PRELIMINARY DATA ON THE YIELD PERFORMANCE OF HEXAPLOID TRITICALES AT HIGH ALTITUDES IN THE KUMAON HILLS*

HEXAPLOID Triticales are being cultivated in Spain (E. Sánchez-Monge, personal communication) and Hungary (A. Kiss, personal communication) and have given higher yields than wheat in the poor sandy soils, without irrigation. As 70% of the total wheat area in our country is still unirrigated yielding as low as an average of 3 to 4 quintals per hectare. Triticale has been suggested to be a potential crop for dry land farming[2], provided suitable varieties are developed for such areas. Approximately one-third of the total area cultivated under crops at high altitudes (7500′ and more above sea-level) in Kumaon hills is grown under wheat in rainfed conditions. A general survey of wheat crop at such altitudes in the Kumaon hills by the authors has shown that the yields are very poor due to severe winter killing and damage by frequent hailstorms. Considering the generally high vigour and hardiness possessed by most of the Triticale strains, an yield trial with eleven hexaploid Triticales received very kindly from Dr. F. J. Zillinsky of CIMMYT in the Second International Triticale Yield Nursery, was conducted at Mornaula Hill Research Station at an altitude of 7500′ above sea-level in the Kumaon hills. Wheat variety, Kalyan Sona was included in the trial as control. The experiment was planted in 2 meter long, six row plots with three replications in a Randomized Block Design. The levels of fertility were 40 Kg N : 30 Kg P : 20 Kg K per hectare. The planting was done on 2nd December, 1971. There was heavy snowfall during mid-January and severe hailstorms were experienced during end of March and early April. No irrigation was given to the experiment.

All the Triticale strains showed a very pronounced winter hardiness. Kalyan Sona suffered badly due to winter killing, poor vegetative vigour and sickly growth. The damage due to hailstorms was also lesser in case of Triticales than in Kalyan Sona. The yields of Triticale strains and Kalyan Sona are given in Table I.

It is seen from Table I that all the Triticale strains have given higher yield than Kalyan Sona. Armadillo PPV-13, Armadillo 133 and Armadillo PM 4 gave significantly higher yields. The yield difference is so pronounced that the highest yielding Triticale strain Armadillo PPV-13 has given nearly six times the yield of Kalyan Sona.

The yields of Triticale strains are very high as compared to wheat, but are not unrealistic considering that wheat varieties like Kalyan Sona, Ridley and others grown at an altitude of 7500′ and more above sea-level are all spring types being cultivated during severe winter season and in general give very poor yields due to winter killing. Although, the Triticale strains used in the present trial are also spring types, they nevertheless show pronounced winter hardiness because of the inherent vegetative vigour and hardiness possessed by Triticales. Another reason for very low yield of Kalyan Sona in the trial could be the very low soil pH (4·3 at Mornaula) which is highly acidic for wheat crop and the sickly growth of the wheat plants observed in the trial might be due to the toxicity for certain trace elements. All the Triticale strains on the other hand appeared to be resistant to acidic soil conditions, as was seen from the healthy growth of the plants.

TABLE I

Yield performance of triticale strains as compared with Kalyan Sona at Mornaula, 1971–72

Sl. No.	Entries	Yield in quintals per hectare
1	Armadillo PPV–13	29·949*
2	Armadillo 133	21·440*
3	Armadillo PM 4	18·703*
4	Armadillo 135	17·249
5	Armadillo 130	17·191
6	Armadillo PPV–8	15·609
7	Bronco 90	9·573
8	Bruin 46	9·280
9	Armadillo 147	8·472
10	Rosner	8·392
11	Armadillo 211	5·258
12	Kalyan Sona	4·664

C.D = 13·689 quintals, * Significantly higher than Kalyan Sona.

Though it is realized that the yield data being given in the present report is only from one location and one season, it however indicates rather strongly that hexaploid Triticales would do well at high altitudes and in the acidic soils, particularly because of their winter hardiness and resistance to the acidic soil conditions, where wheat varieties do not give good yields. As Triticale flour makes good chapati and most of the Triticale strains have been reported to possess high protein content[1], it appears that Triticale holds good promise for cultivation as a more dependable cereal crop of superior nutritional quality at high altitudes and in the acidic soils.

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TRANSLOCATION HETEROZYGOTE INDUCED IN *CAPSICUM ANNUUM* L.

DURING a study on induced mutagenesis in *Capsicum annuum* L. ($2n = 24$) cv. N.P. 46A using physical (gamma-rays and fast neutrons) and chemical (ethyl methanesulphonate and N-nitrosomethyl urea) mutagens, five variants, similar in appearance, were isolated from gamma- irradiated (30 kR) population of 1271 M_2 plants. A single family was found to segregate for these mutants. In the mutant types, the leaf-lamina was divided deeply into narrow lobes, varying from small needle-like to large half or perfect leaf with serrated margins which extended sometimes even upto the midrib giving the appearance of compound leaves and leaflets. The control had obovate simple leaf. In the mutants a striking change from a normal sympetalous to polypetalous condition also occurred. The gynoecium had two styles and stigmas. Pollen fertility was observed to be 70%. The plants were poor bearers and had thin and shrivelled fruits. The calyx did not clasp the upper end of the fruit from one side. The mutants bred true in the succeeding generations.

Cytological examination of the mutants showed that a translocation was involved in the production of such a complex mutation in chilli. The multivalents (trivalents and quadrivalents) at metaphase I of meiosis occurred with a mean frequency of 0·77 per cell as compared to zero in the control. It can be seen from the data (Table I) that there is significant difference in the chromosomes associated in multivalent configurations in the mutant and the control.

Polypetalous mutants have been reported in a normally sympetalous species of *Datura stramonium* (Blakeslee and Avery, 1941) and *Ipomaea nil* (Takenaka, 1956). Similar to the mutant phenotypes of *Datura* and *Ipomaea*, the mutants isolated in *Capsicum*, were weak, abnormal in several respects and were partially sterile. Stebbins (1967) postulated that the difference between separate and united parts probably depends upon a series of coordinated differences in developmental pattern, involving the production and distribution of various growth substances. The evolution of such a difference, therefore, must involve changes in many different genes, the actions of which must be adjusted to each other in order to produce a functional structure of a different kind. It can be assumed that the change in the coordinated activities of the plant parts in the variants obtained in the present study was possible as a result of the induced translocation in at least two chromosomes.

TABLE I

Mean chromosome configuration at metaphase I of meiosis in the mutant and the control

Type	No. of cells	Univalent		Bivalent		Trivalent		Quadrivalent	
		Mean ± S.E.	Range	Mean ± S.E.	Range	Mean ± S.E.	Range	Mean ± S.E	Range
Control ..	125	0·03 ± 0·04	0–2	11·98 ± 0·01	10– 2	0	..	0	..
Mutant ..	125	0·29 ± 0·06	0–2	10·33 ± 0·09	8–12	0·04 ± 0·02	0–1	0·73 ± 0·04	0–2

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