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RETURNS TO SCALE AND CO-OPERATIVE FARMING

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The adoption of the resolution on 'Agrarian Organizational Pattern' at the 64th Session of the Indian National Congress held at Nagpur in June, 1959 has rendered co-operative farming a subject of great national importance and an object of searching analysis. Many economists, research workers, administrators and politicians have expressed their views in favour of or against joint co-operative farming as an ultimate pattern of agrarian organization. The antagonists to the proposal have often advanced the argument that big farms have not shown any economies of scale in respect of higher output per unit of land and that with the increase in the farm size the output per acre tends to diminish. The results of farm management studies have been frequently quoted in this context. Protagonists of the proposal, on the other hand, claim that the efficiency of production as well as overall production can be raised with the adoption of joint co-operative farming. This article discusses why an increase in farm size is not accompanied by an increase in output per unit of land and whether the combination of farms into bigger units through co-operative farming would lead to a fall in the overall output.

The data given in 'Studies in Economics of Farm Management'¹ based on 200 farms spread equally over 20 villages of Punjab, 10 each in Amritsar and Ferozepur districts, have been utilized for this article.

Input and Output Per Acre

The input and output per acre in different size of farms is given below. The input includes cost of all items whether purchased or owned and output is the value of the gross output valued at prices prevailing at the harvest time.

INPUT AND OUTPUT

Size of Farms (acres)	No. of Farms	Input per acre	Output per acre
		Rs.	Rs.
0—5	14	239.9	200.5
5—10	50	202.7	185.7
10—20	78	180.2	172.9
20—50	52	154.5	154.4
50 and above ² ..	6	126.8	142.9
Overall Average ..	200	165.4	162.8

*The views expressed are author's own. The author is thankful to Shri M. C. Joshi for his assistance in the preparation of this paper, particularly in the processing of the data.

1. 'Studies in Economics of Farm Management' organised by the Directorate of Economics and Statistics, Ministry of Food and Agriculture in collaboration with Research Programmes Committee of Planning Commission.

2. The last size-group has not been considered in the note because all the farms in this group lie in Ferozepur district and their number is quite small.

It would appear from the table that output as well as input decreases with the increase in the farm size.

Irrigation and Input and Output

Irrigation is one of the important factors influencing production in agriculture in this region. The percentage area irrigated along with input and output per acre of irrigated and unirrigated lands is given below for the different size-groups :

INPUT AND OUTPUT PER ACRE OF IRRIGATED AND UNIRRIGATED LAND

Size-Group (acres)					Percentage area irrigated	Irrigated		Unirrigated	
						Input	Output	Input	Output
						Rs.	Rs.	Rs.	Rs.
0—5	..	..	..	93	247.1	206.8	142.0	150.0	
5—10	..	..	..	87	215.8	197.3	112.4	109.0	
10—20	..	..	..	76	205.0	201.2	98.7	79.5	
20—50	..	..	..	66	188.2	193.7	85.2	74.3	
50 and above	..	..	..	84	139.7	161.0	61.0	43.4	
Overall Average	..	..	..	74	191.9	192.7	88.8	75.7	

The output per acre in the case of irrigated lands does not show any persistent downward trend while such a tendency is clearly discernable in unirrigated lands. The percentage irrigated area being comparatively low in the case of bigger units, the overall output per acre shows a distinct tendency to fall with the increase in farm size. The inescapable conclusion thus seems to be that in small size farms better irrigation facilities contribute to a great extent towards higher gross output per acre. Timeliness of operations, specially for conserving soil moisture for crops is a very important factor in dry farming. In this respect small size farms are obviously in a better position than the bigger units as may be seen from the number of draught cattle per acre. It is specially so when the type of implements used is almost the same on both the types of farms. The introduction of improved implements affording wider coverage in a specified time may, however, change the position somewhat.

DRAUGHT CATTLE PER ACRE

Size of Farm (acres)	Draught	Cattle
0—5	0.40	
5—10	0.27	
10—20	0.19	
20—50	0.13	
50 and above	0.06	
Overall Average	0.16	

As hiring of bullock labour is not common in the area, a minimum number of draught cattle, that is a pair, is required to be maintained even on small farms, though their size may not afford sufficient employment throughout. Thus the higher number of draught cattle per acre in small size farms is largely a necessity.

