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RESOURCE USE EFFICIENCY OF HYBRID MAIZE PRODUCTION IN CHHINDWARA DISTRICT OF MADHYA PRADESH

UDAY KUMAR DHOMNE & R.S. RAGHUWNASHI
Department of Agricultural Economics & Farm Management,
JNKVV College of Agriculture, Tikamgarh, Madhya Pradesh, India

ABSTRACT

Maize is considered the third most important cereal crop after rice and wheat in the world. Hybrid maize under optimum crop production, protection and nutrient management can produce economically more yield as compared to commercial varieties. Recently some new hybrids are evolved and it is necessary to evaluate their comparative performance. There is a wide scope for increasing area and production in the district. In this situation it is essential to know the reasons of low adoption of improved practices. Thus, present study was canvassed to know the existing knowledge and adoption gap among the farming community of maize growers of the Chhindwara district. The study was conducted on 60 hybrid maize growers (20 from each category according to their size of holding) Chhindwara block of Chhindwara district because of having maximum area and production under hybrid maize crop. The findings indicate that total cost per hectare incurred in hybrid maize production on sample farm was Rs. 34700.76 which decreased as the farm size increased. The proportion of operational cost and fixed cost to total cost on sample farm was 63 and 38 of the total cost was alone contributed byowned and family labours which varied between 38 to 40 per cent on different farm. The cost of cultivation according to various cost concepts (Cost A1 to CostC3) in different size of farms decreased as the farm size increased.

KEYWORDS: Hybrid Maize Under Optimum Crop Production, Protection and Nutrient Management

INTRODUCTION

Maize (*Zea Mays.)* is a major cereal crop and emerging as third most important crop in India after rice and wheat. Maize is having special significance because in addition to staple food for human being and quality feed for animals, maize serves as a basic raw material as an ingredient to thousands of industrial products that includes starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceutical, cosmetic, film, textile, gum, package and paper industries etc. It provides the nutritional security as it contains 72% starch, 10% protein, 4.8% oil, 8.5% fiber, 3% sugar and 1% ash. Due to its high yielding potential, it is called queen of cereals. In the world production, India stands in fifth position in terms of corn production. In India in last one decade maize production have shown a tremendous improvement from 11.50 million tonnes to present level of 19.73 million tonnes due to increased average on increasing demand from feed industry, export demand, ethanol production demand etc. At global level, India ranks 4th in area and 7th in production of maize. Agriculture contributes major amount of our gross domestic product, i.e. 14.2%. Maize is grown in 8.26 million hectares in India with the production of16.72 million tones and productivity is 2024 kg/ha. In Madhya Pradesh it is grown in 0.83 million hectare areas with the production of 1.05 million tonnes, and productivity is 1256 kg /ha.

In Madhya Pradesh Chhindwara, Dhar, Jhabua, Betul, Rajgarh and Mandsaur are the major maize producing

districts. Chhindwara district is the leading district in terms of both area as well as production. The total area under maize in this district is about 94.7 thousand hectares with production of 288.7 thousand tonnes in 2013-14. The climatic conditions of the district are extremely suitable for maize crop. Hybrid maize under optimum crop production, protection and nutrient management can produce economically more yield as compared to commercial varieties. Recently some new hybrids are evolved and it is necessary to evaluate their comparative performance. There is a wide scope for increasing area and production in the district. In this situation it is essential to know the reasons of low adoption of improved practices. Thus the present study entitled "Resource use efficiency of hybrid maize production in Chhindwara district of Madhya Pradesh" was conducted.

MATERIALS AND METHODS

The study was conducted in Chhindwara block of Chhindwara district because of having maximum area and production under hybrid maize crop. For selection of respondents a cluster of hire village's producing maximum hybrid maize were selected in consultation with A.D.A. and other officials of Agricultural Department. The list of hybrid maize growers in the selected villages were prepared according to their size of holding viz; small (up to 2 ha), medium (2.01 to 4 ha) and large (above 4 ha). From each category twenty number of hybrid maize growers were selected by simple random sampling method, thus total number of respondents selected was60 in number. The Cobb-Douglas production function was used for estimation of resource use efficiency of recommended hybrid maize technology by the sample farmers. Opinions of the respondents were also sorted out to identify the constraints in hybrid maize production.

