Conclusion,
Discussion and
Suggestion
CHAPTER VIII

Conclusion, Discussion and Suggestion

The conclusion based on the findings of the present study has been discussed in the following heads.

(I) Distribution Structure

It has been observed that 28 per cent farmers of medium group occupied about 55 per cent of total cultivated area whereas 32 per cent of marginal and small farmers together occupied only 8.88 per cent. Thus, it can be concluded that the distribution of area in the present study was found to be uneven.

(ii) Irrigation

The study concluded that the main sources of irrigation of marginal and small farmers were open well and canal covering about 84 per cent of their total cultivated area whereas irrigation sources on medium and large farmers, were tubewell and pumping sets covering 71.23 per cent and 82.27 per cent to their respective total area under irrigation.

(iii) Capital Investment

The analysis of capital investment on the farms of various categories concluded that total investment per farm was positively correlated whereas per hectare it was negatively correlated with the size of farms.
(iv) Cropping intensity

Cropping intensity on the farms of various size of group of selected farms was observed to be negatively correlated with the size of farms.

(v) Cropping Pattern

The analysis of cropping pattern in the present study clearly concluded that percentage area of good grains specially of wheat and bajra was observed to be significantly higher on marginal and small farms as compared to medium and large farmers to total cropped area showing negative correlation with the size of farms.

(vi) Human labour availability and utilization

The present study concluded that the availability and utilization of family labour was significantly higher on marginal and small farms as compared to medium and large farms whereas the utilization of hired human labour per farm as well as per hectare indicated positive and significant correlation with the size of farm. Further, the study also concluded that family labour utilization of total human labour utilization revealed negative correlation with the size of farms.

(vii) Bullock labour and tractor power utilization

The findings in respect with the above concluded that the utilization of bullock labour was observed to be negatively correlated whereas utilization of tractor power came to positively correlated with the size of farm.

Infrastructure of different system dealing with distribution of fertilizers

(i) Socio-economic status

The analysis of socio-economic status in the present study concluded that majority of marginal farmers being 60 per cent to total selected farmers were found to be of lower socio-economic status whereas only 7 farmers (58.33 per cent) from small group and only 2 farmers (5.00 per cent) from medium farmers and
nil from large farmers to their respective total selected farms belonged to lower social-economic status. Almost similar results were advocated by Chaudhary (1972), Singh (1977), Sharma (1975).

(ii) Education of knowledge

The present study concluded that about 15 per cent of selected farmers were found illiterate and the rest 85% were literate. The educational standard increased with the increase in the size of holding whereas negative correlation was observed between illiterature and size of farm. Similar conclusions were advocated by Misra (1976), Bose and Gupta (1962).

(iii) Age group

The analysis of age of the selected farmers, concluded that 54 per cent of the selected farmers belonged to age group with in 25-50 years of age whereas about 30 and 16 per cent fall in the age group of above 50 years and below 25 years of age respectively. Almost similar results were obtained by Singh (1977) and Sharma (1978).

(iv) Caste distribution

The findings of caste distribution concluded that about 47 per cent of total selected respondents belonged to backward class and 30 and 23 per cent to schedule and upper class group respectively. The per cent age of schedule caste indicated negative correlation, whereas backward and upper class showed positive correlation with the size of holdings. Similar results were reported by Sharma (1978) and Singh (1977).

(v) Type of family

The study of type of family concluded that 60 per cent of the selected farm families belonged to joint family system and showed positive correlation with the
size of farm whereas 40 per cent families belonging to single family system indicated no relationship with the category of farm size.

**Mechanization**

The analysis of mechanization on the selected farms concluded that 36 per cent was as high mechanized farms showing positive correlation with the size of farm. About 48 per cent of selected farms was found as medium mechanized farms and only 16 per cent belonged to lower type of mechanization with negative correlation with the size of farm.

**Scientific orientation**

Scientific orientation study concluded that about 39 per cent to total selected farms were found to be high scientific orientation and showed positive correlation with the size of farm, 53 per cent of the selected farm belonged to medium scientific orientation. Only 8 per cent farmers was found in low scientific orientation and indicated negative correlation with the size of farm.

**Risk orientation**

The risk orientation analysis concluded that about 31 per cent to total selected farmers was observed to be high risk orientation showing positive correlation with the size of farm. On the contrary, 20 per cent belonging to low risk orientation indicated negative correlation with the category of farms. Maximum selected farmers being 49 per cent were observed to be medium risk orientation having to relationship with the size of holdings. Similar observations were advocated by Singh (1972) and Sharma (1978).

