PROUCTIVITY AND CROP PROUCTION STRUCTURE OF LESS-PROGRESSIVE AND PROGRESSIVE FARMERS: A Micro Level Analysis

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Productivity is a major indicator of production possibilities of an economy. The basic objective of the producer is that, how to allocate the limited resources so that producer could get the maximum profit? Productivity of land is determined by the technological relationship between inputs and output. Higher production per unit is desired by the farmers/producers and also to feed the growing population. The application of farm inputs such as high yielding varieties of seeds, fertilizers, insecticides and pesticides, controlled water supply and modern cultural practices results in increasing the productivity. The adoption of farm technology at the recommended level shifts the production function upward. But this change is not uniform in different regions /areas and among various farm sizes. It depends on the intensity of adoption of farm technology. In the paper an attempt was made to find out the productivity crop production of less- progressive farmers and progressive farmers. The main objectives of the present study were; to find out the productivity and production structure and productivity gap of less progressive and progressive categories of the farmers among different farm sizes and to identify the relative use of inputs and returns over total cost and ratio of farm business income to net returns and ratio of family labour and management to net returns under farm sizes.

METHODOLOGY

A sample of 120 cultivating households of Shahtalai Valley of Bilaspur district was selected for the analysis. The data was pertaining for the year 2014-15. The reason for the selection of equal number of farmers in each size class was to find out the comparative picture of the modernization of agriculture and not to find out the size of holding of the study area. The total sample of 120 farmers was further divided into two groups: less progressive farmers and progressive farmers. Those farmers who used less than 50 percent amount of recommended dose of fertilizers were termed as less-progressive farmers and those who used 50 per cent or more amount of fertilizers were termed as progressive farmers. The analysis pertaining to the cost of cultivation of crops was estimated by using different cost concepts i.e. Cost A1, Cost B and Cost C.

The aggregate cultivated area in size class is shown in Table 6.1. It is evident from the table that the average farm size for both progressive and less-progressive farmers in overall farm size was estimated 1.51 hectare, whereas for less progressive and progressive farmers was observed 1.53 hectare and 1.49 hectares respectively. Since the equal number of holdings has been selected from the various farm sizes the study, the concentration of area in the medium size class represents a great difference. It is accounted 52.91 percent of the total cultivated area. It is evident from the table that the percent area under progressive farmers is more than that of less progressive farmers. So for as farm size wise analysis is concerned, it shows relatively more area under the category of progressive farmers in marginal and small size groups, whereas in medium farm size, relatively more area falls under the category of less- progressive farmers as compare to progressive farmers.

Table1.1: Distribution of Aggregate Cultivated area in less-Progressive and Progressive Farmers by size Class

Farm size	Number of farmers	Aggregate cultivated area (Hectare)	Aggregate cultivated area as percent to total cultivated area	Average farm size
Marginal Less progressive	18(45.00)	10.90 (41.12)	6.00	0.61
Progressive	22(55.00)	15.61(58.88)	8.59	0.71
Total	40(100.00)	26.51(100.00)	14.59	0.66
Small less progressive	21(52.50)	28.55(48.37)	15.72	1.36
Progressive	19(47.50)	30.47(51.63)	16.78	1.60

Total	40(100.00)	59.02(100.00)	35.50	1.48
Medium Less progressive	26(65.00)	60.06(62.50)	33.07	2.31
Progressive	14(35.00)	36.03(37.50)	19.84	2.57
Total	40(100.00)	96.09(100.00)	52.91	2.40
Over all Less progressive	65(54.17)	99.51(54.79)	54.79	1.53
Progressive	55(45.83)	82.11(45.21)	45.21	1.49
Total	**120(100.00)**	**181.62(100.00)**	**100.00**	**1.51**

Note: Figures in parentheses denote percent to the total.

Cropping Pattern and cropping Intensity:

The study of cropping pattern is one of the important indicators for measuring the efficient use of farm land. The cropping pattern deals with the nature of crops grown and percentage of area under each crop. The economic studies on cropping pattern normally emphasize two important characteristics of agricultural land; its heterogeneity and possibility of crop substitution. Heterogeneity arises from agro- climatic condition of the particular area, which includes type of soil, temperature and rain fall. The irrigation facilities also contribute to land heterogeneity. Cropping pattern studies also reveal the possibility of crop substitution and, therefore, assume special importance to the crop that could be grown with in that environment. The size of cultivated holding, market situation and prices are other important factors determining the cropping pattern. Table 1.2 shows the cropping pattern of the less progressive and progressive farmer of the sample size. It may be observed from the table that the cereal crops dominate the cropped area. In overall farm size maize, paddy and wheat are the major crops accounting for 28.90 percent, 18.14 percent and 49.24 percent of the gross cropped area respectability. It is clear from the table that highest area falls under wheat crops, followed by maize and paddy. The percentage area of the maize and wheat is under more less–progressive farmers group as compare to progressive farmers whereas in paddy crop, more area falls under the progressive farmers group against less- progressive farmers in over all farm size.

Cropping Intensity

Cropping intensity is the ratio of gross area sown to the net area sown expressed in percentage. It is an important indicator of the production efficiency. Higher cropping means farmers utilize their land more efficiently and maximize production per unit time. The cropping intensity of sample farmers is given in table 1.3. It can be observed from the table that the aggregate cropping intensity of overall farm size was estimated 200.13, whereas, the intensity of cropping of less- progressive and progressive farmers was found 200.05 and 200.23 respectively. It is clear from the table that the intensity of cropping of Less-Progressive, progressive and overall farmers keeps on decreasing with the size of farm .But the cropping intensity of progressive farmers was high than the less- progressive farmers. This confirm the hypothesis that progressive farmer utilize their resource (land) relatively more intensively as compare to less- progressive farmers.

