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TECHNOLOGY TRANSFER IN SMALLHOLDER RICE FARMS IN GUYANA: THE SUCCESS STORY OF THE SIX IMPROVED PRACTICES

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Abstract: Guyana's Agriculture Sector contributes 20% to the Gross Domestic product and is the source of livelihood for nearly 38 % of the population. This sector continues to grow being the main vehicle for poverty alleviation and overall economic development of the Country, while successfully keeping pace with the rising food demand of the country and the region as a whole. Rice (*Oryza sativa* L.) has been the pillar of the agriculture sector in Guyana. The production of this staple food has seen an increasing trend over the past decade, recording the highest production in history of 535,000 tons in 2013. Today more than ever, increased food production depends on judicious use of resources, if the environment is to be preserved. Additionally, issues such as climate change, climate variability, and its long-term impact on food security and environmental sustainability, have become increasingly important. Many factors such as weather, soil, genetics and management considerations affect the way the rice crop will responds to irrigation, fertilizer and other management practices. Determining appropriate crop management strategies under these uncertainties has major economic and environmental implications. The six improved practices promoted by the Guyana Rice Development Board have proven to be a successful management strategy in improving farmer's productivity. In this study we examine the use of the six improved practice as a tool of scientific agriculture production in selected rice growing regions. The study found that farmers who adopted the six improved practices recorded more than 25 % increase in yields when compared to their conventional practices, resulting in these farmers earning higher profits. The Guyana Rice Development Board will continue to promote the adoption of this technology for the continued enhancement of the social and economic development of the farm families of Guyana's rice industry.

Keywords: Climate Change, Adaptation, Guyana, Six Points Practice

INTRODUCTION

Rice is the staple food in Guyana. The rice industry is currently the largest agricultural industry in the country. It is the bedrock of the Guyanese rural economy and over the last two years it became the main contributor to export earnings in the agriculture sector. Rice accounted for about 7% of GDP and 14 % of total exports in 2013 (MOA, 2013, p. 28). It is the greatest user of arable land with approximately 8,000 families directly and 150,000 indirectly associated with the industry. Two rice crops are cultivated annually.

The rice industry in Guyana experienced mixed fortunes over the years. Rice production averaged around 150,000 metric tons in the 1980s but by 1990 this figure declined to a mere 93,400 tons. It rebounded to 168,300 metric tons in 1992. In one of the better periods (1990's)

the annual growth of production averaged 13%, with the increase in area cultivated accounting for 75% of the gain in production. This period was short-lived as production contracted by 18% in the early 2000's, due mainly to stagnation of yields which averaged approximately 4 tons/ ha. This coupled with increasing costs made the business of growing marginally profitable with the resultant effect being farmers abandoning their lands or converting same to other uses. The strategy for improving rice production required a coherent and coordinated technology transfer effort to empower farmers on the various strategic management practices that, when applied in an integrated manner, will result in significant yield increases.

The Guyana Rice Development Board (GRDB) provides extension services for the rice farming sector. In 2007, the GRDB implemented a set of six improved management technologies (renamed "six points" in Guyana), practiced in other Latin American countries in Guyana. This study aims to analyze data collected from six points' demonstrations across the country from 2007 to 2013 and determine its impact on small holder rice farms.

METHODOLOGY OF IMPLEMENTATION

The Farmers' Field School (FFS) approach was identified as a strategy to enhance farmers knowledge through demonstrations in farmers' fields. This approach was result oriented, which served to compare and measure the indigenous practices carried out by the farmers against practices that targeted solving field problems. The main objective of FFS has been 'learning by doing', which placed much emphasis on informal meeting and group participation. The 'six points' became a part of the FFS programme in the spring crop of 2007 and continues to be the main technology for advancing farmers' yields. Approximately twenty two (22) demonstrations were conducted in the first year (2007) which rose to ninety two (92) in 2013 (Table 1). In all, a total of 430 'six points' demonstrations were conducted during the period 2007 to 2013.