**Participation in social organization**

The study of participation in social organization concluded that 57 per cent of total selected respondents participated in 1-2 organization and revealed negative correlation, whereas the farmers participated more that two organization
constituted 39 per cent showed positive relationship with the size of farms. Similar results were observed by Singh (1977).

**Infra-structure of fertilizer distribution agencies**

The analysis of infra-structure of fertilizer distributing agencies concluded that maximum quantity of fertilizer was distributed by the cooperatives being 55.15 per cent in the district under study during 1992-93 with 25.42% of total sale points, 31.25 per cent buffer godowns and 21.95 per cent working staff to total number of sale points, buffer godowns and working staff of various agencies. The respective figure for Private Agencies and Department of Agriculture of the State were observed to 34.75, 59.33, 46.88 and 48.75 per cent (Private Agencies) and 21.87, 15.75, 21.87 and 29.27 per cent in the Department of Agriculture of the state. Similar results were advocated by Misra and Ram (1966), Singh et. Al (1970), Lal (1976), Mittal (1976) and Siddar (1976).

**Preference of selected farmers for fertilizer distribution agencies**

The preferred cooperative, showing positive correlation followed by 33 per cent to private analysis of preference concluded that 54 per cent to total selected farmers agencies indicating negative correlation with the size of farms. The department of agriculture of the state was preferred only by 13 per cent of the selected farmers.

**Distribution of fertilizers by different agencies to selected farmers**

The analysis of fertilizer distribution to the selected farmers concluded that about 60 per cent to total quantity distributed to the selected farmers was shared by private agencies followed by cooperatives being 40 per cent. As regards distribution to fertilizer to large and medium farmer, the role of private agencies was observed to be significantly higher as compared to cooperatives. On the contrary, reverse trend was observed in the case of small and marginal farmers.
wherein the role of cooperatives in the distribution of fertilizers was found to be significantly higher as compared to private agencies.

**Consumption pattern of fertilizer**

The analysis of fertilizer consumption in the form of NPK in the district Sawai-Madhopur for the period from 1990-91 to 1992-93 showed positive relationship with the period in review.

**Consumption pattern of different types of fertilizer under different category of farmers**

The analysis of consumption of different types of fertilizer on the selected marginal farms concluded that the consumption of urea and DAP per hectare on marginal farms was maximum on wheat being 206.75 kg and 113.92 kg representing 71.01 and 58.06 per cent to their respective total consumption on all crops. The consumption of urea per hectare was observed to be minimum on other crops being 61.68 kg whereas the consumption of DAP was found to be minimum on mustard being 27.62 kg per hectare. Almost similar trend of consumption of urea and DAP on various crops on small farms was observed. On the small farms, the consumption of urea and DAP per hectare was again maximum on wheat being 123 kg and 123 kg constituting 61.23 and 63.83 per cent to their respective total consumption on all crops. The consumption of both fertilizer was observed to be minimum being 24.73 kg per hectare in each case representing 18.37 per cent in the case of urea and 19.15 per cent of DAP on other crops. The analysis of consumption of urea and DAP on different crops of medium and large farms concluded that the consumption of urea and DAP per hectare was observed to be significantly higher on wheat on medium farms being 86.54 kg and 63.08 kg (24.46 and 20.45 per cent) as compared to the large farms being 77.01 kg and 49.14 kg (58.49 and 42.81 per cent to their respective total consumption on all crops). Minimum consumption of urea being 61.30 kg constituting 13.15 per cent to total consumption on all crops was found on mustard crops on the medium
farms which was significantly higher as compared to large farms being 17.70 kg (10.99 per cent). On the contrary, the medium consumption of DAP per hectare on large farms was observed on bajra being 10.88 kg representing 9.10 per cent to its total consumption on all crops.

The analysis of over all average consumption of urea and DAP on different crops concluded that the consumption of urea, DAP and their total per hectare was observed to be significantly higher on wheat being 105.73kg, 63.36 kg and 169.09 kg constituting 44.09, 32.78 and 34.93 per cent to their respective total on all crops as compared to various other crops grown on the selected farms. Minimum consumption of urea per hectare on the selected farms on an average was found on mustard being 31.25 kg (10.59 per cent) whereas in the case of DAP, the minimum consumption was on bajra being 24.78 kg (1.99 per cent).