Table 1.2: Cropping pattern of less progressive and progressive farmers

(In percentage)

Crops	Marginal			Small			Medium			Overall		
	Less Prog	Prog	Total	Less Prog	Prog	Total	Less Prog	Prog	Total	Less Prog	Prog	Total
Kharif Maize	33. 41	26.88	28.74	29.26	24.50	28.87	29.43	28.20	28.97	29.58	28.63	28.90
Paddy	18.07	22.22	20.51	17.62	17.31	17.46	17.70	18.22	17.89	17.72	18.64	18.14
Soyabeen	00.18	00.38	00.30	00.86	00.93	00.90	01.00	01.28	01.10	00.87	00.98	00.92
Cheri	00.28	00.29	00.28	02.10	02.10	02.56	01.51	01.76	01.76	01.54	01.94	01.73
Mash	00.04	00.13	00.10	00.16	00.20	00.18	00.34	05.00	00.40	00.26	00.37	00.28
Sub Total	49.98	49.90	49.93	50.00	49.94	49.97	49.98	49.96	49.97	49.99	49.94	49.97

Ravi Wheat	48.05	48.34	48.22	49.40	49.14	49.27	49.54	49.46	49.51	49.34	49.13	49.24
Barley	00.69	00.48	00.55	00.21	00.27	00.25	00.15	00.19	00.17	00.23	00.27	00.25
Barseem	01.24	01.02	01.11	00.32	00.36	00.34	00.20	00.22	00.21	00.35	00.43	00.38
Peas		00.09	00.06	00.07	00.08	00.07	00.07	00.06	00.06	00.05	00.07	00.06
Mustard	00.04	00.19	00.13		00.14	00.06	00.03	00.08	00.05	00.02	00.12	00.07
Maser					00.08	00.04	00.03	00.03	00.03	00.02	00.04	00.03
Sub Total	50.02	50.09	50.07	50.00	50.06	50.03	50.02	50.04	50.03	50.01	50.06	50.03
Gross cropped area (hectare)	21.81	31.28	53.09	57.10	61.06	118.11	120.16	72.12	192.28	199.07	164.41	363.48

Less Prog.= Less Progress

Prog. = Progressive

Table 1.3: Total cultivated area, cropped area and intensity of cropping of less-Progressive and Progressive Farmers

(Area in Hectare)

Farm size	Total cultivated area	Gross cropped area	Cropping Intensity
Marginal less progressive	10.90	21.81	200.09
Progressive	15.61	31.28	200.38
Total	26.51	53.09	200.26
Small less progressive	28.55	57.10	200.00
Progressive	30.47	61.01	200.23
Total	59.02	118.11	200.12
Medium Less progressive	60.06	120.16	200.06
Progressive	36.03	72.12	200.17
Total	96.09	192.28	200.10
Over all Less progressive	99.55	199.07	200.05
Progressive	82.11	164.41	200.23
Total	181.62	363.48	200.13

Note: Figures in parentheses denote percent to the total.

Productivity:

To feed the growing population, the production of agriculture product can either be increased by increasing the land productivity or through intensive cultivation or both .So for as extensive cultivation is concerned, it is not practicable. The land production can be increased by adopting the farm technology at the recommended level. If the inputs are optimally utilized than the only way left for increasing production by adopting the new inputs of technology at the recommended level. Table 1.4 depicts the productivity of less- progressive and progressive farmers in the cultivation of major crops. It can be observed from the table that per hectare productivity of progressive farmers is high as compare to less progressive farmers in overall from size for all the major crops i.e. maize, paddy and wheat has been observed to be 2180 kilograms , 1877 kilograms and 2262 kilograms in overall farm size.. The productivity of progressive farmers is higher than that of less- progressive farmers in all the farm size. The productivity of the less progressive farmers in the cultivation of maize, paddy and wheat is estimated 2069 kilograms, 1810 kilograms and 2165 kilograms respectively, whereas in the progressive farmers it was estimated 2373 kilograms in maize, 1918 kilograms in paddy and 2372 kilograms in wheat. The highest productivity was found in wheat followed by maize and paddy.

Table 1.4: Productivity of Less Progressive and Progressive Farmers in the Cultivation of Major Crops

(Kilogram per Hectare)

Farm size	Maize	paddy	wheat
Marginal Less-progressive	2276	1911	2272
Progressive	2516	2012	2506
Total	2408	1976	2410
Small less progressive	2088	1849	2210
Progressive	2380	1957	2420
Total	2237	1904	2318
Medium Less progressive	1991	1795	2131
Progressive	2244	1887	2284
Total	2083	1830	2188
Over all Less progressive	2052	1823	2169
Progressive	2345	1939	2376
Total	2180	1877	2262

The progressive farmers relatively use more quantity of fertilizers and purchased seed as compare to less- progressive farmers. Further the intensity of adoption of inputs keeps on decreasing with the farm size.

Productivity Gap

Table1.5 indicates per hectare productivity gap, it is estimated by deducting per hectare productivity of the sample farmers from the productivity at experimental station . It gives the broad picture to assess the potential for increasing the productivity of the farmers fields. It is clear from the table that in overall farm size, productivity is lower than that of the experimental station. The highest productivity gap of overall farm size was found in paddy, followed by maize and wheat. It is estimated -41.34 percent-41.08 percent and -41.47percent in paddy, maize and wheat respectively. It is also clear from the table that the productivity gap of progressive farmers is low as compare to less- progressive farmers. It was observed (-) 36.62 percent (-) 39.41percent (-) 37.47 percent in progressive farmers whereas in less- progressive farmers, it was estimated at (-) 44.54 percent (-) 43.03 percent and (-) 42.92 percent in the cultivation of maize, paddy and wheat crop respectively. As far as farm size wise analysis is concerned, it is clear from the table that there was inverse relationship between farm size and productivity gap irrespective of different categories of farmers.

