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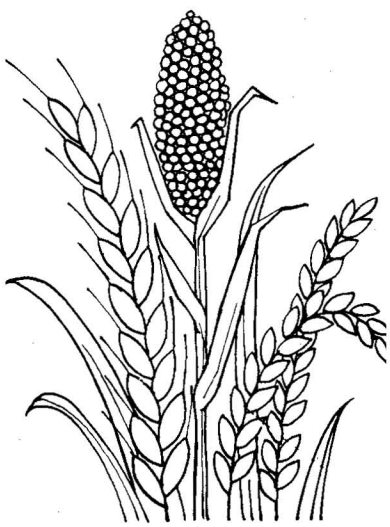

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NOTES

PROFITABILITY OF FARMS IN RAJASTHAN

Introduction

In agricultural enterprise, as in any other, profit is achieved by the proper utilization of resources, which include land, labour, seed, manure and irrigation facilities. Management is also one of the important resources, whose ability to use other resources efficiently is reflected by the extent of 'net profit'[1] realized per unit of land. Profit, as a matter of fact, is the widely accepted and genuine rod of measuring the efficiency of the management. Farmers without profit are doomed to a vicious circle of recurring low income, inefficiency and poor standard of living. Profits are both the cause and the effect of economic progress. In the interest of the society as a whole as well as of the individual farmers, it is necessary that farming as a productive enterprise should be a 'paying' business; otherwise, the vast agricultural sector of our economy will for ever be limping and our economy in general and agriculture in particular will remain backward. The farm management investigations conducted in several States of India reveal that a majority of farms run their business at a loss. Moreover, most of the farms earning profit cluster around low levels of profit. This may be noted from Table I which gives the relevant data for Rajasthan.

TABLE I—FARMS ACCORDING TO THEIR LEVELS OF PROFIT IN RAJASTHAN

Levels of profit (Rs.)	No. of farms	Percentage to total farms	Cumulative percentage
Below 20	14	42.4	42.4
20 — 40	9	27.3	69.7
40 — 60	6	18.1	87.8
60 — 80	2	6.1	93.9
80 — 100	—	—	93.9
100 — 120	2	6.1	100.0
120 and above	—	—	100.0
Total	33	100.0	

Source: Report on Studies in Economics of Farm Management in Rajasthan for 1962-63.

As the level of profit increases, the number of farms decreases.[2]

1. 'Net profit' is defined as the surplus of output over the total cost which includes cash and kind expenses actually incurred and implicit or imputed expenses : price of the factors provided by the farmer himself, for which he has not to pay at present.

2. On the basis of the results of Studies in Economics of Farm Management in Andhra Pradesh, 97.5 per cent of the farms showed profit below Rs. 250 and 77.5 per cent of the farms showed profit below Rs. 100. The range of profit in Madras was above Rs. 1,000, but 75 per cent of the farms earned less than Rs. 500. In Bombay, 82.7 per cent of the farms earned less than Rs. 500. The same tendency is revealed in all the States except Bihar where distribution of farms in all the levels of profit seems relatively uniform.

Most of the farms showing profit are not necessarily efficient ones. Profit on these farms may have been just incidental to favourable physical and climatic conditions during the year. Many farms which earned profit in one year did not do so in the following years. Therefore, it is quite reasonable to assume that profit on such farms may be mainly due to climatic factors. The following facts, based on the findings of the Studies in the Economics of Farm Management in Rajasthan region, show the irregular behaviour of profits in different years :

1. The number of farms that earned profit in 1962-63, 1963-64 and 1964-65 was 33, 21 and 58 respectively out of 98 farms.
2. There were only 11 farms which earned profit in all the three years.
3. Of the 33 farms which showed profit in 1962-63, only 13 farms in 1963-64 and 20 farms in 1964-65 reported earning profit.
4. Of the 21 farms showing profit in 1963-64, only 16 farms showed profit in 1964-65.

On further analysis, it was found that the level of profit for the farms which showed profit in all the three years was not constant and regular.

Method of Study

Though the case study method of comparing extremely good and bad farms has certain serious limitations, it however throws light on the causes of success or failure of individual farms as a productive enterprise. These extreme farms may have certain abnormalities which may not be practicable either to emulate or to discern. Therefore, the causes of profits or the good points about resource use and organization have to be brought on to the surface and differentiated from those of the unprofitable farms. Further, it is not a good practice to compare farms that have shown profit or loss only in one year. As revealed in the preceding section, profit in a particular year may have been due to chance or favourable circumstances. Therefore, only those farms which have showed profit repeatedly for at least two years have been selected for finding out the difference between profitable and unprofitable farms. On account of hazards of rains and other uncontrollable factors even the most rational manager may not get any income. Farms which showed loss in all the three years have been selected for studying the characteristics of unprofitable farms. Twenty-seven farms showed profit for at least two years and 25 farms incurred loss in all the three years. Certain variables of management of resources have been studied on the basis of data relating to the year 1964-65. Two out of these farms which did not show profit in the year have not been included in the study.

The major tool of analysis used in determining the difference between management practices of these farms is testing the significance of differences[3]

3. The formula adopted is as given by A. E. Waugh : Elements of Statistical Methods, McGraw-Hill, New York, U.S.A., 1952, p. 250 for independent series :

$$'t' = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{Q_1^2 + Q_2^2}}$$

where $\bar{X}_1$ and $\bar{X}_2$ are arithmetic averages of the two series ; Q_1 and Q_2 are standard errors of respective averages.

between the average values of different factors for the two types of farms. Thus, the differences that are statistically significant are taken as real differences and those that are not significant are taken as the differences arising due to chance. However, the descriptive measure of an 'average' does not tell the whole story about the distribution of individual items in the series. The average may not be truly representative of the series and may prompt misleading conclusions. The two series may have identical averages but the distribution of items may not be uniform. In one series the variability of items around the average may be uniform or it may be less as compared to the other. Therefore, for establishing the relative variability of the two series the coefficients of variation have been worked out.

Land and Soil Quality

Land is an important factor in production. A rational land management usually ensures profit. A few of the important aspects in land use have been tested for significance in Table II.

TABLE II—DIFFERENCES IN LAND USE AND SOIL QUALITY AND COEFFICIENT OF VARIATION

Factors	Average		't' value	Coefficient of variation (%)	
	Profitable farms	Unprofitable farms		Profitable farms	Unprofitable farms
1	2	3	4	5	6
1. Size of holding (hectare)	5.516 (±0.924)	5.523 (±0.766)	0.011†	83.58	69.09
2. Intensity of cropping	1.02 (±0.005)	1.04 (±0.008)	0.194†	4.99	8.64
3. Per cent irrigated area	30.43 (± 2.34)	32.81 (± 2.25)	0.742†	91.00	80.56
4. Soil quality‡	11.63 (±0.586)	8.25 (±0.531)	4.80*	57.58	76.97

† Insignificant.
* Significant at 1 per cent of significance.
‡ Quality of soil is measured by taking land revenue as the index of land quality.
N.B. Standard errors of the averages are given in brackets.

Usually several economies are supposed to accrue on larger farms. It is, therefore, logical to hypothesize that the profitable farms are larger than the unprofitable farms. However, Table II shows that there is no significant difference between the sizes of the two types of farms. The little difference may have been due to chance.

Further it is interesting to note that the profitable farms are relatively more dispersed than the unprofitable ones. For the profitable farms, the coefficient of variation is 84 per cent whereas it is only 69 per cent for the unprofitable farms. Some of the profitable farms are very big in size while others are small as compared to the average size. Such variation is less for unprofitable farms. However, the average is not truly representative of the two series as variations in both the series are considerable.

Intensity of cropping is 1.02 and 1.04 for the profitable and unprofitable farms respectively. This difference is also statistically non-significant. The coefficient of variation is about 5 per cent and 8.64 per cent respectively. As a matter of fact, mono-cropping is the rule in the district and double cropping is practised only where irrigational facilities are available.

It is commonly believed that farms with more irrigated area may be profitable. However, in the present case the reverse seems to be true. The average irrigated area is 30.43 per cent and 32.81 per cent respectively for the profitable and unprofitable farms. However, the difference between the two values of irrigated area is not significant at 5 per cent level of significance. The coefficient of variation of the average irrigated area is considerable for the two types of farms, being 91 per cent and 80.56 per cent respectively.

