Economic Viability of Organic vs. Conventional Paddy Farming: With Special Reference to Kesbewa Divisional Secretariat Division

D.P. Rajapakshe [a] and **D.W.K. Hemachandra** [b]

[a] *Department of Business Economics, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
dilan.r@sjp.ac.lk

[b] *Department of Business Economics, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
kinkini2009@gmail.com

INTRODUCTION AND THE RESEARCH PROBLEM

Rice is the single most cropped staple food occupying 34% of the total cultivated areas in Sri Lanka. 1.8 million Farmers are, approximately, engaged in paddy cultivation. According to the Department of Agriculture (2014), 95% of the national rice requirement is fulfilled by the domestic production.

As a result of the Green Revolution a remarkable increase has been recorded since independence. There was no use of agrochemicals prior to this Green Revolution and the average yield of rice was low. However, with increasing population and hence increasing demand, a pressure on increasing domestic rice production has emerged. The Department of Agriculture's priority was given to find rice varieties and hence improve them in order to increase the harvest. With the shift from indigenous rice varieties to new improved varieties, new set of problems emerged specially the pest problem. As a result the use of agrochemicals was increased significantly.

Even though the crop level has increased, the problem associated with farming has also increased. Researchers have conducted studies to identify these unsustainable farming practices, their adverse consequences as well as finding alternative farming practices.

According to Yadav et al. (2013) organic agriculture (OF) is a production system which avoids or minimizes the use of synthetic fertilizers, pesticides and the environmental, social, and economic sustainability are the basics of organic farming. Pure OF is a broader system which has a set of technological characteristics such as crop rotation. However, in this study the farms where organic fertilizers are utilized at least for 3 years before the study duration were considered as organic farms due to the absence of pure OF in the study area.

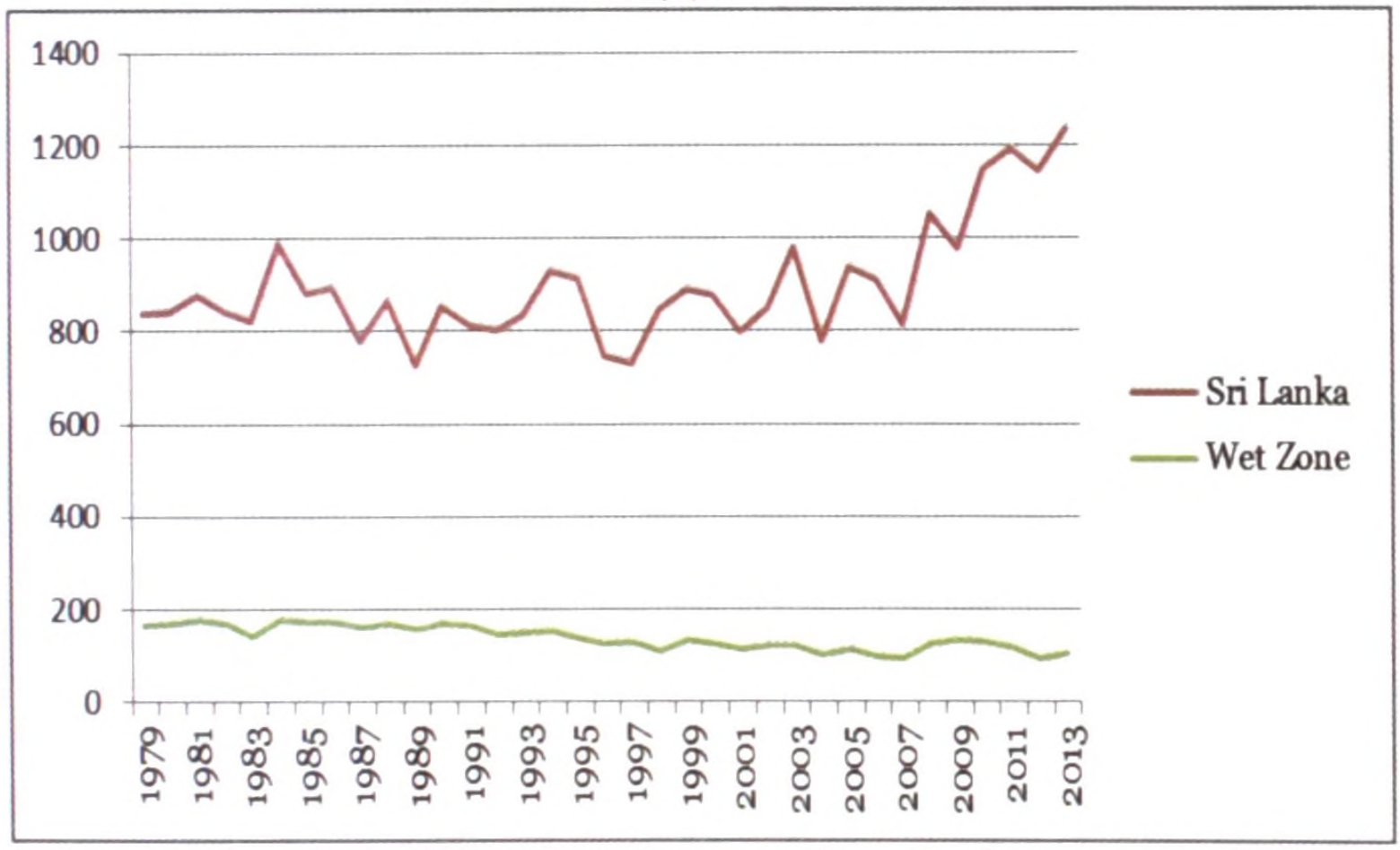
Abdussamie et al. (2010) have defined conventional agriculture (CF) as a production system which employs synthetic fertilizers, and pesticides and accordingly conventional farms were recognized with the usage of agrochemicals.

