Table 1 (cont'd)

| Class | Variety | Class | Variety |
|---|---|---|---|
| | Cultivars with $fg_1$ $fg_3$ (cont'd) | | |
| 8T | Calland<br>Chippewa<br>Dunn<br>Grant<br>Rampage<br>Ross<br>Wirth<br>840-7-3 | 8t | Beeson<br>Harlon<br>Harly<br>Henry<br>Monroe |

†Variety is heterogeneous for two classes; in many of the varieties/lines, only a single plant was tested as being representative of the variety/line.

References

Buttery, B. R. and R. I. Buzzell. 1973. Varietal differences in leaf flavonoids of soybeans. Crop Sci. 13: 103-106.

Buttery, B. R. and R. I. Buzzell. 1975. Soybean flavonol glycosides: Identification and biochemical genetics. Can. J. Bot. 53: 219-224.

Buttery, B. R. and R. I. Buzzell. 1976. Flavonol glycoside genes and photosynthesis in soybeans. Crop Sci. 16: 547-550.

Macnicol, P. K., M. L. Dudzinski and B. N. Condon. 1976. Estimation of chlorophyll in tobacco leaves by direct photometry. Ann. Bot. 40: 143-152.

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1) Inheritance of insensitivity to long daylength.

Genetic tests for daylength insensitivity have been run using PI 297,550, reported to be day-neutral by Polson (1972), as source material. Segregating material was grown under long days at various times from 1973 to 1979, either in a growth cabinet (Buzzell et al., 1974) or in a greenhouse with daylength

extended to 20 hours with incandescent light. Material was classified at 35 to 42 days after planting as either non-flowering, sensitive (S), or flowering, insensitive (I).

The results gave a good fit to expected ratios for a single recessive gene controlling insensitivity (Table 1). Results for an insensitive line, OX619, grown in the field at Harrow and under various daylengths at Ottawa, are given in Tables 2 and 3, respectively.

Table 1

Segregation for sensitive (S) and insensitive (I) responses under 20 hr daylength (non-flowering and flowering at 35-42 days after planting)

| Cross* | $F_2$ | | | $F_3$ | | |
|---|---|---|---|---|---|---|
| | S | I | $\chi^2$ 3:1 | S | Seg. | I |
| PI 297,550 (I) x OX301 (S) | 43 | 15 | 0.023 | 13 | 23 | 9 |
| OX637 (I) x Harcor (S) | 13 | 3 | 0.333 | 5 | 8 | 3 |
| OX633 (I) x OX318 (S) | 60 | 21 | 0.037 | - | - | - |
| Pooled | 116 | 39 | 0.009 | 18 | 31 | 12† |

*PI 297,550, Group 00, from Hungary; OX301 from OX250 (Blackhawk x Midwest) x OX383 (Corsoy x Harosoy 63); OX637 from PI 297,550 x OX301; Harcor from OX383 x Corsoy; OX633 from OX637 x Harcor; and OX318 from OX383 x OX384 (a sister line of OX383 but earlier maturing).

†$\chi^2$ for 1:2:1 is 1.197, P = 0.70 - 0.50.

Bernard (1971) has characterized maturity genes $\underline{E}_1/\underline{e}_1$ and $\underline{E}_2/\underline{e}_2$, and Buzzell (1974) has reported $\underline{E}_3/\underline{e}_3$. The observed daylength-incandescent response seems sufficiently different from that of the previously reported genes to obviate the need for allelism tests. Gene symbols $\underline{E}_4/\underline{e}_4$ are proposed. Determining the linkage groups of the "E" genes in the future ($\underline{E}_1/\underline{e}_1$ is in linkage group 1, Weiss 1970) should establish definitely whether or not allelism is involved. $\underline{E}_4/\underline{e}_4$ is not linked with $\underline{Fg}_1/\underline{fg}_1$ (Buzzell, 1978. Linkage has not been demonstrated for $\underline{E}_3/\underline{e}_3$ (Buzzell, 1974; 1975).

Table 2

Field comparison of OX619 (OX633 x OX318), which is insensitive to long (20 hr) daylength, with other material planted June 7, 1979 at Harrow

| Line | Days from emergence (June 12) to: 50% flowering | R5* | Maturity | Plant height cm |
|---|---|---|---|---|
| | flowering | | | |
| OX619 | 41 | 56 | 93 | 68 |
| OX633 | 45 | 58 | 99 | 80 |
| OX637 | 45 | 58 | 93 | 72 |
| OX318 | 44 | 61 | 107 | 60 |
| Harcor | 53 | 71 | 116 | 97 |
| Harosoy $e_3$ | 44 | 60 | 104 | 92 |
| Harosoy $E_3$ | 49 | 68 | 109 | 90 |
| L.S.D. 0.05 | 1.4 | 0.9 | 3.4 | 8.5 |
| 0.01 | 1.9 | 1.2 | 4.6 | 11.4 |
| C.V. % | 2 | 1 | 4 | 7 |

*Beans just beginning to be felt in the pod.

Other genes are involved in insensitivity to long daylength; for example, the $F_2$ of OX619 x OX328E (early-maturing line from 'Harosoy' x 'Woodworth') segregated 56 non-flowering : 4 flowering which gives a good fit to a 15:1 ratio for two genes. And, with OX619 under extended daylength at Ottawa and Harrow, flowering and pod development are both insensitive to long daylength in contrast to some other material which may flower early but is delayed in pod development (unpublished results). We are continuing research to classify the genes involved.

Table 3

Response of OX619 to various daylengths in comparison to insensitive and sensitive varieties; growth cabinet, Ottawa 1979

| Variety | Stage | Days from emergence at 12 hr | 16 hr | 20 hr | 24 hr |
|---|---|---|---|---|---|
| OX619 | Flowering | 27 | 30 | 29 | 36 |
| | R4 | 38 | 36 | 37 | 43 |
| Maple Presto* | Flowering | 24 | 27 | 31 | 33 |
| | R4 | 35 | 36 | 37 | 42 |
| Harosoy $\underline{e}_3$ | Flowering | 28 | 29 | 40 | 56 |
| | R4 | 35 | 39 | 54 | 73 |

*Maturity Group 000 variety adapted to about 50°N in Canada.

References

Bernard, R. L. 1971. Two major genes for time of flowering and maturity in soybeans. Crop Sci. 11: 242-244.

Buzzell, R. I. 1971. Inheritance of a soybean flowering response to fluorescent-daylength conditions. Can. J. Genet. Cytol. 13: 703-707.

Buzzell, R. I. 1974. Soybean linkage tests. Soybean Genet. Newsl. 1: 11-14.

Buzzell, R. I. 1975. Soybean linkage tests. Soybean Genet. Newsl. 2: 10-11.

Buzzell, R. I. 1978. Soybean linkage tests. Soybean Genet. Newsl. 5: 14-15.

Buzzell, R. I., B. R. Buttery and J. H. Haas. 1974. Soybean genetic studies at Harrow. Soybean Genet. Newsl. 1: 9-11.

Polson, D. E. 1972. Day-neutrality in soybeans. Crop Sci. 12: 773-776.

Weiss, M. G. 1970. Genetic linkage in soybeans: Linkage group 1. Crop Sci. 10: 69-72.

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