CROPPING PATTERN

It would appear that the pattern of cropping followed on farms in different

PERCENTAGE DISTRIBUTION OF GROSS CROPPED AREA

Items	Size-Group (acres)						Overall average
	0—5	5—10	10—20	20—50	50 and above		
Food Crops	56.7	58.1	61.5	63.4	45.4		60.5
Oilseeds	2.9	2.8	2.5	2.6	4.9		3.0
Fibre Crops	13.2	13.5	13.5	14.5	34.7		16.0
Fodder Crops ...	26.8	25.3	22.1	18.9	15.0		20.0
Miscellaneous ..	0.4	0.3	0.4	0.6	—		0.5
Overall	100.0	100.0	100.0	100.0	100.0		100.0

size-groups upto 50 acres on an average compares fairly well with each other. The slightly higher proportion of area under food-crops in higher size-groups is again on account of the comparatively higher percentage of unirrigated lands in these size-groups. These dry lands are generally put under food crops.

PRODUCTIVITY LEVEL OF LAND

(1) *Rent per Acre*.—Rent per acre is not an exclusive indicator of the fertility level of land as the influence of other factors such as pressure of population and location has also to be taken into account.

RENT PER ACRE

Size-Group (acres)	Annual Rent
	Rs.
0—5	73
5—10	67
10—20	59
20—50	55
50 and above ..	49
Overall Average ..	57

The rent per acre shows a conspicuous tendency to fall as the farm size increases. Better quality of land in small units as compared to the larger units can be one of the important factors behind this tendency. Better irrigation facilities in the case of small size farms is another important reason.

(2) *Farm Yard Manure*.—Farm yard manure is the main source of fertility of crop land in the region. It is of particular importance in view of the fact that the level of use of fertilizers is quite low (about Re. 1/- per acre cultivated) and green manuring is not extensively practised. The relative supply of farm-yard manure in different size-groups may roughly be gauged from the number of livestock per acre maintained.

LIVESTOCK PER ACRE

Size-Group (acres)	Livestock (Bullock Units)
0—5	0.92
5—10	0.64
10—20	0.48
20—50	0.31
50 and Above	0.17
Overall Average	0.39

The livestock per acre decreases with the increase in the size of farm.

(3) *Historical Reasons*.—The proportionately larger number of livestock in the small size farms over a long time seems to have contributed to comparatively better fertility of land. Another reason may be the transfers of land on account of distress sales and mortgages from one holding to another. This may have led to further concentration of better quality land in the small size farms. This point needs, however, to be confirmed through a study of such transfers but on *a priori* grounds it may be stated that whenever sales and mortgages of land from one holding to another occur, it is expected that it is the marginal lands which are disposed of first. The bigger farms, therefore, are more likely to include some marginal areas which have been obtained from other farms through such sales and mortgages.

EFFICIENCY MEASURES

The following four indicators have been taken into account to study the comparative efficiency of operation of farm business in different size-groups.

- (1) Net earnings.
- (2) Gross and net productivity of labour.
- (3) Return to capital investment.
- (4) Yield per acre of main crops.

The integrated indicators from these measures will bring out the changes likely to be brought about in the efficiency of farm business by the increase in farm size through co-operative farming.

(1) *Net Earning*;—The net profit or loss per acre, as a surplus of gross output over the total inputs, may be taken as an index of efficiency of production in case farming is taken as a business proposition.

NET PROFIT OR LOSS PER ACRE

Size-Group (acres)	Profit (+) or Loss (—)									
										Rs.
0—5	—39.4
5—10	—17.0
10—20	— 7.3
20—50	— 0.1
50 and above	+16.1
Overall Average	— 2.6

The loss per acre (overall) decreases with the increase in the farm size and the large size-groups earn a profit.

(2) *Gross and Net Productivity of Labour*;—The gross productivity per productive man-work day of 8 hours unit has been calculated by dividing the gross output by the total number of productive man-work days. The net productivity level indicates the earnings per productive man-work day after allowing for the cost of all other items used in the production process except the human labour.

