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Determinants of productivity of hybrid rice in National Food Security Mission districts of Madhya Pradesh

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ABSTRACT

The present study is undertaken in Madhya Pradesh to study the factors affecting on productivity of hybrid rice. Two districts namely Rewa and Mandla, having higher concentration of rice have been selected for the study and 40 hybrid rice growers were selected in each district comprises of 80 hybrid rice growers. A multiple log linier model was used to drawn conclusion. It is observed from the study that the expenses on seed (0.152), chemical fertilizer (0.082), human labour (0.243) were found to be positive and highly significant to production of hybrid rice, which reveals that if all the things remain constant and at the present level of technological adoption an additional expense of ₹1.00 each on seed, chemical fertilizer and human labour will be able to increase the yield of hybrid rice up to 0.152, 0.082 and 0.243 kg ha $^{-1}$ respectively. The expenses on manures, pesticides, machine labour were found to be positive but non-significant shows that there should be need to provide extra attention by the rice growers, while using these crucial inputs at farms. Hence, efforts should be made to provide skill oriented training and demonstration to hybrid rice growers' field for enhance the productivity of hybrid rice in the study area.

Key words: *Determinants, hybrid rice, national food security mission and productivity*

Hybrid rice technology is likely to play a key role in added the rice production. Hybrid rice was planted in an area of 1.4 million ha and an additional rice production of 1.5 to 2.5 million tonnes was added to India's food basket (2008). More than 80% of the total hybrid rice area was found in eastern Indian states like Uttar Pradesh, Jharkhand, Bihar, Chhattisgarh, with some little area in states like Madhya Pradesh, Assam, Punjab and Haryana (Viraktamath, 2011). In Madhya Pradesh rice is cultivated in 11.92 % of total cultivated area (142.86 lakh ha.). The 44.79 % and 1.17 % of area under rice cultivation was found in HYVs and hybrid rice cultivation respectively and remaining was under traditional rice cultivation (Table 1). Hybrid rice has been identified as one of the component under the National Food Security Mission (NFSM) launched by the Government of India (GOI) with the aim to enhance rice production and targeted to cover more and more area under hybrid rice. The approach is to bridge the yield gap in respect of rice through dissemination of improved technology and farm management practices. Similarly, added emphasis is being given for adoption of hybrid rice under the special scheme Bringing Green Revolution in Eastern India (BGREI) of GOI to bring green revolution to eastern India (Viraktamath, 2011).

The spread of the newer varieties replacing the older varieties need to be closely monitored to take advantage of the superior characters of these newer varieties released by various research Institutions. This will help to break the yield plateau that has been experiencing in rice crop in the recent past and to increase the production and productivity of the crop. Though a number of steps are being taken by the Government to popularize these varieties like Frontline Demonstration, minikit supply, organizing training programmes (1-21 days) for farmers, farm women, seed growers, seed production personnel of public and private seed agencies, extension functionaries of state departments of agriculture, officials of state agricultural

universities and NGOs, there is no concrete data to prove that the newer varieties of rice are spreading faster and replacing the older ones. The introduction of hybrid rice high yielding varieties, fertilizers, pesticides and irrigation has improved rice yields significantly and expanded the area under rice cultivation. (Renganathan and Babu, 2006). Looking to the present scenario the time has come to compare the productivity and profitability of hybrid rice over high yielding varieties along with factors affecting the productivity of these newer varieties. Hence, the present study has been undertaken with the following objectives:

1. To compare the productivity and profitability of hybrid rice over high yielding varieties, and
2. To analyze determinants of productivity of hybrid rice.

MATERIALS AND METHODS

The two NFSM-Rice districts i.e. Rewa and Mandla in Madhya Pradesh have been selected for primary survey to address the above stated objectives. As these districts having higher concentration of area under rice cultivation within the group of NFSM districts. The district wise area under hybrid rice was not available for the study (Table 1).

Two representative blocks namely Rewa & Raipur Karchuliyan from Rewa district and Mandla & Nainpur blocks from Mandla district were selected for the intensive investigation. Two villages have been further selected from each block for the study. A list of farmers growing hybrid rice was prepared and classified in to four groups based on their size of holdings i.e. marginal (<1 ha), small (1.01 to 2 ha), medium (2.01 to 4 ha) and large (> 4 ha) farmers and 10 rice growers were selected in each category.

In this way 40 rice growers were selected from each district constituting a sample size of 80 rice grower from both the district. The primary survey has been done during the year 2010-11 with the help of pre-tested schedule.

