FOLIAR APPLICATION OF 2-SEC-BUTYL-4, 6-DINITROPHENOL (DINOSEB) AS A GROWTH STIMULANT ON CORN, ZEA MAYS

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ABSTRACT

FOLIAR APPLICATION OF 2-SEC-BUTYL-4,6-DINITROPHENOL (DINOSEB) AS A GROWTH STIMULANT ON CORN, ZEA MAYS

By

Dennis Fred Kozak

The response of corn, *Zea mays* to 2-sec-butyl-4,6-dinitrophenol (dinoseb), as a growth stimulant, was studied in four experiments. (1) Eight hybrids in two planting dates (May 30, and June 9) were treated with four grams dinoseb per acre. (2) Eight inbred lines of corn were treated with four grams per acre. (3) Four rates (2, 4, 7 and 14 grams per acre) were applied to Michigan 407-2X hybrid on four different dates (June 20, 26, July 2, and 9). (4) Treated (four grams per acre) and untreated plots were compared at 13 overstate locations.

Effects on yield were erratic and inconsistent with relatively few significant differences. Among the significant differences in yield, there were both increases and decreases. Interactions of hybrid x treatment and inbred x treatment were not statistically significant indicating that hybrids and inbreds did not react differently to dinoseb*.

* Dinoseb formulation used was SPARK, Helena Chemical Co.

There were significant differences in yield due to date of application but no significant differences due to rate of application. The interaction date x rate was significant indicating a differential response depending on date and rate of application.

Yields increased significantly at three overstate locations and decreased significantly at four locations with no significant differences at six locations. Treated plots averaged 131.1 bushels per acre and untreated check plots averaged 130.9 bushels.

Differences in ear tip fill and barren plants were generally small, not significant and were not consistent with the yield differences. There were no significant differences in shelling percent, grain moisture at harvest, dates of tasseling and silking.

It is not possible to give an unqualified recommendation for dinoseb as a growth stimulant for corn production based on the results of one-year testing in Michigan.

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Dennis Fred Kozak

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INTRODUCTION

Sub-lethal doses of herbicides may beneficially stimulate the growth of some crop plants.

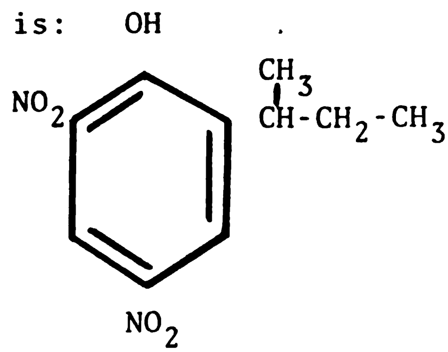
Ohlrogge and associates (16, 17, 18, 19, 20) found that minute amounts of dinoseb (2,sec-butyl-4,6 dinitrophenol) applied during early stages of tassel differentiation increased corn yields in Indiana. Results from unpublished trials in Wisconsin, Illinois, and Michigan in 1975 showed erratic responses.

The objective of this study was to evaluate dinoseb for growth response in corn. (1) Eight hybrids and eight inbreds were treated with one rate and date of application, (2) One corn hybrid, Michigan 407-2X, was treated with dinoseb at four rates and dates of application, and (3) A single treatment was applied at 13 overstate locations in Michigan.

REVIEW OF LITERATURE

Physical and Chemical Properties

2,sec-butyl-4,6 dinitophenol, hereafter referred to as dinoseb, is a dark brown solid or viscous dark orange liquid with a melting point at 32^{o}C and an acute oral LD_{50} of 40-60 mg/kg. The structural formula is:



The molecular formula is $C_{10}H_{12}N_2O_5$ and the molecular weight is 240.2.

Dinoseb is only slightly soluble in water, but fairly soluble in ethanol. It is miscible in ethyl ether, toluene and xylene (2).

Barrons, et al (2) summarized some of the biological properties of dinoseb. Dinoseb is a quick acting contact herbicide. No significant translocation occurs within the plant. Residue studies failed to reveal movement from the exposed tissue to edible plant parts, even in minute quantities. Only plant parts actually contacted with dinoseb are affected. Monocots are difficult to kill beyond the seedling stage due to the protected nature of the growing points. Plants with thick cuticles are relatively tolerant to foliar sprays of water soluble salts of dinoseb. Waxy leaf surfaces are naturally difficult to wet.

When applied preemergence, dinoseb's presence in the soil surface results in death of most small-seeded weeds as they germinate.

Like most other substituted phenols, dinoseb is readily attacked by soil microoganisms and remains active for a relatively short period in the soil, 3-6 weeks (2).

Dinoseb moves as a vapor from very warm moist soil surfaces and may injure leaves or stems of crop seedlings under some conditions. This phenomenon is believed to be a result of vapor distillation (2).

Dinoseb is readily tied up by colloidal organic matter. Its activity is increased when warm humid conditions exist at the time of application, especially when plant growth is rapid prior to application (2).

Meggitt, Aldrich, and Shaw (14) demonstrated that the activity of dinoseb on soybeans increased as temperature increased from 60^{o} to $96^{o}C$. They felt that rate of infiltration and activity increased with temperature. They found that light after treatment reduced the effects of dinoseb while light conditions prior to treatment had no effect. Plants grown under low light intensities were injured more than those grown under high light intensities.

Taylor and Warren (21) showed that the basipetal movement of IAA (Indole Acetic Acid) in plant cells was inhibited by concentrations of dinoseb which stimulated respiration ($5 \times 10^{-7}M$ to $5 \times 10^{-8}M$). Acropetal movement was stimulated by dinoseb concentrations greater than $10^{-5}M$.

Wojtaszek (24) studied the resistance of several plant species to dinoseb. He postulated that resistance was due to the ability of the plant to produce ATP through photophosphorylation. Highly susceptable species (lambsquarter, Chenopodium album, and cabbage, Brassica oleracea capitata) accumulated more ^{32}P in the dark by oxidative phosphorylation. Highly resistant species (pigweed, Amaranthus retroflexus, and crabgrass, Digitaria sanguinalis) accumulated more ^{32}P and subsequently produced more ATP in light than in the dark.

Dinoseb Formulations

Dinoseb is available in several formulations (6): The phenol form (Dow General Weed Killer or Sinox General) is used as a general contact herbicide in orchard, vineyards and forage legumes and as a desiccant to facilitate harvest of potatoes.