The consumption of SPP was confined only to the crops of groundnut and other crops to the extent of 161.06, (81.98 per cent) and 3.05 kg. (18.02 per cent) respectively. The study also concluded that on an average of all selected farms, the quantity of urea, DAP, SSP per hectare was observed to be 55.24 kg, 44.50 kg and 7.02 kg respectively.

Similar results were also advocated by Jha and Shakawat (1972), Mahboob and Jiaul Karim (1974) and Sundaram (1976).

Consumption of fertilizer (NPK) and cropping pattern

The analysis of fertilizer in the form of NPK on different crops on the selected farms as a whole concluded that the consumption of nitrogen per hectare on wheat was found to be maximum being 53.19 kg which was observed to be significantly higher to all other crops grown on the farms. Next to wheat other crops were the prominent consuming nitrogenous fertilizer to the extent of 29.93 kg per hectare followed by bajra 22.12 kg, mustard 21.11 kg and groundnut 12.31 kg. On the other hand, the consumption of phosphatic (P) fertilizer was observed
to be maximum on ground nut (32.58 kg) followed by wheat (30.58 kg) other crops (23.00 kg), mustard (17.51 kg) and bajra (10.20 kg) only per hectare.

The average consumption of N and P for all crops as a whole for all selected farms came to 31.99 kg and 22.33 kg per hectare respectively.

It was also concluded that other crops occupied maximum share being 38.83 per cent and 42.72 per cent followed by wheat (38.31 and 31.54 per cent) of the respective total consumption of N and P on all selected farms.

The contribution of mustard, bajra and groundnut to the total consumption of nitrogen and phosphorous of all selected farms came to 12.36 and 14.54 per cent, 9.14 and 6.04 per cent and 1.37 and 5.19 per cent respectively. Similar results were observed by Tyagi (1978), Tewari and Sharma (1975), Lal (1976), Pandey and Shah (1977).

Consumption of fertilizers in the form of NPK on various categories of farms under study

As regards, the consumption of NPK on the farms of different categories for farmers in concerned, the present study concluded that the consumption of N fertilizers almost in all crops was significantly higher on marginal and small farms as compared to medium and large farms, indicating negative correlation with the size of farms. Almost similar trend was observed in the consumption of (P) fertilizer among the farms of different categories except on the medium farms on which the consumption of (P) was found to be significantly higher as compared to small farms. It was also concluded that average consumption of N and P fertilizers for all crops as a whole was observed to be maximum being 54.66 kg and 31.25 kg with the ratio of 1.75:1 on the marginal farms respectively followed by medium farms being 50.36 kg and 31.75 kg in the ratio of 1.59:1, 36.16 kg and 25.98 kg in the ratio of 1.34:1 on small farms whereas same was found to be lowest on large farms being 17.96 kg and 14.24 kg with the ratio of 1.26:1.
From the above conclusions, it can be inferred that the farmers of medium sized farmers were enlightened, initiative and well versed in the consumption of N and P fertilizers for almost all the crops except wheat in the study area. On the contrary, the farmers of marginal and small farmers were observed to be more anxious in using more quantity of N and P fertilizers on good grains crops specially on wheat in order to produce more quantity of wheat to meet out family needs. It has also been observed that the farmers of large farms were using N and P fertilizers to very limited quantity as compared to other sized farms. Similar results more or less were referred by Meena (1989).

Consumption of fertilizers in the form of NPK on different crops grown on the farms of various categories of farmers

The analysis of consumption of NPK on various crops grown on the farms of different category of farmers concluded that the consumption of N and P fertilizers in the case of wheat were observed to be significantly higher on marginal farms as compared to the farms of other size of groups indicating negative significant correlation with the size of farms highest being 112.70 kg (N) and 52.40 kg (P) per hectare in the ratio of 2.15:1 on marginal farms, 78.72 kg (N) and 56.58 (P) in the ratio of 1.39:1 on small farms, 51.16 kg (N) and 29.02 kg (P) in the ratio of 1.76:1 on medium farms on 44.24 kg (N) and 22.60 kg (P) in the ratio of 2:1 on large farms.

It was also noticed that the consumption of N and P fertilizers on mustard crop was observed to have significant and positive correlation with the size of farm except on the farms of medium farmers, whereas in the case of other crops, the consumption of N and P fertilizers was found to be negatively correlated with the size of farms except on the farms of medium farmers.

The consumption of potassic fertilizer per hectare was confined to ground nut, bajra and other crops being 14.20 kg, 1.81 kg and 0.34 kg respectively only
on medium farms. Similar results advocated by Lavania and Misra (1972), Misra (1975).

