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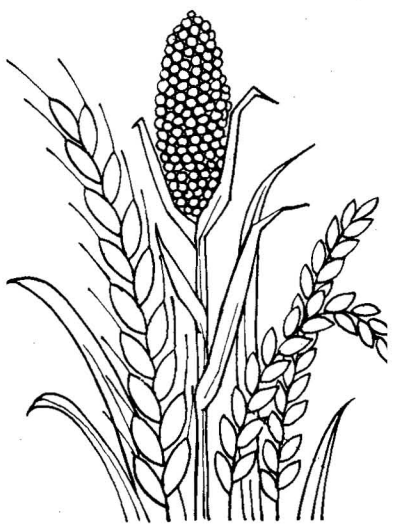

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change in irrigated area ; (3) percentage change in gross cropped area ; and (4) percentage change in area under crops other than foodgrains and fodder, excepting paddy. The rank correlation coefficients are 0.61, 0.62, 0.65 and 0.69 respectively. The corresponding coefficients excluding Nilgiris are 0.58, 0.71, 0.64 and 0.66. All these excepting that for percentage change in net area sown excluding Nilgiris are found to be significant at 5 per cent level. This indicates that extension in cultivated area and extension in irrigation help to account for higher rates of progress in certain districts.

But what is more important is the need for an explanation of the differences in productivity per acre for this accounts for most of the difference in rates of progress. Hence, the per acre output values are examined in relation to the following :—(*i*) percentage change in irrigated area; (*ii*) percentage change in density per acre; (*iii*) percentage change in intensity of cropping ; and (*iv*) percentage change in area under crops other than foodgrains and fodder excepting paddy.

The rank correlation coefficients for the above variables are 0.56, 0.24, 0.76 and 0.39 respectively. All these excepting that for percentage change in intensity of cropping were found to be not significant. In order to find out whether this is due to exceptionally low yields in 1949-50 particularly in some districts, the correction factor was applied to the progress and the rank correlation coefficients were worked out with the new rankings, and even these were found to be not significant. We could not examine the relationship between differential rates of increase in productivity and use of (*a*) fertilizers ; (*b*) improved seeds ; (*c*) improved practices and (*d*) use of electricity, etc. ; since district-wise data on these are not readily available to us. However, the weak correlation between some of the crucial variables that we chose and the changes in production is rather surprising and leads to the suspicion whether much of the noticed differences in the progress of productivity is not due to chance.

REGIONAL VARIATIONS IN AGRICULTURAL PRODUCTIVITY IN ANDHRA PRADESH

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The objects of this paper are (1) to measure the degree of variation in (*a*) output per acre, (*b*) output per head in agriculture, and (2) to account for this variation between different districts of Andhra Pradesh.

The basic data for this purpose are got from the Season and Crop Reports published by the Bureau of Economics and Statistics, Andhra Pradesh, 1959-60.

The Season and Crop Report gives district-wise details regarding acreage, production and farm harvest prices for certain commodities. For the purpose of this paper, returns to land are identified with value of gross product per acre. The value of gross product per acre is derived as follows. For major crops, production and price data are available for individual districts. But for many items under condiments and spices, for fresh and dry fruits, for vegetables, for coconuts, for non-edible oilseeds, for fodder crops and green manures only acreage figures are available in the reports. Neither production figures nor price figures could be got for such crops. In such cases, the nominal price per acre as quoted in the ' Comparative Statement ' showing the output and value of agricultural commodities is adopted. In cases where the nominal price per acre is not available, the returns per acre had to be imputed. For turmeric, garlic, coriander, etc., the returns per acre in the districts are assumed to be equivalent to the return derived from a crop like chillies in the condiments and spices group for which production and price data are available. For fodder and green manure crops a value of Rs. 50 per acre is adopted. For valuing the by-product of cereals and pulses, 10 per cent of the value of the main product is taken. The gross value of product per acre is derived by dividing the gross value of production of all the crops by net area sown.

Output per head is derived as follows. The population of 1961 of the districts is got from the Census Report. Since the percentage of agricultural population of the district is not readily available, the percentage of agricultural population in 1951 is adopted for deriving the agricultural population in 1961. The gross value of the agricultural product of the district is divided by the corresponding agricultural population. This gives the per capita gross product and gives an indication of the variation in the levels of incomes of agriculturists in different districts.