In Sri Lanka, paddy farming has expanded over time both in terms of yield and sown area. But, a reduction of paddy sown area could be identified in the wet zone (Apasingha et al., 2009) (see Figure 1). The abandoned paddy lands have recorded to be 37,128 ha in the wet zone which is a 24.3% of the total paddy lands in the zone in 2008 (152,903 ha). The opposite trend could be identified with respect to the areas excluding the wet zone (the dry and intermediate zones together). Therefore, the paddy production in the wet zone was found to be facing some dilemmas.

Apasingha et al. (2009) have evaluated the reasons driven to the decreasing trend in cultivating paddy lands in the wet zone. Their study emphasized high power cost, high production cost, and rapid urbanization as the major barriers in paddy farming in the Colombo District.

About 43% of the sample of the Colombo District farmers has suffered from higher production cost. The limited time to be devoted for paddy cultivation has led to increase hired labor. Additionally, labor wages have found to be higher in the Colombo District with the deficit of labor supply. Moreover the power costs, agrichemical costs and seed costs have been identified as the other drivers to increase cost of paddy production (Apasingha et al., 2009).

Figure 1: Paddy Sown Area of Sri Lanka and Wet Zone (from 1979 – 2013) ('000 Hectare)



Source: Author Compilation based on data from the Department of Census and Statistics and the Department of Agriculture

Apart from those facts, the insufficient revenue to be spent on farming has also been identified as a problem by 37.5% of the farmers in the Colombo District. Moreover, insufficient yield (for 37.5% of the sample), higher labor wages (for 43.7% of the sample), the engagement of another occupation (for 46.8% of the sample) were recorded as problems in the Colombo District (Apasingha et al., 2009).

Most of the people are engaging in paddy cultivation as an additional source of income in the Colombo District. Their willingness has deteriorated due to various factors as mentioned above.

Hence, this study has been designed to assess the economic viability of two paddy farming practices (OF and CF) in Kesbewa Divisional Secretariat Division.

The research question of the study was,

"Is organic paddy farming economically more viable than conventional paddy farming in Kesbewa Divisional Secretariat Division?"

The primary objective of this study was to compare economic viability between conventional and organic paddy farming in Kesbewa Divisional Secretariat Division. The secondary objective was to compare farmer related characteristics between two farming practices. Whether there is any farmer related characteristic in terms of their education, experience, age etc. that determines the adoption of a specific farming practice was studied under that objective.

The study is unique for the study area and has dedicated to identify directions to promote paddy cultivation in such areas where rapid urbanization and other socio-economic changes occur.

METHODOLOGY

Study Area, Sampling and Data Collection

Colombo, Gampaha, Kalutara, Galle, Matara and Kegalle Districts belong to the wet zone in Sri Lanka.

The greatest abandoned paddy lands were found in the Colombo District (36.6% as a percentage of asweddumized paddy lands in the district in 2008). 53.6% of paddy lands in the Colombo District have not been sown in 2013 (see Table 1). That was the highest among the six districts in the wet zone (Apasingha et al., 2009).