Table 1.5: Per Hectare Productivity Gap between Experimental Station and Farmer's Fields(Less Progressive and Progressive) Under Various Farm Size (in Percentage)

Farm size	Maize	paddy	wheat
Marginal Less-progressive	(-)38.49	(-)40.28	(-)40.21
Progressive	(-)32.00	(-)37.13	(-)34.05
Total	(-)34.92	(-)38.18	(-)36.58
Small less progressive	(-)43.57	(-)42.22	(-)41.84
Progressive	(-)35.68	(-)38.84	(-)36.32
Total	(-)39.54	(-)40.50	(-)39.00
Medium Less progressive	(-)46.19	(-)43.91	(-)43.93
Progressive	(-)39.35	(-)41.03	(-)39.89
Total	(-)43.70	(-)42.81	(-)42.42
Over all Less progressive	(-)44.54	(-)43.03	(-)42.92
Progressive	(-)36.62	(-)39.41	(-)37.47
Total	(-)41.08	(-)41.34	(-)40.47

However, this can't be generalized from the forgoing discussion that the performance of the experiments station can be exactly replicated on the farmers, fields. The experiments at the experimental station are made on small area and these experiments are made under controlled conditions. Therefore, the results of these experiments are not exactly replicable on the farmers' fields. But it cannot be denied that there was a vast scope to increase per hectare productivity of the farmers of adoption technology at the recommended level. The non-adoption of full package of available technology in respect of maize, paddy and wheat may be due to ignorance of farmers about the recommended doses, shortage of critical input like seeds, fertilizers and insecticide/pesticides at the right time and right place, lack of irrigation facilities and high cost of inputs. If the farmers are provided with controlled irrigation, well-tested varieties of seeds and other required facilities, there is much scope to raise the productivity.

Gross Return:

Table 1.6 shows per hectare gross returns of less- progressive farmers and progressive farmers in the cultivation of major crops. It may be observed from the table that the gross returns of all the crops as whole in overall farm size was estimated to Rs. 13715. The gross returns were observed Rs. 13109 and Rs. 1444 in less- progressive and progressive farmers respectively.

Table 1.6: Gross Return of less progressive and Progressive farmer in the cultivation of major Crops(Rupees per Hectare)

Farm size	Maize	paddy	wheat	All
Marginal Less-progressive	13884	13473	14200	13964
Progressive	15348	14185	15663	15239
Total	14689	13931	15063	14713
Small less progressive	12737	13035	13813	13344
Progressive	14518	13797	15125	14701
Total	13646	13423	14488	14039
Medium Less progressive	12145	12655	13319	12840
Progressive	13688	13303	14275	13918
Total	12706	12902	13675	13240
Over all Less progressive	12517	12852	13556	13109
Progressive	14305	13670	14850	14461
Total	13298	13233	14138	13715

Thus the impact of farm technology its intensity of adoption on the progressive farmers over less progressive farmers turns out to Rs. 1352 per hectare in the cultivation of all the crops. The farm size wise analysis shows that the impact of farm technology on the progressive farmers over the less progressive farmers was estimated to Rs. 1275, Rs. 1357 and Rs.1078 in the crops as a whole. So far as the crop wise analysis is concerned, it is clear from the table that the highest per hectare gross returns are obtained in wheat, followed by maize and paddy in overall farm size of the farmers as a whole. The table further shows that the gross returns of the progressive farmers are higher than the less progressive farmers.. An inverse relationship was, found between the gross returns and farm size.

Cost of Cultivation

The analysis of cost and returns is imperative for evolving production plan and for formulating the price policy. The cost data also guide the producer/farmer that which commodities to be more economical to produce. It facilitates the study of the efficiency of various cultivation practices and assists in altering the crop plans by providing information regarding their profitability. It also helps to formulate the effective farm planning. In the present study an attempt has been made to calculate the cost of cultivation of maize, paddy and wheat on the basis of standard cost concepts.

Maize: The input cost analysis of maize crop is given in table 6.7 (appendix- X) The table reveals that per hectare average cost in overall farm size was found to Rs.10228. The single largest item in cost was observed imputed value of family labour, followed by rental value of land, fertilizers, manures and tractor charges. So far as progressive and less progressive farmers are concerned, the expenses on farm yard manures, fertilizers, threshing, interest on working capital and rental value of land high on progressive farmers as compared to less progressive farmers. The cost A1 and B of the total farmers and less-progressive category of farmers and Cost C of total less progressive and progressive groups of farmers show the inverse relationship with the size of farm. None of the farmer was reported to use the insecticides/pesticides for weed control because they undertake it manually for feeding their livestock.

