Factor Inputs Use and Farm Productivity on Different Farm Categories in the Punjab

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The question of relative farm efficiency, reflected by various productivity indices, under different farming situations and arrangements such as farm size and tenure, has been the focus of attention of development economists for a long time. It is also a matter of considerable interest and concern for the politicians and policy makers, especially, in developing countries striving to increase their farm production. Empirical studies under traditional agricultural conditions [4, pp. 815-34] indicated higher output per acre obtaining on small farms as compared to large farms because of intensive cultivation practised on the small farms. With the introduction of "Green Revolution" technology the debate about the distribution of gains of new technology and its impact under different farming situations has assumed special significance. Under increasing population pressure, deteriorating land man ratio in most of the developing countries and rapidly changing agricultural environments, it is important to know how different farm categories compare with each other in terms of their factor inputs use and farm productivity in order to chart out a course of action for increasing farm output. This paper using micro level farm data compares the use of various factor inputs and farm productivity prevailing on different farm categories. These data relate to 1972-1973 cropping year and were collected through a field survey in which 192 farmers operating farm area of upto 50 acres and located in 16 villages of Gujranwala and Sahiwal districts of the Punjab were interviewed.[1] It is hoped that the analysis attempted here will be of some help in providing guidelines for agricultural development in the province.

Findings of the field survey are presented in the following sections. The use of conventional and modern factor inputs, *i.e.*, manual and bullock

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[1]This survey was conducted in connection with the author's doctoral dissertation [7]. For details of sampling procedure, please, refer to [7, 8, pp. 397-415].

labour, farm yard manure and chemical fertilizers, on important crops, on different farm size categories is compared and discussed in the following section. This section also compares the use of chemical fertilizers on sample farms by grouping them according to different tenurial arrangements and the quality of management. Following this comparison of farm productivity of Mexi-Pak wheat, *basmati* rice, cotton and sugarcane on various farm categories is provided. Productivity is defined as the ratio of output to factor inputs. For each factor input a separate productivity index may be computed. But, in this analysis, farm productivity is defined as the ratio of total production to crop acreage for a given crop or in other words the average yield per acre. As most of the fixed costs and other inputs are likely to vary with crop acreage this may serve as a relatively better measure than various partial measures of productivity. Discussion about farm productivity like the one about factor input use is organized according to farm size; farm tenure; and farm management. In addition to these a brief discussion about farm productivity on farms classified according to fertilizer use/non use is also provided. Finally the summary of the salient findings is presented alongwith a brief discussion of the policy implications.

INTENSITY OF FACTOR INPUTS USE ON DIFFERENT FARM CATEGORIES

Conventional Factor Inputs Use by Farm Size[2]

The data on the intensity of conventional factor inputs use, such as manual and bullock labour and farm yard manure, on Mexi-Pak wheat, *basmati* rice, cotton and sugarcane, on sample farms, according to farm size are provided in Tables 1 and 2, respectively. From the examination of these data there appears considerable uniformity in the use of manual and bullock labour for the foodgrain and cash crops across various farm size categories.

The average use level of both manual and bullock labour, per acre, is the highest on sugarcane while cotton is next in order of manual labour use. The higher use of manual labour in case of sugarcane and cotton is, perhaps, inherent in the nature of their various agronomic and cultural operations which are more demanding in terms of their labour requirements and perhaps also due to the longer duration of the sugarcane crop. In terms of bullock labour use wheat is only second to sugarcane. This again is because of the higher bullock labour requirements for various post harvest (threshing and crushing) operations of wheat and sugarcane. Relatively lesser use of bullock labour in case of cotton and *basmati* rice is a reflection of the fact that the use of bullock labour in these two crops is limited to pre-harvesting farm operations only.

The use of farm yard manure, an important source for maintaining soil fertility, on various farm crops seems quite common. However, the prevalence rate and intensity of its use, reflected in expenditure on farm yard manure, varies considerably among various farm crops. The prevalence rate and the use level of farm yard manure was the highest on sugarcane and the lowest in case of Mexi-Pak wheat among the farm yard manure users. The expenditure on its use was, generally, higher on small farms (Table 2).

