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WHEAT YIELD AND ITS COMPONENTS AS INFLUENCED BY GEOMETRY OF PLANTING

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ABSTRACT

In a field trial strip planting geometry was compared with the conventional single row planting system at a uniform seed rate of 80 kg per hectare. The planting geometry comprised 30 cm apart single rows, 45 cm apart paired rows, 60 cm apart triple row strips, 40 cm apart single rows, 60 cm apart paired rows and 80 cm apart triple row strips. The space between the rows of 45 and 60 cm apart strips and that of 60 and 80 cm apart strips was maintained as 15 and 20 cm, respectively. Close row strip planting geometry produced grain yield comparable to conventional single row planting system. However, 30 cm based 2- and 3-row strip planting geometry tended to produce higher grain yields than that of 2-and 3-row strip plantings at 40 cm base. The results suggest that the conventional single row planting system may be replaced by the modern system of strip planting which not only facilitates interculture for effective weed control but also permits interplanting and easy handling of the intercrop without having any adverse effect on the associated wheat crop.

INTRODUCTION

The average wheat yield per hectare in Pakistan is about 1695 kilograms (Pakistan Economic Survey, 1982-83), which is far below the level of production potential of our present recommended varieties. Reasons for low yields are many but planting geometry seems to have a great bearing on the yield potential as it not only determines interplant competition but also the feasibility of intercropping and ease of using intertillage devices for effective weed control and soil moisture conservation. Due to small holdings and intensive system of cultivation, the practice of intercropping in wheat is gaining interest among the

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growers day by day but the conventional methods of planting wheat do not afford convenient interculture or intercropping due to narrow row spacings. In order to facilitate intercropping or use of intertillage devices freely and effectively, an overall change in the existing planting technology of wheat crop appears to be inevitable. In view of this, a new pattren of strip planting has been designed without disturbing the normal plant population per hectare but it needs to be tested against the conventional system of single row planting. Consequently, in the present investigations it was contemplated to evaluate the feasibility and comparative efficiency of the newly suggested 30 and 40 cm based strip planting geometry as against the traditional ones under the irrigated conditions of Faisalabad.

REVIEW OF LITERATURE

Salmon (1924) reported that wheat planted in 20-40 cm apart rows over a period of four years did not show significant difference in grain yield. Harper (1946) studied the effect of 35 or 40 cm apart row spacing against 17.5 to 20.0 cm spacing in wheat and observed non-significant differences regarding grain yield and its various components. Kirna (1963) investigated the effect of different row spacings, i. e., 15.5, 27.5 and 35.0 cm apart on the yield of wheat and reported that winter wheat in southern Michigan should be planted in row spacing of 27.5 cm for obtaining good yield. Siemins (1963) was of the opinion that wide row spacing (76 cm) increased the number of tillers as compared to narrow row spacing (15 cm). Mirza and Nazir (1966) concluded that wheat planted at 20 cm apart row spacing gave higher grain yield than that planted either in 30 or 40 cm apart rows. Agha (1969) obtained the highest grain yield with 15 cm and the lowest at 30 cm of row spacing. Upadhyay and Chaudhary (1971) studied the planting patterns of 15, 20 and 25 cm apart rows and concluded that dwarf wheat V. V. Sonalika S. 308 grown in 20 cm apart rows gave the highest yield of 3.43 tons/ha and it was followed by the yield of 15 cm and 25 cm apart rows, i. e., 3 41 and 3.11 tons/ha, respectively. Close interrow spacing decreasd the number of tillers per plant and 1000-grain weight as noted by Akhtar (1971) who, however, found similar grain yields at 22.5, 30.0 and 37.5 cm row spacing. Mujahid (1972) observed that grain yield and other characteristics were not much affected at 22.5, 37.5 and 45.0 cm row spacing. However, 45.0 cm spacing decreased the tillers per unit area. Skorpik (1974) reported slightly increased grain yield per unit area, markedly increased number of tillers per plant and number of grains per spike at 30 cm spacing but observed decreased 1000-grain weight as compared to 15 cm spacing. El-Shamma (1976) studied the effect of various row spacings on the grain yield and its components and was of the opinion that various row spacings (10-15 cm) had similar effect on the grain yield and its components except 1000-grain weight that was significantly higher in case of wheat sown in 10 cm apart lines than that sown in 15 cm apart lines. Botezan and Moldovan (1978) planted wheat cultivars, Kaukaz and T-195 in single rows (a) 2.5 cm (b) 25 cm apart and (c) double rows 25 cm apart at the normal and 50 per cent of the normal seed rate. Kaukaz yielded 4.48, 3.95 and 4.05 tons of grains/ha at the normal rate and 4.25, 3.65 and 3.77 tons/ha at 50 per cent of the normal seed rate for (a), (b) and (c), respectively. Cohen and Levin (1978) planted wheat cultivar Barkai in plots with 4 strips of 45 or 50 cm and 2 strips of 30 cm width left unsown at every 4 m width. The results recorded non-significant differences in grain yield between the treatments (4.01-4.07 tons/ha).