The per acre product values and per capita product values are divided into 3 groups. Those districts which got less than the State average are considered to be in the category ' low '; those which got a return more than the State average and less than Rs. 300 are placed in the 'medium' and those which gave a return of more than Rs. 300 are placed in the category of ' high '. The figures of each are shown under the corresponding regions, *viz.*, Coastal Andhra, Ceded Districts, Telangana. The results are given in Tables I and II.

Table I reveals a high degree of variation in returns to per acre between different districts. The returns vary from Rs. 91.05 to Rs. 476.33. The table also confirms the generally known picture regarding the low returns to per acre in Ceded Districts and in Telangana. Out of the seven districts in Coastal Andhra, five are in the 'high' group and only one in the 'low' group. None of the Telangana Districts is found in the ' high ' group. Among the Ceded Districts, Chittoor is rather unique.

The picture got from Table II is different from Table I in many respects. The degree of variation between different districts is not so high as in the case of per acre output. The value per capita ranged from Rs. 121.37 to Rs. 306.43, the highest value being between 2.5 and 3 times the lowest value. To examine the difference in extent of variation between per acre output values and per capita values coefficients of variation are computed, and they are 56.39 per cent and 24.52 per cent respectively. Regional averages show that the disparity between Coastal Andhra

TABLE I—VARIATIONS IN PER ACRE OUTPUT (VALUES IN RS.)

Value Groups	Regions	Coastal Andhra	Ceded Districts	Telangana Area
High				
	East Godavari	476.33		
	Srikakulam	459.43		
	West Godavari	422.85		
	Visakhapatnam	385.05		
	Krishna	338.42		
	Chittoor		314.97	
Medium				
	Nizamabad			264.35
	Guntur	250.75		
Low				
	Nellore	192.81		
	Cuddapah		169.90	
	Medak			156.90
	Warangal			155.11
	Ananthapur		142.72	
	Khammam			130.10
	Hyderabad			124.30
	Kurnool		122.62	
	Nalgonda			104.38
	Karimnagar			100.01
	Mehboobnagar			93.80
	Adilabad			91.05
Regional Average		360.80	187.55	135.36

N.B. :

Low : Less than State average Rs. 203.60.

Medium : Rs. 203.60 to 300.

High : Above Rs. 300.

TABLE II—VARIATIONS IN PER CAPITA OUTPUT (VALUE IN RS.)

Value Groups	Regions	Coastal Andhra	Ceded Districts	Telangana Area
High				
	Hyderabad			306.34
	Krishna	304.65		
Medium				
	West Godavari	287.13		
	Ananthapur		282.83	
	Nizamabad			282.40
	Kurnool		263.63	
	East Godavari	263.64		
	Srikakulam	260.75		
	Guntur	256.70		
Low				
	Chittoor		216.74	
	Visakhapatnam	207.92		
	Cuddapah		200.33	
	Nellore	198.50		
	Medak			188.30
	Mehboobnagar			181.44
	Nalgonda			167.03
	Warangal			163.15
	Adilabad			162.28
	Khammam			156.70
	Karimnagar			121.37
Regional Average		254.15	240.88	192.11

N. B. :

Low : Less than State Average Rs. 228.64.

Medium : Between Rs. 228.64 and 300.

High : Above Rs. 300.

and Ceded Districts is not so wide in per capita terms. Similar results are noticed in other Studies. For instance in Kodinar Taluka, while much difference is noticed between the three regions in value of gross crop production per acre the difference in value of gross crop production per family between the three regions is found to be negligible.[1] Telangana is obviously most backward. Nizamabad is however unique. These differences in the two pictures reflect the varying nature of the problem. In Coastal Andhra, per acre productivity is high; but the high density per acre reduces the differences in per capita output between Coastal Andhra and other regions. In Ceded Districts productivity per acre is low but the density is also low. In Telangana, except Nizamabad District, both productivity per capita and per acre are low.

