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Impact of technological interventions on productivity and farm profitability in Madhya Pradesh- Case Studies

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Abstract

The farm profitability has an important role in determining the sustainability of farm business. The objective of this study was to assess the impact of improved technological interventions compared with the indigenous Farmers practices being adopted in the adopted villages by Krishi Vigyan Kendra in the state of Madhya Pradesh. For conducting this study, the Umaria district of Madhya Pradesh was selected and data were collected, processed and conclusions were drawn. The analytical tool used in the study consisted of data collection and analysis for assessing profitability of farm units and CACP cost concept to find profitability of major crops in cropping pattern. The results revealed that paddy and wheat are the major crops of the sample respondents. Average net profitability of paddy and wheat were Rs. 65703 and Rs. 41080 per hectare were recorded by the farmers who adopted the improved technology transferred by Krishi Vigyan Kendra while it was Rs. 56629 and Rs.30709 per hectare respectively by the farmers who adopted indigenous technology. The return per rupee of expenditure for paddy and wheat were Rs.2.62 and Rs.2.15 for adopted respondents against Rs.2.37 and Rs. 1.81 for non-adopted respondent farmers.

Keywords: Farm profitability, Productivity, Improved technology, Indigenous technology.

Introduction

Agriculture is the most important sector of Indian Economy. Indian agriculture sector accounts for 18 percent of India's gross domestic product (GDP) and provides employment to more than 50 percent of the countries workforce. India is the world's largest producer of pulses, spices and spice products. There are various stake holders in this sector and play an important role in development of this sector, one of them is Krishi Vigyan Kendra (KVK), the light house for rural people, is an innovative science based institution, which undertakes vocational training of farmers, farm women, and rural youths, conduct on-farm researches for technology refinement and organize frontline demonstration to promptly demonstrate the latest agriculture technologies to the farmers as well as the extension workers. The KVK function on the principle of collaborative participation of scientist, subject-matter experts, extension workers and farmers. Krishi Vigyan Kendra (KVK) are agricultural extension centres created by ICAR (Indian Council for Agricultural Research) and its affiliated institutions at district level to provide various types of farm support to the agricultural sector. The first KVK on a pilot basis was established in 1974 at Puducherry (Pondicherry) on the recommendation of Mehta committee. KVKs provide several farm support activities like providing technology dissemination to farmers, training, awareness etc. Krishi Vigyan Kendra also known as Farm Science Centre provides solution to problems related to agriculture and allied subjects, as and when faced by farmers of that particular locality. To achieve the set objectives, KVKs undertake following types of activities in the adopted villages: (1) Farm Advisory Service. (2) Training programme for different categories of people. (3) Training programme for the extension functionaries. (4) Front Line Demonstration (FLD). (5) On Farm Testing (OFT). Training is one of the most important activities of Krishi Vigyan Kendra. Training is a planned and systematic effort to increase the knowledge, improve the skill and change the attitude of the person towards a particular subject. Training need assessment is the first and foremost factor to be considered before conducting any training programme. Depending upon the need and categories of trainees, KVK imparts mainly following three types of training; viz; Training to the practicing farmers and farm women, Training to the Rural Youth, and Training programme for the extension functionaries.

The KVK use to impart training on various aspects and coordinate various activities at ground level for capacity building as well as efficient utilization of the resources, thereby increasing the productivity and economic wellbeing of the farming community. The main purpose of this study is to measure and investigate farm profitability of KVK adopted and non-adopted farmers and comparison between them.

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Material and Methods

The conclusions of this study are based on primary data, which were collected from the adopted and non-adopted farmers of the Umari district of Madhya Pradesh. Farmers were selected randomly for collection of data on various predecided aspects of farming. The total number of the Farmers sample size was 90, out of which 45 farmers were those who adopted improved technology and remaining 45 were those who followed indigenous technology. The study was carried out during the year 2017-2018.

The primary data were collected at different point of times on all physical inputs applied by respondents in the production process for various enterprises on the farm. The data on prices of inputs purchased from markets and prices of output realized by farmer from the market. Only those crop enterprises were considered for data collection which are part of commercial agriculture since output price data on crops grown for subsistence farming. Assessment of profitability following cost and returns has been done as used in the study conducted by Meena *et al.* (2016) [4].

