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SUMMARY AND CONCLUSIONS

The present case study shows that unless the technological change is of a particular magnitude it does not have significant impact on the farm economy. The average use of fertilizers of 15.5 lbs. of N per acre did not seem to create impact in terms of significant increase in the gross income per farm or gross output of wheat from wheat area of the farm. Although the farmers who used fertilizers had bigger farms than those who did not, the difference was not significant. Similarly, the family literacy standard was higher in the fertilizer used than in the non-users. But the difference in the literacy standard was not significant. This indicates that in the early stages of adoption of technological change and low use of fertilizers, it is not necessary that big and literate farmers would lead. On the contrary, there is a tendency of reduction of rate of application of fertilizers (N) per acre as the size of the farm increased. However, literate farmers seem to use larger dose of fertilizers (N) per acre.

The gestation period between the first thought of the technological change and putting it into practice even at a low level of intensity is quite large. Unless we take adequate measures to bring down this period, we should not expect to have dramatic results immediately after the introduction of the technological change. What is true about the fertilizer use is likely to be true for any other technological change such as irrigation practices, adoption of better seed, use of insecticides and mechanization of farming.

IMPACT OF DEVELOPMENTAL ACTIVITIES ON TECHNOLOGICAL CHANGES IN VARANASI DISTRICT

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Although the Community Development Programme in Varanasi district, like other parts of the country, covers a wide range of activities and aims at bringing about a revolution in every walk of rural life, greater emphasis has been laid on agricultural programmes in order to achieve self-sufficiency in agricultural production by introducing technological changes. Technological change here refers to a change in the parameters of a production function resulting from the use of new knowledge. Thus, it is to be preceded by scientific innovation. This includes both changes in position and changes in the slope of the production func-

tion.[1] Its effect can be measured through changes in output per unit of input between two periods or two areas. This change in output-input ratio between two periods or areas may also be due to other factors like change in input or output combination or changes in returns to scale. But, it has been shown that neither of these presents a serious limitation to the measurement of technological change through an output-input relationship.[2]

The technological changes envisaged in the Community Development programme are the introduction of improved varieties of seeds, use of chemical fertilizers, adoption of improved cultural practices and implements. However, little is known about the nature and extent of technological changes brought about due to Community Development programme in Varanasi district in Uttar Pradesh. It is with this object in view that the present study has been undertaken. It aims at finding : (1) the changes in the nature and extent of inputs used due to development activities, (2) the effect of these changes on per acre yields, and (3) the effect of these changes on output-input ratio.

Methodology

In the absence of a bench-mark data for a comparative study of changes in technology over time, a sample of two adjoining blocks having similar agro-economic conditions in a year prior to the initiation of the development activities has been drawn. In selecting the blocks care was taken that in one of these development programme should have been going on for a number of years, while in the other it ought not have started at the time of investigation. As such, in assessing the impact of Community Development programme on technology the study relies on a comparison of the existing methods and practices in block and non-block areas. It is based on the assumption that the observed existing differences in the two areas are due to developmental activities. Keeping this in view two blocks, namely, Chiraigaon inaugurated in April, 1957 and Harahua where activities had not started till the time of investigation and as such could serve as a control block were selected for a comparative study. In each block five *Gram Sabhas* were randomly selected for detailed investigation. In each *Gram Sabha* a list of all the cultivating households was prepared with the help of Panchayat records. After ascertaining the size of holding of each household through personal interview with the head, the cultivators were stratified into three categories : (*a*) those having land upto 2.5 acres, (*b*) those having more than 2.5 to 5.0 acres of land, and (*c*) those having more than 5.0 acres of land.

From each strata 20 per cent of the cultivators in each village were randomly selected for primary investigation. In Chiraigaon, 45 cultivator families were selected from the size-group of holdings below 2.5 acres, 27 families each from the size-group of holdings between 2.5 to 5 acres and above 5 acres respectively. The corresponding number of families selected from the three size-groups in Harahua was 42, 15 and 14. On the whole, the study covers 99 families in Chiraigaon block and 71 families in Harahua block. The investigations relate to the year 1962-63.

1. *c.f.*, R. M. Solow, "Technical Change and the Aggregate Production Function," *The Review of Economics and Statistics*, Vol. 39, pp. 312-13.