A fact which the data about the irrigated area do not reveal is that 25 per cent of the irrigated area on the profitable farms was irrigated by the Jawai Dam whereas irrigation on the unprofitable farms was wholly by wells. The cost of irrigation on irrigated area by wells is profoundly more.

Land revenue is usually charged according to the quality of the soil. More fertile is the soil, higher is the land revenue. As such land revenue may be approximately regarded as the index of the quality of the soil. Land revenue for the profitable farms is Rs. 11.63 whereas it is only Rs. 8.25 for the unprofitable farms. The difference is significant at 1 per cent level. On the profitable farms the yield due to good quality of soil is likely to be more as compared to that of unprofitable ones.

Cropping Pattern

Irrational cropping pattern may also be responsible for loss. The difference in cropping pattern is shown in Table III.

TABLE III—CROPPING PATTERN

Name of crops	Profitable farms		Unprofitable farms		't' value
	Per cent area	S.E.	Per cent area	S.E.	
A. Food crops	66.21	4.94	70.59	4.30	0.67†
1. Jowar	20.81	1.44	13.06	1.18	1.22†
2. Bajra	20.46	2.07	14.06	1.22	2.67**
3. Wheat	8.45	0.869	11.71	1.04	1.68†
4. Maize	5.30	0.003	5.51	0.002	0.65†
5. Barley	7.34	1.24	6.21	0.76	0.77†
B Non-food crops					
Til	21.76	1.42	19.54	1.34	1.31†

† Insignificant.
** Significant at 5 per cent level of significance.

It may be noted that, on the whole, there is not much difference in the cropping pattern on the two types of farms. Only bajra, a very profitable crop, is grown more on profitable farms. The two types of farms do not differ significantly so far as the area under food and non-food crops is concerned.

Business Efficiency Measures

Various aspects of land use do not show significant differences. Different criteria of measuring business efficiency of farms have been compared for the two types of farms in Table IV and tested for significant differences.

TABLE IV—DIFFERENCE IN PER HECTARE OUTPUT VALUE, TOTAL COST, VARIABLE COST AND OTHER EFFICIENCY MEASURES

Factor	Average		't' value	Coefficient of variation (%)	
	Profitable farms	Unprofitable farms		Profitable farms	Unprofitable farms
1	2	3	4	5	6
1. Output value (Rs.)	311.85 (±10.64)	283.78 (±12.34)	1.72†	38.70	52.00
2. Total cost (Rs.)	261.95 (±11.14)	359.27 (±10.59)	6.37*	50.35	35.37
3. Variable cost‡ (Rs.)	125.20 (± 7.43)	182.71 (± 6.27)	5.92*	70.40	41.05
4. Output-input ratio	1.19 (± 0.08)	0.79 (± 0.02)	5.00*	34.00	13.00
5. Output-variable cost ratio	2.49 (± 0.22)	1.55 (± 0.13)	3.75*	43.10	43.00
6. Capital-output ratio	2.92 (± 0.31)	4.90 (± 0.59)	3.00*	52.70	59.60
7. Farm business income/ha. (Rs.) ..	186.65 (± 3.49)	101.07 (± 6.97)	10.97*	22.12	82.50

‡ Excluding farm human labour.
† Insignificant.
* Significant at 1 per cent level of significance.
N. B: Standard errors of the averages are given in brackets.

It is usually observed that there is positive correlation between per hectare output and levels of profit. It may, therefore, be hypothesized that per hectare output on the profitable farms may be more than that on the unprofitable farms. Our belief for this hypothesis is further strengthened by the test of soil quality as noted above. It may be mentioned that although output per hectare is more on the profitable farms, the two types of farms do not significantly differ in their per hectare output. There is, however, a large difference between the per hectare total cost on the two types of farms. The unprofitable farms are getting more or less the same level of output for a higher level of inputs. The dispersion of total cost around the average is less in the case of unprofitable farms. Likewise, per hectare variable cost on the profitable farms significantly differs from that on the unprofitable farms.

The input-output ratio and the output-variable cost ratio are more on the profitable farms and significantly differ from these ratios on the unprofitable farms. The capital-output ratio is 2.92 on the profitable farms and 4.90 on the unprofitable farms. The difference is significant at 1 per cent level of significance. Similarly, farm business income (output minus variable cost) is significantly different (more) on the profitable farms than that on the unprofitable farms. However, the coefficient of variation is more on the unprofitable farms.

Thus all these hypotheses except output per hectare about the significant differences in various efficiency criteria between the two types of farms are sustained.

Cost Items

Since the difference in costs as between the two types of farms is significant, it is pertinent to analyse the various components of costs as given in Table V.

TABLE V—AVERAGE INPUT FACTORS PER HECTARE AND THEIR COEFFICIENT OF VARIATION

Factors	Average		't' value	Coefficient of variation(%)	
	Profitable farms	Unprofitable farms		Profitable farms	Unprofitable farms
1. Human labour day	56.64	84.14	3.82*	26.84	37.81
S.E.	± 3.10	± 6.49			
2. Bullock labour day	21.01	30.23	6.31*	32.27	53.26
S.E.	± 0.57	± 1.34			
3. Seed (Rs.)	22.02	27.93	3.48*	60.00	54.20
S.E.	± 1.11	± 1.26			
4. Land Revenue (Rs.)	11.63	8.25	4.80*	57.18	76.96
S.E.	± 0.586	± 0.531			
5. Interest (Rs.)	65.30	61.36	0.90†	62.66	50.11
S.E.	± 3.61	± 2.57			
6. Manures (Rs.)	6.10	2.94	3.55*	132.62	231.30
S.E.	± 0.68	± 0.57			

S.E. = Standard error.
† Insignificant.
* Significant at 1 per cent level of significance.

The hypothesis developed above is that there is no significant difference in output between the two types of farms. Hence, the difference in the profitability of the two types of farms is due to input factors. It is, therefore, further hypothesized that the unprofitable farms might be spending more on human labour, bullock labour and interest on capital.

The hypothesis in the case of human and bullock labour seems acceptable as the difference is significant at 1 per cent level of significance, whereas the difference in the case of interest on capital is non-significant. It should also be noted that the profitable farms include farms growing wheat and other crops irrigated by canal. Here the corresponding interest on the value of wells and other irrigational equipment is not a burden to the extent as it is in the case of unprofitable farms. In fact, interest on the profitable farms is more.

The dispersion of human and bullock labour around the average is more in the case of unprofitable farms whereas it is more in respect to interest on capital on the profitable farms.

The quality of soil (as revealed by the index of land revenue) is poor and the use of manures is significantly less on the unprofitable farms. Expenditure on seed was more on the unprofitable farms, it being Rs. 27.93 whereas the profitable farms spent only Rs. 22.02. This difference is statistically significant. This goes against the hypothesis that the unprofitable farms might be spending less on seed.

Moreover the variability of farms regarding the expenditure on manures and land revenue is more in the case of the unprofitable farms than on the profitable farms. As a matter of fact, many of the farms (both profitable and unprofitable) are not using manures at all.

The main items of significant differences are human labour, bullock labour and seed. These involve heavy expenditure but their marginal productivity is less. However, on further analysis, some interesting facts are revealed.

More expenditure on human and bullock labour and seed indicate that the unprofitable farms might be cultivating more irrigated crops which involve more of these items of expenditure. Secondly, that a significant part of human labour is of farm origin for which the farmer has not to pay. The distribution of human labour according to sources is shown in Table VI.

TABLE VI—PER HECTARE EXPENDITURE ON HUMAN LABOUR ACCORDING TO SOURCE

Type of farms	Farm family labour	Percentage to total	Hired labour (Rs.)	Percentage to total
1. Profitable	59.82	70.2 (±6.12)	25.24	29.6
2. Unprofitable	106.95	86.94 (±2.53)	19.26	13.06

't' value is 2.54. It is statistically significant.

Profitable farms spend more on hired labour. Of the total expenditure on human labour, about 30 per cent was on hired labour whereas on the unprofitable

farms this figure was only 13 per cent. This shows that from the farmer's point of view, loss on account of use of more human labour is not real, because no money on this item is spent from his pocket. The sheer necessity of maintaining life relegates the business calculations to the background. Nevertheless, the interest of the farmer and of the society is served only when there is real profit. Ultimate economic progress depends on profit.