Consumption of fertilizer and irrigation facilities

The analysis of relationship between consumption of fertilizer and irrigation facilities available on the farms of different category indicated significant correlation of consumption of fertilizer (N + P) with the per cent age irrigated area on the farms of different category.

The consumption of both (N + P) fertilizers and irrigated area as found to be maximum being 85.91 kg and 84.61 per cent on marginal farms and minimum being 32.20 kg per hectare and 35.54 per cent irrigated area on large farms, indicated complementary relationship between consumption of fertilizer and irrigational facilities.

Multiple regression equation on the adoption of recommended doses of fertilizer on wheat and bajra

The analysis of multiple regression equation of seven independent variables on the adoption of recommended doses of fertilizer on wheat and bajra crops on the selected farms clearly indicated that 77 per cent variation in the adoption of recommended levels of NPK on wheat and bajra was due to these independent variables. The analysis of regression equation concluded that out of seven independent variables, knowledge (X1), socio-economic status (X2), education (X4) and social participation (X5) were found non-significant. Only sources of information (X7) and Farm implements (X6) were observed to be most important variables contributed maximum influence in the adoption of recommended levels of fertilizers on the selected farms.

CROP ENTERPRISE ANALYSIS
Economic analysis of wheat

I. Cost Structure

The study of distribution of total cost per hectare on various input factors on wheat concluded that human labour cost was observed to be negatively correlated with the size of farms whereas hired human labour cost indicated positive correlation with the size of holdings. The analysis of cost also revealed that the consumption of fertilizers was significantly higher more than double on marginal and small farms as compared to large farms. The cost of irrigation and overhead cost showed negative correlation whereas cost of plant protection and interest on capital indicated positive correlation with the size of farms and showed complementary relationship with the consumption of fertilizers.

As regards, the contribution of various cost to total cost, the study concluded that the contribution of manures and fertilizers and irrigation were found to be negatively correlated with the size of farm whereas the contribution of plant protection measures and interest on working capital indicated increasing trend with corresponding increase in the size of farm.

The contribution of human labour and bullock labour cost to total cost of wheat were observed to be maximum and significantly higher as compared to the cost of other input factors. Similar results were observed by Singh (1966).

II. Yield and value of output

The yield of wheat per hectare was found to be negatively correlated with the size of farm and was in consistence complementary relationship with the cost of manure-fertilizer and cost of irrigation. It was also observed that the cost of production per quintal of wheat was positively correlated whereas the cost of
production of its by product was found to be negatively correlated with the size of farms. Similar results were observed by Gangwar and Chhikage (1974).

**III. Returns over operating and fixed cost**

The analysis of returns of gross output per hectare over operating and fixed cost showed negative correlation with the size of farms. Similar trend was observed in the case of input-output ratio and cost-price ratio. On the contrary, the cost-price ratio of wheat was found maximum on large farms and minimum on marginal farms.

**IV. Measures of farm profit and efficiency**

The analysis of measures of farm profits concluded negative correlation of net income, family labour income and farm business income and their respective share to total value of output with the size of farms. Further, the net income per hectare of wheat was found in consistence with the fertilizer consumption on the farms under study.

**V. Return to capital investment and per rupee return to fertilizer consumption**

The return to capital investment and return per rupee investment of fertilizer revealed positive correlation with the size of farm. It was concluded that the wheat growers were getting on an average of Rs. 5.20 per rupee investment on fertilizer consumption.

**VI. Financial test ratios**

The analysis of financial test ratio did not show any significant deviation on the farms of various size group.

**VII. Return to fertilizer use and benefit-cost ratio**

The analysis of per cent age return to fertilizer investment and benefit-cost ratio showed positive correlation with the size of farm with an overall average of
520 per cent and 6.20:1 indicating thereby, that the selected farmers on an average were getting additional benefit of Rs. 5.20 by investing rupee one on the fertilizer.

**Economic analysis of bajra**

**I. Cost structure**

The analysis of cost structure of bajra showed negative correlation of total human labour and total family human labour cost per hectare with the size of farms whereas hired human labour cost per hectare was found to be positively correlated with the size of holdings. Further, the cost of bullock labour per hectare indicated negative trend whereas the cost of tractor power was found to be positively correlated with the size of farm. Similarly, the cost of plant protection measures, interest on working capital and over-head cost per hectare indicated increasing tendency with the increase in the size of farm. The cost of manures and fertilizer was found maximum on the farmers of medium farmers and minimum on large farms.

