

The Effect of Mutation on  
Correlations Between Characters  
in Gossypium barbadense L.

Vernon Shattuck, Plant Scientist

The chemical mutagen ethyl methanesulphonate (EMS) has been used extensively since it produces a high frequency of mutations accompanied by a low occurrence of chromosomal aberrations in plants. Numerous studies have disclosed the mutagenic capacity of EMS to produce genetic variability in diploid and polyploid plant populations. Treatment with EMS has also modified simple correlations between plant traits.

During the summer of 1980, an EMS-induced  $M_2$  mutant population of Gossypium barbadense L. was assessed for possible alterations in the magnitude of quantitatively inherited variation. This study shows that the chemical treatment modified the relationships among several plant characters.

Pima cotton seeds were imbibed in an unbuffered EMS solution for two hours. Each seed received one milligram of EMS. The seeds were recovered, then placed in rolled germination sheets, and grown for sixty-five hours at 34°C. Seedlings ( $M_1$ ) were eventually transferred to three gallon containers and grown to maturity in the greenhouse during the winter of 1979. Selfed seeds from these plants were collected and grown in the field in 1980. The control and EMS-treated population ( $M_2$ ) were represented by thirty and three hundred forty-five plants, respectively.

The phenotypic correlation coefficients for nine pairs of characteristics in the control and the  $M_2$  are presented in Table 1. The mutagenic application slightly strengthened the positive association between total plant bolls and plant dry weight and the anticipated negative correlation between crude seed protein and crude seed lipid percentage. The treatment significantly weakened the high correlation ( $r = .82$ ) for seed weight and crude seed protein. No significant association was detected for the other traits in this study.

Regression analysis of protein percentage on seed weight in control plants revealed that each milligram change in seed weight was related to an average increase in crude protein of .359 percent.

Within the mutant population under investigation, greater seed size was independent of higher crude seed protein levels. This is graphically depicted in Figure 1. On an individual plant basis, seed volume in certain  $M_2$  plants presented no definite morphological or physiological obstacle which restricted crude seed protein when compared to the control.

Dumanovic et al., recorded a lack of correlation between protein content and 1000 grain weight in EMS mutagenized wheat lines. Other mutagenized material has been shown to possess a significant negative association between mean single grain weight and grain protein accumulation.

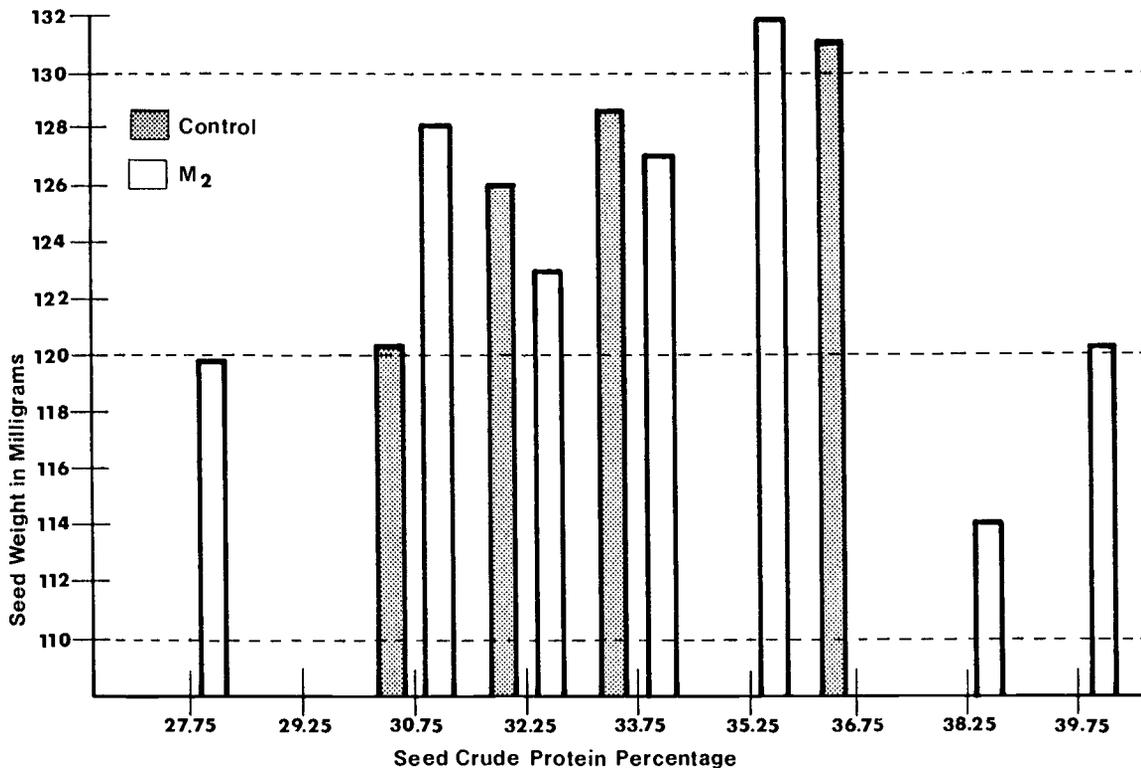
Correlations between characters may be due to either genetic linkages or to physiological and developmental relationships. The altered relationship between seed size and seed protein capacity observed in EMS treated cotton may have arisen partly through a modification in the export of specific photoassimilates as nitrogenous compounds from the assimilating tissue to the cotyledonary amino acid pools, thereby influencing protein anabolism. It may additionally have originated from alterations in the physiological or biochemical processes which eventuated during the reserve protein accumulation phase in developing cotyledons.

TABLE 1. Coefficients of correlation in the control and  $M_2$  generation.

	Control	EMS
Pair of characteristics	$r_{x/y}$	$r_{x/y}$
Total plant bolls - Plant dry weight	+.835*	+.888*
Seed weight - crude seed protein	+.817*	-.085
Crude seed protein - crude seed lipid	-.674*	-.893*
Total plant bolls - crude seed lipid	-.015	+.184
Plant dry weight - crude seed protein	-.118	-.182
Seed weight - crude seed lipid	-.162	+.083
Total plant bolls - crude seed protein	-.284	-.084
Plant dry weight - crude seed lipid	-.389	+.258

\*Significant at 5% level.

FIGURE 1. The distribution of seed weight and seed protein percentage in control and M<sub>2</sub> generation cotton.



Long Staple Cotton Variety Comparisons

Jim Armstrong, Pima County Extension Agent

Strain P-34 has performed well over several years of testing. Indications were that if its performance in 1982 was comparable to previous years it might be introduced as a variety for 1983 planting. These tests were established to provide additional performance data upon which the release decision could be made.

Both tests were identical in design except for the randomization sequence. They compared P-34 with S-5 on a randomized four replication design. Results of these tests are reported below.

Long Staple Variety Comparison

5T Farms, Tom Clark, Marana

Variety	Seed Cotton Per Plot				Total Seed Cotton	Lint/1/2 Per Acre
	Rep 1	Rep 2	Rep 3	Rep 4		
P-34	1540	1470	1380	1360	5750	921 a
S-5	1360	1300	1220	1460	5340	855 a

/1 Values followed by the same letter not significantly different at .05 level by Student - Newman - Keul's test.

/2 Yields for First Pick Only on 11/23/82