In terms of asweddumized lands during *Maha* season, Kesbewa Divisional Secretariat Division has acquired the fourth place among the ten paddy producing Divisional Secretariat Divisions in the Colombo District (Agrarian Development, Minor Irrigation, Industry and Environment Ministry of Western Province 2013). In Kesbewa Divisional Secretariat Division, out of asweddumized paddy lands, around 50% or less has been utilized to cultivate paddy in the recent past (see Table 2). That is the lowest level of asweddumized land usage for cultivation among the major four paddy cultivating DS divisions in the Colombo District[1]. Those findings have shown that the trend of abandoning paddy lands in Kesbewa Divisional Secretariat Division was the severest compared to the other three large paddy producing Divisional Secretariat Divisions. Therefore Kesbewa Divisional Secretariat Division was selected as the study site.

The duration of the study was September 2014 – March 2015, *Maha* season in which the highest cultivation takes place.

The total number of 1641 paddy farmers in Kesbewa Divisional Secretariat Division was the population of the study. There were 73 organic farmers and 1568 conventional farmers represent population. Accordingly multistage random sampling method was used in sample selection.

The farmers were selected on Grama Niladhari Division basis. In order to avoid differentials among farmers and their farming practices, equal sizes of two types of farmers were selected for the sample. Organic farmers were defined as the farmers who were practicing organic farming[2] at least for 3 years (Mendoza 2008). That

[1] Homagama, Kaduwela, Padukka and Kesbewa Divisional Secretariat Divisions

[2] United States Department of Agriculture (2005) has defined organic farming as a farming system that does not allow chemical fertilizers or pesticides because it considers mainly the type of inputs and their judicious use, and resists use of foreign materials, such as DNA via biotechnology (as cited in Nelson 2014).

constraint was important in OF as it takes 3 years to recover the soil after it was subject to intensive use of agrochemicals. Conventional farmers were the farmers who were utilizing agrochemicals in the paddy cultivation.

Both primary and secondary sources were used to collect data. The primary data was gathered using a structured and pre-tested questionnaire along with an in-depth interview.

The first section of the questionnaire was devoted to collect information on farmer characteristics with the intentions of identifying the experience in paddy farming, educational status, employment status, training hours received, number of directly involved family members, age, etc. The profile of the farms such as the specific farming practice, the extent sawn, the variety cultivated, the ownership of the land, and the mode of irrigation were questioned in the second section and the fourth part was to record perceived benefits and drawbacks of the two practices. Thirdly, the questionnaire contains questions to collect data on yield, input items, and revenue for *Maha* season 2014/2015 (September-March). Those data was used in a cross sectional analysis. The above data were collected in cash cost and non-cash cost basis. The actually spent expenses were recorded as cash costs and the inputs which are owned by the farmer and the inputs received for free were valued with current market rates and were considered as non-cash costs.

Theoretically, costs are divided into two categories i.e., fixed costs and variable costs. In this study only the variable costs are considered to estimate the cost of farming (Aheeyar et al., 2005). The data collected was analyzed using SPSS (Statistical Package for Social Sciences) 16.0.

Table 1: Sown and Unsown Paddy Lands of Districts in the Wet Zone

District	Highest Paddy Lands Sown (Hectare)	Sown Paddy Lands in 2013 (Hectare)	Unsown Paddy Lands in 2013 (Hectare)	Unsown Paddy Lands (as a % of the highest paddy lands sown)
Colombo	13,292 (1981)	6,167	7,125	53.6
Gampaha	29,151 (1984)	17,753	11,398	39.1
Kalutara	37,629 (1981)	22,201	15,428	40.9
Galle	41,003 (1986)	20,357	20,646	50.3
Matara	39,101 (1981)	27,791	11,310	28.9
Kegalle	22,161 (1985)	14,145	8,016	36.1

Note: In the parentheses, the years when the highest sown paddy lands found are stated.

Source: Author compilation based on data of the Department of Census and Statistics

Table 2: Harvested Paddy Lands as Percentages of Asweddumized Paddy Lands (%)

DS Division	2009-10	2010-11	2011-12	2012-13	2013-14
Homagama	78.0	80.0	80.0	76.6	76
Kaduwela	81.0	81.0	78.5	79.2	79.6
Padukka	75.3	76.9	76.9	77.7	78.1
Kesbewa	49.5	50	50.7	41.2	36.9

Source: Author compilation using data from Agriculture, Agrarian Development, Minor Irrigation, Industry and Environment Ministry of Western Province (2009, 2010, 2011, 2012, 2013)

Analytical Techniques

First objective was achieved through calculating the financial measures. That has been addressed through a set of financial measures in yield, input, cost and revenue items. Moreover independent sample t-tests were used to check the significance of those mean values between the two practices. The financial measures were based on the studies of Mendoza (2002); Mendoza (2008); and Rubinos et al. (2007) covering yield, input and cost aspects (see Annexure 01).