RESULT AND DISCUSSIONS

Cost of Cultivation

In the farm management studies costs are viewed from different angles for different purposes. Costs of cultivation are used by the Agricultural Cost and Price commission for fixation of support price of agricultural commodities. Besides this, they are also useful in farm planning and policy making. Therefore, due consideration should be given to cover both fixed and operational costs to operate agriculture as a business and not as a way of life only.

The farmers cultivated hybrid maize crop in 31.74% of the gross cropped area of the sample farm. It is observed from Table 1 that the total cost incurred in cultivation of Hybrid Maize at the overall farm level was Rs. 34700 per hectare which was higher in small farm (Rs. 37180/ha) and lowest in large farm (Rs. 32281/ha) revealed inverse relation with the farm size due to scale economies. The operational cost was Rs. 13864, nearly 40per cent of the total cost and the fixed cost was accounted for Rs. 9058, around 26.10 per cent of the total cost. The labour cost on an average accounted to be 39.95 per cent of the total cost which varied from 40.31 per cent in small farm to 41.35 per cent in large farm. The variation in total labour requirement among different size farms is due to difference in the style of operational practices. Among material cost, seed alone contributed about one-tenth of the total cost lowest (Rs.2700/ha) being in large farm and highest being in small farm (Rs. 3600/ha).

Table 1: Cost of Cultivation of Hybrid Maize on Sample Farm (Rs/ha)

Particulars		Size Group			
		Small	Medium	Large	Overall
Operational Cost					
A. Human labour	Family	3804.08 (10.23)	2696.29 (7.78)	2073.19 (6.42)	2857.85 (8.14)
	Hired	5313.05 (14.28)	5878.46 (16.96)	5608.15 (17.37)	5600.08 (16.13)
B. Bullock labour	Owned	2507.38 (6.74)	2339.15 (6.75)	2505.62 (7.76)	2450.71 (7.06)
C. Machine labour	Owned	980.42 (2.63)	2339.82 (6.75)	3162.45 (9.79)	2160.89 (6.22)
	Hired	2382.98 (6.40)	-	-	794.32 (2.28)
Sub Total		14987.7 (40.31)	13253.72 (38.26)	13350.01 (41.35)	13863.88 (39.95)
Material Cost					
A. Seed		3600.00 (9.68)	3060.00 (8.83)	2700.00 (8.36)	3120.00 (8.99)
B. Fertilizer & manure		4409.79 (11.88)	4390.94 (12.67)	4028.74 (12.47)	4276.49 (12.32)
C. Irrigation		-	-	-	-
D. PPM		140.22 (0.37)	150.75 (0.43)	180.12 (0.55)	157.03 (0.45)
Total material cost		8150.01 (21.92)	7601.69 (21.94)	6908.86 (21.40)	7553.52 (21.76)
Interest on working capital@10%		1156.88 (3.11)	1042.77 (3.01)	1012.94 (3.13)	1070.86 (3.08)
Total operational cost		24294.59 (65.34)	21898.18 (63.21)	21269.81 (65.88)	22487.52 (64.80)
Fixed Cost					
A. Rental value of land		8418.66 (22.64)	8306.66 (23.97)	6500.00 (20.13)	7741.77 (22.31)
B. Depreciation		220.00 (0.59)	430.00 (1.24)	740.00 (2.29)	463.33 (1.33)
C. Revenue/tax		17.00 (0.04)	17.00 (0.04)	17.00 (0.04)	17.00 (0.04)
D. Interest on fixed cost@10%		850.00 (02.28)	840.00 (2.42)	837.00 (2.59)	842.33 (2.42)
E. Total fixed cost		9505.66 (25.56)	9593.66 (27.69)	8077.17 (25.02)	9058.83 (26.10)
A. Total cost (Operational + Fixed cost)		33800.25 (90.90)	31491.34 (90.90)	29346.81 (90.90)	31546.13 (90.90)
B. 10% managerial cost		3380.02	3149.13	2934.68	3154.61
C. Total Cost		37180.27 (100)	34640.37 (100)	32281.66 (100)	34700.66 (100)
Grain production (q/ha)		55.00	53.00	49.00	52.00
By product (q/ha)		57.00	63.00	60.00	60.00

