

Effect
of
Phorate Carboforan,
Methomyl, and Disulfoton,
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Effect of Phorate, Carbofuran, Methomyl, and Disulfoton on Growth and Yield of Soybeans

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INTRODUCTION

THE EFFECTS (beneficial or detrimental) of insecticides on the morphology and physiology of crop plants is poorly understood. Arthur and Arant demonstrated plant growth inhibition after treatment with certain insecticides while Wressell and Driscoll suggested that systemic insecticides might stimulate plant growth and thus increase yields. Wheeler and Bass reported that phorate, carbofuran, methomyl, and disulfoton, when applied to soybeans, did not affect germination, number of mature pods per plant, or yield. They did report, however, that soybean plants were taller in plots treated with methomyl and carbofuran. The following experiment was conducted in order to clarify some of the findings of Wheeler and Bass.

METHODS AND MATERIALS

An experiment was conducted at the Gulf Coast Substation, Fairhope, Alabama, to determine some of the effects of disulfoton, phorate, carbofuran, and methomyl on soybean plants. These systemic insecticides were used with six methods of application. These were: granules in seed furrow at planting (plots were planted and granules applied by hand on June 17), granules as a layby sidedressing on July 16, foliar spray at first bloom (August

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6), foliar spray 2 weeks after first bloom (August 20), foliar spray 4 weeks after first bloom (September 3), and a combination of the previous five applications. Blooms began to appear on the soybean plants between July 30 and August 6. The first foliar sprays were applied to appropriate plots on August 6 using a hand operated 2-gallon Hudson sprayer. Later foliar sprays were applied on August 20 and September 3. The insecticide formulations utilized were disulfoton 15 percent G. and 6 pounds per gallon E. C., phorate 10 percent G., and 6 pounds per gallon E. C., carbofuran 10 percent G., and 4 pounds per gallon E. C., and methomyl 5 percent G. and 90 percent W. P. All treatments were applied at the rate of 1 pound per acre. Two untreated checks were provided, resulting in a total of 26 treatments. All treatments (including checks) were replicated four times in a completely randomized block design.

Each plot was 9½ feet wide (three rows) and 15 feet long with no alleys or buffer rows between plots. Soybean seed of the Bragg variety, inoculated with Nitragin®, were planted on June 17, by hand, at the rate of 14 seeds per foot.

Measurements of plant height were made on the following dates: July 16, July 30, August 13, August 27, and September 9. Measurements were made by selecting at random and measuring the tallest stem of 10 plants from the middle 10 feet of the record row in each plot.

Yield data were obtained by harvesting the middle 10 feet of the middle row in each plot on October 24. The soybeans were harvested in each plot by hand and threshed with a small thresher. The threshed beans were placed in paper bags which had been marked with the appropriate plot numbers. To obtain seed weight data, 100 seeds from each plot were weighed. Since seeds were thoroughly dry before harvest and held in the laboratory for several weeks before weighing, moisture content was assumed to be uniform at the time of weighing.

RESULTS

Plant-height measurements were taken to the nearest half-inch. Plants measured 3 weeks after planting averaged 13.8 inches for all plants. The mean extremes ranged from 12.7 inches in plots treated with phorate in the seed furrow to 15.5 inches in plots treated with methomyl in the seed furrow. The mean height of plants from the two untreated checks was 13.0 inches. There were no significant differences (5 percent level) in mean heights

detected among the treatments. Data were taken only from the check plots and plots which had received the appropriate treatments.

Overall mean plant height, taken 2 weeks after application of the July 16 (layby) sidedressing treatments, was 26.3 inches. The mean extremes of these data ranged from 25.0 inches in plots treated with phorate in the seed furrow to 27.6 inches in plots treated with carbofuran in the seed furrow in combination with an application as a sidedressing at layby. The mean height of plants from the two untreated checks was 25.7 inches. No significant differences existed among the treatment mean heights at the 5 percent level.

A third plant-height measurement was taken 1 week after the application of foliar sprays at first bloom. The mean height of all plants was 37.7 inches. The means ranged from 35.8 inches in plots treated with phorate, applied as a foliar spray at first bloom, to 39.9 inches in plots treated with methomyl, applied in

TABLE 1. THE MEAN HEIGHTS IN INCHES OF SOYBEAN PLANTS 1 WEEK AFTER THE APPLICATION OF THE THIRD FOLIAR SPRAY

Treatment*	\bar{x}
Untreated check.....	40.0a
Untreated check.....	42.2a
Disulfoton applied in seed furrow.....	42.5a
Disulfoton applied at layby.....	41.8a
Disulfoton applied at first bloom.....	42.5a
Disulfoton applied 2 weeks after first bloom.....	39.0a
Disulfoton applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	42.7a
Phorate applied in seed furrow.....	39.3a
Phorate applied at layby.....	40.3a
Phorate applied at first bloom.....	40.0a
Phorate applied 2 weeks after first bloom.....	41.6a
Phorate applied 4 weeks after first bloom.....	42.3a
Phorate applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	40.9a
Carbofuran applied in seed furrow.....	40.0a
Carbofuran applied at layby.....	40.5a
Carbofuran applied at first bloom.....	40.4a
Carbofuran applied 2 weeks after first bloom.....	42.5a
Carbofuran applied 4 weeks after first bloom.....	43.1a
Carbofuran applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	41.6a
Methomyl applied in seed furrow.....	42.9a
Methomyl applied at layby.....	38.8a
Methomyl applied at first bloom.....	42.1a
Methomyl applied 2 weeks after first bloom.....	42.7a
Methomyl applied 4 weeks after first bloom.....	39.8a
Methomyl applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	40.8a

* Means designated by the same letter do not differ significantly at the 5 percent level.

the seed furrow. The mean plant height from the two untreated checks was 36.8 inches. No significant differences existed at the 5 percent level among the treatment means.