There can be two sets of definitions of low income regions: (1) Regions with low per capita income despite high productivity resources and (2) regions with low per capita income due to low resource productivity.[2] Though the average income is low in both the regions the content of the problem widely differs. In most cases the low per acre output districts also are low per capita output districts. The three exceptions are Ananthapur, Kurnool and Hyderabad. Of these three, Kurnool and Ananthapur have medium per capita output and Hyderabad has ' high ' per capita output. Among the ' high ' per acre output districts, Chittoor and Visakhapatnam are found to be ' low ' per capita output districts. The problems of these two districts which are densely populated differ from the other low per capita output districts. The variations in per acre output are sought to be explained by associating the output values with some crucial variables which influence the output. Broadly, variations in output per acre may be accounted for by (*a*) resource endowment of the district including level of human investment, (*b*) level of organisation of the resources and (*c*) demographic pressure which necessitates more intensive cultivation. Under the first category the following are considered : (*i*) level of rainfall, (*ii*) poverty or richness of the soil as judged from current and old fallows, (*iii*) percentage of area under irrigation, (*iv*) human investment as judged from level of literacy and (*v*) opportunities for non-agricultural employment as judged from percentage of population depending on non-agricultural enterprises. Under the second category the following are considered : (*i*) intensity of cropping, (*ii*) degree of monetisation as judged from percentage of gross value derived from crops other than foodgrains and fodder[3], (*iii*) percentage of acreage under crops other than foodgrains and fodder. The demographic pressure is judged by density of agricultural population per acre. The relevant figures are presented in Table III.

The level of normal rainfall shows marked variation between the districts. Ananthapur and Kurnool districts record the least rainfall whereas Srikakulam district records the maximum rainfall. The level of rainfall in Ananthapur was 557.8 mm. as against 1087.2 mm. in Srikakulam district. In general the high and medium productivity districts record higher level of rainfall ; but among the low income districts, the rainfall in Warangal and Adilabad is of the same order as in East Godavari, Srikakulam and West Godavari districts. But in Adilabad, this

1. See C. H. Shah : Problems of Small Farmers, The Indian Society of Agricultural Economics, Bombay, 1958.
2. *Ibid.*
3. This is only a rough measure, and had to be taken in the absence of data to build up a more precise measure.

TABLE III—SOME VARIABLES ASSOCIATED WITH LEVEL OF PER ACRE OUTPUT

Districts	Per acre output	Normal level of rainfall in mm.	% of current and old fallows	% of area under irrigation	% of literacy*	% of population depending on agriculture*	Intensity of cropping	% of gross value other than food grains and fodder	% of area under all crops excluding fodder and foodgrains	Density of agricultural population per acre	Percentage of total area under commercial crops† including paddy
1	2	3	4	5	6	7	8	9	10	11	12
High											
East Godavari	476.33	1029.5	3.9	65	17.9	68.7	1.25	31.69	19.11	1.81	82.56
Srikakulam	459.43	1087.2	8.4	54	9.3	77.1	1.32	51.65	24.82	1.76	70.75
West Godavari	422.85	1029.5	7.4	73	21.1	73.3	1.25	25.77	15.64	1.47	86.87
Visakhapatnam	385.05	993.4	3.5	57	9.3	70.8	1.27	48.62	27.75	1.85	61.73
Krishna	338.42	942.1	6.5	66	21.4	64.9	1.21	19.20	11.98	1.11	70.42
Chittoor	314.97	845.6	12.5	33	11.6	75.2	1.11	61.06	32.51	1.45	57.70
Medium											
Nizamabad	264.35	974.6	12.7	40	7.2	68.1	1.08	33.88	15.69	0.94	54.81
Guntur	250.75	821.9	8.0	24	17.3	69.5	1.13	43.98	18.18	0.98	40.19
Average for High and Medium	364.02	965.5	7.9	51.5	14.4	70.9	1.20	39.48	20.71	1.42	65.63

(Contd.)

TABLE III (Contd.)

