EFFECT OF SPACING ON YIELD OF WHEAT

GREGORY[2] has emphasized the importance of studying simultaneously the various factors governing crop production at different levels. The usefulness of work based on this idea has been amply demonstrated by Dastur and his co-workers[1] in the case of cotton under Indian conditions. In 1935 the present writer initiated studies on inter-relation of factors affecting the yield of wheat under irrigation as well as under the conditions of dry farming at the Godrej Farm, Nasik (unpublished work), and obtained striking increases in the yield of wheat by using a heavier seed rate (100 lb./acre) with 6-inch spacing of rows.

In order to confirm this important finding experiments were undertaken with a number of varieties of wheat during 1941-45* and the effect of a heavier seed rate was studied for dry and irrigated land. As the results appear to have some significance a brief summary is given here in the hope that the suggestion made here may prove useful in overcoming to some extent the present food shortage.

Each of the seven experiments given in the table of results was factorial in design with proper replication and randomisation. Only the effect of spacing is given here as it is intended to publish the details of these experiments elsewhere. The 'normal' seed rate varied from 60-80 lb./acre and the 'heavy' seed rate ranged from 90-110 lb./acre. Factorial experiments of 1935-36 had shown that a higher seed-rate increased the yield adequately only when it was distributed evenly in a greater number of rows per acre. It was therefore so arranged that in the normal seed rate the rows were spaced 10-12 inches apart, approximating to the usual practice of sowing behind the country plough, and in the case of the heavy seed-rate the distance between rows was 6-8 inches.

TABLE I. *Effect of closer spacing on yield of straw and grain (lb./acre)*

Seed Rate		1936 Irr.	1936 Dry	1942 Irr.	1942 Dry	1943 Dry	1943 Irr.	1944 Dry	1945 Dry	
'Normal'	(Straw)	701	1213	3106	1435	2685	1709			9122
	(Grain	302	644	1387	775	1667	1443			1822
	(Ratio)	2·32	1·93	2·24	1·85	1·61	3·27			5·00
'Heavy'	(Straw	973	1502	4374	1730	4126	6299			11154
	(Grain)	516	818	1876	931	2197	1803			2036
	(Ratio	1·89	1·84	2·38	1·86	1·88	3·49			5·48

It will be seen from the table that heavy seed-rate has increased the yield appreciably. The result is highly significant statistically in all cases. Russell and Watson[4] have shown that the usual seed-rate in Great Britain varies from 2 to 3½ bushels per acre with 6-inch spacing of rows. Considering this fact it is not surprising that increased seed-rate in the present case has given a higher yield. It is significant that increased yield is obtained by higher seeding rate even on irrigated land. Comparison of yields from dry and irrigated lands shows that higher moisture in the latter has given a significant increase in yield. Obviously, therefore, the seed-rate for wheat appears to be low as a general rule, and it is probably one of the main causes for the low level of wheat yields in this country. This becomes all the more clear when it is realized that the seeding rate in Great Britain is greater in spite of the heavy tillering habit of the English wheats.

The amount of tillering in wheat is not only dependent on the supply of water in the early stages of growth but also on the time of laying down of the rudiments of ears. Whether a crop is on dry land where tillering is restricted, or on irrigated land, considerable proportion of tillers cannot develop into ears because of the hastening of the ripening processes by unfavourable weather conditions especially temperature. In the former case an additional factor, *viz.*, increasing soil drought also causes considerable death of tillers. Studies of growth analysis of wheat at this Institute (unpublished work) also lend support to this view. Even in the case of early variety like I.P. 165 it has been observed that the ear-tiller ratio is 0·5 to 0·7. This ratio has been found to decrease progressively with the length of the vegetative period of different varieties. The potential yield of the plant is, therefore, not achieved.

Moreover root development under the conditions of dry farming is restricted, so that only with a dense stand of plants do the roots adequately explore the available root space. As the soil moisture is lost directly to the air by evaporation a greater proportion of it is made unavailable to the crop when the plants are widely spaced. Closer the spacing, therefore, the more economically is the available moisture used.

Straw yield will be largely determined by the amount of tillering of the plants. It appears from the straw-grain ratios that even with closer spacing (heavy seed-rate) of plants tillering has not suffered. Obviously, therefore, there was no overcrowding of plants. Describing wheat cultivation in Great Britain Percival[3] says that "it is found that increased tillering, rarely if ever, makes up for the reduction in the number of plants which thin seeding entails".

It is, therefore, clear that the seeding rate of wheat may profitably be raised to 100 lb./acre with 6-inch spacing of rows as a measure for increasing the yield.

Indian Agric. Res. Institute,
New Delhi, J. J. CHINOY.
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* During 1936-41 the writer was working in Punjab Physiological (Cotton Failure) Scheme of the I.C.C.C.

1. Dastur, R. H., *et al.*, *Indian J. Agric. Sci.*, **1943**, **13**, 610–30. *Ibid.*, 1944, **14**, 18, 181, 325. 2. Gregory, F. G., *et al.*, *Proc.* 1930. *Confer. Imp. Cotton Growing Corp.*, Pp. 112–130. 3. Percival, J., *Wheat in Great Britain*, 1943. 4. Russell, E. J., and Watson, D. J., *Imp. Bur. Soil. Sci. Tech. Comm.* 1940, No. 40.