(Figures in brackets indicate percentage to the total cost)

Manure and fertilizer together was responsible to cost 11.88 to 12.67 per cent of the total cost for different size groups. Plant- protection measure cost was around 0.44 per cent of the total cost. Interest on working capital was to the extent of 3.08 per cent of total cost on various sizes of farms. Rental value of land fixed items shared more than one-fourth

(22.31%) of the total cost revealed decreasing trend with farm size in absolute terms. The yield of main product per hectare was found to be 53.00 quintals/ha lowest being in large farm (49 q/ha) and highest being in small farm (55 q/ha), indicating the intensive cultivation of hybrid maize by sample farmers.

COST CONCEPT

Almost every day in farm organization and operation cost consideration enters. It is an important tool for measuring farm business activities. The farm management specialists have specified cost of cultivation into cost A1, A2, B1, B2, Cost C1, and C2& C3. These cost concepts have already been taken up in the methodology chapter. In this section efforts have been made to discuss according to (various costs concepts) cultivation of hybrid maize sample farmers and different size groups of land holdings.

Table 2: Cost of Cultivation of Hybrid Maize According to Cost Conception Sample Farms (Rs. /ha)

S. No.	Cost	Size Group			
		Small	Medium	Large	Overall
1	Cost A1 and A2	20727.51	19684.89	19953.62	20110.00 (57.95)
2	Cost B1	21577.51	20488.89	20790.62	20952.62 (60.38)
3	Cost B2	29996.17	28795.55	27290.62	28694.11 (82.69)
4	Cost C1	25381.59	23185.18	22863.81	23810.19 (68.61)
5	Cost C2	33800.25	31491.84	29363.81	31541.96 (90.90)
6	Cost C3	37180.27	34640.37	32281.66	34700.76 (100)

(Figures in brackets indicate percentage to the total)

The table 2 clearly shows that on an average total cost of (cost c3) Rs. 34700.76 per hectare was required to produce this crop of which 58% comprised for the variable cost commonly known as cost A1and A2. After adding interest on fixed capital to cost A1, the cost went up-to 60% as cost B1 and when imputed value of land was further added it was increased up-to 82 per cent. Thus, 10 per cent cost of the cost C2 when added in this cost, it form total cost or cost C3. Table further inferred that cost A1 to Cost C3 decreases with the increase in size of holding. The per cent of various costs to cost C3 did not show any significant difference among different farms in cultivation of hybrid maize on sample farm.

PROFITABILITY CONCEPTS

In any field of business activity profit is the prime consideration. Thus, how much a farmer earns as net income and family labour income as a producing unit and how much satisfaction he and his family derives as a consuming unit are the major deciding factor in organisation and operation of farm. Hence, in this section efforts have been made to discuss the gross income, net income over operational and total cost, family labour income, input-output ratio, and cost of production of hybrid maize

Table 3: Profitability of Hybrid Maize Production on Sample Farm (Rs/ha)

S.No.	Economic Parameter	Size Group			
		Small	Medium	Large	Overall
1	Total operational cost	24294.59	21898.18	21269. 81	22487.52
	Total cost	37180.27	34640.37	32281.66	34700.76
2	Main produce (Rs./ha)	66000	63600	58800	62400
3	By produce (Rs./ha)	6314	6540	5836	6230
4	Gross income	72314	70140	64636	69030
5	Net income over				
(i)	Operational cost	26217.41	27941.18	23050.19	25736.26
(ii)	Total cost	34133.73	35499.63	32354.34	33995.9
6	Input output ratio	1:1.9	1:2.0	1:2.0	1:1.9
7	Cost of production(Rs/q)	561.20	562.00	629.65	581.03