Paddy: The input cost analysis of paddy is given in table 6.8, and appendix –XI)) it is evident from the table that per hectare average cost of overall farm size was found to be Rs. 11291.The per hectare average cost was found high on progressive farmers as compare to less progressive farmers. It has been estimated at Rs.11553 for progressive farmers and Rs.11067 for the less-progressive farmers. It may be observed from the table that the progressive farmers were using more quantity of farm yard manures, fertilizers, insecticides/ pesticides and the use of tractor as compare to less-progressive farmers of overall farm size and across farm sizes as well .Cost AI of the progressive farmers and cost B of the, progressive farmers

Table 1.7: Per Hectare Input Use in Maize Crop by Less Progressive and Progressive farmer(In Percentage)

Cost Item	Marginal			Small			Medium			Overall		
	Less prog	Prog	Total	Less prog	Prog	Total	Less prog	Prog	Total	Less prog	Prog	Total
Hired human labour	--	00.73	00.42	-	00.80	00.42	--	01.10	00.43	--	00.91	00.42
Bullock labour	11.94	08.95	10.24	09.89	07.72	08.74	08.64	07.00	08.00	09.41	07.65	08.59
Seed	00.89	00.88	00.88	00.88	00.83	00.85	00.91	00.85	00.88	00.90	00.85	00.87
Farm yard Manure	13.08	12.30	12.63	12.84	11.89	12.36	11.40	10.70	11.13	12.03	11.47	11.77
Fertilizers	11.65	14.54	13.30	11.66	14.33	13.07	11.00	14.45	12.33	11.28	14.42	12.72
Insecticide pesticides	--	-	--	--	--	--	--	--	--	--	--	--
Threshing	02.47	04.32	03.53	02.58	03.29	02.95	03.11	03.77	03.37	02.87	03.79	03.26
Tractor charges	08.63	09.69	09.23	09.74	10.75	10.27	11.53	11.91	11.67	10.64	11.04	10.83
Depreciation	00.61	00.64	00.63	00.74	00.70	00.71	00.79	00.76	00.78	00.75	00.71	00.73
Land revenue	00.08	00.07	00.07	00.08	00.07	00.07	00.08	00.08	00.08	00.08	00.07	00.08
Interest on working capital	01.46	01.54	01.50	01.43	01.48	01.46	01.40	01.50	01.44	01.42	01.50	01.46
Cost A	50.81	53.66	52.43	49.84	51.86	50.90	48.86	52.12	50.11	49.38	52.32	50.73
Rental value of land	16.90	17.28	17.13	16.34	17.12	16.76	16.27	16.95	16.53	16.38	17.08	16.70
Interest on fixed capital	01.87	2.210	2.060	02.66	02.57	02.62	02.88	02.79	02.85	02.69	02.59	02.65
Cost B	69.58	73.15	71.62	68.84	71.55	70.28	68.02	71.85	69.49	68.45	71.99	70.08
Inputted value of family labour	30.42	26.85	28.30	31.56	25.45	29.72	31.98	28.14	30.51	31.55	28.01	29.92
Cost C (Rupees)	11549	11402	11018	10011	10886	10457	9586	10371	9871	9818	10754	10228

Less Prog. = Less Progressive

Prog.= Progressive

Table 1.8: Per Hectare Input Use in Paddy Crop by Less Progressive and Progressive farmer(In Percentage)

Cost Item	Marginal			Small			Medium			Overall		
	Less prog	Prog	Total	Less prog	Prog	Total	Less prog	Prog	Total	Less prog	Prog	Total
Hired human labour	--	00.54	00.35	--	00.96	00.63	00.56	01.70	01.00	00.32	01.17	00.73
Bullock labour	11.47	08.45	09.49	10.16	07.84	08.72	08.84	05.87	07.67	09.34	07.08	08.27
Seed	02.94	02.59	02.71	02.71	02.52	02.5	02.72	02.47	02.62	02.69	02.48	02.59
Farm yard Manure	04.35	05.21	04.91	04.25	04.74	04.54	04.04	04.55	04.24	04.42	04.73	04.57
Fertilizers	03.97	05.54	05.12	03.90	05.17	04.58	03.73	04.66	04.10	03.78	04.99	04.36
Insecticide pesticides	03.51	04.04	0.3.85	03.52	0.384	03.70	04.02	04.22	04.10	03.75	04.01	03.87
Threshing	01.26	01.69	01.56	01.38	01.75	01.57	01.99	02.06	02.01	01.70	01.85	01.77
Tractor charges	08.83	11.30	10.42	09.64	12.85	11.36	10.62	14.47	12.13	09.95	13.05	11.42
Depreciation	00.62	00.60	00.61	00.66	00.66	00.66	00.71	00.69	00.70	00.68	00.66	00.66
Land revenue	00.13	00.13	00.13	00.14	00.13	00.13	00.14	00.13	00.14	00.13	00.13	00.13
Interest on working capital	01.09	01.17	01.14	01.07	01.19	01.13	01.09	01.20	01.13	01.07	01.56	01.12
Cost A	38.17	41.26	40.27	37.43	41.68	39.53	38.46	42.02	39.84	37.83	41.33	39.49
Rental value of land	17.23	17.16	17.16	16.96	17.04	17.04	16.61	16.74	16.66	17.91	17.62	17.76
Interest on fixed capital	01.77	02.07	01.96	02.45	02.44	02.44	02.54	02.56	02.55	02.38	02.48	02.43
Cost B	57.17	60.49	59.39	56.83	61.17	59.02	57.61	61.32	59.05	58.11	61.43	59.68
Inputted value of family labour	42.83	39.51	40.61	43.16	38.84	40.99	42.39	38.68	40.95	41.89	38.57	40.32
Cost C (Rupees)	11093	11722	11509	10904	11482	11175	10807	11276	10983	11067	11553	11291

Less Prog. = Less Progressive   Prog.=   Progressive

shows positive relationships with the size of farm whereas cost C of the less- progressive farmers, progressive farmers and total farmers shows the inverse relationship with the size of holding.