2. T. T. Stout and V. W. Ruttan, "Regional Patterns of Technological Change in American Agriculture," *Journal of Farm Economics*, Vol. XL, No. 2, May, 1958, p. 198.

Use of Improved Seeds

The distribution of the improved seed in the district is done by the Department of Agriculture through the Co-operative Seed Stores functioning in the area. The village level workers in the block area provide information regarding improved seed to the cultivators. They also arrange seed demonstrations on farmers' land to convince the cultivators of the superiority of new varieties to the existing ones. No such agency at the village level exists in the non-block areas. Here the responsibility, therefore, lies with the Agricultural Inspector who is unable to perform it effectively due to large area. Our investigations reveal considerable differences in the adoption of improved seeds in the block (Chiraigaon) and non-block (Harahua) areas as given in Table I.

TABLE I—ADOPTION OF IMPROVED SEEDS IN BLOCK AND NON-BLOCK AREAS

Size-group (in acres)	Percentage of households adopting improved seeds		Percentage of cropped area under improved seeds	
	Chiraigaon	Harahua	Chiraigaon	Harahua
Upto 2.5	42.22	11.90	20.9[illegible]	4.14
2.5 to 5.0	48.14	13.33	22.54	6.07
Above 5.0	74.07	14.28	30.85	12.92
Average	52.52	12.67	27.28	9.45

The table reveals that while more than half of the families in the block area have adopted some improved seed, in the non-block area only about one-eighth have done so. Further a little more than one-fourth of the total cropped area of investigated families in Chiraigaon block is under improved seed, while in the case of Harahua it is less than one-tenth. The percentage of families adopting improved seed shows a tendency to increase with the increase in the size of holding. The possible reason for this is that cultivators having bigger holdings have better resources and thus have benefited more.

Crop-wise Adoption of Improved Seeds

During the investigation it was found that the authorities in the district have been supplying improved varieties of wheat (N.P. 710, N.P. 760), barley (K_{13}), pea (T_{163}) and paddy (N_{22}, T_{136}, T_9). The extent of improved seeds for these crops in Chiraigaon and Harahua is given in Table II.

It is evident that improved wheat seed is more popular in Chiraigaon block, while in Harahua no such distinction is possible. Further, the percentage of cropped area under improved seeds, in general, is more than the percentage of farmers adopting improved seeds. This indicates that generally farmers putting proportionately more land under a particular crop have adopted improved seed. The investigations further reveal that when a cultivator uses improved seed of a crop, he uses the same in the entire area under that crop. This is due to the fact that once the cultivators obtain improved seed, they multiply the same and keep it in stock for coming years.

TABLE II—CROP-WISE ADOPTION OF IMPROVED SEED

Size-group (in acres)	Percentage of families adopting improved seed						
	Chiraigaon				Harahua		
	Wheat	Barley	Pea	Paddy	Wheat	Barley	Pea
Upto 2.5	57.57 (68.18)	21.21 (16.23)	21.62 (20.52)	17.85 (10.07)	13.16 (9.48)	12.12 (7.61)	10.81 (11.38)
2.5 to 5.0 ..	50.00 (48.10)	37.50 (32.01)	28.00 (31.01)	30.43 (34.03)	13.33 (10.89)	15.38 (15.07)	13.33 (13.10)
Above 5.0 ..	63.96 (79.92)	50.50 (51.63)	44.44 (38.28)	28.00 (22.80)	14.28 (27.85)	15.38 (22.32)	14.28 (30.70)
Average	57.14 (70.10)	29.42 (41.07)	30.33 (33.65)	25.00 (24.43)	13.43 (19.54)	13.55 (17.27)	12.12 (21.66)

N.B. : The figures in parentheses give the percentage of cropped area under improved seeds.

In addition to wheat, barley, pea and paddy supplied by the authorities, a few cultivators had also arranged for the improved seed of sugarcane, potato and maize from various sources through personal efforts. Since our aim is to evaluate the impact of developmental activities on technology and the distribution of these seeds has not been done by the block authorities, they have not been included in Table II.

Use of Chemical Fertilizers and Manures

In the developmental activities considerable efforts are made to popularize the use of chemical fertilizers and compost. The percentage of investigated families using fertilizers and manures along with area covered is given in Table III.