A simple tabular analysis was employed to work out the cost and returns of hybrid and HYVs rice for the purpose of comparison with the help of % increase or decrease in productivity/profitability of hybrid rice. The following form of Log Linear Model was used to identify the factors affecting the productivity of hybrid rice in the study area.

$$y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7$$

Where,

y = Yield a = constant

b_1 to b_8 = regression coefficient X_1 = seed (kg ha^{-1}), X_2 = manure (₹/ha^{-1}), X_3 = Chemical fertilizer (₹ ha^{-1})

Table 1. Area of Rice in Different NFSM Districts of Madhya Pradesh (lakh ha)

NFSM Districts	Total area under cultivation	Total area under rice cultivation	Total Area under cultivation of HYVs	Total area under hybrid rice cultivation
Rewa	4.50 (3.15)	1.16 (6.83)	0.15 (1.93)	NA
Mandla	2.93 (2.05)	1.26 (7.39)	0.37 (4.82)	NA
Shahdol	1.83 (1.28)	1.04 (6.10)	0.23 (2.97)	NA
Anuppur	1.74 (1.22)	0.99 (5.85)	0.08 (1.04)	NA
Katni	2.57 (1.80)	0.94 (5.53)	0.36 (4.69)	NA
Satna	4.27 (2.99)	0.88 (5.18)	0.56 (7.38)	NA
Dindori	2.34 (1.64)	0.79 (4.62)	0.00	NA
Damoh	3.94 (2.76)	0.53 (3.13)	0.14 (1.88)	NA
Panna	3.49 (2.44)	0.61 (3.58)	0.66 (8.71)	NA
Total NFSM	27.61 (19.32)	8.21 (48.21)	2.55 (33.42)	NA
Other Districts	115.26 (80.68)	8.82 (51.79)	5.08 (66.58)	NA
Madhya Pradesh	142.87(100.00)	17.03(100.00)((11.92))	7.63 (100.00){44.79}	0.20*{1.17}

Source: - land records, M.P. Gwalior (2012), * *agricoop.nic.in/Rabi-2010/NSC.ppt*.

Figure in parenthesis shows percentage to total and figure in (()) shows percentage to total area under cultivation and figure in {} shows percentage to total area under rice cultivation

X_4 = Pesticides (₹ ha^{-1})
X_5 = irrigation (number of irrigation ha^{-1}),
X_6 = human labour (human days ha^{-1})
X_7 = machinery labour (hrs ha^{-1}),

RESULTS AND DISCUSSION

To address the objectives comparative profitability of hybrid rice over HYVs of rice and determinants of productivity of hybrid rice have been worked out for the study.

The cost of cultivation of hybrid rice (16569.20 ₹ ha^{-1}) were found to be higher than HYVs of rice (13479 ₹ ha^{-1}) by 18.65%. The similar findings were also reported by Goswami *et al (*2012).

The higher human labour charges (35%) was found to the main component of the total cost of cultivation of high yielding varieties rice followed by machine charges (33%), seed (11%), manures (7%), irrigation (6%), insecticides and pesticides (5%) and chemical fertilizer (2%) (Fig. 1), while in cultivation of hybrid rice the expenses of human labour (37%) was also found more as compared to machine charges (30%), seed (17%), irrigation (6%), insecticides and pesticides (4%), manures (3%), chemical fertilizers (2%) and bullock labour (1%) (Fig.2) The comparative share of seed, hired human labour, insecticides and pesticides was found to be more by 7, 2 and 1 %, while machine charges and manures were found to be less by 3 and 4 % in case of hybrid as compared to HYVs of rice.

The share of expenses on bullock labour, chemical fertilizer and irrigation were found to be same in both the cases, while compared the share of different inputs in hybrid and HYVs. The similar findings were also reported by Kashikar *et al* 2012.

As per as cost of cultivation of hybrid rice is concerned the expenses on seed, machine labor, irrigation, fertilizer, insecticides & pesticides and hired human labour were found to be higher than HYVs of rice by 45.75, 11.34, 19.31, 10.54, 6.13 and 22.05 % respectively, while expanses on manures was found to be less by 95.37% (Table 2). It is also observed from the data that the cost of production (2.50 ₹ kg^{-1}) of hybrid rice was found to be lower than HYVs of rice (₹3.22 kg^{-1}) by 28.80 % due to this the hybrid rice (51.18 q ha^{-1}) gave 42.99% higher yield over the inbred rice (29.18q ha^{-1}), which enhances the net return of hybrid rice (₹ 43605.10 ha^{-1}) by 46.60% over HYVs of rice (₹ 23283.9 ha^{-1}). The benefit cost ratio of hybrid rice (3.63) was also found to be more than HYVs of rice (2.73). Thus, the cultivation of hybrid rice was found to be more profitable over HYVs rice in the study area. The similar findings were also reported by Rao SK (2011).