The cost of cultivation of crops has been worked out by using various cost concepts as described below:

Cost A1: It includes Value of hired human labour, Value of hired and owned bullock labour, Value of hired and owned machine labour, Value of seed (both farm seed and purchased), Value of manures (owned and purchased) and fertilizers, Depreciation, Irrigation charges, Land revenue, Interest on working capital, and Miscellaneous expenses.

Cost A2: Cost A1 + rent paid for leased-in land, Cost B1: Cost A1 + interest on fixed capital (excluding land), Cost B2: Cost B1 + rental value of owned land + rent for leased-in land, Cost C1: Cost B1 + imputed value of family labour, Cost C2: Cost B2 + imputed value of family labour, Cost C3: Cost C2 + 10 per cent of cost C2 as management cost.

Cost of production (per q) = Cost of cultivation ÷ By product value Quantity of Main product

Income measures: The income measures compute are; (1) Gross income: It is the total value of main product. $GI = (Q_m \times P_m)$, Where, GI = Gross income Q_m = Quantity of main product P_m = Price of main product, (2) Returns over variable cost (RVC): $RVC = \text{Gross income} - \text{Cost A1}$, (3) Farm business income (FBI): $FBI = \text{Gross income} - \text{Cost A2}$, (4) Family labour income (FLI) or returns to family labour: $FLI = \text{Gross income} - \text{Cost B2}$, (5) Net income (NI): $NI = \text{Gross income} - \text{Cost C2}$, (6) Returns to management RM = $\text{Gross income} - \text{Cost C3}$, (7) Returns per rupee (RPR) $RPR = \text{Gross income per hectare} / \text{Cost C2 per hectare}$, and (8) Income over cost $A2 + FL = \text{Gross income} - (\text{cost A2} + FL)$.

Results and Discussion

The data on productivity of crops and economics as a result of different technological intervention revealed that there was tremendous enhancement in the productivity and profitability from paddy and wheat crops as compared with the practices being adopted by farmers of the region.

Cost of Paddy Cultivation: The variable, fixed and total cost incurred on paddy cultivation have been presented in the Table 1. In case of Improved Technology adopted and non-adopted respondents, on an average total cost was found to be Rs.40598.67 and Rs.41383.22 per hectare respectively, which was found to be 1.9 per cent less in case of adopted respondent. Out of total cost incurred, the proportion of variable

and fixed cost was found to be 52.89 and 47.11 per cent respectively in case of Improved Technology adopted respondents and 57.46 and 42.54 respectively in case of non-adopted respondents. Variable cost was found to be 9.70 per cent less and fixed cost was 8.65 per cent more in case of Improved Technology adopted over non-adopted respondents.

Table 1: Total, variable and fixed cost (Unit: Rs/ha) in paddy cultivation.

S.No.	Particulars	Improved Technology	Farmers Practices	Difference (%)
1	Labour (Hired)	4065.39 (10.01)	4160.88 (10.05)	-2.29
2	Labour (Family)	952.16 (2.35)	1033.3 (2.50)	-7.85
	Total (Human labour)	5017.55 (12.36)	5194.18 (12.55)	-3.40
3	Machine (Hired)	4092.59 (10.08)	3066.55 (7.41)	33.46
4	Machine (Owned)	622.89 (1.53)	374.77 (0.91)	66.21
	Total (Machine)	4715.48 (11.61)	3441.32 (8.32)	37.03
A	Total Operational cost	9733.03 (23.97)	8635.5 (20.87)	12.71
1	Seed	2624.77 (6.47)	5747.69 (13.89)	-54.33
2	Pesticide	401.20 (0.99)	400.00 (0.97)	0.30
3	Manure	2500.00 (6.16)	2447.92 (5.92)	2.13
4	Fertilizer	4912.02 (12.10)	5154.40 (12.46)	-4.70
5	Irrigation	278.61 (0.69)	261.57 (0.63)	6.51
B	Total Material cost	10716.60 (26.40)	14011.58 (33.86)	-23.52
C	Interest on working capital @10%	1022.48 (2.52)	1132.35 (2.74)	-9.70
	Variable cost (A+B+C)	21472.11 (52.89)	23779.43 (57.46)	-9.70
D	Land revenue	12.00 (0.03)	12.00 (0.03)	0.00
E	Depreciation	314.84 (0.78)	259.93 (0.63)	21.12
F	Interest on fixed capital @12%	1082.64 (2.67)	996.44 (2.41)	8.65
G	Rental value for owned land	17717.08 (43.64)	16335.42 (39.47)	8.46
	Fixed cost (D+E+F+G)	19126.56 (47.11)	17603.79 (42.54)	8.65
	Total cost (VC+FC)	40598.67 (100)	41383.22 (100)	-1.90

