

A NOTE ON THE INHERITANCE OF SEDIMENTATION VALUE IN TWO WHEAT CROSSES¹

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The improvement of baking quality has been an important objective of wheat breeding since the turn of the century. Unfortunately the use of conventional baking tests by plant breeders has been limited because of the large quantities of flour required for each determination. Several prediction tests have been devised for the evaluation of potential breadmaking quality during early stages of breeding programs. The sedimentation test can be adapted for single-plant analysis (1) and is particularly useful for studies on the inheritance of quality. Considerable genetic variability for sedimentation value has been found in advanced-generation lines obtained from crosses of Conley (1) and Tascona (2) with low-quality experimental strains.

The objective of the present investigation was to obtain more specific information on the inheritance of sedimentation value in the first (F_1) and second (F_2) generations from two wheat crosses. Backcrosses of the F_1 to each parent were also made. Twenty-seven seeds each of the parents, F_1 , and backcross generations and 90 F_2 seeds were planted in a nine-replicate, randomized block experiment in the field. Plants within and between replications were spaced 1 ft. apart. Grain harvested from the single plants was milled to 65% extraction on a Geddes and Frisell experimental flour mill. The method of Pinckney *et al.* (3) was followed for the determination of sedimentation value. The variance of each population was obtained from an analysis of variance of the sedimentation data. The heritability percentages, computed from the F_2 and backcross variances (4), were used to predict the amount of progress possible by selection in the F_2 population (5).

The parental means differed by nearly 17 ml. in the Selkirk \times Gabo experiment (Table I) and 11 ml. in the Conley \times Ceres cross (Table II). However, the wide range in sedimentation value within the parental populations may indicate a marked response to variations in plant environment or a lack of genetic uniformity in each variety. The presence of genetic variability in the parents would serve to lower the estimate of heritability. The results suggest that selected pure lines rather than commercial varieties should be used in genetic studies.

The F_1 population means exceeded the midparental values by 3.2 ml. (Table I) and 1.8 ml. (Table II). This partial dominance for high

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TABLE I
FREQUENCY DISTRIBUTION OF SEDIMENTATION VALUE IN SINGLE PLANT POPULATIONS FROM A SELKIRK \times GABO CROSS

GENERATION	CLASS CENTERS (in ml.)																POPULATION		
	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	Mean	Variance
Selkirk									1	1		7	11	6	1		61.5	3.23	
Gabo			3	5	5	8	3	3									44.8	5.87	
F ₁									5	5	4	7	4	2			56.4	6.90	
F ₂	1	3	2	3	4	5	6	4	8	9	11	9	3	11	5	5	1	54.1	48.31
F ₁ \times Selkirk							2	2	2	7	2	4	4	1	2	1		56.2	28.15
F ₁ \times Gabo		3	5	3		3	5	4	4								45.3	25.09	

TABLE II
FREQUENCY DISTRIBUTION OF SEDIMENTATION VALUE IN SINGLE PLANT POPULATIONS FROM A CONLEY \times CERES CROSS

GENERATION	CLASS CENTERS (in ml.)													POPULATION	
	40	42	44	46	48	50	52	54	56	58	60	62	64	Mean	Variance
Conley						1	1	6	5	10	2	1	1	56.6	6.21
Ceres	2	4	8	3	5	2	3							45.7	11.38
F ₁				1	3	2	5	9	5	1	1			53.0	9.68
F ₂	1	5	9	8	2	12	13	14	14	6	5		1	51.5	28.56
F ₁ \times Conley		1		3		3	7	4	5	2	1	1		52.9	17.98
F ₁ \times Ceres	1	1	5	2	2	4	5	3	2	2				49.6	24.79

sedimentation value could be of great value in the production of hybrid wheat. Extensive studies on combining ability might identify varieties or lines whose high sedimentation values are completely recovered in the F_1 generation. It would then be possible to cross these varieties with high-yielding, low-sedimentation parents without loss of quality in the hybrid wheat.

The heritability of sedimentation value, estimated from the variances of the F_2 and backcross populations (4), was 89.8% in the Selkirk \times Gabo cross and 50.2% for the Conley \times Ceres cross. These values indicate the presence of considerable genetic variability for this quality test. The heritability percentages were employed to calculate the theoretical genetic advance expected by selecting the top 5% of the F_2 population. The predicted gains in sedimentation value over the population mean were found to be 23.8 and 10.7%, respectively, for the two crosses. Transgressive segregation for high sedimentation value among the single plants of the F_2 population in Table I suggests that a small proportion of the selected families might exceed Selkirk in sedimentation value. The effectiveness of selection in the Selkirk \times Gabo cross was investigated by intergeneration correlations between F_3 and F_6 families grown in different years. The correlation coefficient between 60 F_3 families grown in 1963 and the same families in the F_6 generation grown in 1965 was +0.74**. Early-generation selection for high sedimentation value in this cross should be highly effective.

Acknowledgments

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