The hypotheses used in the t-test were,

Null hypothesis H_0: There is no significant difference between conventional and organic farms under a specific financial measure

and

Alternative hypothesis H_1: There is a significant difference between conventional and organic farms a specific financial measure

Under the secondary objective farmer related attributes such as education, training, age etc. were compared between two farming practices using SPSS 16.0 and the significance of the differences are checked by calculating the Pearson Chi-square test.

The hypotheses followed in the Pearson Chi-square test were,

Null hypothesis H_0: There is no significant difference between the farmer conventional farmers and organic farmers in a specific farmer characteristic

and

Alternative hypothesis H_1: There is a significant difference between the farmer conventional farmers and organic farmers in a specific farmer characteristic.

RESULTS AND FINDINGS

According to the financial ratio analysis OF was found superior to CF in both the break even yields[3] (BEYs) even with a significantly lower yield under OF (see Table 3). Lower BEY in OF implies a smaller yield required to cover costs. The t-tests have confined significant differences between OF and CF in BEYs. The responsible factor for this situation was higher prices obtained for organic paddy with a great premium. This concludes that the organic farmers should not concern about the level of yield since it needs significantly lower yield than in CF to cover total cost/total cash cost.

The contributory factor for lower harvest obtained in OF was the indigenous rice varieties cultivated where CF obtained higher yields with newly improved varieties (NIVs) (90% OF farms were harvesting indigenous varieties whereas 94% Conventional farms were cultivating NIVs). It was evidenced a significant difference between average yields in two practices. The yield obtained in OF is lower by 36.12% than in CF (see Table 4).

Table 3: Yield and Break Even Yield per Acre

	Practice	Count	Mean	Std. Deviation
Harvest *	Conventional	50	783.6581	362.86478
	Organic	50	439.4400	172.14876
Break Even Yield (with Total Cost)*	Conventional	50	2,371.8055	733.85942
	Organic	50	912.5064	246.75716
Break Even Yield (with Total Cash Cost)*	Conventional	50	1,290.438	554.4261
	Organic	50	518.172	177.8965

** significant under 95% confidence level*

Source: Author compilation based on survey data

[3] Break Even Yield (BEY) is the yield required to cover the cost and is calculated by dividing total cost/cash cost by market price per 1kg of paddy. For this study BEY has been calculated with both total cash costs and total costs.

Table 4: Yield per Acre by Variety

	Variety	Count	Mean	Std. Deviation
Yield per Acre*	Indigenous	48	472.5575	310.94262
	NIV	52	739.8489	298.31815

** significant under 95% confidence level*

Source: Author compilation based on survey data

In gross return to labor inputs[4], and net return to labor inputs[5] demonstrated significant differences between the two farming practices in favor of OF With almost equal average man days spent on both OF and CF (37.24 man days in OF and 37.12 man days in CF), significantly higher returns experienced by organic farmers was responsible for this situation (see Table 5).

Table 5: Gross/Net Revenue per Acre

	Practice	Count	Mean	Std. Deviation
Gross Revenue*	Conventional	50	32,722.6855	15,786.07829
	Organic	50	41,431.1429	15,498.02781
Net Revenue (subtracting Total Cost)*	Conventional	50	-44,490.0048	21,990.27817
	Organic	50	-29,747.0887	21,368.29297
Net Revenue (subtracting Total Cash Cost)*	Conventional	50	-7,674.5234	18,598.40984
	Organic	50	2,032.6548	14,802.81799

** significant under 95% confidence level*

Source: Author compilation based on survey data

Average gross revenue per acre of OF is higher by 26.6% with compared to CF. That is significant under 95% confidence level. Net revenue per acre[6] numbers have documented losses. But, the loss is minimized in organic farms by about 33% than conventional farms

[4] Gross Return to Labor Inputs = Gross Return/ Total Man Days Consumed
[5] Net Return to Labor Inputs = Net Return/ Total Man Days Consumed
[6] Net Revenue per acre has been calculated in two approaches considering total cost and total cash cost separately.

and that is significant in 95% confidence level. When consider net revenue calculated only deducting cash costs, it has shown a profit figure in organic farms while that was a loss in conventional farms. That can be attributed to a 126.4% disparity than the loss in conventional group.