Figures in parenthesis show the per cent to total cost

The average total operational cost in case of Improved Technology adopted and non-adopted respondents was found to be Rs.9733.03 and Rs. 8635.50 per hectare respectively which is higher by 12.7 per cent in case of adopted over non-adopted respondents. Total material coat was found to be lower by 23.52 per cent in case of Improved Technology adopted respondents (Rs.10716.60) as compared to non-adopted respondents (Rs.14011.58). This happened due to the facts that adopted and non-adopted respondents used to invest more on fertilizer (12.10% and 12.46%) followed by seed (6.47% and 13.89%), manure (6.16% and 5.92%), pesticide (0.99% and 0.97%) and irrigation (0.69% and 0.63%).

Cost Concepts in Paddy Cultivation

It is an important tool for measuring farm business activities. The farm management specialists have specified cost concepts into Cost A1, A2, B1, B2, C1, C2, and C3. In this section efforts have been made to discuss according to various costs concepts for cultivation of paddy crop in case of Improved Technology adopted by farmers and non-adopted respondents that is farmer's indigenous practices. Different cost concept of adopted and non-adopted respondents in paddy cultivation is presented in Table 2.

Table 2: Cost of paddy farming due to improved technology and farmer's practices (Rs./ha).

Particulars	Improved Technology	Farmers Practices	% Difference
COST A1 and A2	20846.79 (46.68)	23018.06 (50.57)	-9.43
COST B1	21929.43 (49.10)	24014.50 (52.75)	-8.68
COST B2	39646.51 (88.78)	40349.92 (88.64)	-1.74
COST C1	22881.59 (51.24)	25047.80 (55.02)	-8.65
COST C2	40598.67 (90.91)	41383.22 (90.91)	-1.90
COST C3	44658.54 (100)	45521.54 (100)	-1.90
Cost of Production (Rs/q)	261.80	364.40	-28.16

Figures in parenthesis show the per cent to the Cost C3

The data presented in Table 2 indicates that total cost of cultivation of paddy was found to be Rs.44658.67 and Rs.45521.54 in case of Improved Technology adopted and non-adopted respondents respectively, which was found to be 1.90 per cent less in case of adopted respondents as compared to non-adopted respondents. The proportion of cost A1 and cost A2 was found to be similar but was less for Improved Technology adopted respondents by 9.43 per cent over non-adopted respondents. The proportion of cost B1 and B2 was found to be 49.10 per cent and 88.78 per cent in case of Improved Technology adopted respondents and 52.75 per cent and 88.64 per cent in case of non-adopted respondents. All costs A1 and A2, B1, B2, C1, C2 and C3 were found to be less by 9.43 per cent, 8.68 per cent, 1.74 per cent, 8.65 per cent, 1.90 per cent and 1.90 per cent, respectively as compared to non-adopted respondent farmers. The cost of production was found to be Rs.261.80 and Rs.364.40 per quintal in case of Improved Technology adopted and non-adopted respondents, which is 28.16 per cent less in case of former respondents over non-adopted respondents.

Profitability and income measures for paddy production

A field survey was carried out and the data on profitability and income measures of paddy crop due to Improved Technology and Farmers' Practices has been depicted in Table 3.

Table 3: Income measures of paddy production (Rs./ha).

Particulars	Improved Technology Adopted	Farmers' Practices adopted	% Difference
Yield of Main product (q/ha)	44.15	40.87	8.03
Value of Main Product (Rs./q)	77262.50	71522.50	8.03
Value of By product	29040	26490	9.63
Gross Income	106302.50	98012.50	8.46
Return over Variable Cost	85455.71	74994.44	13.95
Farm Business income	85455.71	74994.44	13.95
Family Labour Income	66655.99	57662.58	15.60
Net income	65703.83	56629.28	16.02
Income over A2+FL	21798.95	24051.36	-9.36
Return to Management	61643.96	52490.96	17.44
Returns Per Rupee	2.62	2.37	10.55

It is evident from the data that on an average yield of main product in case of Improved Technology adopted and non-adopted respondents was found to be 44.15 and 40.87 q/ha respectively and the price was 1750 Rs/q. Yield is found to be 8.03 per cent more in case of Improved Technology adopted respondent as compared to Farmers Practices non-adopted respondents. Gross income was found to be 8.46 per cent more in case of Improved Technology adopted respondents

over non-adopted respondents which were Rs.106302.50 and Rs.98012.50 per hectare respectively.