Conclusions

The foregoing analysis leads us to the following conclusions :

1. A majority of farms incur losses.

2. A majority of profitable farms cluster around low levels of profit.

3. Very few farms of the profitable category showed profit in all the three years.

4. There is no significant difference in the size of holding, irrigated area, intensity of cropping and output per hectare between the two types of farms.

5. There is no significant difference in overall cropping pattern except bajra. The area under bajra is more on the profitable farms.

6. All the criteria of efficiency, output-input ratio, output-variable cost ratio, capital-output ratio, cost per hectare, farm business income are statistically significant in favour of profitable farms.

7. Profitable farms may be characterized as using more manure ; having better quality of soil ; using less human and bullock labour, seed, variable cost and total input per hectare as compared to the unprofitable farms. In other words, the difference for these items is significant.

8. Some of the profitable farms have the advantages of canal irrigation which keeps cost of irrigation at a low level.

9. Even though the level of human labour input is relatively large on the unprofitable farms, a greater proportion of it is unpaid family labour.

10. Farm to farm variation from the average is more on the profitable farms in the case of size of holdings, irrigation, input per hectare, seed and interest, while the reverse is true in the case of intensity of cropping, land quality, output per hectare, human and bullock labour and manures.

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NOTE ON APPLICATION OF PROGRAMMING TECHNIQUES TO INDIAN FARMING CONDITIONS

This note seeks to explain a few issues raised by D. K. Desai in his review of our brochure* which was published in the January-March 1968 issue of this *Journal* (pp. 91—94).

Desai's main criticism of our brochure is in regard to our land use classification contained on pages 11 and 18. This classification is one of the major contributions made by the authors in solving linear programming problem in the context of Indian agriculture. Desai should have appreciated that his revised table proposed on land classification does not admit such activities as wheat-sown-after-fallow (Wr) and wheat-sown-after-*kharif* (Wk) beyond .90 acre, whereas the land use classification should permit such activities to the extent the land is suitable for them. This is so obvious. But to help Desai see it clearly we have solved the matrix using the classification he has suggested. The solution obtained (product mix) on this basis and the one obtained with our classification are reproduced here :

Original matrix			Revised Desai's matrix		
Activity		acres	Activity		acres
P_7	American cotton after fallow ..	2.50	P_7	American cotton after fallow	0.3555
P_1	Wheat after fallow ..	2.00	P_1	Wheat after fallow ..	0.5445
P_9	Sugarcane ..	0.68	P_9	Sugarcane ..	2.1710
P_{10}	Groundnut ..	1.87	P_{10}	Maize after fallow ..	1.9359
P_5	Maize after wheat ..	1.32	P_{10}	Groundnut ..	1.7555
P_2	Wheat after *kharif* ..	3.22	P_3	Gram irrigated ..	1.6000
	Net cash income (Rs.)	4,314.23		Net cash income (Rs.)	3,520.2854
	Decrease in income Rs. 793.94				

The answer is self-explanatory and those who are familiar with the sophistications of programming techniques would not find it difficult to locate the fallacies involved in Desai's revised table. The answer iteration based on Desai's classification yields very different product mix. It permits wheat-after-fallow activity only within the constraint of .90 acre (0.5445 acre) and has resulted into a reduction in farm income from Rs. 4,314.23 to Rs. 3,520.2854.

Again, Desai's comments on Table I.1 in the brochure (page 18) for gram irrigated do not hold good, so long as Cr. land category suitable for gram is also included in the category $(A+B+C)^r$. This point is of critical importance in programming techniques.

Desai has also commented that the authors have not cared to indicate which activities are denoted by P_1 to P_{10} or which restrictions are indicated by P_{11} to P_{23}. This criticism is misplaced because para 2 on page 12 under the head 'Solution of A Problem,' certainly provides an answer to this point.

* Application of Programming Techniques to Indian Farming Conditions, Department of Economics and Sociology, Punjab Agricultural University, Ludhiana, 1967.

Again, Desai has observed that the authors have not explained the notations P_{10} to P_{23} in Table II.3. A more careful examination of this table would show that against the notations P_{10} — P_{23} details of resource restraints are clearly stated in the resource column.

Desai's comments on explanation of the rotations R_1 to R_9 whether they are two-year or single year rotations are answered on page 32 of the brochure where the method of reducing the inputs and output of different rotations to one year basis has been clearly stated.

Again, Desai's comment on 'Mixed Farming Situation' that the supply of farmyard manure from dairy animals for crops should also be mentioned are not supported by facts. While working out returns to fixed resources, the returns from farmyard manure were included in the gross returns and we have spelt out on page 66 of the brochure the details of farmyard manure that would be available, *i.e.*, owned plus purchased less the quantity needed for growing of fodders as a fixed activity. This method certainly takes care of the objection raised by Desai.

Desai has also made a suggestion that Tables II. 24, II. 25 and II. 26 could be consolidated to make one table. One wonders how this could be done when these tables show the final iterations at different levels of dairy activity.

Desai has also raised the point that the existing plan and the optimum plan on pages 37 and 38 do not indicate whether the resource position of the farms was kept the same or was altered. Pages 38 (para 2) and 58 (para 3) clearly state that the borrowing activities were introduced in the optimum plans. Once this is stated, it should not be difficult to judge that after a particular resource was augmented, resource position could not remain the same.

Desai has also criticised our interpretation of the concept of linearity. We find no content in this comment. It is probably true that discussions could be limited to different levels of products obtained to explain the concept of linearity. But if these discussions were extended to elaborate this concept under different situations, *i.e.*, irrigated and unirrigated wheat as well as wheat-sown-after-fallow and wheat-sown-after-*kharif*, it does not in any way detract from the quality of this concept. If Desai blames us for making this concept much more practicable than he would like to do, we share this guilt fully.

Another issue raised by Desai is that we "have not explained as to what are the activities and what kind of data would be needed for relating these activities to resource constraints" while explaining the procedure of planning (page 8). Here all that is needed is to refer to item 2 under 'Procedure of Planning' on page 8 and find these activities having been carefully defined there. While explaining the kind of data needed, we have also referred to the items contained in the schedule which could be used for this purpose. In fact, through applications on various farm situations throughout the brochure, we have adequately demonstrated what sort of data were required for this analysis.

Related to this issue is another question raised by Desai : "How inputs of fixed resource can be worked out from Table IIIA and IIIB" ? A careful examination of these tables would show that we had split up the labour inputs

into permanent and hired labour and such items as irrigation, farmyard manure, capital, etc., which constituted resource restrictions were contained in these tables. A particular resource may be a variable input for an activity, yet it could be and often is a fixed resource for the total farm organization. Examples are capital, irrigation, labour, etc.

Desai also raises a question on irrigation capacity which we have confined to the period April to early July. His objection is that in other parts of the country irrigation might be a restriction in other seasons also. We do not deny this. But since we were working with the conditions obtaining in the Punjab, it would be a natural thing to do to spell out only such irrigation constraints which were applicable to this situation.

Again, to the objection that the figures under the irrigated-unirrigated categories of land do not tally with the total land fit for growing of crops, it is important to appreciate that the total land may not be fit for growing of crops. Some areas might be low lying or might not be cropped due to some other reasons. When a situation is averaged over a large number of holdings, this difference in the total cultivated land and the land available for growing of different crops could occur. There is, however, a typographical error on page 31, *i.e.*, (7.70—1.14= 6.56 acres and not 6.29 acres). Such typographical errors are regretted.

We agree with Desai's comments that uniform notations could be used on the cost minimization problem. But this does not alter the solution of the problem. Moreover, wherever different notations were used, they were explained in the immediately following paragraph and no confusion could possibly arise on this account to the reader.

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AND
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QUANTITATIVE DELIMITATION OF AGRICULTURAL REGIONS IN INDIA*

In an article on "A Regional Approach to Agricultural Development in India—Some Preliminary Results,"[1] an attempt had been made to delineate agricultural regions by grouping districts in various States on the basis of composite land resource indices, worked out by giving decile rankings and some weightage to selected indicators, *viz.*, (*i*) gross area irrigated as per cent of gross area sown, (*ii*) average annual rainfall, (*iii*) extent of cultivated area, (*iv*) intensity of cropping, (*v*) soil characteristics like topography, texture, etc., (*vi*) gross area sown per capita. The indices for district by district composite decile ratings were worked out by taking the lowest composite decile ratings for 10 districts located in Gujarat, Kerala, Madhya Pradesh, Maharashtra and Rajasthan equal to 100. These land resource indices were also compared with composite productivity of rice and wheat district by district.