Wheat: Table 1.9 shows the cost of cultivation of wheat crop. It may be observed from the table that per hectare total cost i.e., cost C of the total farmers of the overall farm size was estimated Rs.11290, whereas the average cost of progressive farmers was high than the less progressive farmers. As it was estimated to Rs.11490 of progressive farmers and Rs.11129 of the less- progressive farmers. The highest cost was found on imputed value of family labour followed by rental value of land, farmyard manures, fertilizers and tractor charges in all farm size irrespective of progressive farmers. So far as farm size wise analysis is concerned, cost A1; of less-progressive, progressive farmers and cost B of the less progressive farmers show the positive relationship with the size of holding whereas the cost B of the total farmers and cost C of the progressive farmers and shows the inverse relationship with the size of farm.

All Crops:

Table 1.10 indicates per hectare input use structure in all crops by less- progressive and progressive farmers. So for as overall position of total farm size is concerned, it was observed that in terms of percentage, the single largest cost item is estimated imputed value of human labour followed by rental value of land, farmyard manures, tractor charges and fertilizers. The average cost of production was observed to Rs.10971 per hectare. Imputed value of human labour, rental value of land, farmyard manures, tractor charges and fertilizers

Table 1.9:Per Hectare Input Use in Wheat Crop by Less Progressive and Progressive farmer
(In Percentage)

Cost Item	Marginal			Small			Medium			Overall		
	Less prog	Prog	Total	Less prog	Prog	Total	Less prog	Prog	Total	Less prog	Prog	Total
Hired human labour	-	--	---	---	00.47	00.24	00.36	00.96	00.58	00.21	00.59	00.39
Bullock labour	09.18	06.01	07.26	08.57	05.55	06.99	07.72	05.46	06.87	08.12	05.60	06.97
Seed	06.95	06.57	06.74	06.74	06.37	06.55	06.80	06.64	06.74	06.79	06.53	06.67
Farm yard Manure	12.84	12.30	12.51	11.84	11.75	11.80	10.98	10.90	10.95	11.43	11.49	11.48
Fertilizers	08.50	10.62	09.78	08.87	10.68	09.82	08.45	10.59	09.26	08.58	10.63	09.52
Insecticide pesticides	--	--	-	--	--	--	--	--	--	--	--	--
Threshing	08.48	08.85	08.70	08.25	08.71	08.49	08.10	08.58	08.28	08.19	08.69	08.41
Tractor charges	05.72	08.77	07.57	07.35	09.54	08.49	09.25	10.60	09.76	08.32	09.84	09.02
Depreciation	00.56	00.57	00.57	00.61	00.61	00.62	00.66	00.68	00.67	00.64	00.64	00.64
Land revenue	00.09	00.09	00.09	00.10	00.10	00.11	00.10	00.11	00.10	00.10	00.10	00.10
Interest on working capital	01.55	01.59	01.57	01.55	01.59	01.57	01.55	01.61	01.57	01.55	01.60	01.57
Cost A1	53.87	55.37	54.79	53.88	55.41	54.68	53.97	56.13	54.78	53.93	55.71	54.75
Rental value of land	17.67	18.44	18.13	1718	18.16	17.69	16.88	17.88	17.26	17.06	18.09	17.54
Interest on fixed capital	01.73	02.17	02.00	02.41	02.43	02.43	02.61	02.70	02.64	02.45	02.50	02.47
Cost B	73.27	75.98	74.92	73.47	76.00	74.80	73.46	76.71	74.68	73.44	76.30	74.76
Inputted value of family labour	26.73	24.02	25.08	26.53	24.00	25.20	26.54	23.29	25.32	26.56	23.70	25.24
Cost C (Rupees)	11249	11888	11631	11254	11664	11467	11049	11175	11095	11129	11490	11290

Less Prog. = Less Progressive

Prog.= Progressive

Table 1.10: Per Hectare Input Use in All Crop by Less Progressive and Progressive farmer (In Percentage)

Cost Item	Marginal			Small			Medium			Overall		
	Less prog	Prog	Total	Less prog	Prog	Total	Less prog	Prog	Total	Less prog	Prog	Total
Hired human labour	--	00.31	00.19	--	00.66	00.37	00.29	01.15	00.62	00.18	00.80	00.46
Bullock labour	10.46	07.45	08.71	08.71	06.61	07.80	08.18	05.97	07.34	08.70	06.47	07.67
Seed	04.33	04.13	04.21	04.07	04.08	04.19	04.40	04.27	04.33	04.35	04.13	04.26
Farm yard Manure	11.32	10.68	10.91	10.04	10.52	10.61	09.79	09.60	09.73	10.26	10.13	10.21
Fertilizers	08.62	10.51	09.77	08.18	10.72	09.79	08.27	10.51	09.13	08.41	10.56	09.42
Insecticide pesticides	00.69	00.92	00.81	00.61	00.70	00.68	00.75	00.82	00.79	00.71	00.80	00.75
Threshing	05.27	06.00	05.71	05.04	05.88	05.64	05.57	05.97	05.75	05.46	05.93	05.69
Tractor charges	07.20	09.60	08.63	07.90	10.51	09.52	10.13	11.71	10.75	09.27	10.82	09.99
Depreciation	00.58`	00.60	00.60	00.62	00.65	00.66	00.71	00.70	00.70	00.68	00.66	00.66