1	2	3	4	5	6	7	8	9	10	11	12
Low											
Nellore	192.81	902.2	9.6	39	14.6	72.6	1.09	14.79	8.92	0.97	38.79
Cuddapah	169.90	689.5	11.1	22	16.8	64.8	1.07	43.81	26.96	0.85	39.33
Medak	156.90	860.9	17.1	21	6.9	76.3	1.06	17.01	14.12	0.83	36.40
Warangal	155.11	1055.7	18.3	28	8.1	65.3	1.08	11.72	9.58	0.95	38.03
Ananthapur	142.72	557.8	10.5	8	14.6	71.8	1.04	58.65	32.49	0.50	38.15
Khammam	130.10	902.6	11.7	21	8.1	65.3	1.00	25.65	8.77	0.83	33.99
Hyderabad	124.30	905.5	12.7	12	25.2	17.0	1.01	22.00	23.93	0.41	39.45
Kurnool	122.62	661.9	11.0	7	12.5	64.6	1.08	42.41	27.99	0.47	33.24
Nalgonda	104.38	681.5	17.7	14	6.2	69.7	1.06	47.13	21.84	0.62	39.61
Karimnagar	100.01	887.0	18.4	28	6.1	58.4	1.03	20.61	15.98	0.82	43.58
Mehboobnagar	93.80	721.6	19.6	12	6.9	70.4	1.02	19.06	17.14	0.52	30.41
Adilabad	91.05	1048.1	8.9	5	5.9	70.9	1.01	16.28	24.63	0.56	34.08
Average for Low ..	131.97	822.9	13.9	18.1	11.0	63.9	1.01	28.26	19.36	0.68	36.84

* As shown in 1951 Census. † Commercial crops are taken to be crops other than foodgrains and fodder.

resource has not been utilised because 'the topography of the district is not suitable for irrigation.'[4] In Warangal this resource had been used to a limited extent. Twenty-eight per cent of the area is under irrigation.

Since the area reported under cultivable waste is not a good guide, area under current and old fallows alone are taken to indicate the poverty and richness of the soil. It is assumed that in areas where the soil is rich, area under current and old fallows is likely to be small. Broadly speaking the proportion of area under current and old fallows is higher in low productivity regions and lower in high and medium productivity regions. Among low productivity regions in none of the districts except Nellore and Adilabad the proportion of current and old fallows is less than 10 per cent. In 'high' and 'medium' productivity districts, Chittoor and Nizamabad alone show a proportion higher than 10 per cent.

Irrigation appears to be a crucial variable. The 'high' and 'medium' districts have generally a high percentage of irrigation. The top five districts have more than 50 per cent of irrigation. All except one, *viz.*, Guntur have more than 30 per cent area under irrigation. In low productivity districts only one district, *viz.*, Nellore has more than 30 per cent of the area under irrigation. Ananthapur, Kurnool, Adilabad, Mehboobnagar and Nalgonda are the least irrigated districts in the low productivity areas.

Levels of literacy in all the districts are low. The maximum level of literacy reported by any district is only 25.2 per cent. The lowest levels of literacy are recorded in Telangana area. Excepting Hyderabad all the Telangana districts recorded less than 10 per cent. At the extreme north, Srikakulam and Visakhapatnam, though high productivity districts, recorded similar levels of literacy. Coastal Andhra excepting Srikakulam and Visakhapatnam recorded the highest level of literacy. Ceded Districts showed intermediate level of literacy. Even though the three districts at the bottom recorded very low level of literacy, literacy and productivity per acre do not appear to show high association.

The percentage of population depending on agriculture varied from 64.9 to 77.1 in the 'high' and 'medium' productivity group and 58.4 to 76.3 in the 'low' productivity group (if Hyderabad district is not considered). In fact the lowest proportion of population depending on agriculture is noticed in Karimnagar district, which is one of the most backward. Non-agricultural population comprised mostly of weavers, and did not have any influence on the productivity of land.

As regards intensity of cropping, the 'high' and 'medium' productivity regions have undoubtedly higher intensity of cropping than low productivity districts. Intensity of cropping is highly correlated with percentage of area under irrigation.

The percentage of area under all crops excluding foodgrains and fodder (commercial crops) and the percentage of gross value other than foodgrains and fodder give a measure of the degree of monetisation of the districts. All the districts

4. Season and Crop Report, 1959-60, p. 11.

except Krishna in the 'high' and 'medium' productivity region derived more than 25 per cent of the value from commercial crops. For Krishna district paddy is more or less a commercial crop. Among low productivity districts only 5 out of 12 recorded more than 25 per cent of the value from commercial crops. But the difference in the average in percentage of area is not so significant though in terms of value there is a big difference.