The ammonium salt (Dow Selective Weed Killer) and Sinox W) is used as a selective contact herbicide in flax, beans, peas, leek, potatoes, coffee, vineyards, orchards and certain other crops and as a desiccant for potatoes and legumes.

The alkanolamine salts such as Premerge 3 (Dow Chemical Co.) is applied to kill geminating seeds contained in the upper soil surface layers in preemergence treatments and also in early post-emergence and directed sprays in several crops. It has been applied to corn as a foliar spray at very low rates as a growth stimulant.

The dinoseb formulation studied in this investigation was SPARK (Helena Chemical Co.). It is a formulation of the alkanolamine salt with a wetting agent and an anti-foaming agent. It is used as a growth stimulant on corn.

Mode of Action of Dinoseb When Used at Herbicide Rates

Dinoseb has been demonstrated to be an inhibitor of oxidative phosphorylation (7, 12, 15, 22, 23). Wojtaszek, Cherry, and Warren (25) working with tomato, *Lyopersicon escalentum* Mill., leaf discs demonstrated that dinoseb inhibited ATP generation, uncoupled oxidative phosphorylation and inhibited ^{32}P accumulation.

Dinoseb appears to uncouple oxidative phosphorylation and to inhibit ATP generation when applied at herbicidal rates. Rates of application when used as a herbicide range from 0.75 to 12 pounds per acre, depending on the crop and weed species.

Dinoseb Formulations Used as Corn Growth Stimulants

Premerge 3 contains three pounds of active dinoseb per gallon. Ohlrogge and associates (17, 18, 20) recommended 0.4 ounce (a.i.) per acre for use as a growth stimulant on corn. For ground application, four fluid ounces of Premerge 3 in 250 gallons of water applied at delivery rate of 25 gallons per acre is recommended. For aerial application, one pint (16 fluid ounces) of Premerge 3 in 150 gallons of water at 3-5 gallons per acre is recommended. An EPA approved non-ionic agricultural surfactant such as Tronic, X-77 or Tween 20 should be used at a rate of 1/2 pint per 100 gallons of spray solution.

SPARK is specifically formulated as a biostimulant for corn. It contains 0.073 lbs. dinoseb per gallon plus a wetting agent and an anti-foaming agent. Recommended rates are one pint of SPARK in 15 gallons of water per acre for ground applications and one pint in five gallons of water per acre for aerial application (17).

Ohlrogge (16, 17, 18, 20) recommended that SPARK or Premerge 3 be applied when the unemerged tassel is 1/2 - 7 inches in length. This interval may last 7-10 days depending upon weather conditions, variety, time of planting and location.

Ohlrogge (17) estimated that 40,000 acres were treated in 1974, 250,000 acres in 1975 in Indiana and another 250,000 acres in other states in 1975. As of June 1976, Federal labeling had not been obtained. State labels for SPARK had been obtained for use in 16 states (Iowa, Kansas, Wisconsin, Ohio, Pennsylvania, Delaware, Alabama, Virginia, Nebraska, Missouri, Indiana, Kentucky, Michigan, New Jersey, Maryland and South Carolina). State labels approve use for grain production only and treated foliage should not be grazed or used as silage for livestock. Use on sweet corn and popcorn has not been approved.

Previous Work With Dinoseb as a Corn Growth Stimulant

Ohlrogge and associates (20) applied Premerge 3 to the leaves of hybrid corn two weeks prior to tassel emergence.

Grain yields were increased significantly at the 5% level of probability. They applied dinoseb at 0.0, 2.5, 5.0, 10.0, 20.0, and 40.0 grams per acre at two dates. Significant increases in rate of silk emergence, plant and ear height, kernels per acre and shelling percentage were obtained when treated with Premerge 3. Barren plants decreased.

They (20) concluded that Premerge 3 (dinoseb) as a foliar spray for corn increased yield five to ten percent. Rates of two to five grams dinoseb per acre applied broadcast two to three weeks before the tassels emerged appeared to give the best response. Some hybrids may be more responsive than others. The beneficial effects appeared to result from both growth stimulation and fungicidal properties of Premerge 3.

In a study of the effect of a wetting agent, they (20) obtained a 55 bushel decrease in corn yield when a wetting agent, Tween 20, in water with no dinoseb was applied. The yields were:

Treatment	Yield (bu/acre)
Water alone (30 gallons/A)	165
Tween 20 + water	110
Twwen 20 + 1 gram dinoseb + water	157
Tween 20 + 2.5 gram dinoseb + water	161
Tween 20 + 5 gram dinoseb + water	162
Tween 20 + 10 gram dinoseb + water	166
Tween 20 + 30 gram dinoseb + water	168

They explained that the sharp decrease in yield was due to smut infection. The solutions containing Tween 20 washed smut spores from the leaves into the leaf whorl where they infected meristematic tissue. Much less run-off into the whorl occurred when water alone was applied. They felt that the addition of dinoseb to the solution appeared to provide some fungicidal action to control smut infection.

Oplinger and Brickbauer (19) concluded from three years (1973-75) of testing in Wisconsin that 6 grams per acre of dinoseb (Premerge 3) increased corn yield 3-5%. The differences were not consistent and not all were statistically significant. Silk emergence was about two days earlier on treated plants. They recommended that farmers with high yield potentials (100+ bushels per acre) try it in 1976 with untreated check strips in their fields.

Hicks and Miller (10, 11) found no significant yield differences in Minnesota, 1974 and 1975, using various rates of Premerge 3. The differences due to treatment ranged from 1-8 bushel increases and 1-3 decreases with none being significant.

Properties of Other Dinitophenol Compounds

Several other dinitrophenol compounds produce growth stimulating effects when applied as low rates.

Krul (13) has shown that 2,4-dinitrophenol (DNP) at a rate of 100mM increased the number of root primordia in hypocotyls of pinto bean, *Phaseolus vulgaris* L., when kept in darkness.

Bruinsma (3) sprayed a young crop of winter rye (6-10 inches tall) with 4-6-dinitro-o-cresol (DNOC) and observed a 10% increase in grain yield. Vegetative growth of treated plants was retarded at first but later recovered and surpassed the control plants in fresh and dry weight. He postulated that the yield increase was due to stronger vegetative growth and a longer period of generative development.

Crafts (5) in 1945, reported that the fresh weight of oats Avena sativa was increased when DNOC was mixed with soil at a rate of 15 ppm. Crafts treated eleven different soils with DNOC. Nine showed stimulation when treated in the range of 5 to 15 ppm. Crafts suggested that the increased plant weight did not result from any nitrogen in the compound.

