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Comparative Economic Analysis of Locally Adapted and Drought Tolerant Rice Varieties in Nawalparasi District of Nepal

Jeevan Lamichhane¹, Yug N Ghimire², Krishna P Timsina², Durga Bdr RanaBhat¹

Abstract

Rice is the most important cereal crop grown mainly by small scale farmers as a food crop in Nepal. Rice production is however low resulting in imports amounting to billions annually. Climate change is a great threat of today to the farming community. Drought is one of the major problem induced by the climate change. Data for was obtained from rice adaptability trials at two V.D.Cs (Dobadi and Rakachuli) of Nawalparasi Districts and was analyzed using Excel and SPSS 16. Adpatability trial consists of Sukha varieties 1,2,&3 which was compared with the locally adapted rice variety Radha 4. For comparison Gross margin, Dominance Analysis and Marginal Rate of Return was calculated. Net Benefit from the Sukha varieties is higher. If farmers changed from locally adapted rice variety to improved drought resistant rice varieties Sukha 1,2&3 they would earn a marginal rate of return 170%, 40% and 8% respectively. Dominance Analysis showed that all the varieties were Undominated. The marginal Rate of Return of the cultivation of Sukha 1 variety is above minimum acceptable rate of return that is 100%. This implies that farmers in rainfed rice growing areas in Nawalparasi District of Nepal are encouraged to plant improved variety Sukha varieties. These results are compelling and speak of the need for reorientation of the agricultural research agenda taking into consideration the existing and emerging abiotic stresses, and the development and dissemination of improved drought-tolerant technologies.

Keywords: drought, rice, economic analysis, gross margin, dominance analysis, marginal rate of return

Introduction

Rice ranks the first among cereal crops in terms of Area, production and livelihood of the people. As the most important staple food of Nepalese people, rice contributes nearly 20% to the agricultural gross domestic product and almost 7% to GDP (MOAD, 2013). The growth of imports has outpaced exports and the agricultural trade deficit has increased over the years from \$124 million to \$373 million (TEPC, 2013). Drought is

¹ Corresponding email: , jeevanlamichhane7@gmail.com, Regional Agricultural Research Station, Lumle

² Socio Economics and Agriculture Research Policy Division, Khumaltar

one of the most important abiotic stresses resulted due to climate change causing significant yield losses across the country especially in the rainfed rice environments. In Nepal 30% of total rice cultivated areas are prone to drought (Gumma, et.al, 2011). National Rice Research Program has developed and released drought tolerant varieties like Sukha-1, Sukha-2, Sukha-3, Sukha-4, Sukha-5, and Sukha-6 to address the problem of drought (NARC, 2012). The overall objective of this study was to recommend profitable and appropriate rice variety for small scale farmers facing the problem of Drought.

Methodology

Study Area

The study was undertaken on drought tolerant rice varieties (Sukha1, Sukha2, and Sukha3) adaptability trial at Dhobadi and Rakchuli V.D.Cs Nawalparasi for two years from 2010 to 2011. Locally adapted variety Radha-4 was used as a check. Dobadi and Rakachuli V.D.Cs lies at an elevation of 300 masl. Average minimum and maximum temperature of the study sites is 5°C and 38°C respectively. The district spreads from 27°21' to 27°47' north latitude and 83°36' to 84°25' longitude in east. Mean precipitation of the area is 2145 mm per year. The soil in the District is heavy loamy soils. Farming in these V.D.Cs is rainfed type. In recent years Drought has been the major problem in these areas. The production is decreasing every year. To address the problem of drought brought by the changing climate adaptability trial had been set at these two V.D.Cs. Whether these drought tolerant varieties were economically viable for farmers or not, Economic Analysis for these varieties is performed.

Data Collection

Primary data on input and output were obtained from the operations carried out during the implementation of the rainfed rice adaptability trials. Data of two years from two V.D.Cs were collected and mean of the cost and yield were calculated. Quantities of purchased inputs from local markets were recorded.

Data Analysis

Data was analyzed using MS-Excel and SPSS. CIMMYT approach was used as a tool for Economic Analysis for collected data. Various analyses include calculation of gross margin, Dominance Analysis and Marginal Rate of Return (MRR). Gross margin was calculated as the difference between the total revenue and Total variable costs for each variety. Total revenue was computed as the product of adjusted average rice yield by the

market price. Adjusted rice yield is calculated by deducting 10% from the Yield of the crop. The cost components include the Human labour, Bullock/Tractor, Seed, Miscellaneous cost and Fixed cost. Gross margin analysis alone cannot give the effective decisions; hence need to carry out further analysis leading to dominance and marginal analysis (CIMMYT, 1998). In a dominated treatment, a higher total variable input cost is incurred to earn the same or a lower net benefit when compared with other treatments. Dominance analysis eliminates dominated treatments from further analysis. MRR (between treatment 'a' and 'b') is given by Change in Net Benefit/ Change in Total Cost. Marginal Analysis was based on the assumption that overhead costs were not included, owner's labour was not included and $MRR > \text{Minimum Acceptable Rate of Return (MARR)}$ which is 100% would be acceptable for a farmer to change from one technology to another.

