

Discussion

The results obtained indicate a loss of precision in the 9 variety tests at Rocky Ford and Alamosa in tons beets and pounds sugar per acre, and a loss in precision in percent sucrose at East Grand Forks by the use of the incomplete block design. In the 16 variety tests a loss of precision was found in tons beets per acre at Rocky Ford and in tons beets and pounds sugar per acre at East Grand Forks. A great increase in precision was observed in the 16 variety test at Alamosa, Colorado. Extremely variable irrigation practice in part accounted for the greater error of the randomized block analysis in this test. In the two 25 variety tests and the 49 variety test at Rocky Ford, increase in precision in tons beets per acre, percent sucrose and pounds sugar per acre was obtained in varying degrees. 5/

Conclusion

From the comparisons of analysis methods herein reported it is indicated that the symmetrical incomplete block design is likely to be less efficient than the randomized block design in tests of 16 varieties or less; and approximately equal to or better than the randomized block design in tests of 25 varieties. In tests of 49 varieties the incomplete block design is likely to be much more efficient than the randomized block design.

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- 1/ Manager and Plant Breeder respectively, Beet Seed Operations, American Crystal Sugar Company, Rocky Ford, Colorado.
 - 2/ Yates, F. A NEW METHOD OF ARRANGING VARIETY TRIALS INVOLVING A LARGER NUMBER OF VARIETIES. (Journ. of Agri. Sci. (England) 26:424-455. 1936.
 - 3/ Goulden, C. H. EFFICIENCY IN FIELD TRIALS OF PSEUDO-FACTORIAL AND INCOMPLETE RANDOMIZED BLOCK METHODS. Canadian Journ. Research (C) 15:231-241. 1937.
 - 4/ Le Clerg, E. L. RELATIVE EFFICIENCY OF QUASI-FACTORIAL AND RANDOMIZED BLOCK DESIGNS OF EXPERIMENTS CONCERNED WITH DAMPING-OFF OF SUGAR BEETS. Phytopathology 39:637-641. 1939.
 - 5/ Under the conditions of these tests, leafspot incidence was not a factor. It is therefore not known as to how much bias would be introduced under such conditions in applying the correction factor (which is fundamental to this symmetrical incomplete block method) to variety yields of varying degrees of resistance to leafspot.

THE INDUCTION OF POLYPLOIDY IN BETA VULGARIS L. BY COLCHICINE TREATMENT

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The plumule region of small sugar beet seedlings was treated, by the single drop method, with colchicine in concentrations of 0.2 and 0.4 percent. The application of colchicine was repeated either four or eight times during successive days. The following selections, designated by current number, were given such meristem treatments:

- 2241 Munerati annual. Low self-fertility.
- 6499 Annual "wild" type from Milpitas, California.
Low self-fertility.
- 2245 Plantain foliage venation type. Biennial in bolting character.
Low self-fertility.

- 2323 Derived from the Tracy strain 2769-24 highly self-fertile.
3653 An inbred strain originally selected from E. Carsner's 286 stock noted for high curly-top resistance. Highly self-fertile.
3521 F₂ progeny of hybrid between Munerati annual x Tracy strain, 2769-24. Self-fertile and segregating for the hypocotyl color genes R - r and the bolting factors B - b (annual vs. biennial habit.)

Following the drop treatment seedlings were found to be greatly retarded in growth. Distorted and roughened leaves were formed. In later stages of growth a return to the normal, flatter type of foliage was apparent. At the time of flowering 45 plants of the 92 seedlings treated with colchicine showed, in some of their branches, varying amounts of larger than normal-sized pollen. Some measure of the effect of colchicine is indicated by the results from pollen examination. It was found that approximately 65 percent of the 45 plants with large pollen developed at least one, and usually several branches whose flowers had large pollen grains in a high proportion. The pollen size of the remaining 47 plants was very similar to that of the normal 1 n grains produced by untreated controls from the same strains.

Cytological observations of pollen mother cells from a limited number of branches which formed high percentages of large pollen grains showed that in general doubling of chromosomes had occurred. The number of chromosomes at Telophase I varied from 17 to 19. Untreated plants with pollen of normal size gave the expected haploid number of 9 chromosomes at the same stage.

Heteroploid plants were obtained in the progenies derived from the colchicine treated seedlings of strains 2241, 3521, and 3653. The presence of such heteroploids, in relatively large percentages, was also noted in the progenies from the crosses of treated plants of strains 2241 x 6499 and 6499 x 3521, respectively.

The conclusion that the offspring from treated plants were heteroploid in nature was based on data concerning stomatal size, pollen diameter, degree of pollen sterility, as well as chromosome number determinations in certain cases. The indications were that one class of heteroploids approximated the tetraploid or 4 n chromosome number of 36. A second class apparently was of the 3 n or triploid type.

The heteroploids derived from colchicine-treated plants of the annual strain 2241 showed no consistent difference in size of plants when compared to the parental diploid stock. However, two heteroploid progenies secured from strain 3521 and the inbred line 3653 differed from the offspring of comparable untreated controls in several respects. These differences were in germination rate, seedling size, leaf shape, flowering habit and amount of seed set.

In addition to the drop method of treatment, seed of the Munerati annual strain 2241 was soaked in 0.4 percent colchicine for periods of 8 hours, 1, 2 and 3 days. Appreciable percentages of plants were found, from all such treatments, some branches of which developed flowers with a high proportion of large pollen. It was evident from previous experience with the meristem treatment that increased pollen size was associated with a doubling of chromosomes. Therefore, it is probable that the plants which were grown from colchicine-treated seed and showed large pollen would give rise to heteroploid offspring.