MATERIALS AND METHODS

The investigations embodied in this paper were conducted at the University of Agriculture, Faisalabad, during 1981-82. The preceding crop was sorghum. The planting geometry comprised 30 cm apart single rows, 60 cm apart paired rows and 80 cm apart 3-row strips. The distance between the rows of a strip was 15 and 20 cm in 30 and 40 cm based planting geometry, respectively. The experiment was quadruplicated using Randomized Complete Block Design with a net plot measuring 7.20 x 6.00m. The crop was sown on November 18, with the help of single row hand drill, using a seed rate of 80 kg/ha. A basal dose of 75 kg N and 50kg P_2O_5/ha was used. The whole of P_2O_5 and half of N was applied at sowing while remaining half of N was top dressed at first irrigation. The crop was kept free of weeds by giving two hoeings with the help of "Kasola". First irrigation was given 20 days after planting while the subsequent irrigations were adjusted according to the crop need. In all 3 irrigations of 7.5 cm each were applied during the entire growth period of the crop. All other agronomic practices were normal and uniform as practised in the area. The crop was harvested on April 22, sun dried and threshed manually. The grain yield was recorded on net plot basis. The data collected were statistically ana lysed by using analysis of variance technique and Duncan's New Multiple Range Test at 5 per cent probability was applied to test the significance of the mean differences (Steel and Torrie, 1960).

RESULTS AND DISCUSSION

The data pertaining to the various yield attributes as affected by the different planting systems are given in Table 1. A perusal of the data revealed that seedling emergence was significantly higher in case of 30 cm based planting geometry than that of 40 cm. However, the differences within the geometrical patterns were statistically non-significant. Higher seedling density per unit area in case of 30 cm geometrical planting pattern was attributed to a more even and relatively sparse distribution of seed in the rows due to more number of lines per plot compared to 40 cm planting geometry where seedling emergence was probably interrupted due to overseedling of the rows. The results further indicated that although germination is an independent physiological process and mainly depends upon the stored food materials of the seed but congested environment due to high seed population in the rows do has suppressing effect on it in one way or the other.

The plant height was not significantly affected by any of the planting geometry under study and it varied from 78.50 to 87.47 cm. It appears from the results that plant height of a cultivar is mainly a genetically controlled character and is little affected by the environmental conditions. These results are in line with those of Harper (1946) and Mujahid (1972). Similarly, the data regarding the number of productive tillers per unit area indicated that the differences among the various planting systems were not large enough to reach the level of significance. However, the overall difference between the 30 and 40 cm based planting geometry was found to be significant. Although the initial individual differences in seedling population were made up by the variable

Table 1. *Wheat yield and its components as affected by different geometrical patterns*

Treatments/observations	Seedling density per unit area (1 x 7.20 m)	Plant height at maturity (cm)	Spike bearing tillers/unit area (1 x 7.20 m)	Number of grains/ spike	Weight of grains/ spike	Grain yield (quintals/ ha)
			N.S	N.S	N.S	N.S
A. 30 cm apart single rows	1525.50a*	85.48	2012.50	31.19	1.41	36-63
45 cm apart double-row strips	1487.00a	80.18	2031.25	33.70	1.44	36.91
60 cm apart triple-row strips	1476.25a	78.50	1942.50	31.30	1.44	35.03
Mean	1496.25	81.38	1995.41a	32.06	1.43	36.19
B. 40 cm apart single rows	1183.50b	85.50	1833.75	33.83	1.45	36.19
60 cm apart bouble-row strips	1167.50b	80.58	1830.00	30 56	1.43	33 86
80 cm apart triple-row strips	1126.75b	87.47	1783.75	33.69	1.43	34.88
Mean	1159.25	84.52	1815.83b	32.69	1.44	34.97

*Any two means not sharing the same letter differ significantly at 5% probability level.

N.S : Non-significant.

tillering potential in both the geometrical patterns but the combined difference could not be made up. This clearly indicates the superiority of 30 cm geometrical pattern to that of 40 cm with range to tillering. These results are supported by the findings of Mujahid (1972) and El-Shamma (1976) but are contradictory to those of Siemins (1963) and Upadhyay and Chaudhary (1971).

The number and weight of grains per spike are important yield components in wheat and are liable to be affected by the changing environment. The data given in Table 1 indicated that although the number and weight of grains per spike under the various planting patterns were variable but the differences. among them were not large enough to reach the level of significance. However, the number and weight of grains per spike varied from 30.56 to 33.83 and 1.41 to 1.45 gm, respectively. These results are supported by the work of Mujahid (1972) but are not in conformity with those of Skorpik (1974).

The data on grain yield per hectare showed that the level of grain yield per hectare was fairly high in all the planting systems. Although there were visible differences among the 30 and 40 cm based geometrical patterns but these were statistically non-significant. These findings are in agreement with those of Salmon (1924), Akhtar (1971), El-Shamma (1976), Cohen and Levin (1978), Botezan and Moldovan (1978), but are contradictory to the findings of Kirna (1963), Mirza and Nazir (1966) and Agha (1969) who reported that 15 or 20 cm space gave higher yield than 30 or 40 cm apart rows in wheat.

The results further revealed that grain yields per hectare at 30 and 40 cm row spacings were almost similar, i. e., 36.19 and 34.97 quintals per hectare, respectively. On the other hand, 2- and 3-row strip plantings at 30 cm base, due to relatively more number of spike bearing tillers per unit area, tended to produce higher grain yields than 2- and 3-row strip plant plantings at 40 cm base. This tendency was attributed to comparatively more number of planted rows per plot and the same seed rate compared to 40 cm based geometry of planting which led to more number of productive tillers per unit area. However, strip planting appeared to be equally good in all respects compared to the recommended single row planting system. In the light of these results it is suggested that strip geometry of planting be introduced in place of single row planting system as it not only facilitates interculture and free circulation of air and light into the inner plant canopy but also permits growing intercrops in wheat during its vegetative growth period without doing much damage to wheat plants.

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