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INTERVARIETAL AND INTER-SPECIFIC PLANT COMPETITION IN WHEAT UNDER TWO IRRIGATION LEVELS.

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Three and 6 combinations of two wheat species, *Triticum vulgare* and *Triticum durum* were tested against pure stands under nomal and low irrigation levels during 1971-72 and 1972-73. Under both the conditions, mixtures gave significant increased yields over the respective elite parents. The average percentage increase for both the years was 12.3 to 35.0 and 21.9 to 37.6 percent under respective conditions of irrigation. The accession in the main yield component, spikes per plant, varied from 23.2 to 28.4% under normal and 14.1 to 53.8% under low level of irrigation. The advantages of using simple mixtures over pure stands are discussed.

INTRODUCTION

The results of recent studies on intervarietal plant competition by Jensen (1953), Gustafsson (1953), Jensen and Federer (1964), Grafius (1966), Shaalan et al. (1966), Briggle et al, (1967a,b), Sing et al. (1967) and Shah (1969) though conflicting, do show the possibility of obtaining over-compensatory effects when certain varieties of cereal crops are planted either mixed or in adjoining rows under field conditions. However, very little information is available on the effects of interspecific competition in cereal crops. The results of such a study of simple mixtures of two wheat species against intervarietal combinations tested under two irrigation levels are reported in this article.

MATERIALS AND METHODS

A competition experiment comprising two varieties each of three wheat species namely mexipak 65, WB22 (*T. vulgare*), D36, D40 (*T. turgidum*) D41, 2031 (*T. durum*), was conducted in the Department of Plant Breeding and Genetics, University of Agriculture, Lyallpur during 1971-72. The experiment was planted in the field on 9th November 1971 with six replications. The seed was prepared by mixing equal number of kernels of component species. Each row was 17½ feet long, spaced 12" apart. The seed was drilled at the rate of 82 lbs per acre. Out of six replications, three were supplied with 5 irrigations (normal) and remaining three with only 2 irrigations (one after

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three week and the other at the booting stage). In all 92 lbs. nitrogen was applied in the form of ammonium sulphate in two equal doses, one at the time of planting and the other with first irrigation. 46 lbs P_2O_5 in the form of super phosphate was applied at the time of planting. At maturity a plot of 6'x1' size was harvested and where it costituted a mixed stand the plants were separated into different components, which were later threshed separately and weighed. The data for other characters was recorded from ten plants selected at random from the remaining plot. The data was gathered for spikes per plant, number of spikelets per spike and 100-kernel weight.

The following year, 1972–73, this experiment was repeated excluding the varieties D 36, D 40. The experiment was planted on 20th November, 1972 in a plot comprising of three rows 16½ feet long. At maturity, a plot of 10' × 1' length was harvested and the data for other characters was collected as in the previous year, Statistical analysis was done according to the standard statistical techniques. The significance of percentage increases over mid parent and elite parent values was determind according to Cochran and Cox (1964). An extract of the data has been given in the tables.

RESULTS AND DISCUSSION

The results of intervarietal mixtures of cereal crops have been reported by Jensen (1952) Gustafsson (1953) Jensen and Federer (1964) Grafius (1966) Shaalan et. at (1966), Briggle et al (1967 a, b) and Shah (1969). The consensus of opinion goes in favour of varietal mixtures. In most of the instances, the results refer to only one environment. In the present studies, 3-6 simple mixtures both intervarietal and interspecific were tested under normal and low levels of irrigation. The data in table 1 show the superiority of both types of mixtures over the elite pure stands in the two environments during both the years. The percentage increase was significant in all combinations except in WB22+D41 under conditions of normal irrigation.

A reference to Table 2 reveals almost identical results. The average increase in percentage of three and five mixtures against elite parent in spike production under the respective environments was significant. The number of spikelets (Table 3) did not show substantial increase or decrease in percentages over the elite parent with the exception of MP+2031 under condition of low irrigation. The mean percentage increase or decrease over the elite parent in kernel weight (table 4) shows superiority of five and two out of six mixtures under normal and low level of irrigations respectively.

This increased productivity of interspecific mixtures opens up new field for increasing agricultural production of cereals and so far, as our knowledge goes, there is no other experiment reported on interspecific

TABLE 1 *Percentage increase in yield per plot of mixed genotypes over performance of elite parent.*

Combination	Normal Irrigations (5) 1971-72	1972-73	%age increase over elite parent (mean of 1-2 year)	Low Irrigations (2) 1971-72	1972-73	%age increase over elite parent (mean of 1-2 year)
MP+WB22	398.3	438.9	35.0*	253.6	297.3	37.6*
MP+2031	345.9	351.0	12.3*	245.6	272.7	29.4*
WB22+2031	286.6	344.6	17.8*	195.3	259.2	33.3*
MP+D41	—	386.7	15.5*	—	276.7	21.9*
WB22-D41	—	340.2	10.3	—	257.4	26.3*
D41+2031	—	330 2	13.8*	—	239.2	32.6*
MP+MP	285.6	334 5	—	173.3	226.9	—
WB22+WB22	227.3	308.4	—	134.6	199.9	—
2031+2031	236.0	252.6	—	169.6	171.3	—
D41+D41	—	289.9	—	—	180 3	—