(Figures in brackets indicate percentage to the total)

From table 3, it is clear that when physical output and by-product are converted into monetary terms the total cost from hybrid maize are Rs. 37,180 Rs. 34,640 and Rs. 32,281 in case of small, medium and large farm with an average of Rs. 34,700 on sample farm. Thus, total cost of hybrid maize decrease with an increase in farm size. Input-output ratio in other words can be termed as the return per rupee of investment. The input-output ratio was more favourable to small farm (1:1.9), followed by medium farm (1:2.0) and large farm (1:2.0). Therefore, it could be concluded that there in a decrease in the ratio of input-output as the size of land holding increase. A glance of the data given in the table 3depicts that per hectare net income over operational cost ranged between Rs. 21269 to Rs. 24294 per hectare. The variation noted reduced in terms of family labour income due to inclusion of a relatively higher imputed value of family labour. The net-income and family labour income decreased with the increase in size of groups. The cost of production per quintal varied from Rs. 561 to Rs. 630 with an average of Rs. 581. It can be said the difference was not quite extra-ordinary between the different size classes.

BREAK-EVEN ANALYSIS

Break even analysis is carried out to arrive at that minimum level at which optimum conditions of cost and returns is equated that is no profit no loss point. The table 4 reveals that selected small farmers will not be at loss even if their actual yield of hybrid maize is lowered by 31.47 qt/ha. Similarly, in case of medium Farman yield lessened by 26.59 qt/ha of the actual yield will be able to cover the total cost of cultivation per hectare. The hybrid maize growers on large farms is at no profit no loss position if yield level on these farms is 20.00 qt/ha. At the overall level hybrid maize yield would remain proposition of no profit and no loss if actual yield declined by 26.14 qt/ha. Thus, the existing cost of cultivation and physical output of crop yielded sufficient profit to the small farmers.

Table 4: Break Even Yield (q/ha) and Price (Rs. /q) Analysis of Hybrid Maize on Sample Farm

Particulars	Size Group			
	Small	Medium	Large	Overall
I. Yield (q/ha) (i) Break even	23.18	23.41	22.00	22.86
II. Actual	55.00	50.00	42.00	49.00
III. Gap	31.82	26.59	20.00	26.14
I. Price (Rs./q) (i) Break even	561.20	562.00	629.65	581.03
II. Actual	1200	1200	1200	1200
III. Gap price (Rs./q)	638.8	638	570.35	618.97

(Figure in parentheses shows percentage change over break- even)

Similarly actual market price of hybrid maize obtained by sample farmers is 1200. Thus, sample farmers are in profitable position in existing yield and price obtained in the study area.

RESOURCE USE PRODUCTIVITY OF HYBRID MAIZE

The regression coefficient of different inputs in the production function were estimated separately for each size group and for the overall sample farms. The estimated values of the regression coefficient of all the input for all the farmers are presented in table 5. The value of coefficient of multiple determination (R2) were found to be quite high in all size groups (82 to 91.1) which indicated that the selected resource in the production function was the best fit.