A fourth plant-height measurement was taken 1 week after the application of foliar sprays 2 weeks after first bloom. The overall mean plant height at this time was 40.4 inches. The mean height ranged from 38.8 inches in plots treated with phorate as a foliar spray at first bloom and plots treated with methomyl as a sidedressing at layby to 42.6 inches in plots treated with disulfoton as a foliar spray 2 weeks after first bloom. The mean plant height from the two untreated check plots was 40.3 inches. No significant differences existed among treatment mean heights at the 5 percent level.

The fifth, and last, plant-height measurement was taken 1 week after the third application of foliar sprays 4 weeks after the first bloom, Table 1. These data revealed an overall mean plant

TABLE 2. THE MEAN SOYBEAN YIELDS IN BUSHELS PER ACRE AFTER THE INDICATED TREATMENTS

Treatment*	\bar{x}
Untreated check.....	35.3a
Untreated check.....	39.7a
Disulfoton applied in seed furrow.....	33.1a
Disulfoton applied at layby.....	36.3a
Disulfoton applied at first bloom.....	37.8a
Disulfoton applied 2 weeks after first bloom.....	38.0a
Disulfoton applied 4 weeks after first bloom.....	36.6a
Disulfoton applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	38.6a
Phorate applied in seed furrow.....	37.1a
Phorate applied at layby.....	39.2a
Phorate applied at first bloom.....	36.9a
Phorate applied 2 weeks after first bloom.....	31.5a
Phorate applied 4 weeks after first bloom.....	38.1a
Phorate applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	40.4a
Carbofuran applied in seed furrow.....	37.1a
Carbofuran applied at layby.....	37.5a
Carbofuran applied at first bloom.....	34.1a
Carbofuran applied 2 weeks after first bloom.....	36.6a
Carbofuran applied 4 weeks after first bloom.....	39.9a
Carbofuran applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	37.5a
Methomyl applied in seed furrow.....	35.3a
Methomyl applied at layby.....	38.1a
Methomyl applied at first bloom.....	36.1a
Methomyl applied 2 weeks after first bloom.....	35.1a
Methomyl applied 4 weeks after first bloom.....	37.4a
Methomyl applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	33.3a

* Means designated by the same letter do not differ significantly at the 5 percent level.

height of 41.3 inches. The mean extremes ranged from 38.8 inches in plots treated with methomyl as a sidedressing at layby to 43.1 inches in plots treated with carbofuran as a foliar spray 4 weeks after the first bloom. The mean plant height from the check plots was 41.1 inches. No significant differences existed among treatment height means at the 5 percent level.

The average yield mean from all plots was 36.8 bushels per acre. The yield means ranged from 31.5 bushels per acre from plots treated with phorate as a foliar spray 2 weeks after first bloom to 39.9 bushels per acre from plots treated with carbofuran as a foliar spray 4 weeks after first bloom, Table 2. The yield mean from check plots was 37.5 bushels per acre. There were no significant differences among yields.

The average weight of 100 seeds from both treated and untreated plots was 15.0 grams. The means by treatments ranged from 14.3 grams from plots that received carbofuran combination

TABLE 3. THE MEAN WEIGHTS IN GRAMS OF 100 SEEDS AFTER THE INDICATED TREATMENTS

Treatment*	\bar{x}
Untreated check.....	14.8a
Untreated check.....	14.8a
Disulfoton applied in seed furrow.....	15.2a
Disulfoton applied at layby.....	14.8a
Disulfoton applied at first bloom.....	15.3a
Disulfoton applied 2 weeks after first bloom.....	15.4a
Disulfoton applied 4 weeks after first bloom.....	14.9a
Disulfoton applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	15.3a
Phorate applied in seed furrow.....	14.9a
Phorate applied at layby.....	14.5a
Phorate applied at first bloom.....	15.2a
Phorate applied 2 weeks after first bloom.....	15.1a
Phorate applied 4 weeks after first bloom.....	14.8a
Phorate applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	15.2a
Carbofuran applied in seed furrow.....	15.0a
Carbofuran applied at layby.....	14.8a
Carbofuran applied at first bloom.....	14.8a
Carbofuran applied 2 weeks after first bloom.....	14.5a
Carbofuran applied 4 weeks after first bloom.....	15.1a
Carbofuran applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	14.3a
Methomyl applied in seed furrow.....	15.8a
Methomyl applied at layby.....	14.6a
Methomyl applied at first bloom.....	14.8a
Methomyl applied 2 weeks after first bloom.....	14.9a
Methomyl applied 4 weeks after first bloom.....	14.9a
Methomyl applied in seed furrow, at layby, at first bloom, 2 weeks after first bloom, and 4 weeks after first bloom.....	15.7a

* Means designated by the same letter do not differ significantly at the 5 percent level.

treatments to 15.8 grams from plots that received methomyl in the seed furrow. The mean weight per 100 seeds from the checks was 14.8 grams, Table 3. No significant differences existed among the means.

There were no significant differences among treatment means throughout this experiment. The insecticides tested had little effect, if any, on soybean plants when applied at the rate of 1 pound per acre.

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