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EXTENT OF VARIABILITY IN SELECTED DRY FARMING DISTRICTS OF UTTAR PRADESH

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The new technology of agricultural production is confined to regions where water resources are good and irrigation assured. Though India has the largest irrigated area of any country in the world yet 80 per cent of the total cropped area is still rain-fed and even if all the irrigation resources were developed and utilized, it is estimated that nearly 60 per cent of the area would still continue to be cultivated under rain-fed conditions.

The inter-regional disparities which existed between rain-fed and irrigated regions of the country increased because of the agricultural transformation. The gap would widen further if nothing is done to improve the agriculture in the rain-fed areas. Fortunately rain-fed agriculture is now coming to the fore. "During the second phase of agricultural development which has just started, an intensive programme has been launched to develop and extend techniques and measures, which are capable of benefiting dry farming regions."[*]

As the name suggests, dry farming is a term assigned to cultivation carried under conditions of scanty or precarious rainfall (the Dry Farming Programme of the Government of India covers areas with an annual rainfall ranging between 37.5 cm. and 112.5 cm.) without any assured irrigation facilities worth the name. As a consequence, the dependence on nature is absolute. The farmers, therefore, practise soil and moisture conservation measures, try to grow short duration and drought resistant varieties of crops with relatively less year-to-year yield variability.

Uncertainty and instability of production is the hallmark of dry agriculture and the dominant problem, therefore, in such areas is the choice of crops with low variations in yields. In this paper, an attempt has been made to examine the extent of variability and uncertainty and correlate the yields with the amount of precipitation in the selected districts of Uttar Pradesh having an average rainfall of 1000 mm. or less. An attempt has also been made to see if the cropping pattern followed in these districts has any relevance to the physical and ecological conditions.

Methodology

The study has been done with respect to the districts of Jhansi, Jalaun, Mathura, Hamirpur and Banda. They were selected on the basis of the

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[*]Economic Survey 1970-71, Ministry of Finance, Government of India, New Delhi, 1971, p. 7.

average annual rainfall and the extent of irrigation facilities. The data for rainfall and the number of rainy days of these districts were collected for the last 20 years. Among these, the data for three years were not available.

Data were also collected on the average yields of major crops of these districts for the same period. These crops are rice, wheat, barley, jowar, bajra, maize and gram. (The percentage of area under these crops to total cropped area is given in Table I.) Data were also collected on the proportion

TABLE I—AREA UNDER SELECTED CROPS EXPRESSED AS PERCENTAGE
OF THE TOTAL CROPPED AREA : 1969-70

District	Crops						
	Rice	Wheat	Barley	Jowar*	Bajra†	Maize	Gram
Jhansi	2·7	28·6	1·86	11·07*	0·036	1·70	23·56
Jalaun	2·4	27·5	3·19	10·52	6·04	0·004	38·10
Hamirpur	1·0	26·3	1·16	16·61	0·79	0·002	39·31
Banda	13·3	19·3	2·74	13·44	3·64	—	35·00
Mathura	0·7	33·2	9·78	8·00	26·45	6·13	9·34

* includes area under jowar + arhar.
† includes area under bajra + arhar.
Source : Based on data obtained from the Directorate of Agriculture, U.P.

of these crops grown under irrigated conditions (Table II). The averages of rainfall, rainy days and yields over the 20 years of study were computed from

TABLE II—PERCENTAGE OF AREA IRRIGATED TO THE TOTAL AREA
UNDER SELECTED CROPS : 1969-70

District	Crops						
	Rice	Wheat	Barley	Jowar	Bajra	Maize	All crops
Jhansi	7·19	4·40	78·03	0·78	—	0·69	4·24
Jalaun	70·65	19·57	15·67	6·94	16·42	22·22	5·56
Hamirpur	50·11	75·87	64·22	—	—	—	1·26
Banda	63·72	19·87	5·65	—	—	—	5·23
Mathura	49·98	72·06	71·55	5·839	2·301	8·009	5·96

'—' indicates practically no area under irrigation.
Source : Based on data obtained from the Directorate of Agriculture, U.P.

these data. The variance and the coefficients of variation for each crop and the rainfall were calculated to measure variability in them. Finally, analysis was done to find if the farmers were growing (preferring) crops with lesser variability (low or zero coefficient of correlation with rainfall) over those having greater variability as a measure of meeting uncertainty.

TABLE III—ARITHMETIC AVERAGE, VARIANCE AND COEFFICIENT OF VARIATION
OF RAINFALL (MM.) IN SELECTED DISTRICTS :   1950-70

District	Arithmetic average	Variance	Coefficient of variation
Jhansi	881·83	28214·12	19·04
Jalaun	936·46	99604·98	33·70
Hamirpur	844·25	66531·19	30·55
Banda	874·74	40605·02	23·03
Mathura	601·10	15628·20	20·81

Source : Based on data obtained from the Board of Revenue, U.P.

