurunegala, Kalawewa, Anuradapura and Polonnaruwa (Table 4). The rate of growth in labor use during Maha seasons was the lowest in Kurunegala.

Time Trend in Per Acre Paddy Yield

During the period from 1979 to 2010 the average paddy yield of Kurunegala, Kalawewa, Anuradapura and Polonnaruwa has increased on average by 72, 72,62 and 77 bushels respectively during *Maha* seasons while the corresponding values during *Yala* season were 61(Kurunegala), 59 (Kalawewa), 52 (Anuradapura) and 70 (Polonnaruwa). It is clear that time trend of paddy yield during *Maha* was higher than that of *Yala* in all districts. However, Kalawewa is the area where the largest gap in average annual increase in paddy yield between *Maha* and *Yala* was observed (Table 4) and it is a matter that should receive due attention because identifying reasons for such vast yield gaps in high potential areas is important.

Table 4. Per Acre Yield and Profit

District	Season	Yield (Bu/Ac)	Price (Rs/Bu)	Profit (Rs/Ac)
Kurunegala	*Maha*	82 (61.0-105.0)	197.00 (45.00-657.00)	5,494.00
	Yala	76 (53.0-107.0)	208.00 (40.00-649.00)	5,166.00
Kalawewa	*Maha*	92 (40.0-117.0)	202.00 52.0-663.00)	7,688.00
	Yala	82 (59.0-111.0)	216.00 (62.00-674.00)	7,401.00
Anuradapura	*Maha*	82 (65.0-111.0)	195.00 (40.00-632.00)	6,239.00
	Yala	80 (50.0-122.0)	224.00 (40.00-688.00)	7,620.00
Polonnaruwa	*Maha*	91 (55.0-122.0)	192.00 (40.00-609.00)	6,473.00
	Yala	88 (67.0-112.0)	212.00 (40.00-664.00)	7,601.00

***Note: Values in parentheses are ranges, all financial values are in nominal terms and averages are the arithmetic means of corresponding values.** Source: Adopted from SEPC(2013))

Though costs and yields have increased over time at different rates per acre nominal profit in paddy production has declined during the period from 1979 to 2010. This is the cumulative effect of low productivity, low paddy prices, sub optimal input use and escalation of input prices. It is interesting to mention that the magnitude of decline in average profit was large in areas with high production potentials though these are the areas with large numbers of paddy stores as well as paddy mills are located. This is not a favorable situation and the reasons for this situation should be explored and remedial measures should be taken with immediate effect.

Table 5 Time Trends in Input Use and Profit

District	Season	Labor(Md/year)	Yield (Bu/Year)	Profit (Rs/Year)
Kurunegala	*Maha*	43.88	72.0	-1,453.00
	Yala	58.10	61.0	-1,280.00
Kalawewa	*Maha*	66.60	72.0	-2,395.00
	Yala	27.89	59.0	-4,626.00
Anuradapura	*Maha*	53.41	62.0	-4,341.00
	Yala	53.90	52.0	-5,037.00
polonnaruwa	*Maha*	62.99	77.0	-4,518.00
	Yala	49.10	70.0	-3,978.00

Source: Researcher developed (2013)

Structure of Cost of production

Labor cost has accounted for 50 – 58 percent of per acre cost of production and so efficient use of labor as well as labor saving technologies such as mechanization of labor intensive operations seem to be possible solutions. Cost of farm power has accounted for 20 – 30 percent of the total cost and the highest input cost was reported in Polonnaruwa during *Yal*a seasons. Though the use of farm machinery is a way to reduce labor cost if rental price of machinery is high farmers will find to replace labor with machinery (Table 5). Because labor component includes both hired and family labor, farmer actually pays only for hired labor and thus what farmer retains as his income is higher than the profit that is stated in this paper. One reason for high labor cost is a weakness in recording these data and not keeping farm records by the farmer. In some cases farmer visit the field in the morning and attends another activity and report the total time utilized as time used for paddy production. In order to avoid this weakness a manageable number farm records should be maintained with close monitoring to record daily activities instead visiting farmer at the end of the season. When farmers were visited at the end of the season, the accuracy of information recorded depends heavily on the memory recalling power of the farmer. Therefore, under the prevailing conditions, it is not possible to make very critical statements about labor cost.

Table 6. Composition of Cost of Production

District	Season	As a percentage of total cost		
		Labor	Farm power	Material inputs
Kurunegala	*Maha*	54	23	23
	Yala	52	22	26
Kalawewa	*Maha*	51	23	26
	Yala	52	22	26
Anuradapura	*Maha*	50	28	22
	Yala	51	23	26
Polonnaruwa	*Maha*	53	20	27
	Yala	58	30	12

Source: Adopted from SEPC (2013)

Conclusions

Farmers have invested more on variable production inputs in areas where the level of risk associated with paddy production is low. That is farmers do invest more in paddy production when the availability of irrigation water is assured.

However, the amount invested on variable inputs is subjected to fluctuations. Yield fluctuation is a common phenomenon in all district considered during this study and this is an area that should be investigated further and remedial measure should be taken with immediate effect to minimize these fluctuations.

Paddy price is another area that is subjected to fluctuations even in the presence of a guaranteed price. This could be due to opportunistic behavior of traders and due to low quality products as well. These aspects should receive due attention and such price fluctuations should be minimizes in order to motivate the farmers as well as to attract youths to paddy production.

High yield fluctuations as well as high yield gaps were observed even in high potential areas and thus, causal factors for the observed differences should be studied with immediate effect and remedial measures should be introduced.

Labor cost and power cost, labor cost and total cost and power cost and total cost are lineally related. That is when one cost component is increased the other component will also increase. Labor and farm power are substitutable inputs and so costs and benefits of labor intensive paddy production and that of mechanized paddy production should be compared and farmers should be encouraged to adopt the beneficial alternative.

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References

Arunashantha, A. and Asan Ali Bin Goalm Hassan, (2011). Resource use efficiency in paddy farming under village tanks. Proceedings of the symposium on modern trends in innovative management held on 27th and 28th, October. Mihintale: Faculty of Management Studies. Rajarata university of Sri Lanka.

Central bank of Sri Lanka, (2007). Annual report (2006). Colombo: Central Bank of Sri Lanka.

Darmple, D.G. (2007). Evaluation studies in developing countries. Office of the policy development and analysis bureau for program and policy conditions. Washington DC, USA: USAID.

Henegedara, G.M. (2002). Agricultural policy reforms in paddy sector in Sri Lanka- An overview.

Sri Lanka Journal of Agrarian Studies. (Vol.10.10). HARTI. Colombo.

Nanthathasan, A. and Palanisamy, K. (2010). Paddy production efficacy of the farmers under tank irrigation system in Tamil Nadu. Journal of Dry Zone Agriculture. Vol. 1(1). Jaffna: University of Jaffna.59-71.