MATERIALS AND METHODS

The dinoseb formulation, SPARK, from Helena Chemical Company was used in all experiments. Treatments were applied to the foliage (plant whorl) with a Hudson back-pack sprayer, equipped with a Teejet fan nozzle #3730308, at a delivery rate of 25 gallons per acre and a pressure of 30 pounds per square inch.

The following parameters were measured in Experiments A, B, and C:

1) plant height at time of application,
2) number of unrolled leaves at time of application,
3) date of tassel emergence (determined when 50% of plants in the plots had tassels that were visible without moving leaves aside),
4) date of silk emergence (determined when 50% of plants in the plot had more than 3 cm of silk protruding),
5) % barren plants,
6) % moisture in grain at harvest,
7) centimeters of bare tips on ears,
8) shelling percentage, and
9) yield in bushels of shelled corn per acre at 15.5% moisture.

The following parameters were measured in the overstate experiments:

1) % barren plants,

2) centimeters of bare tips on ears,

3) shelling percentage, and

4) yield in bushels of shelled corn per acre at 15.5% moisture.

All plots at East Lansing (Experiments A, B and C) were irrigated to maintain optimum plant growth.

Analyses of variance were calculated for each experiment. In addition to the usual 5% and 1% probability levels, confidence limits at a 25% level of probability were calculated and used in interpreting the data. Carmer (4) has defended the use of significance levels of α = .20 to .40. Some researchers are willing to accept lower significance levels than the traditional values of α = .05 or .01.

Analysis of variance tables are not presented when there were no significant differences for the characteristic analyzed.

EXPERIMENT A: Effects on Eight Different Corn Hybrids

The experimental design consisted of eight corn hybrids planted in a systematic arrangement, two dates of planting (May 30, and June 9), two treatments (treated and control) with three replications. Each plot was 30 feet long in 36-inch rows. Dinoseb at a rate of 4 grams per acre was applied approximately two weeks prior to tassel emergence. Agronomic information is given in the footnotes of Tables 1 and 2. Unemerged tassels were within the range of 1/2-7 inches in length as determined by longitudinal sectioning of a few plants of each hybrid.

EXPERIMENT B: Effects on Eight Different Corn Inbreds

A randomized split plot design with eight inbred lines of corn treated and untreated and four replications was planted June 4, 1976. The main plots were treatments and the sub-plots were inbred lines. Dinoseb at a rate of 4 grams per acre, was applied when unemerged tassels were 1/2 - 7 inches in length as determined by longitudinal slicing of a few plants of each inbred. Plot size was one row 30 feet long in 36-inch rows. Other agronomic information is presented in the footnotes of Table 3.

EXPERIMENT C: Effects of Rate and Date of Application

One hybrid, Michigan 407-2X, planted May 10, was used for the rate and date experiment. A randomized split plot design with four dates of application (June 20, 26, July 2, 9) as main plots and five rates (0, 0.5, 1.0, 1.75, and 3.5 pints of SPARK per acre) as sub-plots was replicated four times. The four dates correspond to four, three, two and one week before tassel emergence. The five rates of SPARK equalled 0, 2, 4, 7, and 14 grams dinoseb per acre, respectively.

OVERSTATE EXPERIMENTS

Replicated plots, including a control and one treatment (one pint SPARK in 25 gallons water per acre), applied about two weeks before tassel emergence, were grown at 13 overstate locations in 1976. Dissected plants showed that the unemerged tassels were two to six inches in length when the plots were treated. The hybrid was Michigan 407-2X at 12 locations and Michigan 3093 at one location. Plot size was one row 37 feet long in 30-inch rows. The treatment was applied with a back-pack sprayer.

RESULTS

Eight Hybrids in Two Dates of Planting Treated with Dinoseb, Experiment A

Yield differences due to treatment with dinoseb were not statistically significant for any of the eight hybrids in either date of planting (Table 1, 1A and 1B). the average yield increase due to treatment was only 2.0 bushels for the May 30, planting while there was an average 4.0 bushel decrease for the June 9, planting. In the May 30, planting there were five increases (15.1, 17.0, 3.0, 11.1 and 5.1 bushels) and three decreases (4.1, 16.0 and 15.5 bushels) in comparison of treated and untreated check means for eight hybrids. For the June 9, planting, there were two increases (0.8 and 2.5 bushels) and six decreases (4.8, 4.4, 12.5, 0.9, 1.9, and 11.5 bushels) in treated vs. untreated yield comparisons among the eight hybrids.

None of these yield differences were statistically significant. There was no consistent yield response that could be credited to treatment with dinoseb.

The interaction, hybrids x treatments, was not significant, indicating that the hybrids did not respond to treatment (Table 1A).

The difference (1.4 vs. 1.7 cm.) in bare ear tips was significant at the 25% level of probability for the May 30, planting but not the June 9, planting (Tables 1 and 1C). The average difference in percent barren plants, 1.9% less on treated plots, was not significant for the May 30, planting. In the June 9, planting, treated plots averaged 2.0% more barren plants, significant at the 25% level of probability (Table 1 and 1D).

Ohlrogge, et al (16, 17, 19, 20, 25) found that corn treated with dinoseb had better ear tip fill, fewer barren plants and more second ears which seemed to account for the increased yields. The yield differences in Experiment A, were inconsistent and not significant. Also, the differences in tip fill and barren plants were inconsistent.

Shelling percent and moisture content at harvest were unaffected by treatment with dinoseb (Table 1).

A pre-mature frost occurred on September 24, before corn at either date of planting was physiologically mature. There is no evidence that the frost affected the results from dinoseb treatments.

Date of tassel and silk emergence were not affected by treatment in either planting date (Table 2). Oplinger and Brickbauer (19) found that treated plants silked and pollinated about two days earlier but matured about the same time as untreated plants.

Table 1. Yield, shelling percent, centimeters of bare tips, percent barren plants and percent grain moisture at harvest for eight corn hybrids treated with dinoseb and untreated check for two dates of planting. Experiment A.