Land revenue	00.10	00.10	00.10	00.10	00.10	00.10	00.10	00.10	00.10	00.10	00.10	00.10
Interest on working capital	01.44	01.48	01.46	01.33	01.48	01.46	01.42	01.50	01.45	01.42	01.49	01.45
Cost A	50.01	51.59	51.10	46.60	51.91	50.82	49.61	52.25	50.67	49.54	51.89	50.66
Rental value of land	17.35	17.84	17.61	15.83	17.67	17.31	16.73	17.10	16.95	17.15	17.72	17.34
Interest on fixed capital	01.77	02.16	02.03	08.65	02.39	02.48	02.67	02.70	02.68	02.50	02.53	02.52
Cost B	69.13	71.69	70.74	71.07	71.97	70.61	69.01	72.34	70.31	69.18	72.14	70.52
Inputted value of family labour	30.87	28.31	29.26	28.92	28.02	29.48	30.99	27.65	29.70	30.81	27.86	29.48
Cost C (Rupees)	10998	11713	11445	11550	11385	11108	10566	10956	10699	10732	11287	10971

Less Prog. = Less Progressive

Prog.=   Progressive

accounted for 29.48 percent, 17.34 percent, 10.21 percent, 9.99 percent and 9.42 percent respectively over the total cost i.e. cost C. It is interesting to note that the farmers used the insecticides and pesticides in paddy crop only. It is clear from the table that the average cost of production of progressive farmers is higher than that of less progressive farmers. This difference is mainly due to the inputs such as hired human labour, fertilizers, insecticides/pesticides, threshing, tractor charges, and interest on working capital, rental value of land and interest on fixed capital. The progressive farmers use more percentage of purchased seed as compare to less progressive farmers. The less-progressive farmers use per hectare more quantity of seed as compare to progressive farmers from the recommended level. The farm 'size wise analysis shows that the highest total average cost i.e. cost C of total farmers is observed on small farm size, followed by marginal and medium farmers. The progressive farmers' cost C shows the decreasing trend with the size of holding and cost Al and cost B of the total farmers shows the inverse relationship where cost A and Cost B of the progressive farmers indicate the positive relationship with the size of farm. The use of tractor, fertilizers, insecticides/pesticides was found high on progressive farmers than less-progressive farmers. The average cost of hired human labour and tractor charges of less-progressive, progressive and total farm size was positively associated whereas bullock labour and farmyard manures was inversely related to the size of holding. Further the use of family labour was decreasing with the size of farm of the progressive group of the farmers; It is note worthy that the farmers of all size groups used insecticides/pesticides in paddy crop only. The farmers don't use insecticides/pesticides to weed control reason being that they were using as fodder to feed their livestock.

Cost of Production per Quintal and Net Returns/Gains

The level of extension and adoption of farm technology initiated the phase of transformation of farm economy from subsistence level to commercial farming. However, the pace of modernization is not uniform. Since farm technology is scale neutral means it may be equally productive in different farm sizes. But at the farm level, the rate of adoption of farm technology shows differential response. The rate of adoption of farm technology determine the level of income and employment. Keeping this in view, an attempt has been made to workout the(impact of extent of farm technology on the levels of income differentials. It was analyzed by studying the influence of farm technology on less-progressive and progressive farmers group separately. Table 1.11 shows crop-wise per hectare per quantal cost of production of less-progressive and progressive farmers. First of all taking the overall farm size. it is evident from the table that in all crops the   per quintal cost of production of less-progressive farmers is high as compare to progressive farmers over the total cost i.e.; Cost C, in all the crops. The farm size wise analysis also shows the same trend except paddy crop of the marginal farm size.This revels that the

intensity of adoption of farm techonology increases production cost marginally but it also results in a substantial increase in farm income.

Table 1.12 depicts crop wise per hectare net returns/ gains of less progressive and progressive farmers. First of all, taking the overall farm size, it is clear from the table that the net income of progressive farmer is high than the less progressive farmers over cost A1, B and Cost C in all crops together in overall farm size. The income of the progressive farmers has been estimated to Rs.3174, Rs.6319 and Rs.8604 as compare to Rs. 2377, Rs.5684 and Rs.7792 of less-progressive farmers over cost C, B and Al respectively. This indicates that progressive farmers are utilizing their fixed resource (land) more efficiently than less-progressive farmers. It is also clear from the table that the crop-wise income of progressive farmers was high than the less -progressive farmers. The net income over cost C is found highest in maize, followed by wheat and paddy, both for progressive farmers and less-progressive farmers. It may be observed from the table that there was no negative income over cost C in any size of group of the farmers, revealing that there was no disguised unemployment in any size group among the sampled farmers.

Table 1.11: Per quintal crop wise, per Hectare Cost of Production of less-Progressive and Progressive farmers

Farm size	Cost of production per quintal over cost A,B,C								
	Maize			Paddy			Wheat		
	A1	B	C	A1	B	C	A1	B	C
Marginal									
Less Progressive	236	323	507	222	332	580	267	363	495
Progressive	243	332	453	240	352	583	263	360	474
Total	240	328	458	235	346	582	264	362	483
Small									
Less Progressive	239	330	497	221	335	590	274	374	509
Progressive	237	327	457	245	359	587	287	366	482
Total	238	329	467	232	346	587	270	370	495
Medium									
Less Progressive	235	327	481	232	347	602	280	381	518
Progressive	241	332	462	251	366	598	275	375	489
Total	237	329	474	239	354	600	278	379	507
Overall									
Less Progressive	236	327	478	230	353	607	277	377	513
Progressive	240	330	459	246	366	596	270	369	484
Total	238	329	469	238	559	602	273	373	499

Table 1.12:Crop wise, per Hectare Net returns/ Gains of Less Progressive and Progressive farmers (In Rupees)