[2]Small, medium and large farms in this study refer to farms of upto 12.5 acres, 12.6 to 25.0 acres and 25.1 to 50 acres, respectively.

Table 1

Per Acre Labour Use on Important Crops of Sample Farms by Size of Farm

Crops	Small Farms		Medium Farms		Large Farms	
	Man days	Bullock days	Man days	Bullock days	Man days	Bullock days
Mexi-Pak wheat	27	24	26	24	24	25
Basmati rice	30	18	30	17	29	16
				(Medium and Large Farms)		
Cotton	58	16		16	57	
Sugarcane	131	64		62	128	

Note: There were 61, 79 and 32 wheat growers in small medium and large farm categories, respectively, while there were 41, 62 and 30 *basmati* growers in these farm size categories. There were 47 and 48 cotton growers in small farm group and medium and large farm size groups, and 34 and 49 sugarcane growers in these groups, respectively.

Despite the tendency on the part of small farmers for relatively greater use of conventional factor inputs, the evidence is not strong enough to suggest significant differences in the intensity of their use across various farm size categories. Moreover the small variation observed in their use level does not warrant further analysis of their use on other farm categories.

Use of Chemical Fertilizers

Fertilizer use by farm size.—The data on the use of chemical fertilizers (nitrogenous and phosphate) on important farm crops, according to farm size, are presented in Tables 3 and 4. Application rates of both nitrogenous and phosphate fertilizers, on the user farms, generally appear to be higher on small farms on all the crops under consideration. However, the proportion of fertilizer users was, generally, higher among larger farms. The application rates of nitrogen on small farms were higher by 8 percent, 17 percent, 10 percent and 12 percent than those of large farms, respectively, in case of wheat, rice, cotton and sugarcane. Among the foodgrain crops, the percentage of fertilizer users, both of nitrogen and phosphate, was greater for Mexi-Pak wheat. The extent as well as per acre use level of nitrogen was highest in case of sugarcane, of all the crops considered here.

From the higher use of factor inputs, observed on small farms, it may be argued that small farmers are trying to supplement their meagre land resources by using greater amounts of the conventional as well as modern land saving factor inputs.

Table 2

Farm Yard Manure Use on Important Crops of Sample Farms by Size of Farm

Crops	Small Farms			Medium Farms			Large Farms		
	No. of users	Percent of users	Average expenditure per acre (Rs.)	No. of users	Percent of users	Average expenditure per acre (Rs.)	No. of users	Percent of users	Average expenditure per acre (Rs.)
Mexi-Pak wheat	21	34	37	41	52	31	13	41	24
Basmati rice	23	56	68	38	61	59	14	47	54
				(Medium and Large Farms)					
Cotton	23	49	59	22	46	50			
Sugarcane	29	85	98	43	88	101			

Table 3

Use of Nitrogenous Fertilizers on Important Crops of Sample Farms by Farm Size

Crops	Small Farms			Medium Farms			Large Farms		
	No. of users	Percent of users	Amount of nitrogen used/acre (lbs)	No. of users	Percent of users	Amount of nitrogen used/acre (lbs)	No. of users	Percent of users	Amount of nitrogen used/acre (lbs)
Mexi-Pak Wheat[a]	53	87	54	70	89	48	30	94	50
Basmati rice[b]	31	76	67	42	69	46	22	73	58
				(Medium and Large Farms)*					
Cotton	37	79	56	42	88	51			
Sugarcane[c]	31	91	73	47	94	65			

*Farmers growing cotton and sugarcane were sub-divided into two categories only: (i) small (ii) medium and large combined.

[a]Application rate significantly higher on small farms as compared to those of medium farms at 10 percent significance level.

[b]Application rate significantly higher on small farms as compared to those of medium farms at 1 percent significance level.