Hybrid	Yield (Bu/A)		Shelling %		Bare ear tips (cm)		% Barren plants		% Moisture in grain	
	T	C	T	C	T	C	T	C	T	C
May 30 planting										
Michigan 3093	87.5	72.4	84	82	1.3	1.4	8.8	17.4	40.6	42.3
Michigan 3102	121.0	104.0	84	84	1.7	1.7	8.4	11.1	43.3	45.4
Michigan 333-3X	117.0	114.0	85	85	1.9	2.1	3.8	4.5	45.9	43.7
Michigan 407-2X	138.6	142.7	85	86	1.2	2.0	1.3	1.7	49.4	49.8
Michigan 4122	128.0	116.9	85	86	1.2	1.0	4.7	9.4	49.4	49.0
Michigan 5443	111.0	127.0	85	85	1.8	2.2	9.6	10.2	51.4	51.5
Michigan 575-2X	150.9	145.8	85	85	1.3	1.8	9.5	9.4	52.5	51.4
Michigan 5802	141.0	156.5	86	86	1.0	1.7	3.1	0.7	52.9	49.8
Average	124.4	122.4	85	85	1.4	1.7	6.2	8.1	48.2	47.8
Significance level	NS		NS		25%		NS		NS	
June 9 planting										
Michigan 3093	95.5	94.7	82	82	0.7	1.1	2.7	3.3	55.8	55.7
Michigan 3102	95.6	100.4	81	81	0.4	0.5	9.3	4.7	57.5	56.4
Michigan 333-3X	92.2	96.6	82	83	0.6	0.4	19.8	13.4	64.7	63.6
Mihcigan 407-2X	88.8	101.3	81	80	0.2	0.2	4.5	2.5	62.2	60.8
Michigan 4122	73.2	74.1	82	83	1.0	0.5	6.9	4.0	61.0	61.2
Michigan 5443	109.1	111.0	81	83	0.3	0.6	8.6	4.8	63.8	62.8
Michigan 575-2X	101.9	99.4	83	82	0.9	0.9	4.9	9.4	62.3	62.1
Michigan 5802	137.4	148.9	82	81	0.2	0.2	4.0	2.9	62.4	61.7
Average	99.3	103.3	82	82	0.5	0.6	7.6	5.6	61.2	60.5
Significance level	NS		NS		NS		25%		NS	

T = treated C = untreated check NS = no statistical significance

Planted-5/30 & 6/9/76 Harvested-10/5/76 Plant Population-24,200 Row spacing-36"
Soil test: pH-7.0, P-175 (high), K-180 (medium)
Fertilizer: 250 pounds per acre 19-19-19 at planting and 100 pounds per acre N as anhydrous ammonia 5 weeks after emergence.

Table 1A. Analysis of variance of yield (bushels per acre) for Experiment A, May 30, planting.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	2	2072.37	1035.69	3.83929*
Hybrid	7	21928.3	3132.62	11.6126**
Treatment	1	46.8125	46.8125	.173534
Hybrid x treatment	7	1720.56	245.795	.911159
Error	30	8092.81	269.76	
Total	47	33859.9		

Approximate F statistic with		25%(+)	5%(*)	1%(**)
	2 and 30 df	1.48	3.32	5.39
	7 and 30 df	1.38	2.33	3.3
	1 and 30 df	1.38	4.17	7.56

Table 1B. Analysis of variance of yield (bushels per acre) for Experiment A, June 9, planting.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	2	3786.03	1893.02	6.97193**
Hybrid	7	16374.3	2339.18	8.61513**
Treatment	1	197.375	197.375	.726927
Hybrid x treatment	7	323.156	46.1652	.170025
Error	30	8145.59	271.52	
Total	47	28826.5		

Approximate F statistic with		25%(+)	5%(*)	1%(**)
	2 and 30 df	1.48	3.32	5.39
	7 and 30 df	1.38	2.33	3.3
	1 and 30 df	1.38	4.17	7.56

Table 1C. Analysis of variance for bare ear tips (cm) in Experiment A, May 30, planting.

Source of Variance	df	Sum of square	Mean square	F Ratio
Replication	2	1.70406	.852032	2.08635†
Hybrid	7	4.23392	.604845	1.48107†
Treatment	1	1.16874	1.16874	2.86186†
Hybrid x treatment	7	1.30887	.186981	.457856
Error	30	12.2515	.408385	
Total	47	20.6671		

Approximate F statistic with		25%(†)	5%(*)	1%(**)
	2 and 30 df	1.48	3.32	5.39
	7 and 30 df	1.38	2.33	3.3
	1 and 30 df	1.38	4.17	7.56

Table 1D. Analysis of variance for % barren plants in Experiment A, June 9, planting.

Source of Variance	df	Sum of square	Mean square	F Ratio
Replication	2	345.04	172.52	6.30653**
Hybrid	7	808.88	115.545	4.22413**
Treatment	1	46.4131	46.4131	1.69665†
Hybrid x treatment	7	118.86	16.9801	.620712
Error	30	820.673	27.3558	
Total	47	2139.87		

Approximate F statistic with		25%(†)	5%(*)	1%(**)
	2 and 30 df	1.48	3.32	5.39
	7 and 30 df	1.38	2.33	3.3
	1 and 30 df	1.38	4.17	7.56

Table 2. Plant height and number of unrolled leaves on date of treatment and number of days after treatment to tassel and silk emergence for eight hybrids treated with dinoseb and untreated check for two dates of planting. Experiment A.

Hybrid	Plant height (inches)	Number of leaves unrolled	Days to tassel emergence		Days to silk emergence	
			T	C	T	C
		May 30 planting				
Michigan 3093	39.0	10	9	8	15	16
Michigan 3102	35.0	10	11	9	16	16
Michigan 333-3X	34.5	10	10	10	17	16
Michigan 407-2X	34.0	10	14	12	20	20
Michigan 4122	35.5	10	15	12	18	17
Michigan 5443	33.0	10	10	10	18	19
Michigan 575-2X	35.0	10	13	12	19	19
Michigan 5802	33.0	10	13	12	20	20
Average	34.9	10	12	11	18	18
		June 9 planting				
Michigan 3093	35.0	10	14	15	19	19
Michigan 3102	30.3	10	17	16	22	21
Michigan 333-3X	27.0	10	19	19	24	25
Michigan 407-2X	28.0	10	20	20	25	25
Michigan 4122	33.0	10	19	19	23	23
Michigan 5443	30.0	10	18	19	24	23
Michigan 575-2X	30.6	10	19	19	24	23
Michigan 5802	33.6	10	19	20	23	23
Average	30.9	10	18	18	22	23

Treated = treated C = untreated check

<u>Eight Inbred Corn Lines Treated With Dinoseb, Experiment B</u>

The average yield increase due to treatment with dinoseb was 5.1 bushels, significant at the 25% level of probability (Table 3 and 3A). Seven (Oh545, Mo.17, MS153, A619-Ht, W64A, MS93 and A632-Ht) of eight inbreds showed yield increases of 5.7, 7.7, 4.0, 16.7, 3.8, 4.9 and 1.8 bushels respectively, when treated. The only significant difference at the 25% level of probability was that for A619-Ht, 16.7 bushels.