Table 5: Regression Coefficient of Resources Used in Hybrid Maize Production

Particulars	Size group			
	Small	Medium	Large	Overall
No. of farmers	20	20	20	60
Constant (a)	1.110	1.825	1.946	1.265
Regression Coefficient (b) of				
(X1) Human labour cost (in Rs./ha)	0.135	0.099	0.311*	0.196
	(0.215)	(0.201)	(0.176)	(0.104)
(X2) Machine labour cost (in Rs/ha)	0.452*	0.824**	0.424*	0.464***
	(0.257)	(0.328)	(0.241)	(0.145)
(X3) Seed (in Rs./ha)	0.421*	0.439*	0.375*	0.330***
	(0.239)	(0.249)	(0.213)	(0.084)
(X4) Plant protection (in Rs./ha)	0.120*	-0.021	-0.013	0.009
	(0.068)	(0.100)	(0.045)	(0.032)
(X5) Fertilizers (in Rs./ha)	0.377*	-0.216	-0.107	-0.045
	(0.214)	(0.181)	(0.096)	(0.052)
Σbi	1.057	0.734	0.733	0.954
R2	0.918	0.827	0.848	0.856

(Figures in brackets indicate standard error of regression coefficient)
**** Significant at 10% level of significance***
***** Significant at 5% level of significance***
****** Significant at 1% level of significance***

The return to scale is the sum of the elasticity of resources includes in the power function, which indicates the behavior of change of total return while changing the level of all inputs simultaneously in the same proportion. R2 value was observed to be 0.96 which indicates that functions is best fitted and able to explain the variables (X1 to X5) which were taken and studied to the extent of 96 per cent. At the overall level the sum of regression was 1.057 on small groups 0.734 and 0.733 on medium and large group of farmer, respectively indicating decreasing return to scale in all size groups except small farmers.

The values of coefficient of human labour were found significant in large size category 0.135, 0.099, 0.311*. The value of coefficient of machine labour for all the three size groups was significant at 10 percent level of significance but of overall level of coefficient as found high significance at 1percent of level of significance. It shows that if we increase machine labour investment by 1%, keeping other input factors constant we obtain only 0.45,0.82 and 0.42 present increased production in small, medium and large, respectively.

The values of coefficient of seed for size small, medium and large were observed to be 0.42, 0.43 and 0.37 respectively and were found significant at10% level. It shows that addition of this variable will increase production of the crop. The value of coefficient in all sample size was 0.33 and significant at 5%level which indicated that seed addition in cultivation of hybrid maize crop will increase its production as far as all sample respondents are concerned.

The regression coefficient of insecticide and pesticide for small, medium and large farmer and all sample size groups were observed to be0.120, -0.021,-0.013 and 0.009, respectively. The values of coefficient in medium and large size groups were negative and insignificant but in small group size the value was positive and significant at10% level so it indicates that three is still contribution of this variable in the production of hybrid maize crop in small group of farmer.

The regression coefficients of fertilizer to small, medium and large group of farmer were found to be 0.377, -0.216, -0.107, respectively and was significant in case of medium and large group of farmer. While in case of small farmer the value was positive and significant at 10% level which shows that there was no scope to increase fertilizer in small group of farmer only on production of hybrid maize crop. Overall it could be concluded that variation inhuman labour in large group of farmer machine labour and seed in all the 50three size groups, insecticide and fertilizer only in size group small, will increase the production of hybrid maize crop if increased.

MARGINAL VALUE PRODUCT

The marginal value productivity of each selected input was estimated at geometric mean of gross output and their respective input factors for hybrid maize crop are presented in table 6. The marginal value productivity of human labour for hybrid maize crop were 0.83, 0.61 and 1.42 for small, medium and large size farmers, respectively which shows that an additional rupee invested on small and medium size farmer will add only Rs 0.82 and Rs. 0.61 to the return. It is advisable to invest on this input for hybrid maize production.

Data shows that if we increase the investment on machine labour and seed in all the three size groups will add positive return to the gross income. The marginal value productivity of insecticides and pesticide were 5.12, -0.71 and -0.76 rupees on small, medium and large group, respectively indicated that any investment on this input would bring negative return to the gross income. The MVP of fertilizer was 4.61, -0.425 and -0.78 rupee on small, medium and large farmers group, respectively.