Except weedicide and pesticide cost items[7], all the other cost items per kg of yield of organic farming have recorded higher values than conventional farming (all are significant at 95% confidence level) (see Table 6). Significantly lower yield in organic farms was responsible there.

Table 6: Composition of Costs (per kg)

	Practice	Count	Mean	Std. Deviation
Labor Cost*	Conventional	50	69.643351 (63.28%)	34.5127649
	Organic	50	124.270335 (69.74%)	71.8072222
Power Cost*	Conventional	50	33.780549 (30.69%)	12.5648376
	Organic	50	43.240508 (24.26%)	17.8409900
Fertilizer (inorganic /organic) Cost*	Conventional	50	1.088378 (0.98%)	0.3666341
	Organic	50	4.855277 (2.72%)	6.8705706
Weedicide Cost*	Conventional	50	1.606048 (1.45%)	0.8474612
	Organic	50	0.000000 (0.00%)	0.0000000
Pesticide Cost*	Conventional	50	0.359048 (0.32%)	0.4573618
	Organic	50	0.000000 (0.00%)	0.0000000
Seed Cost*	Conventional	50	3.561245 (3.23%)	1.5223415

[7] Weedicide and pesticide are not utilized in OF

	Organic	50	5.801853 (3.25%)	4.2710146
Total Cost*	Conventional	50	110.038619 (100%)	44.9598375
	Organic	50	178.167974 (100%)	90.8964302

Note: In the parentheses, the percentage of total cost for each cost item is mentioned for each farming practice.
** significant under 95% confidence level*
Source: Author compilation based on survey data

Table 7: Gross Return to Cost Categories (%)

	Practice	N	Mean	Std. Deviation	Std. Error Mean
Gross Return to Total Cost*	Conventional	50	0.440657	0.1694796	0.0239680
	Organic	50	0.612953	0.2059766	0.0291295
Gross Return to Cash Cost*	Conventional	50	0.907792	0.5555715	0.0785697
	Organic	50	1.128353	0.5528622	0.0781865
Gross Return to Non Cash Cost*	Conventional	50	1.029137	0.5013894	0.0709072
	Organic	50	1.502336	0.6531824	0.0923739

** significant under 95% confidence level*
Source: Author compilation based on survey data

In revenue related measures, OF was better than CF due to the price premiums obtained. In terms of Benefit Cost ratio, OF farmers have earned Rs. 0.61 while Conventional farmers have earned only Rs. 0.44. According to Gross Return to Cash Cost ratio, for one rupee invested as cash costs, OF farmers have earned net revenue of Rs. 1.12 where that of Conventional farmers was only Rs. 0.90. Therefore, OF was better in revenue dimensions (see Table 7). The reason should be the premium price obtained for organic paddy in the

market (the average prices for one kg of indigenous paddy and NIV paddy were Rs. 42.00 and Rs. 94.90, respectively). That premiums have been able to mitigate the lower yield harvested in OF compared to CF.

The Comparison of Farmer Related Characteristics between CF and OF has been aimed to address the secondary objective. Study has identified a same set of farmer characteristics between the two groups of farmers. The highest number of conventional farmers was from 46 - 55 age group and the same is true for organic group (26% and 32% from conventional and organic farmers, respectively). The smallest age group in both sub-samples was the farmers older than 65 years (the oldest group). An important finding is the minor participation of the youth (age 25 – 35 group) which is second only to the oldest group. Various socio-economic changes might have led to that situation.

From the sample of conventional farmers (36%), the majority has passed O/L and the same was true for organic farmers (38%). The other educational levels also did not show considerable disparities. In terms of experience, the highest number of farmers (22% and 48%, respectively for conventional and organic farmers) had experience 11-20 years in each farming practice.

The employment status was checked based on whether the cultivation was full time or part time occupation. 80% of conventional farmers and 82% of organic farmers were engaged in paddy farming as a part time income source. The Pearson Chi-square test has evidenced insignificant differences between two farming practices.

CONCLUSIONS AND IMPLICATIONS

Conclusions

Mendoza (2002) found that the yield of OF was higher than CF. The reason was attributed to the ownership of lands where most of the organic farmers were the owners of paddy fields who manage farms better while conventional farmers were tenants. The situation is different in this study due to the same ownership status found between two practices. The reason could be attributed to the yields. The yield was significantly higher in CF due to cultivation of NIVs where indigenous varieties were mostly cultivated in OF.