The decrease in yield of 4.5 bushels for MS70 was not significant.

The interaction of inbreds x treatments was not significant, supporting the conclusion that the inbreds did not react differently to treatment.

Differences in bare ear tips and barren plants did not consistently correspond to the differences in yield. Treatment effects on shelling percent, bare ear tips, barren plants and moisture of grain at harvest were not statistically significant.

There were no significant nor consistent differences in tassel and silk emergence due to treatment with dinoseb (Table 4.).

Table 3. Yield, shelling percent, centimeter of bare ear tips, percent barren plants and percent grain moisture at harvest for eight inbred lines of corn treated with dinoseb and untreated checks. Experiment B.

Inbred	Yield (Bu/A)		Increase (+) or decrease (-)	Shelling %		Bare ear tips (cm)		% Barren plants		% Moisture in grain	
	T	C		T	C	T	C	T	C	T	C
Oh545	28.4	22.7	+5.7	67	69	1.6	2.6	30.5	0.0	80.9	81.7
Mo17	39.2	31.5	+7.7	73	72	0.8	0.3	5.3	6.4	76.3	76.7
MS70	33.8	37.8	-4.5	74	77	1.4	1.5	9.8	7.9	70.1	69.1
MS153	53.3	49.3	+4.0	73	74	0.9	1.2	0.0	0.0	73.0	76.7
A619-Ht	60.8	44.1	+16.7	81	79	1.2	1.2	14.2	11.3	72.8	73.3
W64A	59.8	56.0	+3.8	75	77	1.2	0.7	5.3	9.6	65.6	64.1
MS93	63.0	58.1	+4.9	80	80	1.0	1.3	0.8	14.5	60.8	61.5
A632-Ht	49.9	48.1	+1.8	76	75	3.9	2.9	0.0	2.2	69.5	64.7
Average	48.5	43.4		75	75	1.5	1.5	8.2	8.4	71.1	70.9
Significance level	25%			NS		NS		NS		NS	

T = treated C = untreated check NS = no statistical significance

Planted-5/18/76 Harvested-10/6/76 Plant population-24,000 Row spacing-36"
Soil test: pH-7.0, P-138 (high), K-144 (low)
Fertilizer: 250 pounds per acre 19-19-19 at planting and 100 pounds per acre N as anhydrous ammonia 5 weeks after emergence

LSD: at 25% level of probability:
Treated vs. untreated means = 3.19 bushels per acre.
Inbred x treatment = 9.03 bushels per acre.

Table 3A. Analysis of variance for yield (bushels per acre) in Experiment B.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	3	54.4375	18.1458	.157611
Inbred	7	8541.19	1220.17	10.5982**
Treatment	1	410.031	410.031	3.56146†
Inbred x treatment	7	474.156	67.7366	.588348
Error	45	5180.86	115.13	
Total	63	14660.7		

Approximate F statistic with		25%(†)	5%(*)	1%(**)
	3 and 45 df	1.42	2.84	4.31
	7 and 45 df	1.36	2.25	3.12
	1 and 45 df	1.35	4.08	7.31

Table 4. Plant height and number of unrolled leaves on date of treatment and number of days after treatment to tassel and silk emergence for eight inbred lines of corn treated with dinoseb and untreated checks. Experiment B.

Inbred	Plant height (inches)	Number of leaves unrolled	Days to tassel emergence		Days to silk emergence	
			T	C	T	C
Oh545	21.8	8	20	18	27	24
Mo17	22.6	8	25	25	31	30
MS70	22.3	10	20	22	26	28
MS153	23.8	8	19	18	27	26
A619-Ht	20.3	8	17	21	24	27
W64A	20.8	9	21	21	24	26
MS93	27.0	9	12	13	17	17
A632-Ht	20.5	8	19	21	28	28
Average	22.4	9	19	20	26	26

T = treated C = untreated check

Rate x Date of Application, Experiment C

Sixteen date-rate treatment combinations averaged 6.2 bushels less than the average of untreated checks, 155.4 vs. 161.6 bushels per acre (Table 6). The main effect for dates of application was significant at the 25% level of probability due to the lower average yield for the last date of application, July 9, (Table 5, 5A and 6). The lower average yield for the July 9, application does not appear to be due to injury since yields did not decline with increasing rates. There was a significant decrease in yield for the 7 gram rate compared to the check for July 9, application but no difference for the 2, 4 and 17 gram rates.

Differences in yield due to rates of dinoseb application were not significant (Table 5A and 6). Average yields for the four rates (2, 4, 7 and 14 grams per acre) were 7.2, 5.9, 6.2 and 5.7 bushels per acre lower than the average of the check yields. The interaction, date x rate, was significant indicating that the yield effects due to date of application varied depending on the rate of application and vice versa.

There were five significant differences among 16 specific rate and date treatment combinations (underlined in Table 5) when compared with the untreated check yields. These differences (one significant increase and four significant decreases did not follow a consistent pattern.

The 2 gram rate applied June 20, produced the only significant increase (21.1 bushels) compared to the check, 177.3 vs. 156.2 bushels. Four significant decreases (21.0, 16.2, 36.0 and 20.9 bushels) occurred with treatments of

4 grams on June 20, 14 grams on June 26, 2 grams on July 2 and 7 grams on July 9. None of the other 11 treatment combinations were significantly different from the check yields.

There was an overall lack of consistency in yields among treatment rates from one date to the next. No well defined pattern of response between dates of application were apparent.

Variability in plot yields may have resulted from incomplete irrigation coverage and soil variability. These sources of variability appear to have had greater effect than any of the treatment combinations. The four check yields varied from 154.9 - 170.2 bushels, a difference of 15.3 bushels which was significant at the 25% level of probability.

Analysis of variance (Table 5B) for barren plants indicated some significant differences at the 25% level of probability for specific rate and date treatment combinations. These differences did not correspond with any trend in yields and were inconsistent. Main effects for dates and rates were not significant.

Differences in shelling percent, bare ear tips and percent moisture content of grain at harvest were not statistically significant.

Dates of tassel emergence or silk emergence were not affected by any specific date and rate of treatment combination (Table 7).