TABLE IV—ARITHMETIC AVERAGE, VARIANCE AND COEFFICIENT OF VARIATION (CV)
OF YIELDS (MAUNDS/ACRES) IN SELECTED DISTRICTS :   1950-1970

District		Crops						
		Rice	Wheat	Barley	Jowar	Bajra	Maize	Gram
Jhansi	Mean ..	4·83	9·18	8·1	6·39	5·52	7·43	6·58
	Variance ..	3·538	3·311	17·2853	3·36	3·45	19·655	1·222
	CV ..	38·93	19·82	51·35	28·63	33·69	59·62	16·71
Jalaun	Mean ..	4·82	9·49	9·61	5·32	5·52	7·85	6·32
	Variance ..	3·577	7·43	3·56	3·262	3·691	12·4	1·57
	CV ..	39·21	28·71	19·63	33·94	34·80	44·87	19·82
Hamirpur	Mean ..	4·79	9·16	8·45	7·43	5·41	7·995	6·292
	Variance ..	3·46	4·94	3·52	4·04	2·84	12·36	0·67
	CV ..	38·83	24·43	22·13	27·05	31·23	43·92	13·03
Banda	Mean ..	7·03	7·95	8·415	7·06	5·51	7·89	5·73
	Variance ..	4·10	5·76	5·01	7·79	4·59	12·03	1·81
	CV ..	28·73	30·18	26·63	39·37	38·47	43·97	23·38
Mathura	Mean ..	7·91	12·21	12·29	2·46	4·08	7·73	8·88
	Variance ..	1·46	7·138	7·335	4·526	2·064	15·019	6·265
	CV ..	15·27	21·87	22·03	88·46	35·07	50·19	28·93

Results and Discussion

1. Of the crops studied here, gram has the smallest coefficient of varia-
tion in Jhansi, Hamirpur and Banda; in Jalaun it is 19.82, *i.e.*, only margi-
nally higher (by 0.19) than the lowest coefficient of variation of 19.63 for
barley. In all these districts (except Jhansi) gram is also the crop which
commands the largest area.

2. Maize is the least (or nearly least) important crop in all the five districts. This could well be justified by the fact that but for Mathura (where its coefficient of variation is lower than only that of jowar), the crop has the highest coefficient of variation of all the crops in all the districts.

3. In Jhansi, the first three crops, *viz.*, gram, wheat and jowar have lesser coefficient of variation than the other four crops.

4. In Jalaun, the coefficient of variation is the lowest for barley (19.63) followed by gram (19.82), wheat (28.71), jowar (33.94), bajra (34.80), rice (39.21) and maize (44.87). If we do not consider barley, the importance of crops in terms of their acreage is exactly in the same order as their coefficients of variation in yields.

5. In Hamirpur, according to the acreage, the ranking of crops is gram, wheat, jowar, barley, paddy, bajra and maize. The order of these crops on the basis of coefficient of variation is gram, barley, wheat, jowar, bajra, paddy and maize which is similar to the actual acreage except for barley (which has 64 per cent in area under irrigation) and bajra.

6. In Banda district, the order of crops in accordance with the coefficients of variation does not strictly match their order in terms of acreage but the differences among coefficients of some crops of their acreages are marginal.

7. In Mathura the coefficients of variation for wheat, barley, gram, bajra, maize and jowar are 21.87, 22.03, 28.93, 35.07, 50.19 and 88.46 respectively. Their order in terms of acreage is wheat, bajra, barley, gram, jowar and maize. Here also, the cropping pattern matches fairly well with the variability of crops.

Conclusions and Suggestions

1. A study of the coefficients of variation of selected crops and the proportion of their area to the total area shows that, by and large, the farmers are quite rational. The cropping pattern matches well with the relative variability of different crops and the farmers are taking crops having lesser variability to meet the uncertainty of rainfall.

2. In Jhansi, though 78.03 per cent of the area under barley is irrigated (as against 4.4 per cent in the case of wheat), the variance of barley is higher and the per acre yields are lower than those of wheat. Perhaps the farmers are preferring barley over wheat due to lack of inputs (more required for wheat than barley). If so, the productivity in the district can be increased considerably if the irrigated area under barley is shifted to wheat. This could be done by adequate provision of credit and resources.

3. Gram appears to be the most stable crop (in terms of yields) under rain-fed conditions. The evolution of high-yielding varieties of gram should be the prime focus of attention of breeders. It is clear that the yields per acre are extremely low in the case of gram and there is a great scope for im-

provement. This assumes added significance in view of the fact that in the year 1970-71, though our country had record yields of rice, bajra and wheat, the pulses had shown a marginal decline.

4. (i) A scheme of crop insurance may be introduced in these districts. In almost all cases, the coefficient of variation is more than 20 per cent both in the case of yields and rainfall and crop insurance may give some income stability to the farmer.

(ii) Our analysis has taken only crops into account. In these districts, livestock is an important supplementary enterprise. While jowar and bajra command nearly one-sixth of the total cropped area in these districts, the cattle to which these crops are fed continue to be of poor breed. Improved breeds of milch animals and sheep, suitable for the region, should be introduced on a large scale.

INCOME RAISING POTENTIAL ON RAIN-FED FARMS IN JABALPUR DISTRICT : MADHYA PRADESH

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More than 75 per cent of the cropped area in India is rain-fed and most of the measures to increase production are confined to irrigated areas. In Madhya Pradesh about 95 per cent of the cultivated area is rain-fed. In recent years the planners and the agricultural scientists have shown serious concern over this vast area under rain-fed crops. Possibilities of increasing production and income on these areas are now being explored by introducing new varieties of crops or new management practices.

For all practical purposes, the terms like "dry farming," "dry land farming" or farming under "rain-fed" conditions have been assumed to be the same. The pertinent question like what should be the optimum crop combinations in rain-fed farms of Jabalpur district in the light of available resources inclusive of new technology has been attempted in the present study.

Description of the Area

Jabalpur district of Madhya Pradesh is situated at the upstream of Narbada Valley covering an area of 3,779 square miles. The soils of the district