Vol XVIII (1-4) 1981

HERITABILITY STUDIES ON YIELD AND YIELD COMPONENTS IN HEXAPLOID TRITICALE

M. Afzal, A. Rehman Chowdhry and Muhammad Aslam Chowdhry*

In five crosses of triticale heritability estimates for nine plant characteristics were computed. The heritability estimates for different plant characters were generally high except that moderate values were obtained for fertility and 1000-kernel weight. The cross NIAB-T 103xNIAB-T 157 showed highest heritability estimates for number of tillers per plant, number of spikelets, per spike number of grains per spike and yield per plant, while cross NIAB-T 103 x NIAB-T 163 showed highest heritability estimates for plant height and yield per plant.

NIAB-T 103 appeared to be a good parent line for use in a hybridization programme for evolving high yielding strains of triticale.

INTRODUCTION

Triticale is a man made cereal developed from a cross between the genus *Triticum* (wheat) and Secale (rye). It is an amalgam of both the parents seeking to combine the good attributes of both wheat and rye (Ahmed and McDonald, 1974). The Plants are vigorous in growth, tiller profusely with long spikes and can grow well on light soils (Shakoor *et al.*, 1978). Triticale has great yield potential particularly on marginal lands as well as under stress conditions (Hatrik, 1972).

During the recent past the success obtained in hexaploid triticale has been more rewarding than in the octoploid triticale (Quinones, 1973). Although considerable progress has already been made, there is a further need for improvement in fertility and grain characters to make it profitable under stress conditions and competitive under optimum agricultural conditions. Various

*Department of Plant Breeding & Genetics, University of Agriculture, Faisalabad.

methods have been used to improve the hexaploid triticale by various breeders with varying success. However, a breakthrough was achieved when vigorous hybridization and selection programmes were undertaken and individual plant selections showing higher level of fertility and better grain characters were made (Zillinsky, 1973).

In a well planned breeding programme, heritability estimates are frequently computed to predict the genetic behaviour of a strain in selection. The present study was initiated to compute heritability estimates in some hexaploid triticale strains for yield and its components.

MATERIALS AND METHODS

The experimental material consisted of five crosses; NIAB-T 103xNIAB-T 77, NIAB-T 103 x NIAB-T 157, NIAB-T 103 x NIAB-T 163, NIAB-T 158 x NIAB-T 103 and NIAB-T 159 x NIAB-T 167. The F_2 progenies along with their parents were grown during 1978 in field, in the randomized complete block design with three replications. The rows were planted 25 cm. apart and plants within each row 15 cm. apart. At least 700 plants were grown for each cross combination. The experiment received normal cultural practices. At maturity the data were recorded on these characters ; plant height, (cm.) number of tillers per plant, spike length, (cm.) number of spikelets per spike number of grains per spike, yield per spike, (gm.) fertility, 1000-kernel weight (gm.) and yield per plant (gm.).

Heritability estimates in the broad sense were computed by the method Mahmud and Kramer (1951) and genetic advance was calculated as follows on the basis of 10 per cent selection intensity.

$$G.A. = S.D. \times h \times i$$

RESULTS AND DISCUSSION

Statistical analysis of the experimental data revealed that heritability estimates for different plant characters were generally high, except that moderate values were obtained for fertility and 1000-kernel weight. The cross, NIAB-T 103 x NIAB-T 157, showed highest heritability estimates for number of tillers per plant, number of spikelets per spike, number of grains per spike and yield per plant (Table 1). The results of the present investigation are in

Table 1. *Heritability estimates and genetic advance in five crosses of Triticale.*

CROSSES	Plant height	Tillers/ plant	Spike length	Grains/ spike	Yield/ spike	Ferti- lity	1000 Grain Wt.	Spikelets/ spike	Yield/ plant
NIAB-T 103 x *h²	74.83	50.08	51.43	34.76	86.57	66.40	16.45	60.02	83.67
NIAB-T 77 **GA	15.18	4.91	1.26	9.16	2.16	13.65	1.67	2.98	22.38
NIAB-T 103 x	86.97	60.99	80.74	79.03	78.08	57.19	66.60	75.35	91.12
NIAB-T 157	22.82	6.15	1.83	21.24	1.12	8.44	7.30	4.10	28.85
NIAB-T 103 x	94.29	51.07	71.98	37.13	88.38	54.86	36.96	35.78	89.92
NIAB-T 163	20.87	5.03	4.36	8.34	2.11	9.18	4.09	1.77	30.69
NIAB-T 158 x	73.14	50.66	71.54	57.97	69.13	76.13	27.09	41.56	66.81
NIAB-T 103	16.11	5.94	6.84	14.54	1.05	16.31	3.48	1.78	20.11
NIAB-T 159 x	84.76	50.69	96.26	77.11	56.09	50.43	70.78	52.83	83.08
NIAB-T 167	11.16	5.58	4.40	15.56	0.61	5.34	6.38	1.92	24.09

* = Heritability in percentage.