[c]Application rate significantly higher on small farms as compared to that of other farms at 10 percent significance level.

Fertilizer use by farm tenure.—Data on fertilizer use on selected farm crops, according to tenurial arrangements on the sample farms, are presented in Table 5. A perusal of this table indicates that the percentage of fertilizer users was much higher on owner-operated farms as compared to that of tenant farms. The average amount of fertilizer used, per crop acre, on owner operated farms was higher by 36 percent and 22 percent in case of wheat and cotton, respectively. The differences in the average rates of fertilizer use on these crops were also found to be statistically significant. However, the same was not true for rice and sugarcane where the pattern of fertilizer use was more or less uniform. Nevertheless, it may be pointed out that the application rates of fertilizers on owner as well as tenant farms were well below the levels recommended by the agronomists for various crops.[3]

Table 5

Fertilizer Use on Sample Farms by Farm Tenure

Crops	Owner Farmers (fertilizer users)			Tenant Farmers (fertilizer users)		
	Number	Percent	Average amount of fertilizer used/acre (N. lbs)	Number	Percent	Average amount of fertilizer used/acre (N. lbs)
Mexi-Pak wheat[a]	106	91	55	47	84	40
Basmati rice	71	79	55	24	56	57
Cotton	58	84	56	21	81	46
Sugarcane	57	93	69	20	91	67

[a]Application rate significantly higher on owner operated farms as compared to that of tenant farms at 1 percent significance level.

It is common knowledge that share tenants will cultivate much less intensively than owner operators or cash tenants if they must pay the full cost of purchased inputs such as fertilizers but share with their landlords the increased produce that results from them. Despite the land reform measures emphasizing the sharing of input costs between the landlord and the tenant it is discouraging to note lesser use of chemical fertilizers on tenant farms. It is a well known phenomenon that tenants are not only economically handicapped but also on institutional front. Historically, share tenants in the province have not enjoyed occupancy rights and have sometimes experienced frequent turn overs and it acts as a disincentive for various farm investments including the use of fertilizers.

[3]Per acre recommended levels of nitrogen for Mexi-Pak wheat, local rice, cotton and sugarcane are 125, 60, 75 and 175 nutrient pounds respectively [1, pp. 243-52].

The ability to finance the use of fertilizer and other innovations is of critical importance in the farmers' final decision about their adoption. Credit institutions, generally, offer loans to farmers against land or some other security and the share tenants often fail to pass the criterion of credit worthiness of the financial institutions and thus are denied access to the credit which they may need equally badly alongwith other farming groups. The lack of finances and access to the institutional credit, insecurity of tenure and market imperfections may be partly responsible for the lesser use of chemical fertilizers on tenant farms.

Fertilizer use by management.—Farms in the sample were subdivided into two categories: having good managers; and having average type of managers. This grouping was based on the perception and actual adoption of improved cultural practices and knowledge of improved farming technology such as the importance of chemical fertilizers and the recommended practices in this regard such as plant protection measures, timings and methods of crop sowings adopted etc., by the farm operators. It may be mentioned here that a greater proportion of sample farms having good managers turned out to be those who were owner operators and operated larger farm area than the category of small farms (Table 6). As the knowledge about improved farm technology and its use was one of the important factors in determining the quality of management, it is natural to expect higher intensity of fertilizer use on farms operated by good managers. This is exactly what is observed. Not only the percentage of fertilizer users among the good farm managers was higher but their use level was also, substantially and significantly, higher on all the crop under consideration (Table 7). The average rate of fertilizer application on farms with good managers was higher by 31 percent, 20 percent, 38 percent and 28 percent for Mexi-Pak wheat, *basmati* rice, cotton and sugarcane, respectively. Nevertheless, the fertilizer use even on better managed farms was considerably below the recommended levels for various crops.