Farm size	Income Differential over Cost A1,B and C											
	Maize			Paddy			Wheat			All		
	A1	B	C	A1	B	C	A1	B	C	A1	B	C
<u>Marginal</u>												
Less Progressive	8524	6544	3335	9238	7131	2380	8140	5958	2951	2464	6361	2966
Progressive	9230	7007	3946	9349	7094	2463	9081	6630	3775	9185	6842	3526
Total	8912	6798	3637	9290	7096	2415	8690	6349	3432	8865	6817	3268
<u>Small</u>												
Less Progressive	7748	5845	2726	8954	6838	2131	7750	5545	2559	7962	5865	2524
Progressive	8873	6729	3632	9011	6774	2315	8662	6260	3461	8791	6507	3316
Total	8823	6297	3189	9005	6828	2248	8218	5911	3021	8394	6195	2931
<u>Medium</u>												
Less Progressive	7461	5625	2559	8499	6429	1848	7356	5202	2270	7598	5548	2274
Progressive	8283	6236	3317	8565	6389	2027	8003	5703	3100	8194	5992	2962
Total	7760	5847	2835	8526	6416	1919	7597	5389	2580	7819	5718	2541
<u>Overall</u>												
Less Progressive	7669	5797	2699	8665	6421	1785	7554	5383	2427	7792	5683	2377
Progressive	8679	6563	3551	8895	6573	2117	8449	6083	3360	8604	6319	3174
Total	8109	6130	3070	8774	6494	1942	7957	5698	2848	8157	5978	2744

So far as farm size wise analysis is concerned, it was evident from the table that the income over cost C, B and Al was high in progressive farm size group than that of the less progressive farm size group. This indicates that with the extent of farm technology, the gross and net returns were increased, irrespective of farm size class Cost A1, comprising all cash and kind expense, which includes the value of bio-chemical and mechanical technology, shows a wide variation except paddy crop. The highest income over cost C was observed in maize, followed by wheat and paddy in all the farm sizes where the farm business income i.e. net income over cost Al is found to be the highest in paddy crop, followed by maize and wheat crop.

Table 1.13 depicts crop wise income differential of progressive farmers over less-progressive farmers in terms of gross value of output come over cost Al and cost C. Taking the overall position it can be observed from the table that absolute differences in terms of gross value of output over cost Al and over cost C have been estimated at Rs.1352, Rs.812 and Rs.797 respectively. The percent differences over less, progressive farmers were estimated at 10.31 over gross value of output, 10.42 over cost Al and 33.53 over cost C. The crop-wise analysis shows that the highest percent difference was estimated in wheat, followed by maize and paddy over cost

C, whereas in terms of gross value of output and over cost Ai, the highest percent difference was observed in maize, followed by wheat and paddy. The difference in income, in terms of gross value of output, is observed 9.13 percent , 10.17percent and 8.40percent of marginal, small and medium farmers respectively in all crops as a whole.

Table 1.13: Crop wise Income Differential/ Net Gain of Progressive Farmer over less Progressive Farmers (Rupees per Hactare)

Farm size	Crops			
	Maize	Paddy	Wheat	All
Marginal				
1. **Gross Value of output**				
Absolute Difference	1464	712	1463	1275
Present Difference	10.54	05.28	10.30	09.13
2. **Income Over Cost A1**				
Absolute Difference	706	111	941	721
Present Difference	08.28	01.20	11.56	08.52
3. **Income Over Cost C**				
Absolute Difference	611	83	824	560
Present Difference	18.32	03.49	27.92	18.88
Small				
1. **Gross Value of output**				
Absolute Difference	1781	762	1312	1357
Present Difference	13.98	05.84	09.49	10.17
2. **Income Over Cost A1**				
Absolute Difference	1125	57	912	829
Present Difference	14.52	00.64	11.77	10.41
3. **Income Over Cost C**				
Absolute Difference	906	184	902	792
Present Difference	33.24	08.63	35.25	31.38
Medium				
1. **Gross Value of output**				
Absolute Difference	1543	648	956	1078
Present Difference	12.70	05.12	07.18	08.40
2. **Income Over Cost A1**				
Absolute Difference	822	66	647	596
Present Difference	11.02	00.78	08.80	07.84
3. **Income Over Cost C**				
Absolute Difference	758	179	830	688
Present Difference	29.62	09.69	36.56	30.26
Overall				
1. **Gross Value of output**				
Absolute Difference	1788	818	1294	1352
Present Difference	14.33	06.36	09.55	10.31
2. **Income Over Cost A1**				
Absolute Difference	101	230	895	812
Present Difference	13.17	02.65	11.85	10.42
3. **Income Over Cost C**				
Absolute Difference	852	332	933	797

Present Difference	31.57	18.60	38.44	33.53

Over cost A1, it was estimated 8.52 percent,10.40 percent and 8.40 percent and over cost C it was obtained at 18.88 percent, 31.88 percent and 30.26 percent for marginal, small and medium farmers respectively. It may be observed from the analysis that there was inverse relationship between percent difference and farm size in wheat crop in terms of gross value of output. In the cultivation of wheat and paddy, the positive relationship was estimated between farm size and income differentials over cost C. Other variables show erratic relationship with the size of farm. The highest percentage income difference in terms of gross value of output was obtained in maize, paddy and wheat crop in the small farm size, followed by medium and marginal farm size. The income differential over cost C was estimated highest on medium farm, followed by small and marginal farm size. It is clear from the analysis that all progressive farmers under different farm sizes was benefited more over less progressive groups by adopting the farm technology. The highest impact of income differential was observed in wheat crop followed by maize and paddy. The lowest percentage difference was found in paddy because both the categories of farmers i.e. less-progressive and progressive were used relatively less quantity of modern inputs because the difference in the intensity of adoption of bio-chemical technology in less progressive and progressive farmer was found low than the maize and wheat.