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* The author is grateful to Shri J. S. Sarma, Joint Commissioner in the Ministry of Food and Agriculture, Government of India for suggesting various improvements in the original draft. Personal views alone are expressed here.

1. *Indian Journal of Agricultural Economics*, Vol. XIX, No. 1, January-March, 1964, pp. 176-192.

In the present revised exercise, the delineation of agricultural regions is again based on composite land resource indices, which, in turn, have been worked out on the basis of decile ranking approach. The difference in the present land resource indices compared to the previous one arises on account of (*a*) different weights assumed for the selected indicators and (*b*) shifting the base from the average of 10 lowest composite decile ratings to an all-India average. The revised weights for the selected indicators and their basis are given below :

Indicators	Weights	Remarks
1. Area cultivated as per cent of total reporting area (1960-61)	1.0	
2. Gross area sown per capita (1960-61)	1.0	No weightage has been given for the amount of area sown per capita. The differences in the quality of area have been taken into account under rainfall, irrigation and soil characteristics.
3. Average annual rainfall (1959-62)	Up to 30″=1.0 Between 31″–74″ =2.0 75″ & above=1.5	Areas having rainfall up to 30″ have been considered to be dry areas. Areas having rainfall between 31″-74″ have been considered to be assured rainfall areas good for multiple cropping and hence a weightage of 2.0 has been assumed. Rainfall beyond 74″ has been considered relatively less beneficial and, therefore, 1.5 has been assumed as the weight.
4. Gross area irrigated as per cent of gross area sown (1960-61)	2.0	Based on the rough order of difference in the per acre yield rates between irrigated and unirrigated areas.[2]
5. Intensity of cropping (1960-61)	1.0	No separate weightage for double cropping has been assumed because the necessary account for difference in the quality of land has already been taken care of under irrigation and rainfall categories.
6. Soil productivity ..	1.5	In order to isolate the impact of the quality of soil reflecting the fertility and chemical contents, a weightage of 1.5 has been assumed.

On the basis of the weights indicated above, decile rating for each of the 6 indicators have been combined for each of the districts studied in order to arrive at composite decile ratings. The composite decile ratings based on the selected 6 indicators have been assumed to reflect the land resources in each of the various districts. In order to assess the relative level of land resources in various districts of India, average all-India composite decile ratings have been worked out and taken as the base (=100) for constructing composite land resources index for all the districts in the 15 major States of India. On the basis of the land resource indices, the agricultural regions of India have been delineated and the results are summarized below.

While agricultural regions have been delineated on the basis of land resource indices explained above, account has also been taken of the per acre gross value

2. D. R. Gadgil : Economic Effects of Irrigation, Gokhale Institute of Politics and Economics, Poona, 1948.

productivity (exclusive of value of by-products) based on 20 crops for the triennium 1959-60 to 1961-62. The 20 crops considered here for the purpose of studying the relative productivity levels are rice, wheat, jowar, bajra, maize, barley, *ragi*, gram, *tur*, linseed, sesamum, rapeseed and mustard, castorseed, groundnut, sugarcane (in terms of *gur*), cotton, jute, sunhemp, mesta and tobacco. For the purpose of valuation of production of 20 crops, weighted all-India harvest prices were used, the Statewise production being the weights for each of the various crops. In the case of crops where harvest prices were not available, wholesale prices in the peak marketing season were used. Uniform weighted prices were used for a particular crop over districts. For getting the gross value of production for 20 crops for each of the 300 districts, the average production during the triennium 1959-60 to 1961-62 was multiplied by the all-India weighted prices for each of the 20 crops in a district and this was divided by the average gross area sown (1959-60 —1961-62) under these 20 crops for getting the per acre gross value productivity. Thus :

$$Y_d = \frac{\sum_{j=1}^{20} q_j \left\{ \sum_{i=1}^{15} \frac{p_{ij} \; w_{ij}}{\sum_{i=1}^{15} w_{ij}} \right\}}{\sum_{j=1}^{20} a_j}$$

Where Y_d =per acre gross value composite productivity (20 crops) for a district.

q_j =average gross physical production for a crop (j), during the triennium 1959-60—1961-62 for a district.

p_{ij} =annual harvest price for a crop (j) in a State (i) for 1960-61.

w_{ij} =average gross production for a crop (j) in a State (i).

a_j =average gross area sown (1959-62) for a crop (j) in a district.

After working out the per acre gross value productivity, district by district, the indices of per acre productivity, like the land resource indices, were worked out taking the average all-India per acre gross value productivity as the base (=100).

For the purpose of evaluating the status of different regions, the indices of land resources and productivity have been classified under the following heads:

Land resource indices	*Crop productivity indices*
Very Low : Less than 50	Less than 50
Low : 50—75	51—100
Medium : 76—100	101—150
High : 101—150	151—200
Very High : 126—150	201+

Table I presents the maximum and minimum levels of land resource indices and composite crop productivity indices observed in various districts of India.

TABLE I—MAXIMUM AND MINIMUM LEVELS OF LAND RESOURCE INDICES AND CROP PRODUCTIVITY INDICES (ALL-INDIA INDICES = 100)

States	Land resources		Crop productivity	
	Maximum	Minimum	Maximum	Minimum
Andhra Pradesh ..	126 (W. Godavari)	84 (Chittoor)	216 (E. Godavari)	66 (Adilabad)
Assam ..	118 (Nowgong)	69 (Sibsagar)	203 (Nowgong)	118 (Kamrup)
Bihar ..	136 (Shahabad)	84 (Saharsa)	174 (Dhanbad)	81 (Palamau)
Gujarat ..	91 (Surat)	60 (Kutch)	194 (Surat)	37 (Banaskantha)
Jammu & Kashmir ..	104 (Jammu)	63 (Doda)	160 (Anantnag)	67 (Poonch)
Kerala ..	123 (Trivandrum)	70 (Kozhikode)	238 (Kottayam)	162 (Kozhikode)
Madhya Pradesh ..	134 (Balaghat)	58 (Jhabua)	127 (Bastar)	57 (Rajgarh)
Madras ..	137 (Thanjavur)	79 (Tirunelveli)	255 (Kanya Kumari)	127 (Ramnad)
Maharashtra ..	118 (Bhandara)	69 (Buldhana)	194 (Kolaba)	48 (Wardha)
Mysore ..	126 (Shimoga)	70 (Gulbarga)	299 (Coorg)	31 (Bijapur)
Orissa ..	126 (Bolangir)	76 (Koraput)	151 (Ganjam)	105 (Baudh Khondhmals)
Punjab ..	148 (Ferozepur)	36 (Lahul & Spiti)	158 (Ludhiana)	45 (Lahul & Spiti)
Rajasthan ..	117 (Bharatpur)	44 (Jaisalmer)	99 (Udaipur)	11 (Bikaner)
Uttar Pradesh ..	138 (Sharanpur)	81 (Almora)	214 (Muzzaffarnagar)	70 (Bahraich)
West Bengal ..	148 (Birbhum)	86 (24-Parganas)	223 (Hooghly)	127 (Malda)
15 States ..	148	36	299	11

It may be pertinent to mention that land resources may not always be reflected in composite crop productivity because of the heterogeneity in the utilization of resources and their availability as also the risk and uncertainty involved in climatic conditions. The actual pressure of population on land, untimely rainfall, non-availability of credit facilities and late ploughing or similar disturbances in some agricultural operations may lead to the deviations in the results. Keeping in mind this broad limitation, we may proceed for a study of agricultural regions first within administrative boundaries of States and then over States. The agricultural regions have been considered on the basis of 1961 Census zones. These zones are as follows :

1. Northern Zone : Jammu & Kashmir, Punjab, Rajasthan, Delhi, Himachal Pradesh.
2. Central Zone : Uttar Pradesh, Madhya Pradesh.
3. Eastern Zone : Bihar, Orissa, West Bengal, Assam, Manipur, Tripura, North East Frontier Agency, Nagaland, Sikkim.

4. Western Zone : Gujarat, Maharashtra, Dadra and Nagar Haveli.

5. Southern Zone : Andhra Pradesh, Mysore, Kerala, Madras, Pondicherry, Laccadive, Minicoy and Amindivi Islands.

Areas which have not been included in any Zone: Andaman & Nicobar Islands and Goa, Daman and Diu.