Similarly, the total cost per hectare of bajra was found maximum on medium farms and minimum on large farms, which were in consistence with the cost of manure and fertilizer.

As regards, the contribution of various input factors is concerned, the analysis concluded almost similar increasing trend of contribution various input factors to the total cost on the farms of various size group. The contribution of operating cost showed negative trend whereas the contribution of fixed cost to total cost indicated positive tendency with the increase in the size of farm.

**II. Yield and value of output of Bajra**

The present study revealed that the yield of bajra grain and its total value per hectare was found to be significantly higher on medium farms as compared to the farms of other size groups which were in consistence with the consumption of
manures and fertilizer on various farms under study. On the contrary, the cost of production per quintals of bajra grain was observed to be minimum on medium farms and maximum on the farms of small farmers.

**III. Return of output over operating and fixed cost per hectare**

The return of output over operating and fixed cost per hectare was observed to be significantly higher on the medium farms as compared to the farms of other size groups, more or less, similar trend was found in the case of cost-price ratio both of bajra grain and its by-product.

**Measures of farm profits and efficiency**

The analysis of measures of farm profits concluded that the net income, family labour and farms business income per hectare of bajra were observed to be significantly higher on medium farm as compared to the size of other farms. On the contrary, the share of net income, family labour and farm business income to total value of output showed positive correlation with the size of farms.

**Return to capital investment and per rupee investment on fertilizer**

The study concluded that the return to capital investment showed increasing trend with the increase in size of farm exception large farm on which it was observed to be a bit lower as compared to medium farms. On the other hand, return to per rupee investment on fertilizer indicated positive correlation with the size of farms except on the medium farms on which it was lowest.

**Financial test ratio**

The analysis of financial test ratios did not indicate any relationship with the size of farm. However, the gross, operating and fixed ratio were observed maximum on the farms of small farmers whereas gross ratio was found to be minimum on marginal farms indicating more efficiency in farm operation on these
farms as compared to the farms of other size groups in getting same value of output by incurring lesser total cost.

**Benefit cost ratio**

The benefit cost ratio was observed to be inversely correlated with the investment on fertilizer on the selected farms. The study of benefit cost ratio clearly concluded that there is much scope of increasing the investment on fertilizers especially on large farms to maximize the production of bajra crop per hectare.

**REGRESSION ANALYSIS**

**1. Consumption Function of Fertilizer**

Cobb-Douglas type of regression function was fitted to assess the impact of some independent variables like gross cropped area \((X_1)\), Gross irrigated area \((X_2)\) Area under HYV \((X_3)\), Annual rainfall \((X_4)\), Time element \((X_5)\) on fertilizer consumption in the district under study. The analysis of above function indicated that the value of \((b_x1)\) was found to be negative but non-significant having negative effect on the consumption of fertilizer \((Y)\). The value of \((b_x4)\) and \((b_x5)\) were observed to be positive but non-significant indicating no effect of these variables on fertilizer consumption. Only two independent variables \((X_2)\) and \((X_3)\) were observed to be significant and positive being 0.801 and 0.944, indicating much effect on the consumption of fertilizer in the study district.

Further, the analysis of matrix of simple correlation co-efficient between dependent variable \((Y)\) and independent variables \((X_1 \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots ..
analysis it is concluded that the fertilizer consumption in district Sawai-Madhopur, was very much influenced by above mentioned independent variables viz. X2, X3 and X5. The analysis also indicated that the gross cropped area affected the fertilizer consumption negatively.

2. Production function of wheat

(i) Regression equation

Cobb-Douglas regression equation was fitted to express the yield of wheat (Y) as a function of various inputs. An examination of co-efficient of multiple determination (R2) of wheat concluded that the human labour cost (x1), manure-fertilizer cost (X4) and cost of irrigation per hectare (X5) claimed 81 per cent variation in the yield of wheat on all selected farms as a whole.

(ii) Elasticities of production

A critical examination of elasticities of production clearly revealed that the production elasticities (b) of human labour, manure-fertilizer and irrigation were found positive and significant and less than one concluding there by diminishing return to each significant individual input variable whereas production elasticities of bullock labour and seed came to non-significant, showing no effect on the production of wheat.