GROSS AND NET PRODUCTIVITY PER PRODUCTIVE MAN-WORK DAY

Size-Group (acres)						Gross Productivity	Net Productivity
						(Rs.)	(Rs.)
0—5	..	..	..	..	..	3.77	0.69
5—10	..	..	..	..	..	4.15	1.04
10—20	..	..	..	..	..	4.67	1.33
20—50	..	..	..	..	..	5.32	1.66
50 and above	..	..	..	..	..	6.98	2.68
Overall Average	..	..	..	..	..	5.02	1.53

Both gross as well as net productivity per productive man-day shows a persistent tendency to rise. This is also an indicator of superior *efficiency of production* in the higher size groups than in the smaller ones.

(3) *Return to Capital Investment*:—Return to capital investment measures the "Pay off" rate of the investment. It has been worked out as :

$$\text{Return to Capital Investment} = \frac{\text{Farm Investment Income}}{\text{Capital Investment}}$$

(Farm investment income has been calculated by deducting from gross output, expenses actually incurred as well as imputed ones except interest on capital investment and rental value of land).

RETURN TO CAPITAL INVESTMENT

(Land, implements, machinery, equipment, drought cattle, cattle-sheds, wells and irrigation structures)

Size-Group (acres)	Capital Investment per acre		Farm Investment Income per acre		Percentage Return to Capital Investment	
	Including Land	Excluding Land	Including Land	Excluding Land	Including Land	Excluding Land
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
0—5 ..	1465.3	250	36.6	—36.4	2.5	—14.6
5—10 ..	1417.9	171	52.0	—15.0	3.7	— 8.8
10—20 ..	1244.0	150	53.7	— 5.3	4.3	— 3.5
20—50 ..	911.4	102	56.9	+ 1.9	6.2	+ 1.9
50 and above ..	650.6	46	66.1	+ 17.1	10.2	+ 37.2
Overall Average	1041.4	108	56.4	— 0.6	5.4	— 0.6

It may be seen that capital investment decreases while farm investment income increases with the increase in the farm size resulting thereby in a comparatively higher rate of return to capital investment in higher size groups. In this connection it may be mentioned that at farms in lower size-groups a minimum of certain items of capital investment has to be maintained though their utilization may be far from full on account of the smaller size of the farms. Bullock labour and dead stocks bear special mention in this connection.

Another important feature brought out by this analysis is that if remuneration to land is accounted for by its rental value, return to the remaining capital investment is negative upto the size-group 10-20 acres.

(4) *Yield per Acre*:—The yield per acre of two main crops, i.e., wheat irrigated and American cotton are also comparatively higher in larger size-groups than in the case of smaller ones.

YIELD PER ACRE OF WHEAT IRRIGATED AND AMERICAN COTTON

Size-Group (acres)	Wheat Irrigated (Grain)	American Cotton (Kapas)
0—5	10.96	4.85
5—10	9.61	5.26
10—20	11.77	5.33
20—50	11.89	7.08
50 and above	16.76	6.44
Overall Average	11.89	6.26

*A Paradox;—*A similar cropping pattern in different size-groups and higher yields per acre of main crops in larger size-groups brings out a paradoxical situation as to why the gross output is low in their case. It may be noted that the intensity of cropping decreases with the increase in the size of farm.

$$\text{Intensity of cropping} = \frac{\text{Gross cropped area}}{\text{Cultivated area}} \times 100$$

(Net area sown + current fallow)

Thus a more extensive practice of double cropping in lower size of farms increases the gross output per acre in their case even when the yield of individual crops is low.

INTENSITY OF CROPPING

Size-Group (acres)	Irrigated	Unirrigated	Overall
0—5	164	145	162
5—10	155	122	152
10—20	144	112	136
20—50	133	105	124
50 and above	111	104	109
Overall Average	137	108	129

LUMPY FACTORS USE

(1) *Human and Bullock Labour;—*The bigger farms definitely demonstrate a comparatively better efficiency of production as indicated by the net profit or loss, gross and net productivity of labour and yield of major crops. A more