Regions	Number of Demonstrations							
	2007	2008	2009	2010	2011	2012	2013	
2	5	19	22	7	12	11	9	
3	8	19	22	9	16	13	23	
4	2	3	2	3	7	9	11	
5	3	8	6	8	17	19	30	
6	4	13	15	17	22	17	19	
Total	22	62	67	44	74	69	92	430

Table 1. Demonstrations held in regions from 2007 to 2013

Six point's technology

The six points are: time of sowing, seed rate, seed treatment, weed control, balanced nutrition and water management. This is further illustrated below:

1. Time of Sowing
   Solar radiation has a significant impact on the yield of rice. Shading during the reproductive phase affects the number of spikelets per panicle. During ripening shading reduces grain yield due to a spurt in spikelets (Yashida, 1981). Adjusting the date of sowing so that the crop can receive the maximum solar radiation from the start of primodial stage to heading stage or flower emergence allows the varieties to fully express their yield potential.

2. Seed rate
   The rice plant depends on solar radiation, moisture and soil fertility for growth and nutritional requirements. A thick population may have limitation in the maximum availability of these factors. High densities of plants produce weak plants, susceptible to lodging and attack of diseases, especially *piricularia* and *rhizoctonia*. It is therefore necessary to ensure that there is the optimum density of plant population per unit to produce healthy, strong plants and ultimately higher yields.

3. Treatment of seeds
   Farmers apply pyrethroids base products for the control of early season pests, especially water weevil. The pyrethroids kill only the adult weevils, not the eggs or larvae and therefore require repeated applications. A healthier and more economic form to attack this problem is to treat the seeds with insecticides. Treated seeds provide control of the first larvae generation and inhibit population growth. In this way only the insects that affect the plant is controlled and those that are beneficiary are protected, returning the ambient balance in the crop.

4. Weed Control
   Weeds compete with the crop for light, nutrients, and space. Ploughing, puddling and leveling although these operations reduce the incidence of weeds, they should be combined with other forms of control. The control of weeds is most effective when it is done at an early stage (1 – 3 leaves). The mixture of herbicides pre and post emergent applied at early post emergence permits a good control. The management of water allows better residual control preventing re-infestations and reducing costs.

5. Balanced Nutrition
   The crop should depend on the adequate nutrients that allow it to take advantage of the ambient conditions and to express the genetic potential of the varieties. All fertilizer recommendations should be based on soil analysis. Phosphorus and potassium based fertilizers should be incorporated before planting or immediately after early draining or about (4-6 DAS) to give maximum results. In terms of nitrogen, precautions need to be taken to prevent great loss by the inadequate management of urea. The application of N is optimum if it is done in the field on dry soil and applied in the indicated phases of the crop, before permanent flooding. After the application on dry soil the farmers should

irrigate and establish a thin layer of constant water, preferably within five days of Nitrogen application. The flood incorporates the nitrogen fertilizer into the soil.

6. Water Management
   Water management is very critical in maximizing rice yields. It is necessary for weed control, preventing nitrogen loss and maximizing grain-filling. To achieve these results it is necessary to establish the layer of water as soon as possible. In leveled fields, water established for sowing should remain in the field until removal to allow for weed control and application of fertilizer. Re-flooding after fertilization of 22 DAS will prevent loss of nitrogen due to volatilization.

