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1) Evaluation of commercial soybean cultivars for leaf feeding resistance to *Heliothis zea*.*

The phenomenon of plant resistance to insects may be classified into three components, namely, nonpreference, antibiosis, and tolerance (Painter, 1951). Clark et al. (1972) observed that although PI 227.687 had many *Heliothis zea* eggs and larvae on the plants, the amount of pod damage was considerably less as compared with PI 171.451 and PI 229.358. They suggested that PI 227.687 might have some antibiosis mechanism against *H. zea*. Leaf feeding studies have shown that these PI's have high level of antibiosis for *H. zea* (Hatchet, Beland and Hartwig, 1974) and Mexican bean beetle (*Epilachna varivestis*—Mulsant) (Van Duyn, Turnipseed and Maxwell, 1972).

The objective of this study was to investigate leaf feeding resistance to *H. zea* by means of antibiosis tests, among soybean cultivars commonly grown in the Middle Atlantic States of the U.S.A.

Materials and methods: Seven commercial soybean cultivars ('Cutler,' 'Essex,' 'Hill,' 'York,' 'Delmar,' 'Wye' and 'Shore'), 3 plant introductions (171.451, 229.358 and 227.687) and one advance breeding line (D67-3297) were evaluated for antibiosis in foliage feeding tests. The cultivars were planted in the field on May 25, 1974, to provide fresh leaves for feeding tests. On August 1, 1974, a leaflet was selected from the uppermost fully developed trifoliolate of each cultivar and placed in clear plastic containers 5.1 cm in diameter and 3.7 cm deep. Each cup contained two paper towel discs of 1.27 cm diameter soaked in water to maintain humidity in the cup. *H. zea* larvae were reared for 6 days on the general lepidopterous diet in 1 oz clear jelly cups. On the seventh day 30 *H. zea* larvae of uniform size were selected for each soybean cultivar. A single larva was placed in each cup and covered. Foliage was replaced at 24 hr intervals throughout the larval period.

Larval mortality was recorded every day, and the weight of survivors was recorded after 6 days feeding on leaves. Pupal weight on the ninth day after pupation and the number of days to pupation and adult emergence were also recorded.

*This is a part of a CSRS/USDA funded project.

Table 1
Development of Heliothis zea larvae on leaves of different soybean cultivars or PI's

Cultivar or PI [†]	Larval wt. (mg) ⁺⁺	No. larvae pupated	\bar{x} days to pupation	Pupal wt. (mg) ⁺⁺⁺	\bar{x} days in pupal stage	No. adults emerged	% emer- gence
D67-3297	366a*	19	17.7d*	245a*	12.9a*	15	50.0
Cutler	360a	15	19.4bcd	211abcde	11.9b	8	26.7
Delmar	347a	20	18.8cd	228ab	11.9b	7	23.3
Hill	319ab	14	18.7cd	229abc	11.8ab	6	20.0
Essex	310ab	15	19.2bcd	190bcde	11.0b	8	26.7
York	300ab	14	19.3bcd	208abcde	11.7b	7	23.3
Wye	254bc	12	20.3abc	232abcd	11.7b	10	33.3
Shore	244bc	12	21.1ab	166de	10.8b	5	16.7
PI 171.451	222c	9	20.8abc	168cde	11.5b	4	13.3
PI 229.358	207c	10	21.8a	176bcde	10.7b	6	20.0
PI 227.687	189c	12	21.8a	162e	11.7b	7	23.3

* Means not followed by the same letter were significantly different at the 0.05 probability level according to Duncan's multiple range test.

[†] 30 larvae/treatment.

⁺⁺ Mean weight of larvae after 6 days feeding.

⁺⁺⁺ Mean weight of pupae on ninth day after pupation.

Results and discussion: H. zea showed a marked differential response in larval and pupal weights, mean days to pupation and percentage emergence when reared on leaves of different soybean cultivars (Table 1). The larvae reared on D67-3297 gained maximum average larval (366 mg) and pupal (245 mg) weights within the period of experimentation. Percentage emergence of moths was also the highest (50%) for this cultivar. The results indicated that D67-3297 was the most susceptible and had the lowest level of antibiosis. The least larval (189 mg) and pupal (162 mg) weights were recorded on PI 227.687. Percentage emergence of moths was 13.3% for PI 171.451 and 16.7% for Shore, indicating a high level of antibiosis for these two cultivars.

Larvae reared on the leaves of Shore, Wye and the three PI's gained significantly less weight as compared with York, Essex, Hill, Delmar, Cutler and D67-3297. Significant differences were also found in pupal weight (Table 1). Pupal weights of H. zea reared on Shore, Essex, and the three PI's were significantly less than Wye, York, Hill, Delmar, Cutler, and D67-3297.

H. zea larvae reared on Shore, Wye and the three PI's passed through a significantly extended larval stage as compared with York, Essex, Hill, Delmar, Cutler and D67-3297.

Cultivars Shore and Wye exhibited a high level of antibiosis for H. zea and show promise in reducing the amount of pod damage, overwintering pupal population and number of moths in the next generation. Planting of soybean cultivars with high level of antibiosis will also reduce the number of insecticide applications.

Acknowledgements: The authors express their sincere thanks to Drs. Edgar E. Hartwig (Plant Science Research Division, USDA, Stoneville, MS), J. Hatchet and Franklin D. Brewer (BICL, USDA, Stoneville, MS) for supplying seeds of three resistant PI's, showing techniques and equipment used in antibiosis studies and supplying H. zea eggs for experimentation, respectively.

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1) Seed yield efficiency in soybeans.

Soybean (*Glycine max* (L.) Merrill) cultivars with high seed yield efficiency (SYE) can be used in breeding programs to increase yield. An efficient cultivar can be characterized either by a high ratio of seed to nonseed dry weight (above ground unthreshed air-dry weight of plant at maturity minus seed weight) or by a steep regression slope of seed over nonseed dry weight. High SYE indicates that a high proportion of total plant dry weight is seed weight (Veatch, 1930). Dry bean (*Phaseolus vulgaris*) cultivars studied by Wallace and Munger (1966) differed distinctly in their harvest indices (HI = economic yield divided by total plant dry weight x 100). Efficient plants utilize more energy for production of seed and less for nonseed plant parts. Schutz and Brim (1967), utilizing regression coefficient analysis of SYE values, found that certain varieties became more efficient in competitive situations than in pure stands.

The present investigation was undertaken to determine the extent of variability of SYE in ten selected soybean varieties.

Materials and methods: The experiment was conducted during 1971 at the Agronomy Farm of The Ohio State University, Columbus, Ohio. Ten soybean varieties, belonging to maturity groups I, II, III, and IV, were selected on the basis of their diversity in maturity, plant height, and growth habit. Most of the seeds were supplied by the Regional Soybean Laboratory, Urbana, Illinois. The seedlings grown in the greenhouse were randomly arranged in the field and spaced 91 cm apart in 71 cm rows. The number of single plant replications were: 'Aoda,' 12; 'Cayuga,' 9; 'Giant Green,' 8; 'Habaro,' 20; 'Hakote,' 9; 'Henry,' 46; 'Kent,' 39; 'Kura,' 13; 'Manchuria,' 7; and 'Wayne,'