Table 5. Yield, shelling percent, centimeters of bare ear tips, percent barren plants and percent moisture in grain at harvest for Michigan 407-2X corn hybrid treated with four rates of dinoseb on four dates with untreated checks. Experiment C.

Date	Rate (gm/A)	Yield (Bu/A)	Increase (+) or decrease (-)	Shelling %	Bare ear tips (cm)	% Barren plants	% Moisture
6/20	Check	156.2	-----	85	1.2	0.5	40.8
	2.0	177.3	+21.1	86	1.7	0.0	42.8
	4.0	135.2	-21.0	85	1.4	0.0	44.8
	7.0	161.9	+ 5.7	86	1.3	5.0	43.9
	14.0	154.0	- 2.2	86	1.5	0.0	36.6
Treated Average		157.1		86	1.5	1.3	42.0
6/26	Check	165.1	-----	86	1.4	3.8	40.7
	2.0	156.8	- 8.3	87	1.5	4.8	42.0
	4.0	166.9	+ 1.8	86	1.5	0.2	44.6
	7.0	154.1	-11.0	81	1.3	4.8	41.6
	14.0	148.9	-16.2	86	1.2	3.9	38.4
Treated Average		156.7		85	1.4	3.4	41.7
7/2	Check	170.2	-----	87	0.8	0.0	43.2
	2.0	134.2	-36.0	81	1.3	1.7	40.5
	4.0	171.3	+ 1.1	87	1.6	6.8	41.5
	7.0	171.5	+ 1.3	87	1.3	0.0	41.8
	14.0	164.8	- 5.4	86	1.7	0.6	44.4
Treated Average		160.5		85	1.5	2.3	42.1
7/9	Check	154.9	-----	87	1.2	0.5	43.7
	2.0	149.6	- 5.3	83	1.2	0.0	41.7
	4.0	149.6	- 5.3	85	1.4	6.9	45.9
	7.0	134.0	-20.9	85	1.5	0.5	42.5
	14.0	155.9	+ 1.0	83	1.0	0.0	37.6
Treated Average		147.3		84	1.3	1.9	41.9
Significance level		25%		NS	NS	25%	NS

Planted-5/10/76 Harvested-10/7/76 Plant population-24,200
Row spacing-36"
Soil test: pH-6.5, P-137 (high), K-120 (low)
Fertilizer: 250 pounds per acre 19-19-19 at planting and 100 pounds per acre N as anhydrous ammonia 5 weeks after emergence.
NS = no statistical significance

* Least significant difference at 25% level of probability = 15.3 bushels per acre.

Table 5A. Analysis of variance for yield (bushels per acre) in Experiment C.

Source of Variance	df	Sum of squares	Mean square	F ratio
Replication	3	4014.75	1338.25	3.29722*
Date	3	1952.38	650.792	1.60344†
Rate	4	501.125	125.281	.308671
Date X Rate	12	9468	789	1.94396†
Error	57	23134.8	405.873	
Total	79	39070.9		

Approximate F statistic with		25%(†)	5%(*)	1%(**)
	3 and 57 df	1.41	2.84	4.31
	4 and 57 df	1.38	2.61	3.83
	12 and 57 df	1.29	2.0	2.66

Table 5B. Analysis of variance for % barren plants in Experiment C.

Source of Variance	df	Sum of squares	Mean square	F ratio
Replication	3	22.014	7.33801	.33023
Rate	4	66.5497	16.6374	.748728
Date	3	62.2569	20.7523	.933909
Rate X Date	12	346.793	28.8994	1.30055†
Error	57	1266.59	22.2209	
Total	79	1764.21		

Approximate F statistic with		25%(†)	5%(*)	1%(**)
	3 and 57 df	1.41	2.84	4.31
	4 and 57 df	1.38	2.61	3.83
	12 and 57 df	1.29	2.0	2.66

Table 6. Average yield (bushels per acre) for Michigan 407-2X corn hybrid treated with four rates of dinoseb on four dates with untreated checks. Experiment C.

Date	Untreated check	Rates (grams/acre) 2.0	4.0	7.0	14.0	Treated average for dates	Increase (+) or decrease (-)
June 20	156.2	<u>177.3</u>	<u>135.2</u>	161.9	154.0	157.1	+0.9
June 26	165.1	156.8	166.9	154.1	<u>148.9</u>	156.7	-8.4
July 2	170.2	<u>134.2</u>	171.3	171.5	164.8	160.5	-9.7
July 9	154.9	149.6	149.6	<u>134.0</u>	155.9	147.3	-7.6
Average for rates	161.6	154.4	155.7	155.4	155.9		
Increase (+) or decrease (-)	-----	-7.2	-5.9	-6.2	-5.7		

LSD at 25% level of probability:

Rates = 6.83 bushels per acre
Dates = 7.64 bushels per acre
Dates x rates = 15.3 bushels per acre.

Table 7. Plant height and number of unrolled leaves on date of treatment and number of days after treatment to tassel and silk emergence for Michigan 407-2X corn hybrid treated with four rates of dinoseb on four dates with untreated checks. Experiment C.

Date	Rate (gm/A)	Plant height (inches)	Number of leaves unrolled	Days to tassel emergence	Days to silk emergence
June 20	Check	15.5	7	32	37
	2.0	15.3	7	32	36
	4.0	15.1	7	33	34
	7.0	16.8	7	27	32
	14.0	15.9	7	28	32
Treated average		15.8	7	30	34
June 26	Check	23.2	8	21	25
	2.0	23.0	8	21	27
	4.0	22.5	8	21	24
	7.0	23.4	8	21	25
	14.0	22.5	8	21	24
Treated average		22.9	8	21	25
July 2	Check	32.8	9	15	20
	2.0	30.0	9	15	19
	4.0	32.5	9	15	19
	7.0	34.0	9	15	15
	14.0	34.6	9	16	20
Treated average		32.8	9	15	18
July 9	Check	60.2	11	9	13
	2.0	59.3	11	9	14
	4.0	63.0	11	13	16
	7.0	53.0	11	9	13
	14.0	51.0	11	7	13
Treated average		56.6	11	10	14

Overstate Experiments

Yield differences due to treatment were significantly higher at the 25% level of probability at three locations, significantly lower at four locations and not significantly different at six locations (Table 8 and 8A-8G). The average yield for treated plots compared to untreated checks for the 13 locations was practically equal, 131.1 vs. 130.9.