RESULTS

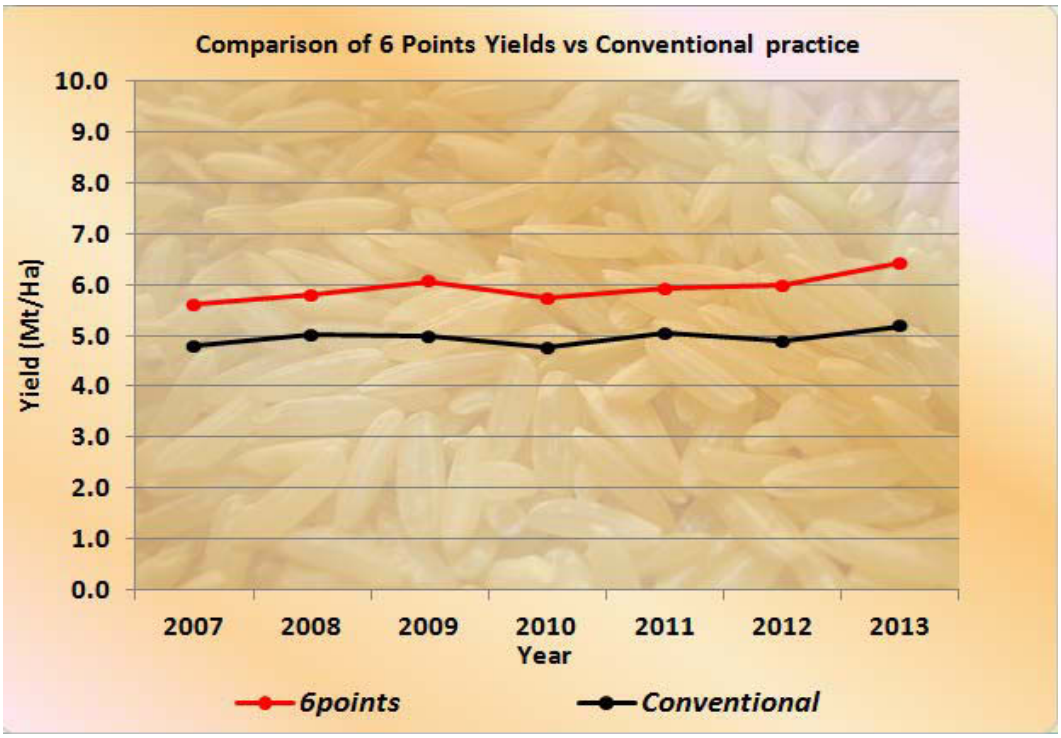

Fig.1 Comparison of Six points and Conventional Practice yield

It is seen in Fig.1, yields of the 'six points' and conventional practices increased over the period, however the yields of the 'six points' practices was consistently higher than the conventional practice. Farmer using the 'six points' technology obtained over 1.2 tons/hectare more than conventional farmers, Figure (2)

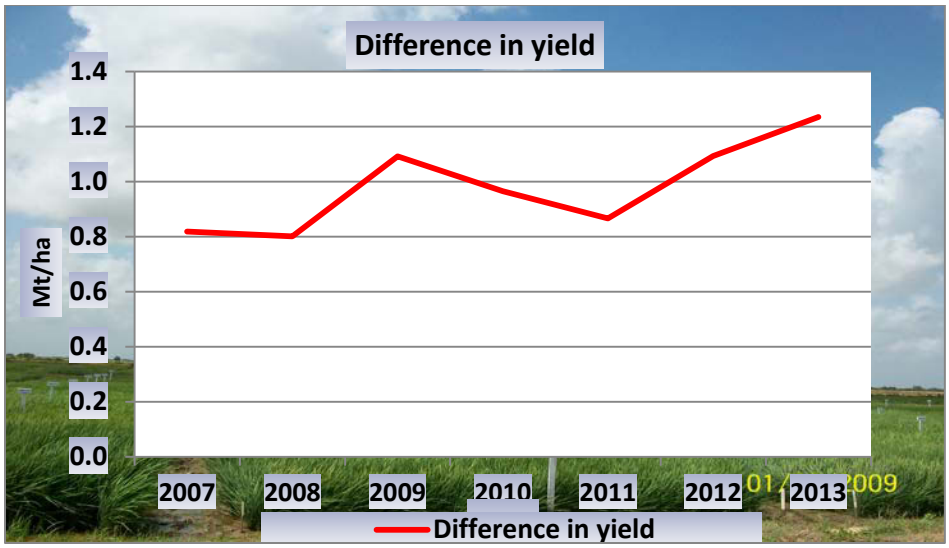

Fig.2 Difference in yield between Six Points and Conventional practice

The increased yield obtained by the farmers practicing the 'six points' resulted in increased income allowing their profit to be approximately 53% greater than those farmers who didn't practice the six points' (Fig.3).