TABLE III—ADOPTION OF FERTILIZERS AND MANURES

Size-group (in acres)	Percentage of families using fertilizers and manures					
	Chiraigaon			Harahua		
	Nitrogenous	Phosphatic	Farmyard manure	Nitrogenous	Phosphatic	Farmyard manure
Upto 2.5 ..	68.88 (27.77)	6.66 (0.52)	57.77 (9.01)	50.00 (10.12)	—	61.90 (11.16)
2.5—5.0 ..	66.66 (26.68)	18.51 (1.02)	70.37 (18.38)	73.33 (8.38)	—	66.66 (8.52)
Above 5.0 ..	92.59 (36.66)	44.44 (9.82)	88.88 (13.58)	85.71 (14.11)	—	85.71 (14.81)
Average ..	74.74 (32.62)	20.20 (6.63)	69.69 (11.74)	54.22 (11.91)	—	66.19 (11.09)

N.B. : The figures in parentheses give the percentage of area covered by fertilizers.

We observe that like improved seed, use of fertilizers is more in the block area than in the non-block area. On an average, about 75 per cent of the farmers in the block area and 54 per cent in the non-block area use nitrogenous fertilizers. The percentage of families using fertilizer tends to increase with the increase in the size of holding. The percentage of area covered under fertilizers is much

lower than the percentage of families using them. This suggests that even when a farmer uses fertilizer, he uses it on a small area of his holding, mainly due to procedural and financial difficulties in obtaining it and lack of conviction amongst cultivators about the recommendations.

Phosphatic fertilizer is used to a very limited extent only. Only one-fifth of the investigated families in the block area and none in the non-block area have reported the use of phosphatic fertilizers. The practice of using compost is prevalent in both the areas, although most of the cow-dung is used as fuel and only that collected under forced circumstances during the three rainy months is scantily spread in different plots.

Although a high proportion of families is using fertilizers, the same is being used in inadequate quantity. The use of nitrogenous and phosphatic fertilizers (in terms of ammonium sulphate and superphosphate) per cropped acre on investigated families is given in Table IV.

TABLE IV—USE OF NITROGENOUS AND PHOSPHATIC FERTILIZERS (LBS. PER CROPPED ACRE)

Size-group (in acres)	Nitrogenous fertilizer		Phosphatic fertilizer	
	Chiraigaon	Harahua	Chiraigaon	Harahua
Upto 2.5	17.83	0.40	5.22	—
2.5 to 5.0	12.88	0.13	4.76	—
Above 5.0	19.22	4.10	3.54	—
Average	18.48	2.76	3.97	—

On an average, 18.48 lbs. and 2.76 lbs. of nitrogenous fertilizer are being applied to an acre by the investigated families in Chiraigaon and Harahua blocks respectively which is very low. Even if we estimate the same on the basis of the area covered the dose comes to about 57 lbs. and 23 lbs. respectively. This is also quite inadequate to provide sufficient nutrients.

Our investigations reveal that potato, wheat, paddy, barley and maize are the important crops to which nitrogenous fertilizers are applied. However, the percentage of area covered by them varies from crop to crop as given in Table V.

TABLE V—EXTENT OF THE USE OF NITROGENOUS FERTILIZERS IN IMPORTANT CROPS

Crop	Percentage of area covered with nitrogenous fertilizers							
	Chiraigaon				Harahua			
	Size-group (in acres)				Size-group (in acres)			
	Upto 2.5	2.5 to 5.0	Above 5.0	Average	Upto 2.5	2.5 to 5.0	Above 5.0	Average
Wheat	48.43	62.62	87.63	73.54	18.90	5.81	40.44	27.99
Barley	38.00	33.28	65.57	52.88	7.23	17.97	17.31	14.94
Paddy	55.07	56.98	66.43	62.68	9.15	—	28.20	21.89
Maize	47.87	37.50	43.46	43.17	18.76	23.62	23.46	21.99
Potato	98.83	78.66	98.65	93.69	60.20	88.06	86.29	74.05

The greatest use of nitrogenous fertilizer in both the areas is in the case of potato, followed by wheat, while its minimum use in the case of Chiraigaon is in maize and in Harahua in barley.