Family labour income was observed to be Rs.66655.99 per hectare in case of Improved Technology adopted respondents and Rs.57662.57 in case of non-adopted respondents, which is higher by 15.60 per cent in case of Improved Technology adopted over non-adopted respondents. The net income of Improved Technology adopted respondents was found to be Rs.65703.83 and non-adopted respondents was Rs.56629.28. Improved Technology Adopted respondents realised high net income by 16.02 per cent as compare to non-adopted respondents.

The return per rupee investment was found to be Rs.2.62 and Rs.2.37 in case of Improved Technology adopted and non-adopted respondent farmers, s respectively. It is evident from the above findings that yield, return over variable cost, family labour income, net income, return to management and return per rupee were found to be more due to improved technological interventions over farmers indigenous practices by 8.03%, 13.95%, 15.60%, 16.02%, 17.44% and 10.55% respectively. The data on different profitability measures recorded in present study revealed that different interventions of improved technology lead to significantly high productivity and profitability from paddy crop as compared to farmers prevailing practices.

Variable, fixed and total Cost in Wheat Cultivation

Cost incurred on different items for cultivation of wheat due to improved Technological interventions and Farmers traditional practices has been Table 4.

Table 4: Total, variable and fixed cost of wheat cultivation (Unit: Rs./ha) due to improved technology and farmer's practices.

S.No.	Particulars	Improved Technology Adopted	Farmers traditional Practices	Difference (%)
1	Human Labour (Hired)	2167.25 (6.09)	2567.59 (6.83)	-15.59
2	Human Labour (family)	1213.41 (3.41)	918.39 (2.44)	32.12
	Total (Human Labour)	3380.66 (9.50)	3485.98 (9.27)	-3.02
3	Machine (Hired)	5622.68 (15.79)	4280.67 (11.39)	31.35
4	Machine (owned)	293.62 (0.82)	1213.41 (3.23)	-75.80
	Total (Machine)	5916.3 (16.62)	5494.08 (14.61)	7.68
A	Total Operational cost	9296.96 (26.11)	8980.06 (23.89)	3.53
1	Seed	4523.81 (12.71)	7712.32 (20.52)	-41.34
2	Pesticide	496.23 (1.39)	531.92 (1.41)	-6.71
3	Manure	0 (0.00)	0 (0.00)	0.00
4	Fertilizer	5690.78 (15.98)	5628.10 (14.97)	1.11
5	Irrigation	982.14 (2.76)	1631.46 (4.34)	-39.80
B	Total Material cost	11692.96 (32.84)	15503.80 (41.24)	-24.58
C	Interest on working capital @10%	753.681 (2.12)	949.48 (2.53)	-20.62
	Variable cost (A+B+C)	21772.71 (61.16)	25186.12 (67.00)	-13.55
D	Land revenue	12 (0.03)	12 (0.03)	0.00
E	Depreciation	259.05 (0.73)	267.49 (0.71)	-3.16
F	Interest on fixed capital @12%	782.793 (2.20)	702.26 (1.87)	11.47
G	Rental value for owned land	12775.5 (35.88)	11424.89 (30.39)	11.82
	Fixed cost (D+E+F+G)	13829.34 (38.84)	12406.64 (33.00)	11.47
	Total cost (VC+FC)	35602.06 (100)	37592.76 (100)	-5.30

Figures in parenthesis show the per cent to the total cost

The data presented in Table 4 indicate that the total cost was found to be Rs.35602.06 and Rs.37592.76 due to Improved Technological interventions and Farmers Traditional Practices respectively. The total cost was found to be less in case of former by 5.30 per cent over non-adopted respondents. Out of

the total cost incurred, the proportion of variable and fixed cost was found to be 61.16 per cent and 38.84 per cent respectively in case of Improved Technology respondents and 67 per cent and 33 per cent respectively in case of non-adopted respondents. The variable cost was found to be 13.55 per cent less and fixed cost was 11.47 per cent more in case of Improved Technology adopted respondents over non-adopted respondents.