NORTHERN ZONE

1. Jammu & Kashmir

On the basis of land resource indices, the State of Jammu & Kashmir has been divided into four broad agricultural regions. The regions consisting of Jammu and Kathua is showing high land resources. Barring Doda, the rest of the districts fall in the medium category of resources. As against this, the districts of Anantnag, Srinagar and Baramulla are having relatively high productivity indices compared to resource indices and, specifically speaking, Anantnag falls in the high productivity group and Baramulla and Srinagar in the medium category. The rest of the districts are having productivity levels in the low group of productivity.

2. Punjab and Haryana

The agricultural regions formed by the group of districts like Amritsar, Ludhiana, Ferozepur running through Bhatinda down to Hissar is perhaps the best agricultural region of the Punjab and Haryana and perhaps of India and high value productivity crops of wheat and cotton are grown here. In fact, the highest productivity levels are observed in these set of districts in the whole of North Zone. The hilly districts of Lahul & Spiti and Simla come under low and very low resource group, though from the point of productivity, Simla falls in the medium group. Punjab and Haryana are one of the fertile areas of India and has in their domain alluvial soil which is rich for the growth of wheat, gram and rice. In fact, in productivity, these areas are richer than any other part of the northern region and it so appears that the productivity levels observed in this region tend to decline as one proceeds towards south-east through the western and central U.P. plains. The districts comprised of Gurgaon, Mahendragarh represent the backward region of the Punjab and therefore both resource and productivity indices are comparatively low in these districts. The extension of Bhakra Nangal irrigation to this region will perhaps change this part into a prosperous area.

3. Rajasthan

Rajasthan has about eight agricultural regions on the basis of land resources. The most prosperous region is represented by the districts of Ajmer, Bhilwara, Pali, Udaipur and Chittorgarh as also Alwar and Bharatpur. From the point of view of productivity, practically all the districts are relatively backward excepting the districts of Dungarpur (99), Udaipur (99), Bundi (79), Banswara (84), S. Madhopur (74), Chittorgarh (79) and Bhilwara (84). Most of these districts fall in the productivity range 75-100 which represents low productivity group. In none of the districts, the productivity exceeds the all-India productivity. It touches very near the all-India productivity in the districts of Dungarpur and Udaipur. In most of the districts of Rajasthan, the average size of

holding is relatively high but the land is of poor quality. The availability of red and black, desert soil, brown, red and yellow soils, with relatively less rainfall and low percentage of irrigation are good only for the growth of inferior grains and therefore both the physical and gross value productivity is relatively low. In some of the recently developed parts like Ganganagar, the yield is still below the all-India average yield, as it will still take some time to tap the irrigation potential created there.

CENTRAL ZONE

4. Uttar Pradesh

On the basis of land resource indices, Uttar Pradesh can be delineated into eight agricultural regions. Relatively speaking, Western Uttar Pradesh represented by the districts of Saharanpur, Muzaffarpur, Meerut, Bulandshahr, Aligarh, Etah, Mainpuri represent the best agricultural region in the whole of Uttar Pradesh and this is reflected by very high productivity levels and very high land resources in many of the districts in this tract of Uttar Pradesh. Another good agricultural region from the point of view of availability of land resources is found in Eastern Uttar Pradesh and is represented by the districts of Gonda, Basti, Gorakhpur, Deoria, Azamgarh, Barabanki. These districts are relatively better from the resource point of view, yet from the point of view of productivity, there seems to be under-utilization of agricultural resources in this part. Broadly speaking, it has been observed that both resources and productivity decline from Western Uttar Pradesh to Central Uttar Pradesh and again in Eastern Uttar Pradesh, though the resources in some of the districts again go up, productivity tends to decline in the Indo-Gangetic belt. However, within the same region, say Western Uttar Pradesh, composite crop productivity tends to decrease from north to south. Thus, productivity tends to decrease from Muzaffarpur and Saharanpur towards south. One of the possible reasons might be the commercial bias represented mostly by sugarcane cultivation. This region is also relatively prosperous because of agro-based industries which have developed around this region. Relatively speaking, though Eastern Uttar Pradesh has sugarcane cultivation, yet there are frequent floods and drought almost every year and because of relatively less commercialized cultivation, the region on the whole happens to be backward and hence there is a great need for establishing agro-based industries in this part of the Indo-Gangetic belt.

5. Madhya Pradesh

Madhya Pradesh could be divided into nine agricultural regions on the basis of availability of land resources. The region formed by the group of districts falling in South-Eastern Madhya Pradesh, *viz.*, Balaghat, Durg, Raipur, is perhaps the best agricultural region. The crop productivity is also relatively medium in this region. The high productivity (almost all-India average) observed in these districts get extended towards Bastar, Raigarh, Bilaspur, Surguja, etc. In these set of districts, the high productivity levels might partly be explained by the high valued crop of rice which is grown over red and yellow soil.

The most backward agricultural region of Madhya Pradesh seems to be located in the Central Madhya Pradesh. In this part both land resources and crop productivity indices are relatively low. The low productivity is partly explained by low valued crops like jowar. Wheat and cotton are other crops grown here but the proportion of area under each of these crops is rather insignificant. Medium black soil is prevalent here.

WESTERN ZONE

6. Gujarat

Gujarat could be divided into five agricultural regions. The Saurashtra region formed by the districts of Jamnagar, Rajkot, Surendranagar, Amreli, Bhavnagar and Junagadh is relatively backward both in respect of land resources and crop productivity. Groundnut, jowar and bajra being low valued crops perhaps deflate the per acre gross value productivity indices for these districts. The soil types in this region are deltaic alluvial, coastal alluvium and medium black.

Regions three and four constitute the Gujarat area. The northern districts of Banaskantha, Sabarkantha, Mehsana and Panchmahals are relatively backward both from the point of view of land resources and crop productivity, as compared to the southern districts of Kaira, Baroda, Broach and Surat. The medium black soil and coastal alluvium prevalent in the southern districts seem to be favourable for high value productivity crops like cotton, rice. Thus the per acre gross value productivity index for Surat, Kaira and Baroda are 194, 139 and 111 respectively. Productivity in Broach perhaps gets deflated due to cotton-jowar combination.

7. Maharashtra

Maharashtra could be divided into six agricultural regions on the basis of land resources. From the point of view of land resources, the region formed by the districts of Nasik, Ahmednagar, Poona, Dhulia, Jalgaon, Aurangabad, which fall in the Deccan and Marathwada areas having medium and deep black soil is perhaps the best region. However, the per acre gross value productivity index is not very high, because the crop pattern is oriented towards jowar, bajra and groundnut complex. From the point of view of productivity, Konkan area (Thana, Kolaba, Ratnagiri), Deccan (Kolhapur) and Vidarbha (Bhandara) seem to be the best. Perhaps, the cultivation of rice and cotton in these districts, as against jowar, bajra, groundnut combination in other districts explain their superiority in productivity.

SOUTHERN ZONE

8. Andhra Pradesh

In Andhra Pradesh, four agricultural regions emerge on the basis of land resources. The best agricultural region is formed by the coastal districts which are having both high resources and high productivity. The relatively backward region seem to be located in the central part of Andha Pradesh, formed by the districts like Mahbubnagar, Nalgonda, Khammam, etc. Guntur though included in this region is an exception from the point of view of productivity. In the Southern Andhra Pradesh, though the resources are relatively high, yet these are not reflected in high productivity levels and therefore need investigation.

9. Mysore

Mysore could be divided into four agricultural regions. The best agricultural region from the point of view of land resources is formed by the districts of Shimoga, Chikmagalur, Hassan and Mandya having red and laterite soil (Central Mysore).

These districts are also having relatively high value productivity due to rice-*ragi* crop complex. The best set of districts from the point of view of value productivity are located in the South-Western portion, represented by the districts of South Kanara, North Kanara, Coorg and Mysore having rice as the major crop grown on laterite and coastal alluvium soils.

The districts located in Northern Mysore and South-Eastern portion are having relatively less land resources along with relatively low productivity. The crops grown in North Mysôre are jowar, bajra, groundnut and cotton on deep black, medium black, mixed red and black soils. In the South-Western portion, *ragi*, rice, groundnut seem to be the common crop combinations grown on red soil.