EMPLOYMENT PER FARM WORKER AND PER PAIR OF BULLOCKS PER ANNUM ON THE FARM AND HUMAN LABOUR INPUTS PER ACRE

Size-Group (acres)			No. of permanent farm workers per acre	Employ- ment per farm worker	Employ- ment per pair of Bullocks	Human and Bullock Labour Inputs per acre				
						Human Labour		Human Labour (Total)	Bullock Labour	
						Family and Ex- change	Hired		Family and Ex- change	Hired
0—5	..	..	0.33	203	67	33.2	5.3	53.23	30.0	0.0
5—10	..	..	0.23	226	97	30.1	4.7	44.77	28.0	0.1
10—20	..	..	0.16	262	122	23.8	6.1	37.04	23.8	0.2
20—50	..	..	0.11	286	142	16.9	7.4	29.05	18.8	0.1
50 and above	..	..	0.04	444	173	6.4	11.8	20.46	12.2	1.5
Overall	..	..	0.13	267	126	19.4	7.1	32.45	20.9	0.2

$$\left. \begin{array}{l} 1. \text{ Wheat Irrigated } Y = 8.70 + 0.288x_1 - 0.122x_2 \\ \text{ (Grain Yield)} \\ 2. \text{ American Cotton } Y = 2.33 + 0.1353x_1 - 0.0501x_2 \\ \text{ (Kapas)} \end{array} \right\} \begin{array}{l} \text{Regression} \\ \text{Coefficients} \\ \text{are significant.} \end{array}$$

Y = physical output per acre.

As regards bullock labour, the two regression equations indicate that its use is pushed in some cases to the extent that it becomes rather inimical to higher yields. Though the necessity for further research on the problem need hardly any emphasis, it is expected that in smaller farms where under the existing crop schemes the bullock labour could only be employed for only two to three months in a year, its excessive use may be taking place.

INVESTMENT ON DEAD STOCK (IMPLEMENTS, MACHINERY AND EQUIPMENT) PER ACRE

Size-Group (acres)										Investment
0—5	..	..	..	..	..	..	..	..	..	Rs. 38.3
5—10	..	..	..	..	..	..	..	..	..	29.1
10—20	..	..	..	..	..	..	..	..	..	27.8
20—50	..	..	..	..	..	..	..	..	..	22.4
50 and above	..	..	..	..	..	..	..	..	..	12.3
Overall Average	..	..	..*	..	..	..	..	..	..	24.6

The bulk of farms in the country are family farms. The criteria of farm efficiency, namely, net earnings, productivity of labour and returns to capital investment used in the paper earlier are not quite appropriate in the case of family farms though these are quite suitable for the co-operative farming system. The main objective of the family farms is to maximise the returns to owned resources, viz., land, family labour and owned capital. In order to make the figures between different size-groups comparable, the returns to land, permanent labour (family as well as permanent farm servants), fixed capital and management are computed. This renders all the farmers to the status of a peasant proprietor having all permanent farm labour as belonging to his family.

[illegible]

The farm business income (returns to land, permanent labour, fixed capital and management) shows a tendency to fall with an increase in the farm size. The difference, however, is not so wide between size-groups upto 20 acres.

It will be of interest to compare the rate of increase in the farm business income with some of the tendencies exhibited by the crucial data presented in the paper earlier.

INDICES OF PER ACRE VALUE

(0—5 acres as base)

Size-Group (acres)	Output	Input	Output as per cent of Input	Labour days (Crop produc- tion and main- tenance of drought cattle)	Labour Productivity		Investment		Return to Invest- ment includ- ing land	Returns to land, perman- ent labour, capital invest- ment & manage- ment
					Gross	Net	Includ- ing land	Exclud- ing land		
0—5	100.0	100.0	84	100.0	100.0	100.0	100.0	100.0	100.0	100.0
5—10	92.6	84.5	92	84.1	110.1	150.7	96.8	63.4	148.0	98.6
10—20	86.2	75.1	96	69.6	123.9	192.7	84.9	60.0	172.0	95.0
20—50	77.0	64.4	100	54.6	141.1	240.6	62.2	40.8	248.0	85.3
50 and above	71.3	52.9	112	38.4	185.1	388.4	44.4	18.4	408.0	81.4
Overall	81.3	68.9	99	60.8	133.2	366.7	71.1	43.2	216.0	88.6

Output as well as input decreases with an increase in the farm size, the rate of fall in input is more conspicuous as compared to that of output. It results in an increasing output/input ratio with the increasing size of farm.