*=calculated significant value = 11.5
MP, WB22=T. vulgare
D41, 2031=T. durum

TABLE 2 *Percentage increase in spike per plant of mixed genotypes over performance of elite parent.*

Combination	Normal Irrigations (5) 1971-72	1972-73	%age increase over elite parent. (mean of 1-2 year)	Low Irrigattons (2) 1971-72	1972-73	%age increage over elite parent. (mean of 1-2 year)
MP+WP22	22.3	23.0	28.0*	15.3	15.3	35.4*
MP+2031	22.6	22.6	28.4*	12.3	16.0	51.6*
WB22+2031	18.6	18.6	23.2*	13 6	12 3	14.1*
MP+D41	—	20.3	12.8	—	13.2	39.8*
WB22-D41	—	16.6	6.4	—	12.6	11.9
D41+2031	—	17.0	9.0	—	14.3	53.8*
MP+MP	17.3	18 0	—	9.3	9.3	—
WB22+WB22	14.3	14.3	—	11.9	11.0	—
2031+2031	15.6	14.6	—	9 6	9.0	—
D41+D41	—	15 6	—	—	9.3	—

*=calculated significant value=14.00
MP, WB22 = T. vulgare
D41,2031 = T. durum.

TABLE 3. *Percentage increase or decrease in spike of mixed genotypes over performance of elite parent under normal and low irrigation levels.*

Combination	Normal Irrigations (5) 1971-72	1972-73	%age increase over elite parent. (mean of	Low Irrigations (2) 1971-72	1972-73	%age increase over elite parent (mean of 1-2 year)
MP+WB22	20.6	22.3	0.5	18.0	19.6	3.9
MP+2031	21.3	21.6	0.5	21.0	18.3	8.9
WB22+2031	18.6	21.0	1.5	—	19.0	2.8
MP+D41	—	21.3	1.4	—	19.3	0.5
WB22+D41	—	20.0	1.5	—	18.3	1.7
D41+2031	—	19.6	3.5	—	17.6	0.0
MP+MP	21.0	21.6	—	17.6	18.3	—
WB22+ WB22	20.0	20.3	—	18.3	18.0	—
2031+2031	20.0	20.3	—	17.0	17.6	—
D41+D41	—	19.0	—	—	17.0	—

*calculated significant value = 6.30
MP, WB22=T. vulgare
2031, D42=T. durum.

TABLE 4. *Percentage increase or decrease in 100-kernel weight of mixed genotypes over performance of elite parent.*

Combination	Normal Irriation (5) 1971-72	1972-73	%age increase over elite parent. (mean of 1-2 year)	Low Irrigations (2) 1971-72	1972-73	%age increase over elite parent (mean of 1-2 year)
MP+WB22	3.22	3.19	4.6*	2.85	2.82	3.3*
MP+2031	4.50	4.19	12.1*	3.81	3.98	7.4*
WB22+2031	3.51	3.79	1.1	3.22	3.22	2.9
MP+D41	—	4.83	2.5*	—	4.24	31.2
WB22+D41	—	4.89	9.9*	—	4.19	42.8
D41+2031	—	5.40	2.7*	—	4.99	16.8
MP+MP	3.27	3.37	—	3.02	3.06	—
	2.76	2.85	—	2.28	2.43	—
WB22+ WB22	4.40	4.46	—	4.10	4.19	—
D41+D41	—	6.10	—	—	5.79	—

*calculated significant value = 2.20
MP, WB22 = T. Vulgare
2041, D41 = T. durum.

competition on wheat. This increase in yield can be fully exploited in the developing countries like Pakistan where due to population explosion, the need of the hour is to increase production of food grains as quickly as possible. It may be mentioned that for the development of a new variety, at an accelerated speed, 8-10 long years are needed with good deal of expenditure and effort. If such simple mixtures can boost acre yields to one-half as much high yield as shown in these experiments, the total increased production can be well imagined.

The new high yielding wheat varieties commercially grown in the country lack certain quality characteristics and as such are not so popular with the consumers as the old commercial varieties which fetch premium in the market. This handicap can easily and promptly be removed by growing suitable and appropriate mixtures, may be intervarietal or interspecific.

With the spread of new wheat varieties in the country, new and new bio-types of rust races have started appearing year after year. This simple technique of using mixtures of different rust resistant and adaptable varieties or species can help check or control the epidemics of rusts.

These mixtures have shown better performance under adverse environmental conditions provided by curtailing the number of irrigations applied during the growth period. It appears that just like F_1 hybrids, mixtures are more stable in perormance under conditions of unfavourable growth and development. This provides ample evidence for getting increased production by growing simple mixtures under water stress condition. These results are quite in agreement with Sing *et al* (1967) who recommended the use of heterogenous groups of individuals for increasing productivity under stress condition. Thus it may be inferred that different genotypes in mixed planting can yield even higher than the elite variety or varieties in pure stand and further that response will be different under different environments and this fact will have to be taken care of before recommending suitable mixtures for commercial use.

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