DURING the past 5 years a series of investigations has been conducted at the Iowa Agricultural Experiment Station to determine the differential response of a wide range of genotypes in corn, oats, and soybeans to several growth regulating compounds. These studies have been made in the laboratory using the root suppression test and in the field with standard spray techniques. Results of these studies, including the cytostatic effects of 2,4-D on apical meristem of oats and the inheritance of differential response to 2,4-D in corn, have been published (1) (3) (4) (5) or are currently in press. Many studies have been reported, largely in the abstracts of the North Central Weed Control Conference, on varietal response of crop plants, using varieties or hybrids that are commercially grown, to determine tolerance limits for chemicals now used as herbicides.

The present investigation with soybeans, however, was designed as an exploratory study to determine (from an agronomic point of view) the differences that might exist among a group of introductions from the Orient. It was believed that this source of material, from which present soybean varieties originated either as selections or from crosses among these selections, might represent a wider range in genetic diversity than could be found among more recently developed varieties adapted in maturity to the cornbelt. Discovery of even a few strains with a relatively high degree of tolerance might therefore prove to be of value to the soybean breeder as parents for use in developing agriculturally desirable strains that could tolerate dosage rates effective in selective weed control. Such strains might also be of value to the physiologist for further studies on the causes of injury to plant tissues by growth regulators.

An attempt also was made in this study to determine the relationship between the response to 2,4-D of strains tested in the seedling stage under greenhouse conditions using the single droplet technique (2) and their field response to spray application of 2,4,5-T as measured by reduction in seed yield. Previous studies with soybeans8 had shown a poor relation between the root suppression test and field response to 2,4-D as measured by dry weight of leaves. Rapid tests to screen a large number of selections for differential response would be a valuable aid in a breeding program.

MATERIALS AND METHODS

From among nearly 2,000 introductions available4 from the Orient, a group of 200 was chosen to represent a cross-section from China, Manchuria, Korea, and Japan within the maturity range adapted at Ames, Iowa. An attempt was made to conserve the limited seed during the winter, 1951-52 in cooperation with the U. S. Department of Agriculture field station, Visalia, Calif., but failed due to severe freezing temperatures. It was successfully made in 1952 at Ames, Iowa, and in Missouri, in cooperation with the Regional Soybean Laboratory. Among the original 200 strains, 16 were too low in germination to provide adequate seed.

Screening tests with the micro-droplet technique were conducted in the greenhouse during the winter, 1952-53 and 1953-54 since 2,4,5-T could not be effectively used on so many seedlings do not show a marked response when treated with 2,4,5-T using the micro-droplet technique. After a period of preliminary studies to determine optimum contacting agents, solvents, manner of application and modifying effects, the following procedure was adopted.

Five soybean seeds per strain were planted in a mixture of 3 inches of clay pots previously filled with 3 inches of the same mixture to reduce moisture evaporation. After the seedlings had full unifoliolate leaf stage and the central leaflet of the trifoliolate leaf was almost fully expanded, all seedlings of each strain were treated by removing the central leaflet midway between the second and third trifoliolate leaf. Plants were then permitted to continue growth at temperatures of 70 to 75°F. For 2 weeks, or until trifoliolate leaf was expanding. The effect of 2,4-D on the second leaf was recorded as a percentage reduction in length, in comparison with the check for each of the first, central, and third trifoliolate leaf. Greatest reduction occurred on the second leaf; rarely did it extend to the third trifoliolate leaf. Greatest reduction was recorded in the trifoliolate leaf.

For the field studies, all strains with sufficient seed were planted in a split-split design of four replications with maturity group 0 to group 4 as whole plots, treatments (check, 2,4,5-T equivalent of 2,4,5-T per acre) as sub-plots within treatments as sub-sub-plots. The range for each area was 0 to group 4. 40 strains were tested in 10 replicates with greenhouse temperatures in late spring appearing to modify results. In a few strains, when sufficient progeny were not available, the means are based on less than 10 replications.

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