Results and Discussion

Gross margin contains details of cost components of rainfed rice production that vary with the type of rice varieties. Dominance Analysis gives details on interaction between total variable costs and net benefits. On equal footing marginal rate of return gives details on percent return to additional investments as a farmer changes from Radha-4 (locally adapted) to Sukha varieties.

Table 1: Gross margin per hectare for locally adapted and drought tolerant rice varieties

Operations	Rice varieties			
	Local	Improved		
Variable cost	Radha- 4	Sukha-1	Sukha-2	Sukha-3
Human labour	38000	45000	43000	42000
Bullock/Tractor	9000	9000	9000	9000
Seed	2000	1500	1500	1500
Miscellaneous	4000	4500	4500	4500
Cost(Fertilizer,Plant protection,sprayer				
Total Variable Cost	53000	60000	58000	57000
Fixed Cost (Land tax,Water tax, Farm Depreciation, Repair cost)	250	250	250	250
Total Cost	53250	60250	58250	57250

Revenue				
Yield(t/ha)	3.6	5.0	4.6	4.4
Adjusted yield(t/ha)	3.24	4.5	4.14	3.98
Selling price per ton	17000	15000	15000	15000
Total Revenue	55080	67500	62100	59400
Net Benifit	1830	7250	3850	2150

Source:Field Survey,2011

Table 1 shows that locally adapted rice variety Radha-4 had lowest gross margin per hectare compared to the drought tolerant Sukha rice varieties. The market price of Sukha varieties is lower than the Local varieties. Due to the highest yield of Sukha Varieties compared to the local one selling price per ton for Sukha varieties is highest. Total cost was smallest for locally adapted variety and highest for Sukha 1. It was only Bullock and Tractor cost that did not vary across the varieties. To generate more information for effective decision making there was need to perform Dominance Analysis.

Table 2: Dominance Analysis of local and sukha varieties

Rice Varieties	Total Variable Cost	Net benefit	Dominance
Local	53250	1830	Undominated
Sukha 3	57250	2150	Undominated
Sukha 2	58250	5200	Undominated
Sukha 1	60250	7250	Undominated

Source: Field Survey,2011

From Dominance Analysis all rice varieties were undominated which implies that increase in total variable costs associated with change from one variety to another and had a commensurate increase in the net benefit and hence decision on the best variety to adopt cannot be decided at this stsg. This leads to the analysis of the marginal rate of return (MRR) which threw more light on the relationship among the undominated varieties in terms of increasing costs and benefits. Results of the dominance analysis indicate that no variety dominates the other hence it is prudent to look at the effects on returns from changing from one variety to another.

Table 3: Marginal Rate of Return of Local and Sukha Varieties

Rice Varieties	Total Variable Cost	Net Benefit	MRR(%)
Local	53250	1830	-
Sukha 3	57250	2150	8
Sukha 2	58250	3850	40.4
Sukha 1	60250	7250	170

Source: Field Survey, 2011

Table 3 shows the marginal rate of return for changing from Radha-4 to the drought tolerant sukha varieties. The highest marginal rate of return was 170% while the least was 8%. A change to Sukha 3, Sukha 2 and Sukha 1 would increase the farmers return of 0.08%, 0.4% and 1.7% respectively. The total cost and Net Benefit increases which can explain why no variety dominated the other. The high MRR for Sukha 1 can be attributed to the high yield compared to other improved varieties.

Small scale farmers would be better off if they changed from locally adapted rainfed rice variety to drought tolerant rice variety due to higher MRR these varieties generates. The MRR was higher above 100% for the Sukha1 variety which is above the minimum acceptable rate of return. It was also found that none of the varieties was dominated suggesting that cost implications may not have a bearing on farmers decision to change from low net benefit technology to a high net benefit one, a farmer who is keen on high profit margin would choose Sukha 1 which gave the highest MRR compared to other Sukha varieties. It is recommended that farmers in rainfed rice growing area with scanty rainfall should adopt any of the Sukha varieties to address the food insecurity and poverty prevalence concerns in the country.

It seems profitable to adopt the Sukha varieties as compared to the local one. Very few study has been done regarding the Economic Analysis of the drought tolerant crop in Nepal. Similar result has been found by Okecl and wawire at Kenya, Africa. A experiment conducted at Kisumu District of Kenya under rainfed condition showed that the drought tolerant rice variety NERICA 1, NERICA 4, NERICA 10, NERICA 11 had the highest marginal rate of return compared to the local variety Durado precoce. NERICA 1, 4, 10 & 11 had the Marginal Rate of Return 148%, 148%, 225% & 303% respectively. This implies farmers would adopt any of the NERICA varieties since these varieties have got highest MRR.

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