Table 6: Marginal Value of Product of Resources Used in Hybrid Maize Production

Resource	Size Group		
	Small	Medium	Large
	MVPi	MVPi	MVPi
X1	0.828	0.614	1.422
X2	4.262	10.673	4.856
X3	7.964	1.123	5.939
X4	5.120	-0.719	-0.765
X5	4.615	-0.425	-0.787

CONSTRAINTS

Analysis into costs and returns for hybrid maize production of sample farmers discussed in the previous section reveals the fact that many farmers have not used recommended levels of inputs. Therefore, it was thought to find out the constraints, in reaching goal as shown under scientific management. The technological economic and institutional

constraints were reported by the respondents which have been presented in table 7.

Table 7: Constraints in Hybrid Maize Production

S.No.	Constraints	Size Group				Ranking
		Small (N=20)	Medium (N=20)	Large (N=20)	Overall (N=60)	
1	Knowledge about seed variety, rate	15 (75)	17 (85)	16 (80)	48 (80)	II
2	Unavailable irrigation	12 (60)	10 (50)	03 (15)	25 (42)	X
3	Unawareness of NPK dosage	15 (75)	13 (65)	10 (50)	38 (63)	VIII
4	Unfavourable product price	15 (75)	13 (65)	17 (85)	45 (75)	III
5	Unfavourable climate condition	11 (55)	13 (65)	15 (75)	39 (65)	VII
6	Lack of capital	19 (95)	17 (85)	15 (75)	51 (85)	I
7	Attack of disease and pest	14 (70)	13 (65)	15 (75)	42 (70)	VI
8	Low plant population	11 (55)	10 (50)	09 (45)	43 (71)	V
9	Shortage of labour	09 (45)	09 (45)	11 (55)	29 (48)	IX
10	Higher cost of cultivation	17 (85)	14 (70)	13 (65)	44 (73)	IV

(Figures in brackets indicate percentage to the total)

The results shows that the lack of capital was reported as a main constraint in hybrid maize production irrespective of the size of holdings followed by low plant population, less knowledge about seed variety, unfavourable price, high cost of cultivation, attack of disease and pest, unfavourable climate condition, unawareness of NPK dosage, shortage of labour and water scarcity as reported by 80, 75, 71, 70, 65, 63, 48, and 42percent of the house hold. This identified constraints need to minimize through extension service financial assistant for increasing the adoption of production technology and achieving the level of production of hybrid maize on sample farm.

CONCLUSIONS

On the basis of findings it can be concluded that the total cost per hectare incurred in hybrid maize production on sample farm decreased as the farm size increased. The proportion of operational cost and fixed cost to total cost on sample farm alone contributed by owned and family labours. Cost of cultivation according to various cost concepts (Cost A1 to CostC3) in different size of farms decreased as the farm size increased. Thus, sincere efforts are made by the extension personnel to motivate the farmers to adopt non-conventional production technology. KrishiVigyan Kendra should identify the problems of farmers and feedback and solution of constraints be provided in time to the farmers. To raise the fund for hybrid maize research 1 per cent cess/tax be imposed on the farmers who sell their produce in mandi. The accumulated fund be used for location specific research related to increase the hybrid maize productivity. The cost of cultivation incurred in hybrid maize production is reduced by curtailing the labour cost and reallocation of available budgets be made in various production factors to raise the benefit.

REFERENCES

1. Bhalerao MM. 1992. Input used efficiency in Indian agriculture a study ofvegetable and oilseed. Indian Journal of Agriculture Economics, 47 (3):485-486.
2. Chikkappa G, Karjagi, Jat S.L, Parihar CM and Kumar A. 2012. Maize research in India-historical prospective and future challenges. *Maize Journal* 1: 1-6
3. Haque, T. 2006. Resource use efficiency in Indian Agriculture. Indian Journal of Agri. Econ., Vol. 61(2): 65-75.
4. Soni SN, Daraf RK, Karumvanshi SM and Singh R. 1998. Production potential and economic viability of different cropping pattern in Sidhi district of M.P. Advance and Pl. Sci. LL(1): 53-155.