** = Genetic advance.

agreement with those reported by Fonseca and Patterson (1968), Tikka *et al.* (1973) and Ghafoor (1975). The cross NIAB-T 103 x NIAB-T 163 showed highest heritability for plant height and yield per plant.

Tall stature was one of the problems in the early triticale breeding programmes (Zillinsky and Lopez, 1973). However, the height level has been considerably reduced in most of the hexaploid triticale through the incorporation of dwarfing genes of Norin. 10 and Tom Thumb origin (Kiss *et al.*, 1979) Another dwarfing source of winter rye Uc-90 was reported by Gustafson *et al.* (1973). The high heritability estimates obtained for plant height show that selection for this character in positive direction can be effectively made. Albrecht (1976) and Sayed (1978) reported moderate heritability estimates for 1000-kernel weight. In the present investigation, the moderate heritability estimates obtained for this character point to a careful planning and consequent selection. Sapra and Hughes (1979) suggested that seed selection for greater density and large size at an early generation (F_2) with renewed selection pressure applied in each advancing generation would result in greater seed weight, higher seed-set percentage and higher seed yield, apparently dependent on the parental combination. However, the present investigations revealed that NIAB-T 103 is a good parent for use in a breeding programme as in most of the crosses it gave high heritability estimates particularly with NIAB-T 157 and NIAB-T 163. These lines therefore, may yield good recombinants if used in a carefully planned breeding programme.

LITERATURE CITED

Ahmed, S. R. and C. E. McDonald. 1974. Amino acid composition, protein fractions and baking quality of triticale. Triticale: First Man-made cereal. Amer. Assoct. Cereal Chemist Inc. 137-149.

Albrecht, B. 1976. Studies on the heritability of culm length and other characters in Winter wheat. Demokratischen republic No. 143, 95-103, 1976. (Pl. Breed. Abst. 47 (7): 6252: 1977).

Fonseca, S. and F. L. Patterson. 1968. Yield component heritabilities and interrelationship in winter wheat (Triticum aestivum L) crop Sci., 8; 614-617.

Ghafoor, A. 1974. Inheritance and heritability of some agronomic characters in some wheat crosses. M.Sc. Thesis, Univ. Agri., Lyallpur.

Gill, K. S., S. S. Bains., G. Singh and K. S. Bains. 1975. Partial diallel test crossing,for yield and its components in *Triticum aestivum* L. Dep. Pl. Breed. Punj. Agri. Univ., Ludhiana, India. 29-33. (Pl. Breed. Abst. 45 (b) : 4262; 1975).

Gustafson, J. P., C. O. Qualset and J. A. Rupert. 1973. Registration of UC-90 dwarf rye germplasm. Crop Sci; 13: 1:131-132.

Hatrik, S. 1972. Trials with triticale wheat and rye. Pakusy S triticale, Pseni-cau a razou. Poda a uroda 20 (11): 406-408, 1972. (Triticale Abst. 1:4; 171, 1975).

Kiss, A., J. M. Kiss and T. G. Sallai. 1979. Selection for grain yield in hexaploid triticale. Proc. 5th Int. Wheat Genet. Symp. India, 1137-1143.

Mahmood, I. and H. H. Kramer. 1951. Segregation for yield, height and maturity following a soybean crosses. Agro. Jour. 43 : 605-609.

Quinones, M. A. 1973. Triticale : A man made new botanical genus. Triticale breeding and research at CIMMYT. CIMMYT Res. Bull. 24, 3-11.

Sapra and Hughes. 1979. Selection for kernel density and size in hexaploid triticale. Proc. 5th Int. Wheat Genet. Symp. India; 1161-1171.

Sayed, H. I. 1978. Inheritance of five characters of wheat. (Pl. Breed. Abst. 49; 1: 133, 1979).

Shakoor, A., M. S. Sadiq , M. Y. Mujahid and M. Afzal. 1978. Triticale as a grain and fodder crop for barani areas of Pakistan. Wheat Research and Production in Pakistan (edited by M. Tahir) Pakistan Agri. Res. Council 1; 108-112.

Tikka, S. B. S., S. N. Jaimini and S.N. Goyal. 1973. Variability studies under barani conditions. Sci. and Cult. 39 (3) : 129-130. (Pl. Breed. Abst. 44 (3): 1428, 1974).

Zillinsky, F. J. 1973. The triticale improvement programme at CIMMYT. IN : Triticale IDRC-024e. Proc. Int. Symp. 1973 EL Batan, Mexico; 81-85.

Zillinsky, F. J. & A. Lopez, B. 1973. Breeding for improved agronomic characteristics. Triticale Breeding and Research at CIMMYT. CIMMYT Res. Bull. 24, 3-11.