(iii) Marginal value productivities

The analysis of marginal value productivities of significant variable showed high value of marginal value product of manure-fertilizer and irrigation concluding greater scope of higher production of wheat by increasing the level of manure-fertilizer and irrigation up to state. It was also observed that present level of consumption of fertilizer on the selected farms was very low than that of recommended level as well as optimum level. Further, since the value of marginal value product of bullock labour and seed was not found significantly higher than
that of their respective prices, concluded no scope to increase the level of these inputs.

(iv) Optimization of input factors

Comparison of optimal and existing levels of various input variables on the sample farms as a whole concluded that the optimal levels of fertilizer and irrigation were significantly higher as compared to their existing levels. Just reverse trend was observed in the case of bullock labour cost and seed. The above findings finally concluded that the production of wheat per hectare can be maximized simply by reallocation of farm inputs and shifting the funds spent on human, bullock labour and seed in favour of fertilizer and irrigation upto the stage of optimal levels.

(v) Maximization of production of return of wheat

A critical examination of fitted regression equation concluded that the yield of wheat can be increased under optimal level of inputs to 41.76 quintals from 30.72 quintals at existing levels of inputs simply by optimization and reallocation of variable inputs under capital constraints resulting and additional yield of wheat of 11.04 quintals per hectare valuing Rs. 2870.40 on the sample farms over and above of original level of net income.

Production function of bajra

Only four independent input variables were taken in the regression equation. A critical examination of above equation concluded that production elasticity of human labour (X1) and manure-fertilizer (X4) were observed positive and significant whereas bullock labour cost (X2) and cost of seed were found to be non-significant indicating there by that about 85 per cent variation in the yield of bajra on the selected farms as a whole was due to these two significant variable inputs. Further, the analysis of marginal value productivity of manure and
fertilizer was observed to be significantly higher being Rs. 4.14 than that of its price concluding greater opportunity of higher production of bajra per hectare by increasing the level of fertilizer on the selected farms. As regards optimization of input variables, the analysis concluded optimal level of manure-fertilizers was significantly higher than that of its existing level whereas the same in the case of bullock and human labour cost were observed to be significantly lower as compared to their respective optimal levels revealing thereby that shifting and reallocation of available funds used on human labour and bullock labour in favour of manure fertilizer may maximize the production of bajra per hectare on the sample farms.

Similarly, the critical examination of regression equation clearly concluded that yield of bajra per hectare can be maximized to 19.50 quintals from its existing level of 15.81 quintal showing an additional yield of 3.69 quintals valuing Rs. 590.40 simply by shifting and reallocation of variable inputs under capital constraints over and above original net profit. The surplus bullock and human labour may be used in subsidiary occupation like marketing of produce of hire basis poultry farming and keeping of mulch cattle etc. More or less similar findings were reported by Agarwal (1964-65), Agarwal and Foreman (1954) Saran, Ram (1969) Gangwar and Chhikage (1974) and Singh and Paul (1974), Azad (1986) and Srikant and Acharya (1989) and Nirmala (1991).

**Suggestions and recommendation**

Before dealing the suggestions, it is felt necessary to focus upon the constraints responsible for low level of fertilizer consumption, based on the findings of the present study as well as according to the explanation of the selected respondents and scientist.

**The constraints**
1. The study observed that about 41 per cent of farmers were not using fertilizer due to lack of irrigation, about 40.88 per cent due to small size of holdings, 30.16 per cent due to non-availability of fertilizers in time, about 29 per cent due to lack of financial resources and about 22 per cent due to ignorance of profitability of fertilizer use.

2. The study also indicated that about 8 per cent of the selected respondents were not adopting recommended fertilizer practices due to lack of knowledge and 50 per cent due to higher fertilizer prices. Faith in the deterioration in the fertility of soil due to use of chemical fertilizer was also observed for not adopting the recommended level of fertilizers.

3. The main reasons for low level of consumption of fertilizers in comparison to targets have been
   - Natural causes such as drought, floods and attack of pests and diseases in some states.
   - Lack of availability of credit for distribution of fertilizer.
   - Gaps in extension and promotional effects.
   - Inadequate and inefficient fertilizer distribution arrangement and system.
   - Unfavourable price-ratio between inputs and product received.

4. Some selected respondents highlighted the causes of non-adoption of fertilizer recommendations as inadequate and untimely supply along with high price, increasing crop susceptibility to pest and diseases, development of acidity and consequent deterioration of physical condition of soil.

5. Some selected respondents also reported high risk and uncertainty along with high cost of production, non-availability of fertilizer in the villages, deterioration in the taste of produce and adverse effect of fertilizer on the soil fertility to be main causes for not adopting fertilizer recommendations.

