Indian J. Genet., 58(3): 375-377 (1998)

Short Communication

EFFECT OF SELECTION CYCLES ON ASSOCIATIONS AMONG SUGAR YIELD AND ITS COMPONENTS IN SUGARBEET (*BETA VULGARIS* L.)

D. P. PANT AND T. B. SINGH

Department of Genetics and Plant Breeding,
G. B. Pant University of Agriculture & Technology, Pantnagar 263 145

(Received: June 10, 1996; accepted: September 30, 1998)

In sugarbeet (*Beta vulgaris* L.) continuous improvement of yield depends upon the accuracy and ease with which superior genotypes can be identified. Since root yield is negatively associated with sucrose percentage [1,2], it is imperative that selection is done on the basis of higher sucrose with optimum root yield. In the integrated structure of the plant, various characters are inter-related with each other either directly or indirectly. Therefore, selections made for one characters may lead to correlated response in the other. In this background, study of character correlations in populations subjected to various cycles of selection becomes more relevant.

Selection was started in two open pollinated populations namely Pant S-10 and Pant Comp-3 of sugarbeet. Co-selection cycle was started by selecting 145 and 140 superior mother roots from two populations chosen on the basis of cercospora leaf spot, (*Cercospora bataticola*) rating up to 5 and total soluble solids (T.S.S.) values ranging from 17 to 24 per cent. These selected roots were planted in two intercross plots in isolation at Auli, Joshimath. The seed was collected separately for each plant at harvest. Thus single plant progenies (29 and 36 plant progenies) of these two populations were planted in two replications alongwith check varieties at Pantnagar in CI selection cycle for evaluation and further selection, saving some seed from each progenies.

Remnant seed of Pant S-10 and Pant Comp-3 which had shown higher total soluble solids, sucrose percentage and low incidence of cercospora leaf spot during root crop evaluation were planted for raising stecklings. These stecklings were kept in trenches for thermal induction at Auli, Joshinath in winter and were planted in spring after thermal induction. The seed harvested on (36) single plant progenies of Pant S-10 and Pant Comp-3 were evaluated in replicated trial alongwith two check varieties at Pantnagar in C2 selection cycle.

Remnant seed of Pant S-10 and Pant Comp-3 progenies which had shown high T.S.S., sucrose percentage and low incidence of cercospora leaf spots were separately

bulked and two independent populations were planted in intercross block in isolation. The seed was collected on the basis of single plant performance in 1985. These single plant progenies of Pant S-10 (62) and Pant Comp-3 (34) were evaluated alongwith two check varieties at Pantnagar in C3 selection cycle for root crop evaluation. Single plant observations were recorded on the basis of randomly selected five plants except root yield, top yield and gross sugar yield which were taken on plot basis. Following character were observed. Number of leaves/plant, leaf length/plant in cm, leaf width in cm/plant, leaf angle/plant, leaf area in cm/plant, total soluble solids in percent/plant, sucrose percentage/plant, root yield kg/plot, top yield kg/plot, cercospora leaf spot (rating scale 0-10)/plant and gross sugar yield kg/plot. Correlation between all plant characters under study at phenotypic level was estimated as per [3].

Significant negative correlation of number of leaves was observed with T.S.S. at harvest in C2 cycle of selection of Pant Comp-3 (- 0.325)* population. The negative association of leaves with T.S.S. at harvest might be due to the mutual shading of leaves leading to inefficient photosynthesis and accumulation of T.S.S. [4].

Leaf length was positively associated with leaf width in C1 and C2 of Pant S-10 (0.549**, 0.364*) and Pant Comp-3 populations (0.364* and 0.453*) The significant positive association of leaf length with leaf area was found in all the cycles of selection on both the populations. The leaf length showed negative significant association with T.S.S. at harvest (–0.382*) in C2 population of Pant Comp-3.

Highly significant positive correlation of leaf width and leaf area was found in all the cycles of selection in both the populations. The leaf width and leaf angle showed significant positive association in C1 (Pant Comp-3) and C2 (Pant S-10) selection cycles [5]. Leaf area was found to be positively correlated with leaf angle in C1 of Pant S-10 (0.352)* and Pant Comp-3 (0.331*) populations. The significant positive correlation of leaf area and top yield was found in C2 for Pant Comp-3 (0.393*) [6].