Table 6

Management by Farm Size and Tenure on Sample Farms

	Small Farms		Medium Farms		Large Farms		Total
	Owners	Tenants	Owners	Tenants	Owners	Tenants	
Good management	31	10	45	15	21	3	125
Average management	17	15	11	13	19	2	67
	48	25	56	28	40	5	192

Table 7

Fertilizer Use by Farm Management

Crops	Good Management			Average Management		
	Fertilizer users		Average amount used/acre (N. lbs)	Fertilizer users		Average amount used/acre (N. lbs)
	No.	Percent		No.	Percent	
Mexi-Pak wheat[a]	114	97	54	39	72	41
Basmati rice	73	77	58	33	58	48
Cotton[b]	60	97	57	19	58	41
Sugarcane[c]	62	97	71	15	79	56

[a]Fertilizer use level significantly higher on farms having good management as compared to the farms having average type of management at 1 percent significance level.
[b]Fertilizer use level significantly higher on farms having good management as compared to the farms having average type of management at 5 percent significance level.
[c]Fertilizer use level significantly higher on farms having good management as compared to the farms having average type of management at 10 percent significance level.

FARM PRODUCTIVITY ON VARIOUS FARM CATEGORIES

Farm Productivity by Farm Size

The average crops yields of important crops, prevailing on sample farms, according to farm size, are presented in Table 8. A perusal of the data provided in this table indicates relatively higher yields of food-grain crops on large farms. Cotton yields were also higher on large farms while in case of sugarcane the small farms obtained higher per acre yields.

Table 8

Average Yield of Important Crops by Farm Size

Crops	Small Farms		Medium Farms		Large Farms	
	Average yield/ acre	Maximum yield	Average yield/ acre	Maximum yield	Average yield/ acre	Maximum yield
Mexi-Pak wheat[a] (Pounds of wheat)	1,902	4,321	1,924	4,506	2,172	4,485
Basmati rice (Pounds of paddy)	2,019	4,646	2,003	4,674	2,154	4,390
Cotton (Pounds of seed cotton)	799	1,796	821	2,528		
Sugarcane (Pounds of gur)	2,975	5,130	2,750	6,037		

[a]Average wheat yield significantly higher on large farms as compared to the other categories at 10 percent significance level.

Large farms in case of Mexi-Pak wheat obtained yields which were higher by 14 and 13 percent respectively, as compared to small and medium farms. Moreover, these differences were found to be statistically significant. For *basmati* rice, also, the yield of paddy on large farm was higher by 7 and 8 percent, as compared to small and medium farms, respectively.

The per acre yield of cotton was higher on medium and large farm category by 3 percent as compared to small farms while the small farms outyielded the large farms by 8 percent in case of sugarcane. Nevertheless, these yield difference, were found to be statistically insignificant.

It is noted that generally higher per acre yields, though the differences were not statistically significant with the exception of wheat, were observed on relatively large farms as compared to small farms. It is also noted that the small farms were found using higher levels of conventional as well as modern factor inputs, again the differences in the input use level were not always statistically significant. From this, one may be tempted to think that large farms were technically more efficient as compared to small farms. However, this may or may not be really so. Some of the other plausible arguments for these differences in average yields are discussed below.

Fertilizer use is an important factor in increasing crop yields. In our analysis of comparative fertilizer use we observed a greater proportion of large farmers using fertilizers as compared to the small farmers and we have found crop yields on fetilizer using farms to be higher than those of non users (Table 13) which may partly explain low average yields on small farms. No doubt that among the fertilizer users small farmers were using relatively higher amounts of fertilizer per acre but it may be pointed out that these differences were often not substantial. Moreover, it should be emphasized that in case of fertilizers and other modern factor inputs such as pesticides, etc., not only the amounts of factor inputs used but also the timings of their use, method of application and other complementary inputs and cultural practices *i.e.* management of new technology, are critical in determining their efficiency. We observed in our previous section that large farms had relatively better farm managers. The author has also observed the problem of timely availability of fertilizer to be more acute for small farmers and also that large farmers consulted with the local extension agents more frequently on matters relating to fertilizer use and other improved farm practices. 53 percent of the small farmers as compared to 45 percent of the medium and large farmers reported that fertilizers were not available at the appropriate time. Only 14 percent of the small farmers, 36 percent of the medium farmers and 26 percent of the large farmers consulted with extension agents on matters relating to use of fertilizers [8, pp. 397-415]. Evidence available from other sources [5, p. 89] also indicates higher percentage of pesticide users among the large farms. Moreover, the large farms in the sample had an edge over small farms in terms of their greater control over irrigation as a larger percentage of them had their own Tube-wells (Table 9).