6. Some authors like Bansel and Jechemits advocated that transport, demand, higher cost, reliability on recommendations in-adequate information on the type and quantity of fertilizer, inadequate demonstration and extension services to provide the technical know-how on the efficient use of fertilizer, unfavourable relationship between the fertilizer and produce prices, in-
adequate marketing system of agricultural produce are some of the factors which discourage the farmers in the economic use of fertilizer.

7. Currey (1985) identified the causes for non-adopting the recommended levels of fertilizers as logical problems, poor distribution procedure and system, low fertilizer use efficiency, uncertainty attached to obtaining economic returns and not adopting other aspects of crop production like improved varieties of crops and use of irrigation.

8. Lack of soil testing fertilities was reported by all selected farmers as a constraints of fertilizer use.


Suggestions and recommendations

In order to solve the problems responsible for low level and in-efficient use of fertilizers in the study area, following suggestions and recommendations based on the conclusions of the present study can be made to all the persons who are directly or indirectly involved in the production, distribution, promotion and consumption of fertilizers more efficiently, technically and in accordance with recommended levels.

1. The conclusions of the present study clearly insighted the facts that the influence of socio-physiological variables like education, factors effecting economic status, size of farm, socio-economic status, social participation, training in scientific farming, mechanization and risk bearing capacity have been found directly correlated with the consumption of fertilizer. Hence, it
is suggested that the Government extension workers, scientist, agriculture university authorities, K.V.K. workers should adopt the following measures in order to make the farmers more enlightened in the use of fertilizers.

2. The government should extent the education facilities in the rural sector by starting at least one higher secondary school in each panchayat area.

3. The Government should start crop insurance plan for each crop especially for food grain and commercial crops and also announced the minimum support price in advance in order to increase the risk bearing capacity of farmers.

4. The extension workers, KVK authorities, Govt. agricultural department and fertilizer manufacturers should organize fertilizer demonstration on the farmers fields to let them know the impact of fertilizer on crop production and should organized Kisan Mela, Agril. Based exhibition and short training camp for transferring latest advancement technology in crop as well as animal husbandry and also distribute the latest literature in respect of the above to the farmers. The farmers are advised to come forward in participating in the social organization in order to increase their social status. It is also suggested that the fertilizer manufacturers, other agencies involved in the distribution of fertilizer should together come forward for the promotion and distribution of fertilizer and to assess the farmers on the basis of their traits.

5. The cooperatives have been observed to serve the farmers well in respect with the distribution of fertilizer to the respondents. It is suggested that cooperative structure should further be strengthened and the methods and procedure should be simplified and effective.

6. Most of the sale points of fertilizer belonging to various distributing agencies are found to be located either at selected sub-division or in semi-urban area of the district. Hence, it is suggested to evolve a specific location
of sale point for promoting fertilizer consumption in the study area. It is also suggested that at least one sale point should be located at Gram Panchayat level, if it is not possible at village level.

7. The consumption of NPK nutrients in the study area has not been found as per recommendation and no manufacturer of fertilizer has fixed the ratio of NPK for balanced fertilizer. Hence, it is suggested that all manufacturers of fertilizers should fixed similar and same ratio of NPK in consultation with the agriculture university experts.

It is noted that the fertilizer dealers store only nitrogenous fertilizer due to its great demand. It is suggested that fertilizer dealers should also pay more emphasis on the use of complexes and also store the balanced fertilizer to create the demand in the consumption area. Agriculture universities, department of agriculture of the state and manufacturers of fertilizers should organize short training programme for the farmers, extension workers and dealers to make more effective use of balanced nutrients.

8. In view of services rendered by department of agriculture, cooperatives and private agencies in the field of promotional activities, distribution of literature, conducting field demonstrations and documentary film show, provision of loans, it is suggested that all distributing agencies should formulate common programme of availability of credit, technical known-how and better sale services. It is also recommended that small packets of NPK should also be made available by the manufacturers particularly for small and marginal farmers.

9. It is observed in the present study that major sources of information in respect with the proper use of fertilizers to the farmers viz. the progressive farmers, demonstrations, exhibition, Kisan Mela, Farmer’s day, Farmers’ Training centres etc. are not found effective. It is therefore recommended that a tailor made extension literature on rational use of fertilizers for different crops and for different areas of the state should be published and
distributed to the farmers. This task should be assigned to agricultural universities of the state. Side by side soil testing and soil crop rotation study should also be conducted to educate the farmers about the judicious use of different fertilizers.