The total operational cost was observed 26.11 per cent and 23.89 per cent in case of Improved Technology adopted and non-adopted respondents respectively. The material cost was found to be 32.84 per cent in case of Improved Technology adopted and 41.24 per cent in case of non-adopted

respondents. Material cost was 24.58 per cent less in case of Improved Technology adopted over non-adopted respondents. This is attributed to the fact that the Improved Technology adopted and non-adopted respondents used to invest more in fertilizer (15.98% and 14.97%) followed by seed (12.71% and 20.52%), irrigation (2.76% and 4.34%) and pesticides (1.39% and 1.41%).

Cost Involved in wheat Cultivation

The details regarding costs incurred on different parameters in wheat crop cultivation due to improved technology and farmers' traditional practices were recorded and the same have been summarised in Table 5.

Table 5: Cost of Wheat farming due to improved technology and farmer's practices (Rs./ha).

Particulars	Improved Technology Adopted	Farmers traditional Practices	Difference (%)
COST A1 and A2	20801.24 (53.16)	24794.45 (59.60)	-16.11
COST B1	21584.03 (55.16)	25496.711 (61.29)	-15.35
COST B2	34359.53 (87.80)	36921.60 (88.76)	-6.94
COST C1	22797.44 (58.26)	26415.10 (63.50)	-13.70
COST C2	35572.94 (90.90)	37839.99 (90.96)	-5.99
COST C3	39133.15 (100)	41599.27 (100)	-5.93
Cost of Production (Rs/q)	587.04	765.45	-23.31

Figures in parenthesis show the per cent to the cost C3

The data presented in Table 5 reveals that on an average total cost was found to be Rs.39133.94 and Rs.4599.27 for Improved Technology respondents and non-adopted respondents respectively, which is less by 5.93 per cent in case of Improved Technology respondents over non-adopted respondents. The cost A1 and A2 also followed similar trend and registered Rs.20801.24 and Rs.24794.45 per hectare, respectively. The cost of production was found to be Rs.587.04 and Rs.765.45 per quintal in case of Improved Technology respondents and non-respondents respectively. Similar trend was observed with respect to the cost of production which was found to be 23.31 per cent less in case of Improved Technology respondents as compared to non-adopted respondents.

Economics of Wheat Crop Cultivation

The data on different cost and income parameters as influenced by improved technology interventions and farmer's practices were analysed and the same have been summarised in Table 6.

Table 6: Production (q/ha) and profitability (Rs/ha) of wheat crop cultivation due to improved technology.

Particulars	Improved Technology Adopted	Farmers traditional Practices	Difference (%)
Yield of Main product (q/ha)	35.76	31.93	11.99
Value of Main Product (Rs./ha)	62043.60	55398.55	11.99
Value of By-Product (Rs./ha)	14609.40	13150.80	11.09
Gross Income (Rs./ha)	76653.00	68549.35	11.82
Return over Variable Cost (Rs./ha)	55851.76	43754.90	27.65
Farm Business Income (Rs./ha)	55851.76	43754.90	27.65
Family Labour Income (Rs./ha)	42293.47	31627.75	33.72
Net income (Rs./ha)	41080.06	30709.36	33.77
Income over A2+FL (Rs./ha)	22014.65	25712.84	-14.38
Return to Management	37519.85	26950.08	39.22
Returns Per Rupee	2.15	1.81	18.95

The data depicted in Table 6 indicate that yield of main product was found to be 35.76 q/ha and 31.93 q/ha in case of Improved Technology respondents and non-respondents respectively, which is 11.99 per cent higher in case of the former. The price of the main product was Rs.1735/- per quintal. Gross income of Rs.76653 and Rs.68549.35 per hectare and net income of Rs.41080.06 and Rs.30709.36 per hectare, respectively was recorded due to Improved Technology respondents and non-adopted respondents. Income over A2 + family labour was found to be Rs.22014.65 and Rs.25712.84 per hectare in case of Improved Technology Adopted and non-adopted respondents respectively, which is less by 14.38 per cent in case of the former as compared to later. Returns fetched due to Improved Technology Adopted and farmers practices was Rs.37519.85 and Rs.26950.08 per hectare while the same trend was observed with respect to return per rupee investment and the values recorded were Rs.2.15 and Rs.1.81, respectively.

Conclusion

The main conclusions emanated from the results of this study are that yield, gross income, net income, family labour income, return to management and return per rupee investment were significantly high when farmers adopted improved technology over traditional farmers indigenous practices by 11.99%, 11.82%, 33.77%, 39.22% and 18.95% respectively. It is therefore recommended that technological interventions for paddy and wheat crop cultivation played significant role in realising highest production and profitability over farmers traditional practices of cultivation.

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