All the determinants of productivity which included in log linear model were found to be gave positive response over the production of hybrid rice

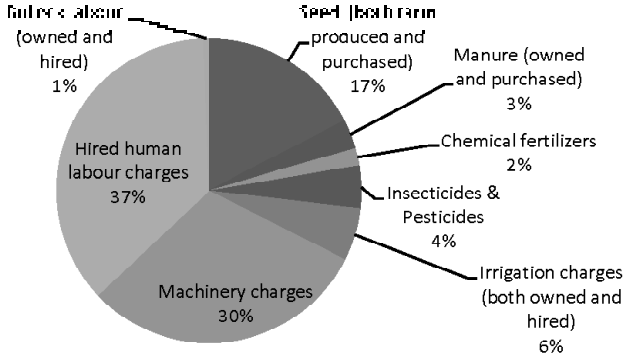

Fig.1. Comparative Share of different cost items in Total Cost of Cultivation of Hybrid Rice (₹16569.20/ha)

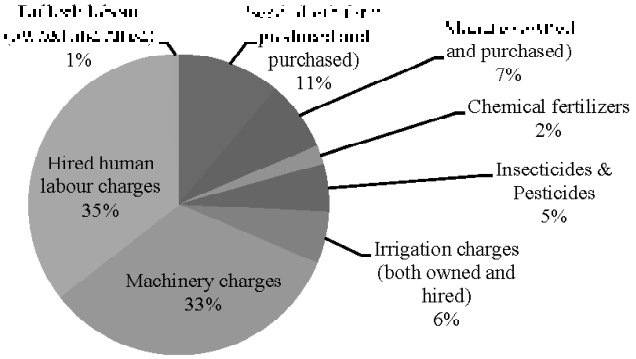

Fig. 2. Comparative Share of different cost items in Total Cost of Cultivation of HYVs Rice (₹13479.00/ha)

except expenses on bullock labour, which was found negative and significant. The expenses on seed (0.152***), chemical fertilizer (0.082***), human labour (0.243***) were found positive and highly significant, which reveals that if all things remains constant and at the present level of technological adoption an additional expense of ₹ 1.00 each on seed, chemical fertilizer and human labour will be able to increase the yield of hybrid rice up to 0.152, 0.082 and 0.243 kg ha^{-1} respectively (Table 3). This reveals that the hybrid rice is responding to application of inputs significantly which is reflected by the enhancement in productivity as well as profitability by 43 and 46 % respectively (Table 2).

The expenses on manures, pesticides, machine labour were found to be positive but non-significant, which shows there is need to provide extra attention while using these crucial inputs at rice growers' farms. There is also a need to provide skill oriented training and demonstrations of these technologies at their field. The coefficient of multiple regressions of fitted model was found to be 0.568. Hence, the fitted function was found good fit as selected variables were found to be able to explained 56.80 % variability in the yield of hybrid rice.

Thus, as rice is a choice crop of millions of poor and small farmers not only for income but also for household's food security. This will be done with effective implementation of production programme *e.g.* NFSM and BGREI *etc*. An average rice grower harvested only 51.18 q ha^{-1} against the potential of 120

Table 2. Comparative Costs and Returns for Hybrid over HYVs (₹ ha^{-1})

Particulars	Hybrid	HYVs	% increase Over HYVs
Costs			
Seed (both farm produced and purchased)	2884.14	1506.91	47.75
Manure (owned and purchased)	516.31	1008.71	-95.37
Chemical fertilizers	311.5	278.68	10.54
Insecticides & Pesticides	739.41	694.12	6.13
Irrigation charges (both owned and hired)	934.42	753.95	19.31
Machinery charges	5048.39	4475.67	11.34
Hired human labour charges	6043.9	4710.96	22.05
Bullock labour (owned and hired)	91.11	49.97	45.15
Total cost	16569.20	13479	18.65
Unit cost of production (₹ kg^{-1})	2.5	3.22	-28.8
Returns			
Yield of paddy (q/ha)	51.18	29.18	42.99
Market price (₹/q)	1102.21	1120.11	-1.62
Value of grain yield (₹/ha)	56414.3	32682.8	42.07
Value of straw yield (q/ha)	47	51	-8.51
Total value of the produce (gross return)	60174.3	36762.8	38.91
Net return	43605.1	23283.9	46.6

Table 3. Determinants of productivity of hybrid rice (Rs ha^{-1})

Independent variables	Coefficients (b)	Std. Error	t	P-Value
Constant	1.862***	0.239	7.793	.000
Seed	0.152***	0.041	3.690	.000
Manure	0.005	0.004	1.091	.279
Chemical fertilizer	0.082***	0.023	3.594	.001
Pesticide	0.007	0.009	0.735	.465
Irrigation	0.005	0.004	1.308	.195
Human labour	0.243***	0.053	4.568	.000
Bullock labour	-0.015*	0.008	-1.722	.089
Machine labour	0.002	0.012	0.159	.874

R2 = 0.568 *** Level of Significance at 1% probability level, ** Level of Significance 5% probability level; *Level of Significance 10% probability level

q ha^{-1}. The replacement of high yielding varieties by hybrid is very slow and needs to be given priority looking to its advantages in term of productivity as well as profitability. This will definitely increase the productivity of rice, income of the farmer and bring the desirable changes in the standard of living of farming community. Hence, there is need to replace the seed of high yielding varieties by hybrid seed and to provide skill oriented training regarding packages and practices of hybrid rice. The efforts should be made to encourage the progressive farmers and officers of the KVKs, Agriculture Departments, NGOs, etc. to popularized hybrid rice in the area.

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