10. Kerala

Kerala can be divided into four agricultural regions on the basis of land resources. High land resources seem to be located in Trivandrum. Trivandrum, Kottayam and Palghat are having very high productivity levels as against the relatively low productivity levels in Cannanore, Kozhikode and Trichur. High value productivity levels of rice might explain the high productivity in these areas, in the background of a mixture of soil types like coastal alluvium, lateritic, laterite and forest. Rich growth of coconut and tapioca is the special feature of these districts. It may, however, be pointed out that the land resources and land productivity cannot strictly be compared in Kerala, because of the inclusion of the various land resources on the side of resources, but on the productivity side the output on account of plantation crops has been excluded and since Kerala is an important plantation area, this exclusion might deflate the per acre productivity and therefore these indices are not as realistic in Kerala (as is also the case in Assam) as in the case of other States where the plantation crops' role is rather insignificant.

11. Madras

Of the two agricultural regions in Madras, high land resources are observed in the Coromandal coastal districts like Chingleput, South Arcot, North Arcot and Thanjavur. Productivity also happen to be high in this belt. In the inland Madras districts, land resources and productivity fall in the medium category barring Kanya Kumari which is having very high land resources and productivity.

EASTERN ZONE

12. Orissa

Of the three agricultural regions, the Coastal Region, though has relatively less land resources, yet contains best productivity districts. Resources are high in Western Orissa, but the crop productivity in some of the districts (B. Khondamals, Kalahandi) is relatively low and therefore needs investigation.

13. Bihar

Relatively high resources have been observed in Shahabad, Gaya and Patna. But the productivity levels are relatively low. These cases need careful investigation. On the whole, there seems to be declining trend in productivity with the increase in resources. How far this situation is explained by the annual recurrence of floods and drought in Bihar, needs detailed surveys and investigations.

14. West Bengal

It may be observed that in practically all the districts of West Bengal, the productivity indices exceed the resource indices. High productivity indices are observed in the Himalayan West Bengal as also in the Gangetic West Bengal. The Western West Bengal, through which flows the Ganges is, of course, having high land resources along with high productivity.

15. Assam

High agricultural resources seem to be located in U.K. & J. Hills and Nowgong along with high productivity.

Now it is proposed to study the agricultural regions over States, ignoring State boundaries.

I. Eastern Coastal Region

The Eastern Coast commencing from Kanya Kumari in the south to Midnapur and Hooghly in West Bengal in the east reveals, by and large, high land resource indices, which are higher than the all-India average. This region which is formed by the coastal and adjoining districts is principally a rice growing tract and is relatively richer in resources as compared to the Western Coast. Here it may be of interest to note that, relatively speaking, Coromandal coastal districts as also Andhra coastal districts are richer in land resources compared to Orissa and West Bengal coastal districts.

The superior position of the Eastern Coastal districts in terms of land resources is also reflected by the relatively high productivity indices. Productivity is more or less in harmony with the resources. The coastal alluvium, alluvial and red soils prevalent in the Eastern Coastal districts are favourable for high productivity of rice and other high valued crops.

II. The Western Ghats and Coastal Region

The Western Ghats and Coastal Region starting from Trivandrum in the south to Kutch in the north-west have relatively less land resources than its counterpart—Eastern Coastal region, barring some districts of Kerala (Trichur, Ernakulam and Trivandrum). The overall picture shows that this region is having medium category of land resources. The coastal districts of Gujarat contain less land resources than the coastal districts of Maharashtra (Konkan division) which in turn lags behind the Malnad districts of Mysore. These districts are ultimately excelled by some of the districts of Kerala like Trichur, Ernakulam and Trivandrum. Thus, broadly speaking, as one traverses from north to south in this region, one witnesses greater availability of land resources.

Broadly speaking, the overall, productivity levels in Western Ghats specially in the southern part of it, are comparable to the levels of productivity in the Eastern Coastal districts. However, the coastal region of Kutch and Saurashtra are backward in productivity owing to scanty rainfall. In Saurashtra and Kutch, the percentage of area irrigated to gross area sown is very low. Kutch, being mainly a jowar-bajra producing area, gets productivity levels deflated due to the inferior cropping pattern.

III. Maharashtra (except Konkan Division), North Mysore and Telengana Region

This region has, on the whole, medium land resources, though there are exceptions like Warrangal, Medak, Nizamabad and Karimnagar, having resources above all-India average. Further, within this region, the group of districts in Maharashtra and North Mysore, running parallel to coastal districts (Dhulia, Jalgaon Nasik, Aurangabad, Ahmednagar, Poona, Satara, Sholapur and Belgaum) are having relatively high resources, compared to the rest of the districts of Maharashtra and Mysore (Amravati, Akola, Yeotmal, Parbhani, Nanded, Bidar, Gulbarga, Bijapur, Raichur, etc.). Further, within each of the three sub-regions in this region, *viz.*, (*i*) the districts of Maharashtra and North Mysore running adjacent to the coastal districts, (*ii*) rest of the districts of these States, (*iii*) Telengana districts, land resources tend to decline from north to south.

In this region, productivity is, on the whole, low. It is particularly very low in North Mysore (Bijapur and Gulbarga). Productivity levels are relatively high in Telengana compared to the Deccan, Marathwada and Vidarbha areas of Maharashtra.

IV. Southern India (Other than Coastal Areas, North Mysore and Telengana)

This includes Southern Mysore, Rayalaseema (Andhra Pradesh) and inland Madras. The districts of Southern Mysore located along the coastal areas of Mysore (Shimoga, Chikmagalur, Hassan and Mandya) have the highest level of land resources in this region, followed by the districts of Rayalaseema and inland Madras. But productivity is the highest in the inland Madras district, followed by the districts of Southern Mysore and Rayalaseema. The discrepancy between the relatively high land resources and the relatively low crop productivity in Southern Mysore merits serious attention.

V. North Gujarat and Rajasthan Dry Area Region

This region is composed of cotton, groundnut and bajra growing districts of Gujarat and Rajasthan and is inclusive of districts like Banaskantha, Sabarkantha, Panchmahals, Mehsana, Surendranagar in Gujarat and Ganganagar, Churu, Bikaner, Jaisalmer, Barmer, Jodhpur and Nagaur in the desert areas of Rajasthan (Western). The districts falling in the desert areas of Rajasthan are more backward with regard to the availability of land resources. The alluvial and medium black soils of Gujarat, where cotton, jowar, bajra and groundnut are the major crops, yield an average value productivity per acre lower than the all-India average. The average gross value productivity per acre is much lower than the all-India average in the desert areas of Rajasthan.

VI. Eastern and South-Eastern Rajasthan

This region which combines Eastern Rajasthan plains, South-Eastern plateau and hills has land resources exceeding the all-India average or very near the all-India average. The alluvial, red and yellow, mixed black and red soils of the region principally grow gram, bajra, maize and jowar. The average productivity levels are, however, much lower as compared to the land resources in many districts located in Eastern Rajasthan and this needs careful examination. The productivity

levels come up only in the districts of Udaipur, Chittorgarh, Banswara and Dungarpur. Perhaps, the low value crops like bajra and jowar partly explain the situation.

VII. Chambal Ravines and Uttar Pradesh Plateau and Hills

This region is demarcated by the Chambal river in the west and is comprised of Gwalior, Bhind, Morena, Datia, Tikamgarh, Chhattarpur (Madhya Bharat Low Lands) and Jhansi, Jalaun, Banda and Mirzapur districts of Uttar Pradesh. In most of these districts, both the land resources and productivity are below the all-India average, barring Gwalior where land resources and productivity levels are above the all-India average.

VIII. Madhya Pradesh (except South-Eastern Portion—Chatisgarh Plains and Madhya Bharat Low Lands)

In this region, land resources are below the all-India average and pertain to the medium category. The level of land resources is relatively higher in the districts of Seoni, Chhindwara, Narsimhapur, Hoshangabad and Betul. As against this, the crop productivity levels seem to be higher in the east and tend to decrease as one proceeds towards west. The discrepancy in the availability of land resources and productivity requires examination.

IX. South-Eastern Madhya Pradesh and Orissa Inland

This region consists of Bhandara district of Maharashtra, Surguja, Raigarh, Bilaspur, Durg, Balaghat and Bastar of Madhya Pradesh and inland Orissa. This region has, by and large, resources and productivity exceeding the all-India average. Broadly speaking, both tend to increase as one moves towards the east, *i.e.*, inland Orissa. The red, yellow, mixed red and black soils are yielding relatively high productivity per acre.