The rainy weather condition during the wet season was the reason to have lower yields in the study of Mendoza (2008) but, the gross revenue was not lower since a price premium was received. For this study also price premium has played the leading role to make OF more viable economically. In contrast Quintela and Ricardo (2007) have concluded that the organic farming is economically viable even the producers' prices are the same with conventional products due to higher yield. In net revenues calculated in this study, both the practices were not satisfactory, but OF has mitigated higher costs due to the premium prices.

A study in India revealed that some farmers are reluctant to convert to OF because of the perceived high costs and risks involved (Charyulu and Biswas 2010). In most of the researches, whether it was lower or higher the yield than in CF, OF has had superior net revenues (Mendoza 2002, 2008). The main reason was higher cash cost for agrochemicals which is lower in OF. But, in this regard there was no significant difference between the total cash costs or total non-cash costs or between total costs though agrochemicals in conventional farming is significantly higher than organic farms. The reason for the almost identical total costs was the absence of agrochemicals (fertilizer and pesticides) in OF while incurring higher costs in labour, fertilizer and seed inputs (in terms of per acre costs).

Therefore, the conclusion would be, organic paddy farming is economically more viable compared with conventional practice in Kesbewa DS division.

Implications

Hence, the OF must be promoted by the agricultural authorities through programs to make farmers aware about the comparative economic viability of the two farming practices. Another important finding is that the cost of farming is high irrespective of any practice. Therefore, the government support should be extended beyond the fertilizer subsidy. Most of the time smallholder farmers cultivate paddy as an additional source of income. Due to the limited availability of time to be spent on farming, they always tend to hire labor. Labor cost is the prominent cost category in the production cost (63.28% in CF and 69.74% in OF as a percentage of total cost). Thereby, the farmers should be motivated to cultivate in harmony as a team and exchange labor (*Attam* system).

Identical nature of both the groups could be identified in comparison of farmers' characteristics. Therefore, it could find no influence from those characteristics on the adoption of a specific farming system (OF or CF).

Additionally, it was found that lack of motivation of the youth in the study area to engage in paddy farming. It is recommended to motivate the youth to enter organic paddy farming along with the programmes suggested above.

The findings of this research could be confined only to the study area since the limited scope of the study such as the small sample selected.

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ANNEXURE

Financial Measures used to compare Organic and Conventional Paddy Farming Practices

Input Related Financial Measures

$$Gross\ Return\ to\ Labor = \frac{Gross\ Return}{Total\ Man\ Days\ Consumed}$$

$$Net\ Return\ (with\ Non\ Cash\ Cost)\ to\ Labor = \frac{Net\ Return\ (with\ Non\ Cash\ Cost)}{Total\ Man\ Days\ Consumed}$$

Cost Related Financial Measures

$$Power\ Cost\ per\ kg\ of\ Yield = \frac{Total\ Power\ Cost}{Yield\ in\ kg}$$

- This ratio was calculated with respective the other cost items also.

$$Total\ Cash\ Cost\ per\ kg\ of\ Yield = \frac{Total\ Cash\ Cost}{Yield\ in\ kg}$$

$$Total\ Non\ Cash\ Cost\ per\ kg\ of\ Yield = \frac{Total\ Non\ Cash\ Cost}{Yield\ in\ kg}$$

$$Total\ Cost\ per\ kg\ of\ Yield = \frac{Total\ Cost}{Yield\ in\ kg}$$

Yield Related Financial Measures

$$Break\ Even\ Yield\ (with\ Total\ Cost) = \frac{Total\ Cost}{Selling\ Price\ per\ kg\ of\ paddy}$$

$$Break\ Even\ Yield\ (withoutNonCashCost) = \frac{Total\ Cost\ without\ Non\ Cash\ Cost}{Selling\ Price\ per\ kg\ of\ paddy}$$

Return Related Financial Measures

$$Net\ Return\ (without\ Non\ Cash\ Cost)\ to\ Labor = \frac{Net\ Return\ (without\ Non\ Cash\ Cost)}{Total\ Man\ Days\ Consumed}$$

$$Gross\ Return\ to\ Total\ Cost\ = (Benefit\ to\ Cost\ Ratio) = \frac{Gross\ Return}{Total\ Cost}$$

$$Gross\ Return\ to\ Cash\ Cost = \frac{Gross\ Return}{Total\ Cash\ Cost}$$

$$Gross\ Return\ to\ Non\ Cash\ Cost = \frac{Gross\ Return}{Total\ Non\ Cash\ Cost}$$