Table 9

Availability of Tubewell Water on Sample Farms by Size of Farm

Position regarding availability of tubewell water	Small Farms		Medium Farms		Large Farms	
	Number	Percent	Number	Percent	Number	Percent
Tubewell water available from tubewell on the farm	19	26	52	62	28	80
No tubewell on farm but tubewell water available from other tubewell owners selling water	47	64	29	34	5	14
Neither tubewell on the farm nor tubewell water available	7	10	3	4	2	6
	73	100	84	100	35	100

Griffin has argued that in developing countries economic and Political powers are concentrated in a small group and as a result factor markets are highly imperfect [3]. Many members of the rural community have restricted access to the means of production and this effects the methods of cultivation that are used and the efficiency of the system. Falcon also, observed that unequal distribution of land and capital is frequently accentuated by an unequal access to water and technical knowledge [2, pp. 698-722]. It is an open secret that small farms while performing their farm operations are not only economically and technically handicapped but also suffer because of institutional imperfections. The inadequate supplies of essential resources of irrigation and working capital, the gaps in the information about the use of modern factor inputs and the complementary cultural practices, poor management and unequal access to factor input and product market may be hindering the efforts of small farmers and working against his interest in addition to the limitations imposed by his poor resource endowments.

We observed that the differences in case of Mexi-Pak wheat yields are more than other crops. A possible explanation for this may be the familiarity of farmers across various farm size categories with *basmati* rice, cotton and sugarcane crops grown since long time. They were more or less able to absorb changes in the production technology of these crops overtime. Whereas in case of Mexi-Pak wheat, a relatively new crop variety, the learning process is still under way. From various compaigns emphasizing new wheat varieties and package of various factor inputs, small farmers because of their inherently disadvantageous position were the last to benefit and thus got relatively lesser yields. The results of regression analysis presented in Table 10, also appear to support our conclusions that higher per acre yields in case of wheat were associated with large farms. It appears that the technical change, represented by new wheat seeds, has had a discriminatory impact as new wheat seeds were more demanding in their use of material inputs, especially fertilizer and technical know how and water.

From our results it appears that the previously known phenomenon of relatively higher crop yields per acre on the small farms as compared to large farms, prevailing under traditional farming situation, is disappearing. Recent studies carried out in India also support this conclusion [9, pp. 277-90].

Table 10

Estimated Coefficients of Regression Equation

$(LNY = b_0+b_1 \ Ln\, x_1+b_2 \ x_2)$†

Crops		Constant	x_1	x_2	R^2	F. Ratio
Mexi-Pak wheat						
	(1)	6.787	0.142** (2.630)		0.039	6.951
	(2)	6.780	0.121* (2.241)	0.172** (2.730)	0.080	7.340
Basmati rice						
	(1)	7.271	0.056 (1.018)		0.008	1.010
	(2)	7.293	0.042 (0.737)	0.072 (1.059)	0.016	1.060
Cotton						
	(1)	6.202	0.086 (1.265)		0.017	1.590
	(2)	6.154	0.083 (1.221)	0.087 (1.012)	0.027	1.310
Sugarcane						
	(1)	7.751	0.0231 (0.304)		0.0012	0.093
	(2)	7.744	0.0211 (0.274)	0.0231 (0.218)	0.0017	0.070

†Y = Yield per acre of respective crops
x_1 = Farm area in acres
x_2 = Farm tenure used as a dummy variable = 1 for owner operators, 0 for tenants.