X. Assam

Assam can broadly be divided into two broad regions (1) Western Assam plains and hills (Goalpara, Kamrup, Darrang, Nowgong, Garo Hills, U.K. & J. Hills), (2) Eastern Assam plains and hills (Lakhimpur, Sibsagar, U. M. & N. C. Hills, Cachar and Mizo Hills). Relatively speaking, the Western Assam commands higher land resources. But from the point of view of per acre crop productivity, Eastern Assam is having higher productivity levels. In other words, the productivity levels along with Brahmaputra river seem to be relatively less compared to land resources. This might be because of the annual recurrence of floods in these districts. But this aspect requires detailed examination.

XI. Northern Himalayan Region

This comprises Jammu & Kashmir, Himalayan Division of Punjab, the Kumaon Hills and Uttar Khand Division of Uttar Pradesh. This region, on the whole, has medium land resources, but the productivity levels are relatively high. Rice, maize and wheat are the major crops of the region.

XII. Punjab, Uttar Pradesh and Central Western Bihar Plains

This region presents more homogeneity with regard to land resources and has high land resources falling as it does in the Indo-Gangetic belt. The alluvial soil is rich for the growth of wheat, gram and rice. In per acre crop productivity, Western Punjab and Western Uttar Pradesh are richer than any other part of this region. Indeed it so appears that the per acre value productivity tends to decline as one proceeds from Western Uttar Pradesh to Eastern Uttar Pradesh. This feature is also discernible with a sub-region (Western Uttar Pradesh) where the value productivity decreases as one moves from north to south.

XIII. Northern Bihar and North-Western Bengal Plains

This region includes Saran, Champaran, Muzaffarpur, Darbhanga, Saharsa, Monghyr and Purnea districts of Bihar and Himalayan West Bengal (Darjeeling, Jalpaiguri) as also Malda and West Dinajpur districts of West Bengal. The entire region has land resources varying from medium to high levels, but with regard to per acre value productivity, Northern Bihar is relatively more backward than the Northern West Bengal. Rice is the major crop and soil is alluvial.

XIV. Chota Nagpur and West Bengal Plains

With high land resources and high value productivity per acre, West Bengal Plains maintain their supremacy over Chota Nagpur Division of Bihar. The fertile alluvial soil of West Bengal in contrast with the red soil of Chota Nagpur Division might be one of the factors responsible for its superior position in per acre value productivity. It has to be examined as to how far lack of flood control and soil conservation measures are responsible for relatively lower levels of value productivity in Chota Nagpur Division.

This exercise has shown that by studying the relative position about the availability of land resources and the composite productivity levels, it is possible to pinpoint areas where there is a scope for further exploitation of the available resources. The importance of such studies is greater in the present context when emphasis has shifted to area planning at lower levels like districts, blocks, etc.

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AGRICULTURAL FINANCE CORPORATION

The transformation of Indian agriculture as a result of the application of modern technology is likely to greatly alter both the magnitude and the character of agricultural finance. Till very recently there was a remarkable consensus on the question of the ideal agency for the supply of agricultural credit. As late as 1965, the Informal Group on Institutional Arrangements for Agricultural Credit, appointed by the Reserve Bank of India, stated that "the co-operative agency remained the best means of promoting institutional agricultural credit under Indian conditions," and a grudging concession was made in favour of Agricultural Credit Corporations in a few States, but purely as a temporary and transitional phase. There is now a sudden volte-face and everybody—including the Government and the Reserve Bank—has commenced accusing other banking institutions of neglecting the agricultural sector. Be it, as it may, it is obvious that there are now second thoughts on the subject and what has come to be known as the 'multi-agency approach' is being accepted. The establishment of Agricultural Finance Corporation bears testimony to this development.

With a view to helping the commercial banks participate actively and extensively in the development of agriculture, the Agricultural Finance Corporation Ltd. has been formed on 10th April, 1968. It is a limited liability company registered under the Companies Act, 1956 with an authorized capital of Rs. 100 crores and a paid-up share capital of Rs. 5 crores.

The main objects of the Corporation are to finance by all possible ways and means, among other things, by lending or advancing moneys or by rendering other financial facilities and assistance on such terms as seem expedient whether with or without security, to or in respect of agriculture, agricultural produce and agricultural operations and all activities connected with agriculture and in particular the financing of and assisting in the following activities : (*a*) mechanization of agriculture and agricultural operations; (*b*) processing of agriculture, agricultural operations or agricultural produce and industries connected therewith; (*c*) construction of warehouses, godowns, silos and of buildings and structures for storage, preservation and protection of agricultural produce and materials required for the carrying on of agricultural activities; (*d*) transportation of agricultural produce and other materials required for agricultural operations; (*e*) construction of markets and other works to promote the sale and distribution of agricultural produce; (*f*) promotion, establishment and maintenance of food industries; (*g*) production, supply and distribution of agricultural produce, fertilizers and pesticides, ploughs, tractors and other agricultural machinery equipments and implements; (*h*) purchase, sale, breeding and rearing of livestocks and animals; (*i*) growing, improving, preserving and maintaining of forests, forest products and other forest wealth, etc.

The Corporation is to perform the following two specific functions, *viz.*, (1) to promote commercial banks' advances for agricultural development, and (2) to finance individuals, institutions and organizations, undertaking agricultural enterprises. The promotional role of the Corporation is highlighted by the fact that it will support and strengthen the commercial banks in their programmes of lending for agricultural development. In particular, the Corporation will help to locate and identify areas or projects for investment by banks, assess the econo-

mic and technical feasibility of the projects and suggest projects to be taken up by the banks either singly or on a consortium basis. It will also assist the banks in conducting surveys of the potential for investment, production and deposit mobilization with a view to selecting operational areas as well as in establishing agricultural finance departments, in recruiting and training the staff and guiding their operations in the field of agricultural finance. More importantly, it will act as a guarantee organization providing guarantee to banks in respect of projects suggested and cleared by it. It will also promote and conduct studies on completed projects, projects under implementation and the potential ones with a view to drawing lessons of experience in regard to the types of projects and the pattern of financial assistance best suited to achieve the objects. It is proposed to establish contacts with Central and State Governments, Agricultural Development Corporations, Agricultural Universities and Departments of Agriculture, State Electricity Boards, Associations of Agricultural Industries, etc., with a view to keeping in touch with the policies, locating areas of interest to the banking sector and promoting co-ordination of efforts between the various agencies engaged. The Corporation will act as a clearing house for exchanging experience gained by banks in financing agricultural development programmes.

The second important function of the Corporation is direct financing of farmers for production purposes which will be limited to only a few selected projects/areas. This is mainly with a view to gaining experience in financing new projects and to pass on the experience to the commercial banks. The Corporation may formulate a project, work out its economics and invite a consortium of banks to lend to the project. It may also participate in financing the project with a view to giving a lead to the commercial banks.

Provision of finance for the building up of the infra-structure for agricultural development is another important function of the Corporation. The projects which will be supported by the Corporation include (*a*) service units, institutions and/or organizations rendering agricultural services to farmers for reasonable charges, (*b*) agricultural processing industries, (*c*) production, distribution and marketing of agricultural inputs, (*d*) vertical integration of agriculture by bringing together the agro-processing industries and farmers and meeting of credit requirements of these industries to enable them to supply production requisites to farmers on credit, (*e*) construction of warehouses, regulated markets, etc., (*f*) minor irrigation and (*g*) other such projects which contribute to increased agricultural production. Recently, the Corporation has provided finance to State Electricity Boards.

AGRICULTURAL REFINANCE CORPORATION*

Another important financial institution for promoting agricultural development is the Agricultural Refinance Corporation, set up in July, 1963. The object of the Corporation is to help in augmenting the resources available for provision of medium and long-term finance for agriculture. It is primarily a refinancing agency providing financial accommodation of a long-term nature for those major

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developmental projects which cannot be financed by the existing credit agencies or by the commercial banks either on account of the volume of funds involved or the terms and conditions of repayment or because the projects are such as cannot be brought within the normal rules of business under which the land development banks are functioning. It is not intended to replace the existing normal arrangements for long and medium-term finance. The Corporation provides refinance facilities for the following purposes : (*a*) reclamation and preparation of land with a view to fully utilizing irrigation facilities, (*b*) development of special crops, such as coffee, tea, arecanut, coconut, cashewnut, cardamom, etc., (*c*) development of mechanized farming, use of electricity for tube-wells, pump-sets, etc., and (*d*) development of animal husbandry, dairy farming, pisciculture (including, co-operative fisheries) and poultry farming.