Centimeters of bare ear tips were significantly lower at the 25% level of probability for treated plots at three locations (Table 8, 8J, 8K, 8L). There was a small but significant increase in bare ear tips for treated plots at two locations (Table 8, 8H and 8I). These differences did not correspond with the yield differences. Differences in ear tip fill at the other eight locations were not significant.

Shelling percent was not significantly affected by treatment at any of the locations. There were no barren plants in any treatment combinations or check plots.

Table 8. Yield, shelling percent, centimeters of bare tips and percent barren plants for Michigan 407-2X corn hybrid at 12 overstate locations and Michigan 3093 at Grand Traverse county treated with dinoseb and untreated checks.

County	Planting dates	Yield (bu/A)		Shelling %		Bare ear tips (cm)		% Barren plants		Significance level	
		T	C	T	C	T	C	T	C	Yield	Bare ear tips
Monroe	5/14	173.4*	159.9	85	85	0.3	0.2*	0	0	25%	25%
Hillsdale	5/11	145.3*	120.9	85	85	0.8	0.9	0	0	25%	NS
Branch	5/15	116.8	117.5	86	86	0.6	0.9	0	0	NS	NS
Kalamazoo	5/22	76.8	94.7*	86	86	0.9	0.5	0	0	5%	NS
Cass irrigated	5/10	166.3	184.8*	87	87	0.9	0.7	0	0	25%	NS
Cass muck soil	5/22	170.5	172.4	86	87	0.6	0.5	0	0	NS	NS
Kent	5/12	136.8	153.8*	86	84	0.7	0.4*	0	0	25%	25%
Muskegon	5/24	93.9	87.7	85	85	0.3	0.5*	0	0	NS	25%
Sanilac	5/20	156.2	157.6	85	85	0.2	0.4*	0	0	NS	25%
Saginaw	5/20	102.4	87.4	83	83	0.5	0.6	0	0	NS	NS
Huron	5/13	114.8	114.5	82	77	0.9	1.1*	0	0	NS	25%
Montcalm	5/5	160.5*	149.9	83	84	0.4	1.0	0	0	25%	NS
Grand Traverse	5/18	90.1	100.9*	80	80	1.3	1.0	0	0	25%	NS
Average		131.1	130.9	85	84	0.6	0.7	0	0		

T = treated C = untreated check NS = no statistical significance

*Significant difference at 25% probability level.

Table 8A. Analysis of variance of yield (bushels per acre) in Monroe county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	3	2064.63	688.208	6.57557†
Treatment	1	387.828	387.828	3.70555†
Error	3	313.984	104.661	
Total	7	2766.44		

Approximate F statistic with		25%(†)	5%(*)	1%(**)
	3 and 3 df	2.36	9.28	29.5
	1 and 3 df	2.02	10.1	34.1

Table 8B. Analysis of variance of yield (bushels per acre) in Hillsdale county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	4	10366.3	2591.57	6.13417†
Treatment	1	1483.53	1483.53	3.51148†
Error	4	1689.92	422.48	
Total	9	13539.7		

Approximate F statistic with		25%(†)	5%(*)	1%(**)
	4 and 4 df	2.06	6.39	16.0
	1 and 4 df	1.81	7.71	21.2

Table 8C. Analysis of variance of yield (bushels per acre) in Kalamazoo county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	3	124.957	41.6523	.726742
Treatment	1	639.035	639.035	11.1498*
Error	3	171.941	57.3138	
Total	7	935.934		

Approximate F statistic with		25%(†)	5%(*)	1%(**)
	3 and 3 df	2.36	9.28	29.5
	1 and 3 df	2.02	10.1	34.1

Table 8D. Analysis of variance of yield (bushels per acre) in Cass-irrigated county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	5	2468.78	493.756	.94688
Treatment	1	1028.59	1028.59	1.97254†
Error	5	2607.28	521.456	
Total	11	6104.66		

		25%(†)	5%(*)	1%(**)
Approximate F statistic with	5 and 5 df	1.89	5.05	11.0
	1 and 5 df	1.69	6.61	16.3

Table 8E. Analysis of variance of yield (bushels per acre) in Kent county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	5	1286.23	257.247	.486789
Treatment	1	868.734	868.734	1.64391†
Error	5	2642.28	528.456	
Total	11	4797.25		

		25%(†)	5%(*)	1%(**)
Approximate F statistic with	5 and 5 df	1.89	5.05	11.0
	1 and 5 df	1.69	6.61	16.3

Table 8F. Analysis of variance of yield (bushels per acre) in Montcalm county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	3	591.844	197.281	2.18304
Treatment	1	222.625	222.625	2.46349†
Error	3	271.109	90.3698	
Total	7	1085.58		

		25%(†)	5%(*)	1%(**)
Approximate F statistic with	3 and 3 df	2.36	9.28	29.0
	1 and 3 df	2.02	10.1	34.0

Table 8G. Analysis of variance of yield (bushels per acre) in Grand Traverse county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	3	1098.77	366.255	5.01737†
Treatment	1	233.289	233.289	3.19585†
Error	3	218.992	72.9974	
Total	7	1551.05		

Approximate F statistic with		25%(†)	5%(*)	1%(**)
	3 and 3 df	2.36	9.28	29.0
	1 and 3 df	2.02	10.1	34.0

Table 8H. Analysis of variance of bare ear tips (cm) in Monroe county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	3	.253374E-1	.844581E-2	.463736
Treatment	1	.406124E-1	.406124E-1	2.22992†
Error	3	.546376E-1	.182125E-1	
Total	7	.120587		

Approximate F statistic with		25%(†)	5%(*)	1%(**)
	3 and 3 df	2.36	9.28	29.5
	1 and 3 df	2.02	10.1	34.1

Table 8I. Analysis of variance of bare ear tips (cm) in Kent county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	5	.471366	.942732E-1	1.54562
Treatment	1	.208032	.208032	3.41071†
Error	5	.304969	.609937E-1	
Total	11	.984366		

Approximate F statistic with		25%(†)	5%(*)	1%(**)
	5 and 5 df	1.89	5.05	11.0
	1 and 5 df	1.69	6.61	16.3

Table 8J. Analysis of variance of bare ear tips (cm) in Muskegon county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	5	.410944	.821887E-1	2.84403†
Treatment	1	.945189E-1	.945189E-1	3.2707†
Error	5	.144494	.288987E-1	
Total	11	.649956		

		25%(†)	5%(*)	1%(**)
Approximate F statistic with	5 and 5 df	1.89	5.05	11.0
	1 and 5 df	1.69	6.61	16.3

Table 8K. Analysis of variance of bare ear tips (cm) in Sanilac county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	4	.662599E-1	.016565	.481049
Treatment	1	.792098E-1	.792098E-1	2.30027†
Error	4	.13774	.344351E-1	
Total	9	.28321		

		25%(†)	5%(*)	1%(**)
Approximate F statistic with	4 and 4 df	2.06	6.39	16.0
	1 and 4 df	1.81	7.71	21.2

Table 8L. Analysis of variance of bare ear tips (cm) in Huron county.

