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THE RELIABILITY OF INDIVIDUAL PLANT SELECTION IN F_2 OF SOME WHEAT CROSSES.

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The reliability of individual plant selection in F_2 was tested for tiller number, spike length and grain yield in three reciprocal crosses between exotic and local wheat varieties. The results indicated that the single plant selection made on a visual basis was generally effective for grain yield, but tiller number and spike length did not seem to be reliable creteria for such selections. Marked cytoplasmic effects noticed in these crosses suggested that the order of the cross was also important in constituting populations for individual selections.

INTRODUCTION

The yield potential of short-statured wheats can be further improved through hybridization with well adapted local varieties and improved selection procedures. The efficacy of selection for high-yielding plants from an early segregating generation is limited by not only the size of the population grown but also the ability of a breeder to distinguish such types from mediocrities. Bell (1963) probably was the first to study the reliability of single plant selection for yield in the F_2 generation of barley and suggested that a large F_3 nursery was necessary since single plant selection in F_2 was relatively ineffective. His interpretations were supported by Shebeski (1967) who tested single F_3 selection in wheat for yield in F_3 against the means of the cross and found that half of the lines yielded more and half less than the control, confirming the view that single plant selection for yield was not very effective. Correlation between selection and control was low or even negative in the case of tiller number (McNeal, 1960). Frey (1962) made comparison between three classes, i.e., good, random and poor for yield. All of them behaved alike in one cross, but the poor category gave less yield as compared to the other two classes in the second cross. Continued observation through the F_5 generation revealed that the phenotypic expression of single plants was so confounded that visual selection based upon them was ineffectve.

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In view of their greater susceptibility to environments, economic characters. like grain yield, are not easy to identify. Most plants selected for higher yield in an early segregating generation may behave quite differently in the subsequent generations, thus undermining the reliability of individual plant selection for higher yields. The present study was designed to test the reliability of such selections for yield.

METHODS AND MATERIALS

The wheat varieties included in the present study were semidwarf Mexipak and Sonora64, and tall-statured C273 and Dirk crossed as follows :

Mexipak x C273	and reciprocal
Mexipak x Dirk	and reciprocal
Dirk x Sonora64	and reciprocal

Large enough F_2 populations of these crosses wece raised at this station in space-planted nurseries. At maturity, 40 apparently high-yielding plants were selected from each of these F_2 populations and on everyone of them were recorded observations for tiller number, spike length and grain yield.

A bulk composite was constituted from a single head harvested from each F_2 plant in the nursery to serve as a control in the F_3 tests. The F_3 nursery was planted in the field in the manner described by Briggs and Shebeski (1968). The experimental plot consisted of 3 rows, 6 feet long, spaced 6 inches apart. A 2-foot wide blank strip separated the two plots to minimize inter-plot competition. Every other F_3 plot was a control representing the F_2 mean. Thus the F_3 progeny of each one of the 50 F_2 selected plants was directly compared with the adjacent control. Data were recorded on 3 feet of the central row selected at random in each experimental plot. While tiller number and grain yield were measured from the ertire 3 feet sampled; the mean spike length in F_3 was computed from 10 spikes randomly picked from this area. Correlation coefficients between the F_2 selected plants and their F_3 progenies were also computed for the 3 characters studied.

RESULTS AND DISCUSSION

The data presented in Tables 1-3 revealed that the average performance of the selected F_2 plants ranged among crosses from 27.8 to 39.9 for tiller number per plant, 90-136 mm for spike length, and 52.0 to 68.0 gm. for grain yield. Individual selections made of the well-tillered, good-looking, robust plants in F_2 were generally effective in improving the yield potential of the

TABLE 1. *Average tiller number per plant of the selected F_2's, per unit area of F_3's, and of control and F_2-F_3 correlation coefficients.*

Cross	Tiller number.		Control	$F_2 - F_3$ Correlation Coefficient
	F_2	F_3		
Mexipak x Dir_2	27.8	92.5	86.2	0.48
Dirk x Mexipak	38.0	108.6	89.5	0.52
C273 x Mexipak	28.9	89.5	84.5	0.47
Mexipak x C273	39.9	106.2	93.5	0.48
Sonora 64 x Dirk	37.9	87.5	76.0	0.49
Dirk x Sonora64	39.8	87.2	79.3	0.48

TABLE 2. *Mean spike length (mm) of the selected F_2 plants, their F_3 and control and F_2-F_3 correlation coefficients.*

Cross	Mean spike length		Control	F_2 - F_3 Correlation Coefficient.
	F_2	F_3		
Mexipak x Dirk	122	102	101	0.42
Dirk x Mexipak	126	107	101	0.43
C273 x Mexipak	120	98	90	0.67
Mexipak x C273	116	107	92	0.76
Sonora64 x Dirk	90	96	92	0.67
Dirk x Sonora64	116	97	92	0.61

TABLE 3. *Mean grain yield (gm) of selected F_2 plants, their F_3 and control and F_2-F_3 correlation coefficients.*

Cross	Mean grain yield		Control	F_2-F_3 Correlation Coefficient.
	F_2	F_3		
Mexipak x Dirk	98.0	114.5	96.7	0.66
Dirk x Mexipak	52.0	105.6	95.5	0.59
C273 x Mexipak	57.2	104.6	98.1	0.63
Mexipak x C273	63.0	110.0	96.3	0.61
Sonora64 x Dirk	54.6	116.0	107.1	3.59
Dirk x Sonora64	61.7	93.1	89.6	0.47

selected populatians, since in all crosses the F_3 progenies from the selected F_2 plants showed a marked tendency to outperform the control plots representing the means of the respective F_2 populations. Although, while making individual plant selections, the tillering condition, spike length and healthy appearance of the F_2 plants easily attracted the attention of the selector and influenced his choice, the data presented did not indicate a stronger relationship in these populations between tiller number, spike length and grain yield, The grain yield of the F_3 progeny plots appeared to regress more on the F_2 grain yield than on the tiller number and/or spike length, with the exception of the Sonora64 x Dirk cross. From this, it would appear that tiller number and spike length may not necessarily be very reliable criteria for such selections.

Cytoplasmic effects were also important as the reciprocal differences observed in most crosses for tiller number, spike length and grain yield were very conspicuous. Again, the pattern of reciprocal differences was not cosistent for the various characters studied. Of considerable importance, therefore, is the order of a cross in making effective selections when certain varieties are used as parents in various kinds of crosses. In the present study, Mexipak used as a female parent in single crosses with Dirk and C273 as male parents apparently produced a greater proportion of high-yielding segregates whereas the crosses made with Dirk and C273 as female parents yielded segregates of relatively low yield potential as evident from the comparative F_2 and F_3 yields in Table 3.

The correlation coefficients between the selected F_2 plants and their F_3 offspring for the 3 characters were possitive and significant. These values further corroborate the observations that the F_2 individual selections led to an appreciable genetic advance in these populations as the selector was able to identify high-yielding genotypes by visual inspection.

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