10. In response of general complaint of the selected farmers regarding the increase in the price of fertilizer day by day causing the decrease in the consumption of fertilizer, it is suggested that the price of fertilizer should be fixed in accordance with benefit-cost ratio and the parity in the price of fertilizers and the product produced should be maintained in order to accelerate the consumption of fertilizer and income of the farmer.

11. It is observed from the present study that on the whole of selected farms, the irrigation was confined to about 54% of the cultivated area. It was also observed that the main sources of irrigation on the small and marginal farms were confined to open well and canal covering 84% of the cultivated area which can not be considered as an assured sources. In view of the above facts, it is recommended that government should extend the minor irrigation projects by installing tube-wells at a faster rate mainly for small and marginal farmers. Side by side, it is suggested that the big farmers should install the tube-wells at their own cost and should provide irrigation facilities to small and marginal farmers at a cheaper rate.

12. In view of observations of the present study in respect with uneven distribution of land in the study area. 1/3rd selected farmers owned only 9 per cent area whereas 2/3rd farmers owned 91 per cent of total cultivated area, hence it is suggested that the Government should take legal step to decrease the disparity in the possession of land and the excess land possessed by the big farmers under ceiling of land act should be taken up and distribute it either to land-less labours or to the marginal farmers. Further, the land possessed by Gram panchayat should also be distributed to the marginal farmers.

309
13. The present study visualized that the consumption of fertilizer per hectare on the marginal and small farmers was significantly higher as compared to medium and large farms. In view of the above conclusion, it is suggested that the small and marginal farmers should be given more emphasis and priority in the allotment of fertilizers in accordance with their requirement.

14. It is a general feeling of the selected respondents and other selected officers that in order to create a significant impact on agricultural productivity through efficient use of fertilizer, it is suggested that the farmers awareness of the agronomic potential to be derived for the use of NPK at the recommended levels. The physical availability of fertilizer stock should be within easy reach of the farmers at the time of planting. The prices of fertilizers should be relative to the additional income expected from the crops. The distribution policy should be motivated at macro-cum-micro level to promote the sale of fertilizer.

15. Mittal in his report of 1986 suggested that the fertilizer should be stored at a strategic location nearer to consuming centres. This system will save time required for supplying the fertilizers and will ultimately reduce the pressure on storage in the factories, godowns and silos and will also reduce the stress on transportation. Ready availability of fertilizer ensures sales when ever and where ever required.

16. It is observed that the marketing cost of fertilizers including transportation, storage, packing, advertising and credit etc. accounted a major share of the cost of fertilizer, which is to be paid by farmers. It is therefore suggested that efforts should be made by all concerned personals to reduce the marketing cost by advertising the trade mark of different fertilizer manufacturer together and combined instead of individually. The reduction in the marketing cost will significantly effect on the economics of fertilizer use.
17. Karim (1976) advocated that the fertilizer policy should include "Ensuring harmonies and balanced expansion in both supply and utilization of fertilizer in time with food production objectives. He also suggested to avoid cyclical balances between supply and demand.

18. It has been observed during the course of present study that most important problems faced by the selected farmers were:

❖ High cost of production of crops due to high prices of fertilizers along with other inputs like insecticides and pesticides.
❖ Inadequate and non-availability of right type of fertilizer in right time.
❖ Inadequate and untimely availability of finance from financing institutions.
❖ Lack of technical know-how in the use of fertilizer.

Hence, it is suggested that the following steps should be taken up by all concerned authorities and extension workers to push up fertilizer consumption.

❖ Reduction in the fertilizer prices.
❖ Financial provision should be made available to farmers as and when required and lending procedure should be simplified.
❖ Right type of fertilizer at right time should be provided to the farmers in their villages or near by places.
❖ Technical information in respect with efficient use of fertilizer should be communicated to the farmers.
❖ Incentive minimum support price should be made available.
❖ Crop insurance scheme should be formulated for each crop in order to increase their risk bearing capacity.
❖ Adulteration in fertilizer should be checked and trader involved in such spurious work should be penalized.
❖ Soil testing facilities should be made available at village level.
❖ Crop wise Recommendations regarding the balance use of fertilizers should be made.
❖ Proper awareness should be developed among the growers about the merit and demerits of the chemical fertilizers.
❖ To check the adulteration of chemical fertilizer, testing laboratories should be developed at tehsil headquarters.
❖ There should be well knitted linkage between growers and suppliers of chemical fertilizers.