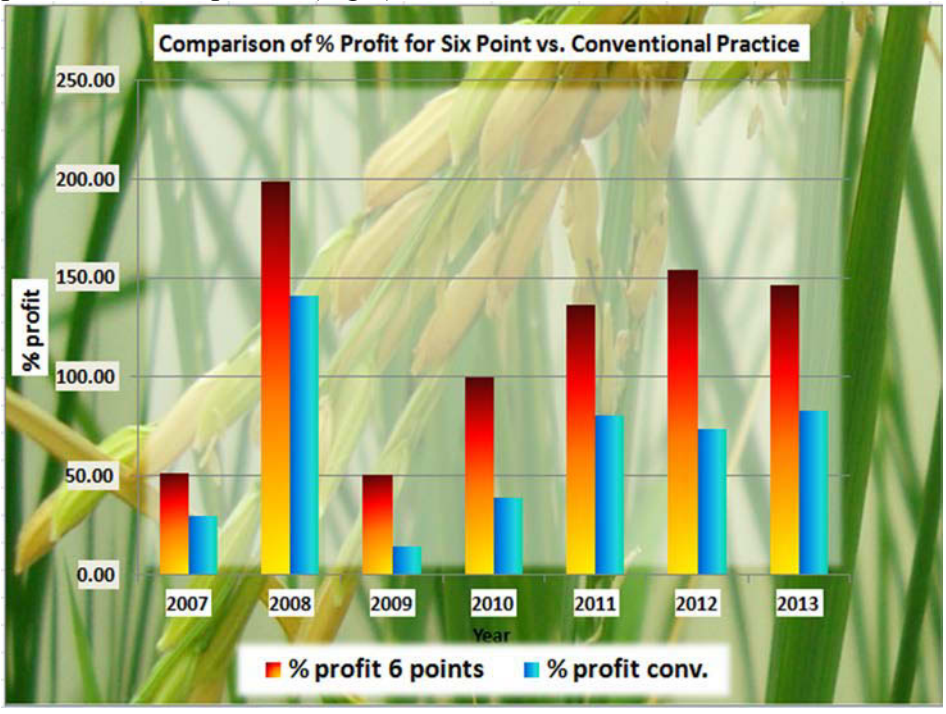

Fig.3 Comparison of Percentage Profit received with 6 points and Conventional Practice

DISCUSSION

The 'six points' programme proved successful in increasing farmers' yield and by extension their livelihoods through increased percentage profit. The considerable benefits that are gained from

'six points' encouraged the GRDB's Extension department to target a 90% adoption of the technology. However, for this goal to be achieved several challenges must be addressed.

Water is very critical for the success of the programme. Farmers are often prevented from releasing water from their fields to apply Nitrogen fertilizer since they are dissuaded by the uncertainty of the availability of water to reflood. This can be due to low water level in the reservoirs, blocked irrigation canals or lack of reservoirs in some areas. All agencies that are responsible for providing water to farmers inclusive of the Water Users Association (WUAs), National Drainage and Irrigation Authority (NDIA), Regional Democratic Councils (RDCs), should make a concerted effort to make water available on time. Greater collaboration among these agencies will definitely allow water to be provided on a timelier basis to farmers.

Sometimes factors that are extraneous to the Board's mandate can prevent farmers from applying the knowledge gained on the 'six points' technology in their fields. Low prices for paddy compounded by delayed payment by millers can result in these farmers not applying the required inputs and also on time if they do aquire it. Regulations are in place to ensure millers pay farmers on a timely basis however experience has proven that this is not enough and other methods must be looked at.

Generally fields are not entirely level for rice cultivation thus making the management of water very challenging. This can result in loss of nutrients; rapid growth of weeds and additional costs to flood fields since the low areas accumulates more water. Leveling fields requires sophisticated equipment, which is beyond the reach of the farmer. It is therefore recommended that the government embark on a program to assist farmers to level their field by providing the service of a fleet of machines.

It is expected adoption by all farmers should be achieved by the year 2017. This will require a collaborative and determined effort by all players to allow this to take place. The development of higher yielding varieties by the Rice Research Station, complimenting the 'six points' practice will ensure farmers achieve higher yields. The 'six points' technology could be further refined through more research making it a stronger technology for even greater yields in the future.

CONCLUSION

The 'six points' technology package of practices without any doubt contributed to increased yield and profitability of the farmers further improving their standard of living. While the adoption of technologies are impacted by factors such as characteristics of the technology, the information accompanying it, the appropriateness of the technology and support in terms of research and policy, the role of extension cannot be overemphasized. Many gains have been made with the 'six points' technology; this needs to be built upon to make Guyanese rice farmers world class producers.

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