Leaf angle showed significant and positive association with sucrose % in C1 of Pant S-10 population (0.383*). Such an association is expected as erect leaves decrease mutual shading of leaves to increase the photosynthetic efficiency of plants resulting in more accumulation of sucrose in roots. The significant and negative correlation was found between leaf angle and cercospora leaf spot incidence in C1 (–0.427*) and C2 (–0.353*) cycles of Pant S-10 population.

The T.S.S. at harvest showed a positive correlation with sucrose percent for Pant S-10 and Pant Comp-3 populations in all the selection cycles. However, the association was significant only in C1 (0.542**) of Pant Comp-3 and C2 (0.542**) of Pant S-10 population [8]. Thus the present study indicated that T.S.S. may be used as a reliable basis for initial selection of sugarbeet genotypes for high sucrose.

The sucrose percentage was found negatively associated with cercespora leaf spot in all the cycles of selection for both the populations. The results indicated that high incidence of cerospora leaf spot has an adverse effect on sucrose percentage. Significant positive association of sucrose percent with gross sugar yield/plot was found in C1 (0.546**), C3 (0.491**) of Pant S-10 and C3 of Pant Comp-3 population (0.409*) in conformity with the earlier results [1,6]. Highly significant positive association of root yield/plot with gross sugar yield/plot was found in all the selection cycles of both the populations [9,10]. Significant positive association of root yield/plot with top yield/plot was found in C2 of Pant Comp-3 population (0.385). Positive association of top yield/plot with gross sugar/plot was observed in all the selection cycles of both the populations [11].

REFERENCES

1. L. Powers, W. P. Schmehl, W. T. Federer and M. G. Payne. 1963. Chemical, genetic and soil studies involving thirteen characters in sugarbeets. J. Am. Soc. Sug. beet. Technol., **12**(4): 393-448.
2. C. Tsuda and S. Hosokawa. 1969. Plant breeding studies on the negative correlation between root weight and sugar content in sugarbeet : Considerations on the relation between these two characters based on Mass selection experiments. Hokkaido diagku nogakuba Hobun kiyomem., 7(1): 19-25, (C.F.P1. Breed. Abst. **40** : 3475).
3. G. R. Searle. 1961. Phenotype, genetic and environmental correlations. Biom., **17**: 474-480.
4. M. Stout. 1960. A new look of some nitrogen relationship affecting the quality of sugarbeet (*Beta vulgaris* L.). J. Am. Soc. Sug. Beet. Technol., **15**(5): 388-398.
5. R. F. Follet, W. R. Schmehl and Jr. Viets. 1970. Seasonal leaf area, dry weight and sucrose accumulation by sugarbeets. J. Am. Soc. Sug. Beet. Technol., **16**, 3: 235-252.
6. R. Kapur, B. L. Srivastava, H. M. Srivastava and V. K. Saxena. 1985. Character association in sugarbeet (*Beta vulgaris* L.). Agric. Sci. Dig. India., 5(1): 17-20.
7. J. S. Maheshwari. 1976. Chemical genetic studies in some sugarbeet (*Beta vulgaris* L.) inbred lines. Unpublished M. Sc. (Ag.) thesis, G.B.P.U.A. & T., Pantnagar, India.
8. R. Koitzsch, J. Birke and W. Reiher. 1966. Experimental measurements for following the accumulation of substances contained in sugarbeet. Albrecht, Zhae-Arch. agrarment for schung station Mum Cheberg, East Germany., **109**(2) : 1127-1137.
9. I. Antonov. 1984. Variability and inheritance of leaf number and weight in sugarbeet. Genetikai selektsiya., **17**(1): 3-9. (C.F.Pl. Breed. Abst. **55**: 19176).
10. E. A. Bychko and I. B. Galetskaya. 1985. Correlation analysis and heritability of technological quality in sugarbeet. CF. P1. Breed. Abst., **55**: 11-8842.
11. S. S. Pandey. 1981. Genetic studies in sugarbeet (*Beta vulgaris* L.) with special reference to genotypic variability, character association and adaptation under varied soil moisture contents. Ph D. thesis, G.B.P.U.A. & T., Pantnagar, India.