*Significant at .05 level
**Significant at .01 level
(Figures in parentheses are the calculated t-values)

Farm Productivity by Farm Tenure

The average crop yields prevailing on the sample farm, according to their tenurial arrangements, are presented in Table 11. As expected per acre crop yields, for all the crops, were higher on the owner operated farms than those of the tenant farms. Average crop yields, on owner operated farms

were higher by 19 percent, 4 percent, 8 percent and 1 percent, respectively, for wheat, rice, cotton and sugarcane. Though higher yields were observed on owner operated farms, for all the crops under discussion nevertheless, the yields were significantly higher in case of wheat only. Results of regression analysis also indicate significantly higher wheat yields associated with owner operated farms (Table 10). From our discussions on fertilizer use we may recall that higher prevalence rate and intensity of fertilizer use per crop acre was observed on owner operated farms. Requibuz-Zaman in his study on share cropping in Bangladesh, also observed higher yields and fertilizer use per acre on owner operated farms as compared to share cropped farms [6, pp. 149-72].

Table 11

Average Yields of Important Crops by Farm Tenure

Crops	Owner Farmers		Tenant Farmers	
	No. of observations	Average yield/acre	No. of observations	Average yield/acre
Mexi-Pak wheat[a] (Pounds of wheat)	116	2,072	56	1,736
Basmati rice (Pounds of paddy)	90	2,070	43	1,984
Cotton (Pounds of seed cotton)	69	828	26	766
Sugarcane (Pounds of gur)	61	2,851	22	2,818

[a]Average wheat yield significantly higher on owner operated farms as compared to tenant farms at 1 percent significance level.

Farm Productivity by Farm Management

It appears that the quality of farm management is an important factor in influencing the farming efficiency and determining crop yields. As previously discussed, the sample farms were sub-divided into two categories based on the quality of management. The crop yields prevailing on sample farms according to the management quality are provided in Table 12. It is noted that yields for all the crops were substantially and significantly higher on the farms operated by good managers as compared to those run by average type of managers. The average crop yields of those farms operated by the average type of managers were 74 percent of those of the better managed farms in case of wheat and cotton and 84 percent in c: se of rice and sugarcane. It may be recalled here that significantly higher rates of fertilizer applic tion were observed on better managed farms and also the owner operated farms and relatively large farms had an edge over the tenant operated and small farms in terms of the quality of management.

Table 12

Average Yields of Important Crops by Type of Management

Crops	Good Management			Average Management		
	No.	Percent of total	Average yield/acre	No.	Percent of total	Average yield/acre
Mexi-Pak wheat* (Pounds of wheat)	18	69	2,144	54	31	1,567
Basmati rice* (Pounds of paddy)	95	71	2,154	38	29	1,762
Cotton* (Pounds of seed cotton)	62	65	895	33	35	652
Sugarcane (Pounds of gur)	64	77	2,951	19	23	2,476

*Average yields of wheat, rice and cotton were significantly higher on better managed farms as compared to the other category at 1 percent significance level.

Farm Productivity by Fertilizer Use

Table 13 presents average yields, prevailing on sample farms, of various crops under consideration according to fertilizer use and non-use. An examination of Table 13 shows that per acre yields, of all crops, were higher on the

Table 13

Average Yields of Important Crops by Fertilizer Use

Crops	Fertilizer Using Farmers			Fertilizer Non Using Farmers		
	No.	Percent of total	Average yield/acre	No.	Percent of total	Average yield/acre
Mexi-Pak wheat[a] (Pounds of wheat)	153	89	2,031	19	11	1,409
Basmati rice[b] (Pounds of paddy)	95	71	2,137	38	29	1,806
Cotton (Pounds of seed cotton)	79	83	833	16	17	700
Sugarcane (Pounds of gur)	77	93	2,862	6	7	2,579

[a]Average wheat yield on fertilizer using farms was significantly higher than that of non users at 1 percent significance level.