Source of Variance	df	Sum of squares	Mean square	F Ratio
Replication	4	.43646	.109115	3.40821†
Treatment	1	.125439	.125439	3.91808†
Error	4	.128061	.320153E-1	
Total	9	.68996		

		25%(†)	5%(*)	1%(**)
Approximate F statistic with	4 and 4 df	2.06	6.39	16.0
	1 and 4 df	1.81	7.71	21.2

DISCUSSION

One-year results showed no consistent responses in yield or other plant characteristics from application of dinoseb on either corn hybrids or inbreds. The few significant increases in yield were offset by significant decreases in other treatment situations. It is not clear whether the decreases in yield were actually due to a response from the dinoseb treatments or merely random effects independent of treatment.

On the basis of one year's data in Michigan, it is not possible to recommend treatment with dinoseb. A clear case favorable for dinoseb treatment could not be established even when arithmetic differences were considered, ignoring statistical analyses. The results and this conclusion do not agree with those presented by Ohlrogge and associates in Indiana (16, 17, 18, 20) who have been recommending dinoseb as a growth stimulant for corn production since 1974. Yield response obtained in Wisconsin (19) and Minnesota (10, 11) in 1974 and 1975 were also erratic and not clearly favorable although the authors did recommend that farmers try the treatment.

Ohlrogge *et al* (16, 17, 18, 20) have worked extensively with dinoseb as a growth regulator in corn production since

1968, longer than anyone else. They have experimented with it under a wide range of conditions and included a number of different variables and factors in their experiments. All of their reported yield increases were not significant and in some cases no statistical analyses were presented. No cases of yield decreases have been reported in their results with dinoseb.

Unpublished results reported in Prairie Farmer April 16, 1976 stated that yields were reduced 10-15 bushels per acre on four different hybrids in tests conducted by Dr. R. R. Johnson at the Dixon Springs experiment station in southern Illinois in 1975. There was no yield response in experiments conducted by Johnson at Urbana, Illinois.

The same publication reported that Iowa State University experiments in 1975 at several locations showed small but "not convincing" increases.

Variations in formulations, including surfactants, time of application, amount of water per acre, variety differences and other variables may account for some of the erratic responses obtained to date by various investigators.

The treatments chosen for the Michigan experiments in 1976 reported here were based on the recommendations from Indiana experiments. These recommendations were followed closely and accurately. There was no apparent deviation from the recommended procedures to account for the erratic responses obtained.

Additional experiments and tests may help to clerify the reasons for inconsistent responses. With the relatively small increases of 5-10% expected, based on the Indiana experiments, and the variability in plot yields experienced in the Michigan experiments in 1976, it is recommended that the number of replications per treatment be increased. Three to six replications were used. It appears that more replications may be needed in experiments where the expected yield response is small, 5-10%. Increasing the number or replications may aid in lowering the estimates of statistical confidence limits.

Since the cost of material (20-25 cents per acre for Premerge 3 and surfactant and $1.50 per acre for SPARK) and application ($2-4 per acre) is minimal, some corn producers may be willing to make the investment even though the odds for small and/or significant yield increases are not high. More information is needed to explain the yield decreases observed in some experiments. Are these decreases due to an adverse effect on the corn plant due to treatment or are they due to the variability that exists in field experiments independent of treatment?

SUMMARY AND CONCLUSIONS

The effects of foliar applications of dinoseb, as a growth stimulant, on the yield and other characteristics of corn were investigated in 1976 in Michigan. A formulation of dinoseb, SPARK, manufactured by Helena Chemical Company was used.

(1) Eight corn hybrids in two dates of planting were treated with an equivalent of four grams dinoseb per acre. Yield differences due to treatment were not statistically significant for any of the hybrids in either date of planting. Treated plots in the May 30, planting averaged only 3.0 bushels more corn per acre while there was an average 4.0 bushel decrease in the June 9, planting. The interaction of hybrids x treatment was not significant.

(2) Eight inbred lines of corn were treated with four grams of dinoseb per acre. Yields from treated plots increased 1.8 to 16.7 bushels for seven of the inbreds (Oh545, Mo.17, MS153, A619-Ht, W64A, MS93 and A632-Ht) and decreased 4.5 bushels for MS70. The only statistical significant difference was the 16.7 bushel increase for A619-Ht. Inbred x treatment interaction was not significant.

(3) Four rates (2, 4, 7 and 14 grams dinoseb per acre) were applied to Michigan 407-2X hybrid on four dates (June 20, 26, July 2, and 9). Significant differences in yield occurred

with only 5 of the 16 specific date-rate treatment combinations -- one increase in yield and four decreases in yield. Treated plots averaged 6.2 bushels less than the average of untreated checks, 155.4 vs. 161.6 bushels per acre.

The main effect for date of application was significant due primarily to the lower yields obtained on plots treated July 9. Yield differences due to rate of application were not significant. Date x rate interaction was significant indicating that effects on yield with different dates of application varied depending on rate of application and vice versa.

(4) Treated (dinoseb at four grams per acre) and untreated check plots were evaluated at 13 overstate locations. Yield differences due to treatment were significantly higher at the 25% level of probability at three locations, significantly lower at four locations and not significantly different at six locations. Treated plots averaged 131.1 bushels per acre and untreated check plots averaged 130.9 bushels.

(5) Overall, the effects of dinoseb on yield were erratic and inconsistent, and there were relatively few significant differences. Significant decreases in yield as well as significant increases in yield occurred in the various comparisons.

(6) Few significant differences in ear tip fill and barren plants occurred in these experiments. There were no significant differences in shelling percent, grain moisture at harvest, dates of tasseling and silking.

(7) It is not possible to give an unqualified recommendation to farmers that treatment with dinoseb should be included in their corn production program based on these one-year data in Michigan. Additional experiments may be needed to firm up the recommendations to farmers.

Even though the cost of material and application is relatively small, instances of yield decreases are of concern.

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