Changes in Cultural Practice and Improved Implements

In the Community Development programme attempts are made to introduce changes in existing cultural practices and use of implements by arranging demonstrations. However, these attempts have met with partial success only. Of the different improved implements recommended, only iron plough is found with a few cultivators. Our investigations reveal that a few farmers have made use of other improved implements like cultivator and hand hoe brought at the block headquarters for demonstration purposes, but none of them have purchased the same so far.

TABLE VI—EXTENT OF ADOPTION OF CULTURAL PRACTICES

Improved practice	Size-group (in acres)	Percentage of families adopting							
		Chiraigaon				Harahua			
		Upto 2.5	2.5 to 5.0	Above 5.0	Average	Upto 2.5	2.5-5.0	Above 5.0	Average
U. P. method of wheat cultivation		51.51 (51.38)	41.51 (42.24)	51.85 (69.59)	48.80 (61.34)	—	—	—	—
Japanese method of paddy cultivation		— —	8.69 (5.74)	12.00 (7.87)	6.57 (6.23)	—	—	—	—
Dibbling		12.12 (3.03)	4.16 (1.23)	11.11 (8.17)	9.52 (5.42)	—	—	—	—
Green manuring		6.66	3.70	14.81	9.09	—	—	—	—
Iron plough		—	3.70	18.51	6.06	—	—	35.71	7.04

N.B. : The figures in parentheses give the percentage of area covered under improved practices.

From the above table we observe that the U. P. method of wheat cultivation has been adopted by 48.80 per cent of the farmers in Chiraigaon block. Like improved seed of wheat here also the percentage of area covered by this method is more than the percentage of families adopting it. The adoption of other practices like the Japanese method of paddy cultivation, dibbling, green manuring and improved implements even in Chiraigaon block has been made to a very small extent. Except a few in the size-group of holdings above 5 acres who have adopted improved plough, none of the recommended practices have been adopted in Harahua.

Effect of Technological Changes

Technological changes bring about a change in input and output structure on farms. As mentioned earlier, its effect can be measured through differences in the output-input ratio and average yield in both the areas. The output-input ratio for important crops as investigated is given in Table VII.

TABLE VII—OUTPUT-INPUT RATIO FOR IMPORTANT CROPS

Crop	Chiraigaon			Harahua		
	Input-Rs./acre	Output-Rs./acre	Output-input ratio	Input-Rs./acre	Output-Rs./acre	Output-Input ratio
Wheat	179.66	261.16	1.43	181.50	244.00	1.34
Barley	40.09	206.89	1.47	133.15	190.93	1.43
Paddy	72.65	141.47	1.95	69.28	127.80	1.84
Maize	60.32	120.53	2.00	62.30	111.10	1.78
Potato	461.56	720.23	1.55	368.80	565.14	1.46

The output per unit of input varies considerably from crop to crop, although it is higher in Chiraigaon than in Harahua. This difference may be attributed mainly to more adoption of improved practices in the former block. It indicates that the adoption of improved practices favourably affects the output-input ratio and since the extent of adoption has been small the difference is also not much.

The average yield of important crops along with the difference in yield in both the areas is given in Table VIII.

TABLE VIII—AVERAGE YIELD OF IMPORTANT CROPS

Crop	Average yield in maunds per acre		Difference in yield	
	Chiraigaon	Harahua	In maunds	Percentage
Wheat	11.33	10.19	1.14	10.1
Barley	11.64	9.80	1.84	15.8
Paddy	10.36	9.21	1.15	11.1
Maize	9.63	8.16	1.47	15.3
Potato	90.83	81.00	9.83	10.8

The yields per acre like output-input ratio are higher in Chiraigaon than Harahua, the variation being from 10.1 to 15.8 per cent. This difference may be attributed to the difference in the adoption of improved practices.

Conclusion

A study of the impact of developmental activities on technological changes reveals considerable difference in the adoption of improved practices in block and non-block areas. Although a high percentage of farmers in Chiraigaon has started using improved seed and fertilizer, the proportion of total cropped area covered under both these practices is quite small. This suggests that even when a farmer has adopted an improved practice, he has done so on a small area. The output-input ratio and yields per acre in Chiraigaon are a little higher than in Harahua, thereby indicating the favourable effect of improved practices on per acre output-input ratio and yield. Since the extent of adoption has been small, the difference in output-input ratio and yields per acre in the two blocks do not seem to be significant.