[b]Average rice yield on fertilizer using farms was significantly higher than that of non users at 5 percent significance level.

fertilizer using farms as compared to the yields obtaining on the farms that did not use the chemical fertilizer. Moreover, the differences in the average yields of these farm categories in case of wheat and rice were also statistically significant. The per acre yields on farms not using chemical fertilizers were only 69 percent, 85 percent and 84 percent of the fertilizer using farms in case of wheat, rice and cotton respectively. The per acre yields of the farmers who applied fertilizers to their sugarcane crop was 11 percent higher as compared to the yields of those who did not, however, the difference was found to be statistically insignificant.

As discussed earlier the use of phosphate was more common on wheat than any other crop under consideration. This may partly explain why the difference between the average yields of fertilizer users and non users were more pronounced in case of wheat as the balanced use of fertilizer nutrients is likely to lead to higher yields than that of single nutrient application.

CONCLUSIONS AND IMPLICATIONS

Our analysis of previous sections reveals that despite the tendency on the part of small farmers to use higher amounts of conventional factor inputs such as manual and bullock labour and farm yard manure the pattern and use level of these inputs does not appear to vary significantly among various farm size categories.[4] Nevertheless the intensity of fertilizer use for important farm crops was higher among small farmers though the percentage of fertilizers users was greater among large farmers. Moreover, the extent as well as the level of fertilizer use was substantially higher on owner operated farms as compared to the tenant operated farms. Similar pattern was observed in respect of fertilizer use on farms operated by good managers as compared to those run by the average type of farm managers.

Despite the tendency to use higher level of both the conventional and modern factor inputs the farmers operating small farms were obtaining lower crop yields. This trend was more pronounced in case of Mexi-Pak wheat. It appears that the previously known phenomenon of higher per acre yields, under traditional farm technology, obtaining on small farms is gradually disappearing. It is hypothesized that unequal access to modern factor markets including institutional and extension services may be partly responsible for that. Owner operated farms, generally, obtained higher per acre yields than the tenant operated farms. Moreover the average yields obtaining on fertilizer using farms were significantly higher than those obtaining on farms not using any fertilizer. The farms having better farm managers out yielded the farms having average type of managers for the foodgrain as well as cash crops.

As the Punjab is mainly a land of small farms the lower crop yields obtaining on small farm should be a matter of special concern to the policy makers. The potential for increasing farm production on all the farm categories as indicated by the wide range between the maximum and average yields in each farm size category, is another issue requiring immediate attention. The

[4]As our sample was restricted to the canal irrigated districts of the Punjab the results will be valid for such areas only and not applicable to other areas.

future strategy for agricultural development should include not only the measures to boost farm production, but also measures designed to increase the farm productivity in general and of small farms in particular.

Economists know from their production theory that farmers don't maximize yields as the profits are higher at below the level of maximum yield. If so even the maximum yields obtaining on the sample farms were below their potential and hence suggest that production target, which is economically viable, should be aimed at.

Every effort must be made to bridge the gap between the maximum yields achieved on some of the farms and the average yields prevailing on majority of the farms. The extension services have to play a significant role in this regard. They should not only advise the farmers about the general improved farm management but also provide specific guidance about the crop requirements of modern factor inputs according to local conditions, their mix up, timing and method of use. In this connection they should pay special attention to the small farmers who are in greater need of their services.

Emphasis should be on improving the management obtaining on the farms. The mass media, especially the radio, can play an important role in this regard. The demonstration plots are also an important mean in educating the farmers about improved husbandry practices.

Farmers in general and small farmers in particular are economically and institutionally handicapped in performing various farm operations. Every effort must be made to remove various institutional bottlenecks involved in providing them adequate and timely supplies of modern factor inputs and credit to finance their use. Small farmers and tenants deserve special consideration in the provision of institutional credit, particularly in the form of supervised credit to realize the maximum potential of modern farm technology.

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