It may be noted that corresponding to 1.4 per cent higher farm business income in the size-group 0-5 acres as compared to 5-10 acres, the labour input is higher by 16 per cent and the capital investment by 3 per cent (30 per cent excluding land). A 30 per cent additional input of human labour and 15 per cent more capital investment (40 per cent excluding land) in size-group 0-5 acres as compared to 10-20 acres are accompanied by only 5 per cent increase in the farm business income. A substantial difference, however, is there (15 per cent) between farm business income of size-groups 0-5 and 20-50 acres. Here again the corresponding difference in the labour input is (+) 45 per cent and that of capital is (+) 38 per cent (+ 60 per cent excluding land). The cropping pattern followed in different size of farms is almost the same. This analysis thus points out to the dire necessity of adjusting suitably the farm plans of the farms leading to a more complete and rational use of their resources.

CONCLUSION

The analysis points out that the higher gross output per acre in the lower size-groups is mainly on account of better quality of land and more irrigation facilities.³ Now the question arises that if these farms are combined into larger units, will these advantages dwindle to insignificance?⁴ Obviously, the answer is 'no.' On the other hand these basic advantages can be better exploited by combining them with the internal economies of scale exhibited by larger farms through a comparatively superior efficiency in the operation of farm business.⁵

The conclusion thus emerges that the combining of the small farms into co-operative units will not lead to the deterioration in the total output assuming that the management efficiency remains the same as before even after the formation of joint co-operative farms. The role of management for the economic success of co-operative farming hardly needs any emphasis. The management problems in their case will be much more complicated than on the farms individually operated. Two types of diametrically opposed forces will be inherent in the structure of co-operative farms — factors leading to deterioration in the individual initiative, cohesive forces, etc., will tend to bring down the efficiency while factors such as internal as well as external economies, enhancement in risk bearing capacity, etc., will offer opportunity for stepping up production profitably and initiating new ventures. The economic success of co-operative farms will thus depend upon the way the favourable forces are harnessed and the antagonistic forces are eliminated as far as possible. A large amount of variability has been found in the performance of even nearby farms under almost identical conditions. It thus provides a good basis for co-operative management to improve their decision. It could be attempted in the beginning to attain the highest level of efficiency already exhibited by a farm or farms among these comprising the co-operative farm. The method is known as direct⁶ comparison or efficiency factor method.

In the stage of service co-operatives, preceding joint co-operatives, it would be useful to combine the farms into suitable groups. Apart from giving guidance to them to make use of the external economies through service co-operatives, the farmers may be helped and assisted in improving their crop plans by discussion and exchange of experience. The small group approach of extension combined with the direct comparison at this stage will provide motivation to the farmers to increase their efficiency level of production and will acquaint them to some extent with the possible internal economies of scale attainable under joint co-operative farms.

The introduction of high-profit labour intensive crops in the farm plans of co-operative farms may be advisable for a more complete and rational use of

3. Also larger per unit inputs of labour and capital, though with diminishing marginal returns. (Ed.)

4. Subject to what is stated in the next paragraph regarding efficiency of management. Besides, labour may not be available on low returns as in the case of small farms. Alternately, if wages are to be paid at market rates it may not be profitable to use (employ) labour on tasks with low marginal returns. On account of both these considerations input of labour per acre may decrease even on co-operative farm, as it does on larger individual farms. This may result in lower gross output for given amount of other inputs. (Ed.)

5. Provided the Co-operative Farm Management is free to determine its labour supply. (Ed.)

6. For details refer to "Agricultural Extension Method in Farm Planning" by N. S. Randhawa, *Agricultural Situation in India*, July, 1959.

lumpy resources, the strength of which will be much more on a co-operative farm than on farm of equal size operated individually. The co-operative farms will be in a much better position to introduce such changes than the individual farmers as in the latter case the low risk bearing capacity is the major impediment in the way of adoption of such improvements. Many such adjustments in farm plans would be required to exploit the resources appropriately under a new organization. The training in farm planning through the budget-method⁷ of analysis would thus be necessary for working out the optimum allocation of resources with alternative uses consistent with pre-determined goals.*

7. For details refer to "Budget-Method in Farm Planning" by Dr. G.D. Agrawal and N.S. Randhawa, *Agricultural Situation in India*, April, 1959.

* While this issue of the *Journal* was in press, we were surprised to find this article printed in the *Agricultural Situation in India*, Vol. XV. No. 4, July, 1960 without any intimation to us. [Editors.]