Density of agricultural population per acre is highly correlated with per acre output. The high and medium productivity districts are those in which the agricultural population per acre is one or more, whereas the low productivity districts are those which have less than 1 per acre. The simple correlation coefficient between per acre output value and density per acre is found to be 0.9392. But it will be misleading to conclude that increased density will lead to increased output. For density is highly correlated with percentage of area under irrigation. The simple correlation coefficient between percentage of irrigated area and density per acre is found to be 0.8721. It is more realistic to infer that the migration of labour from poorer to richer regions has led to variations in density.

Yields per acre of major crops of the districts are examined. It is seen that rice is a significant crop in almost all the districts. But specialisation in rice production is found mostly in high productivity districts. Paddy yield varied from 743 lbs. in Adilabad district to 1502 lbs. in Chittoor district. Yields of jowar varied from 324 lbs. in Cuddapah to 763 lbs. in Medak. In respect of cotton, yields varied from 25 lbs. in Mehboobnagar district to 68 lbs. in Guntur and Nellore districts. Yields in groundnut varied from 390 lbs. in Nalgonda to 952 lbs. in Ananthapur district. These figures indicate high variations in yields. But the low productivity regions are not necessarily districts which show low yields and variations in yields between crops alone do not account for large variation noticed in per acre output values between low and high productivity districts. Cropping pattern is found to be more significant for explanation of this variation. A review of per acre values of crops in different districts has shown that paddy and commercial crops yield much higher values than other crops. Hence the percentage of area under paddy and commercial crops is examined. The results are shown in column 12 of Table III.

The results show quite clearly that 'high' and 'medium' yielding regions have an entirely different cropping pattern and cropping pattern alone would account for most of the variations. But within the low productivity districts the variation could be accounted for by differences in yields, for these districts have similar cropping pattern. Mehboobnagar and Adilabad which are in the bottom show the lowest yield in respect of many crops. Adilabad which shows the lowest gross product per acre is a chief habitat of scheduled tribes in the State.[5] The majority of population live in small villages which are no more than a cluster of poorly built huts. The Census Report points out that this district has some potentialities for the generation of hydro-electric power and the resources are as yet unharnessed.

To examine the functional relationship between value of output per acre and associated variables, two associated variables, *viz.*, percentage of irrigated area and

5. Census of India 1951, Volume IX, Hyderabad—Part I A Report, p. 20.

percentage of area under foodgrains and fodder are chosen. The multiple regression equation in the linear form

$$Y = a + b_1 x_1 - b_2 x_2 \text{ is fitted.}$$

(x_1 = percentage of irrigated area.

x_2 = percentage of area under foodgrains and fodder).

The result is as follows :

$$Y = 469.11 + 5.98 x_1 - 5.40 x_2$$

The value of per acre output is 224.79 and the standard error is 87.46. The limits, within which this value (Y) could be fixed at, are 312.25 and 137.33.

The multiple correlation coefficient (R) is 0.723 and is not significant at 5 per cent level. The coefficient of determination (R^2) is 0.5226.

The net regression coefficients, their standard errors and the corresponding ' t ' values are given below.

Particulars	Regression Coefficient	Standard Error	't'
Percentage of irrigated area	5.9817	0.2910	20.56
Percentage of area under foodgrains and fodder	—5.3994	3.9698	1.36

The ' t ' is significant at 5 per cent level in case of percentage of irrigated area and is not significant with respect to the other variable.

The individual correlation coefficients are calculated and are found to be 0.95 and 0.70 for percentage of irrigated area and area under foodgrains and fodder respectively. The t's have been computed and found to be significant at 5 per cent level.

Conclusion

The main conclusion of this study may now be indicated. The low productivity districts are mainly those which have low resources endowment. Low resource endowment leads to a low level of organisation. This is mainly reflected in the cropping pattern. These regions devote themselves more to inferior value yielding crops which are found to be other than paddy and commercial crops. Improvement of the physical framework within which farmers operate is a necessary condition for improvement of the level of organisation, and thereby the gross value of product.

Demographic pressure had led to low per capita product in two districts, namely, Chittoor and Visakhapatnam, despite high gross output per acre. Diversion of population from agriculture is a pressing need in these two districts.