All State Co-operative Banks, Central land development banks and scheduled commercial banks which are shareholders of the Corporation are eligible for financial assistance, which will be mainly by way of refinance to the borrowing institutions. In special cases where a loan for financing a particular activity is considered necessary, the Corporation might directly finance those co-operative societies which are approved by the Reserve Bank for that purpose. The minimum amount of financial assistance that can be obtained from the Corporation by way of refinance/loans is fixed at Rs. 1 lakh. The period of loans is limited to 15 years but in exceptional cases may be extended up to 20 years.

The Corporation has sanctioned in all 128 schemes relating to agricultural development up to June 30, 1968 involving a financial outlay of Rs. 107.57 crores. Out of this outlay, the Corporation is committed to refinance Rs. 90.59 crores. The number and type of schemes sanctioned by the Corporation include 54 schemes for minor irrigation, 24 for the reclamation and development of land, 2 for soil conservation, 37 for the development of plantation and horticulture, 2 for the purchase of tractors and power tillers, 4 for poultry farming and 5 for the development of marine fisheries. Of the total number of schemes sanctioned, 93 schemes or 73 per cent are to be implemented through the Central land development banks, involving a financial outlay of Rs. 98.61 crores or about 92 per cent of the total outlay; 26 schemes (20 per cent) with a financial outlay of Rs. 3.87 crores are to be financed through the scheduled commercial banks and 9 schemes (7 per cent) involving an outlay of Rs. 5.09 crores through the State co-operative banks. Among the different States, Andhra Pradesh had the largest number of schemes sanctioned, *viz.*, 20, Mysore 17, Kerala 14, Madras 13, Punjab 11, Gujarat and Maharashtra 10 each, Haryana and Madhya Pradesh 6 each, Assam, Bihar and Uttar Pradesh 4 each, Delhi and West Bengal 3 each, Jammu & Kashmir, Orissa and Rajasthan one each. During 1967-68, the number of schemes sanctioned by the Corporation was 89, accounting for nearly 70 per cent of the total and the outlay on these schemes amounted to Rs. 68.16 crores, constituting 63 per cent of the total outlay. Of this outlay, the Corporation is committed to refinance Rs. 58.64 crores or 86 per cent of the outlay, as against Rs. 7.68 crores for the 13 schemes sanctioned in 1966-67. Thus judged by the number of schemes sanctioned by the Corporation, the total financial outlay involved and its commitments, the Corporation has made accelerated progress.

The Corporation's total disbursements increased from Rs. 6.98 crores in 1966-67 to Rs. 12.65 crores in 1967-68, of which Rs. 11.90 crores or 94 per cent

were disbursed to land development banks and the rest to scheduled commercial banks and State co-operative banks. The States which have shown a good performance in this respect are Andhra Pradesh, Punjab and Haryana; the other States showed a shortfall in performance.

Good progress has been made by the financing banks in the implementation of the schemes sanctioned by the Corporation. Up to 1967-68, about 3.30 lakh acres of dry crop land in Andhra Pradesh, Mysore and Madras were levelled and developed for being brought under irrigation from major irrigation works. Under the soil conservation schemes sanctioned in six districts of Maharashtra, an area of 3.02 lakh acres was developed. Under minor irrigation schemes, 328 new wells and 1,147 tube-wells were constructed and 424 pump-sets installed. Under the marine fisheries schemes, 100 mechanized boats were constructed and supplied to fishermen in the South Kanara district of Mysore. In respect of other schemes sanctioned by the Corporation such as for the development of plantations and horticulture, progress achieved in some States was fairly satisfactory.

As regards the schemes sanctioned during 1967-68, the 54 minor irrigation schemes sanctioned in different States envisage the digging and construction of 59,981 wells/tube-wells and installation of 40,845 diesel/electric pump-sets. The land reclamation schemes numbering 8 in Andhra Pradesh, Gujarat, Maharashtra, Mysore and Punjab propose to cover a total area of 3.86 lakh acres. The 18 plantation crop schemes envisage to bring about the development of about 36,000 acres under commercial and orchard crops in seven States. Under the three fisheries development schemes sanctioned in Andhra Pradesh, Kerala and Madras, it is proposed to supply 144 mechanized boats to fishermen. The four poultry schemes envisage the installation of 504 poultry units and the purchase of 1,52,000 layers. The tractor scheme sanctioned in Haryana entails the purchase of 330 tractors and the power tiller scheme in Mysore, the purchase of 200 power tiller units.

There has been a progressive shift in the pattern of schemes submitted for refinance, from land development projects of long gestation period to those of relatively quick return in agricultural production. This trend is evident from the fact that out of 134 newly submitted schemes at the end of June, 1968, 74 pertained to minor irrigation. Since 1967-68, the Corporation has sanctioned refinance for additional 23 schemes involving an additional outlay of Rs. 11.28 crores of which the Corporation has committed to refinance Rs. 10.05 crores. These minor irrigation schemes propose to bring into commission another 11,299 tube-wells or wells and about 3,300 pumping sets. The total number of schemes sanctioned by the Corporation from its inception to September, 1968 has risen to 151, involving a financial outlay of Rs. 118.66 crores of which the Corporation is committed to supply Rs. 100.41 crores.

Of the 188 proposals for refinance submitted to the Corporation during 1967-68, 132 were from co-operative land development banks, 14 from State co-operative banks and 42 from scheduled commercial banks. Economic feasibility studies were completed in respect of 120 schemes and the Corporation arranged for technical feasibility studies of 94 schemes by various technical experts on its panel, and other agencies.

A number of important changes were made during 1967-68 in regard to the policies and procedure of the Corporation for the sanction of refinance to co-operative financing institutions and scheduled commercial banks. The contribution of State Governments to special development debentures floated by land development banks to finance minor irrigation schemes was reduced from the normal 25 per cent to 10 per cent from 1966-67. As some areas have yet to take advantage of this concession, this facility has been extended up to 30th June, 1969. The Corporation also agreed to provide through the Central land development banks refinance facilities in respect of the loans advanced by them to farmers for the expenditure to be incurred by them by way of charges paid to the Electricity Boards or deposits kept with them for obtaining electric connections to enable the farmers to energise their wells. The ceiling for such loans is restricted to Rs. 3,000 per well. This new scheme introduced in May, 1968, has given a stimulus to the electrification of wells used for agricultural purposes, as is evident from the fact that the Corporation has sanctioned 16 minor irrigation schemes containing a loan component of Rs. 2.58 crores which are to be passed to the relevant Electricity Boards.

Some of the facilities newly offered to commercial banks are as follows. The Corporation has now decided to refinance loans by commercial banks for the development of tea and coffee plantations involving the repurchase of run-down estates as well as virgin land under certain terms and conditions and limited to the extent of 50 per cent of the value of the estate or virgin land to be acquired. The other relaxations made in the case of these banks are in regard to the loan procedure of the Corporation. Loans for medium and long-term purposes for agricultural development which are subsequently refinanced by the Corporation have been excluded by the Reserve Bank from the 5 per cent ratio which the banks are expected to maintain between their term lending and deposits. It has also been decided not to insist on individual reports on the property of each borrower for schemes involving a large number of cultivators such as minor irrigation schemes. The banks are allowed to produce only a composite certificate of their solicitors/ legal advisers as to the soundness, marketability and legality of the titles of borrowers. It has also been agreed to provide refinance facilities to the commercial banks which advance medium and long-term loans to plantation estates for purchase of agricultural machinery and development of land for cultivation of food crops also on the estate. The original condition of refinancing loans to individual farmers in compact areas has now been relaxed. It has been decided that loans advanced by commercial banks for financing the purchase of agricultural implements are eligible for refinance even though the individual borrowers are spread over a comparatively wider area, provided the banks take adequate steps for supervision over the utilization of loans. Refinance loans are now made available by the Corporation to commercial banks and State co-operative banks for the construction of modern godowns and silos for the areas of agricultural production.