6.8 Output/Input Ratio:

Table 1.15 shows the output/input ratio of less-progressive and progressive farmers. The output/input ratio has been estimated over cost C. The output/input ratios serve as a crude index of

Table 1.14: Output/ Input ratio of Less Progressive and Progressive farmer in the cultivation of major Crops

Farm size	Maize	paddy	wheat	All
Marginal Less-progressive	1:1.32	1:1.21	1:1.26	1:1.27
Progressive	1:1.35	1:1.21	1:1.32	1:1.32
Total	1:1.33	1:1.21	1:1.30	1:1.29
Small less progressive	1:1.27	1:1.20	1:1.23	1:1.23
Progressive	1:1.33	1:1.20	1:1.30	1:1.29
Total	1:1.30	1:1.20	1:1.26	1:1.26
Medium Less progressive	1:1.27	1:1.17	1:1.21	1:1.22
Progressive	1:1.32	1:1.18	1:1.28	1:1.27
Total	1:1.29	1:1.17	1:1.23	1:1.24
Over all Less progressive	1:1.27	1:1.16	1:1.22	1:1.22
Progressive	1:1.33	1:1.18	1:1.29	1:1.28
Total	1:1.30	1:1.17	1:1.25	1:1.25

Profitability and give an idea of the relationship between farm size groups and productivity. It can be observed from the table that the productivity unit of

expenditure on inputs was more than the unity both for less-progressive and progressive farmers. They had thus, having increasing returns from all the crops. This reveals that both less-progressive and progressive farmers are enjoying the increasing returns to scale, i.e., the productivity is greater than one in relative terms. It seems to be the greater awareness of farmers regarding the adoption of farm technology. It is also clear from the table that the returns per rupee invested was observed high in the category of progressive farmers than that of less-progressive farmers. The cost of production shows that average cost was higher on progressive farmers than that of less- progressive farmers. The other rentals that if there is higher cost of production, the gross and net returns were also high. The table further indicates that the output/input ratio of overall farm size of all the crops was observed as 1:1.28 and 1:1.22 of the progressive and less-progressive farmers respectively. In overall farm size 'the highest output/input ratio was found in maize, followed by wheat and paddy crop. The farm size wise analysis` shows that the output/ input ratio was higher on less-progressive farmers than that of progressive farmers, irrespective of all crops and farm sizes. The analysis also shows that there was inverse relationship between all the categories of farms and output/input ratio except the less- progressive category of marginal farm size in maize crop. With the size of farm, total input was decreasing with the size of holding. As a result of it, gross as well as net returns also decreased with the size of holding.

Suggestions

The State Government through regional research stations should undertake a comprehensive study of climatic and soil conditions along-with biological and environmental implications. On the basis of study, improved strains should be recommended for a particular area, because simply sowing of high yielding varieties of seed hardly solve the complicated problem of, achieving high productivity target. As a policy matter, best type of improved varieties of seeds should be recommended. Much attention should be paid to extension work and demonstration to induce peasants to take up this programme seriously. It should be the responsibility of regional research station to evolve improved strains of crops for the region. The farmers should have proper guidance from extension officials regarding time of sowing/ transplanting, fertilizing/ manuring, insecticides and pesticides (time and quantity) and medium-. cultural practices. The level of productivity is determined by all these factors.

It is well recognize that the fertilizer use and irrigation facilities have a positive correlation. In un-irrigated areas, fertilized crop fields show higher productivity as compared to unfertilized crops.It is suggested that the effective promotion of chemical fertilizers can be done with technical studies like soil test to determine the quantum of different types of fertilizers needed under specific conditions. Soil test summaries and regional research stations should prepare soil fertility maps of each village. Extension officials must educate the farmers about those nutrients, which are deficient in their fields and soil. These soil surveys can also provide a strong foundation for the adoption of a scientific cropping pattern. The staff deputed to collect soil samples should also collect the information regarding those factors which influence fertilizer quantity such as moisture regime, fields' slope, and texture of the soil, variety of crop along-with soil tests to arrive at

a good fertilizer recommendation. The cultivators should have proper knowledge from extension officials regarding the balanced use of nutrients and right time of fertilizer (NPK) application. The adoption of recommended practices would increase the efficiency of fertilizer use and raise return on it. The use of fertilizer depends on whether adequate fertilizers are available at desired place, time and quality of nitrogen, phosphorus and potash. It is recommended that the sale of fertilizer be opened partly to private traders, because it is not be possible for the co-operative societies to shoulder the entire burden and it would eliminate monopoly distribution by co-operative societies. The private traders may take it competitive which would be a stimulating factor in reducing prices, thereby increasing demand and helping in minimizing present difficulties.

It is recommended that the borrowing from institution should be provided at cheaper rate to the poor peasants. The terms and conditions of loan should be simple. Equally important is the point that credit extension should be on easy repayment terms for a medium period of time. Moreover, in the case of draught or monsoon failure, peasants should be given option to postpone payment till good harvest. This is possible if specific fertilizer loan is sanctioned.   The farmers should be educated by the extension officials through farm trials and demonstration that the use of insecticides/ pesticides increases the productivity per unit of land. The farmers must be motivated by the extension works and rural institution for the separate cultivation of fodder. So that both the objectives: to increase productivity and the fodder's demand for the livestock can be achieved.

A good proportion of the fertilizing ingredients contained in the farm yard manure are allowed to go waste thorough improper handling, with the result that farm yard manure prepared by the farmers is of reduced value in increasing crop production. It is recommended that the methods like dry earth boxes, loose boxes, manure pits which affect the maximum conservation of both urine and dung in a thorough state of decomposition, intermixed with straw and dry earth by practiced. The cultivation of green manuring crops must be developed. The village extension workers must popularizes these methods among cultivators.

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