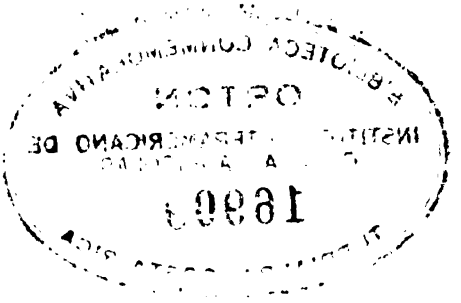
Esteves

Effects of some growth-regulating substances on the germination, growth, and sucrose content of sugarcane

EFFECTS OF SOME GROWTH-REGULATING SUBSTANCES ON THE GERMINATION, GROWTH, AND SUCROSE CONTENT OF SUGARCANE

by

Guillermo Esteves, Jr.



INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES
TURRIALBA, COSTA RICA

August, 1953

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A Thesis

Submitted to the Faculty Committee in partial fulfillment of the requirements for the degree of

Magistri Agriculturae

at the

Inter-American Institute of Agricultural Sciences

APPROVED: Kenneth L. Olsen
Advisor

Committee

H.C. Thompson
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BIOGRAPHY OF AUTHOR

Guillermo Esteves, Jr., was born in Santurce, Puerto Rico. He received the degree of Bachelor of Sciences in Agronomy from the University of Maryland, College Park, Maryland, in 1951. That same year he entered the Inter-American Institute of Agricultural Sciences for graduate work in Plant Physiology. In August, 1951, he was awarded a Research Fellowship by the Shell Development Co., Modesto, California, for work on agricultural chemicals, during the course of which the present study was completed.

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INTRODUCTION

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Today, for the first time in the history of agriculture, man can change the pattern of growth and development of plants. Already the practical applications of growth-regulating substances are many. However, unlimited possibilities for their application still exist, and many more are being added as new growth substances are discovered in research laboratories over the world.

The present study was undertaken to evaluate the effects of a number of growth-regulating substances when applied at three different stages in the growth of sugarcane: (1) As pre-planting treatment to sugarcane seedpieces, (2) In herbicidal and hormonal concentrations at an early stage in the growth of a ratoon crop of sugarcane, and (3) To a mature crop of sugarcane prior to harvest.

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EFFECTS OF SOME GROWTH-REGULATING SUBSTANCES ON THE GERMINATION OF SUGARCANE

Review of Literature

Germination constitutes a critical stage in the development of the cane plant. During this period changes take place in the food reserves, enzyme activity and growth-regulating substances in the seed material. Germination is influenced by many factors, such as variety of cane, origin of the seed stock, age of seed, nutrient supply in the cuttings, size of cuttings, depth of planting, orientation of the buds at planting, soil moisture and temperature, soil aeration, etc. When germination is delayed by one or more of these factors, the seedpieces are subject to attack by microorganisms which in a short time may cause decay of the seedpiece, bud, or young shoots.

In areas where the growth of sugarcane is limited by a short growing season the importance of hastening the growth and maturity of the crop is fully realized. The uniformity of development resulting from early germination will allow the plants to close-in earlier in their competition with weeds. Faster multiplication of the seed stock of new varieties could also be achieved.

The amount of seed stock used to plant one acre of cane in the different cane producing areas of the world

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The amount of seed stock used to plant one acre of cane in the different cane producing areas of the world

varies from 0.25 acre to 0.12 acre or less of standing cane (78). When the conditions necessary for good germination are present, and when planting stock of good quality is used, there is evidence that the amount of seed can be reduced considerably (3, 10, 18, 86). Any factor which might stimulate the germination and early production of shoots would be of importance to the economic production of sugarcane.

Increased germination as a result of hot-water treatment was observed by Brandes and Klaphaak (13) in 1923. They reported that immersion of cuttings in water for 20 minutes at 52° C. resulted in rapid development of buds and increased growth of the young cane stools. When the entire stalk was subjected to hot water treatment prior to planting, nearly all of the buds on the stalk developed, indicating that their dormancy had been broken by the treatment. There is, however, a very narrow range of temperatures and duration of treatment that is effective.

Similar treatments with hot or cold water have been investigated in many countries (18, 23, 53, 85, 89). Soaking cane pieces in solutions containing chemical compounds has been tried also (19, 52, 64, 68, 69, 73, 74). Other possibilities that have been investigated are treatment with fungicides (27, 38, 51, 52, 89), insecticides (12), and with growth-regulating substances (14, 44, 72,

varies from 0.25 acre to 0.12 acre or less of stubling cane (75). When the conditions necessary for good germination are present, and when planting stock of good quality is used, there is evidence that the amount of seed can be reduced considerably (3, 10, 16, 66). Any factor which might stimulate the germination and early production of shoots would be of importance to the economic production of sugarcane.

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85). Compounds such as chlorohydrin and acetylene have been utilized also (85).

Apical dominance is clearly exhibited in sugarcane. Normally, a bud will not develop as long as it forms part of a standing stalk due to the inhibiting effect of the growing point on the lateral buds. This dominant effect of the uppermost bud is strongest in cuttings from the upper sections of the stalk, and diminishes in cuttings from the middle and basal sections of the stalk (78). It is assumed that this inhibition is due to the formation and translocation of a growth-regulating substance or substances from the growing point of the stalk (18, 78). Removal of the top, or cessation of its function as a result of injury by natural or mechanical means, or flowering, results in breaking the dormancy of the upper lateral buds.

The effect of auxin relations on the development of sugarcane was reviewed by Van Overbeek in 1943 (79). In a series of experiments in Puerto Rico (81, 85, 86) he succeeded in isolating a growth substance from sugarcane nodes which behaves like synthetic indoleacetic acid. A small part of this substance (about 3 parts per billion parts of fresh tissue) is found "free", while approximately 40 times this amount is held in storage

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and can be released by special methods. He concluded that auxin controls the development of buds and roots, and that a high concentration of auxin will tend to inhibit the development of these buds. He suggested that the increased rooting and decreased tillering of horizontally oriented stalks as compared to vertically oriented stalks may be due to the increased auxin concentration at the nodes of horizontally oriented cane.

Engard and Nakata (24) reported extraction of at least two different substances from sugarcane tissue: a growth-promoting substance of the acid type and an inhibitor. Van Overbeek et al. (81) also reported extraction of an inhibitor from boiled tissue. Brandes and Van Overbeek (14), elaborating on the work of Brandes and Klaphaak (1923) found that immersion of seed in water at 52° C. for 20 minutes stimulated bud development, but the same effect on single-bud cuttings could be inhibited by application of cotton plugs soaked in 100 mg. per liter naphthaleneacetic acid to the basal cut surfaces. They concluded that the stimulation of bud growth by hot-water treatment and a lowering of the auxin level are correlated.

Van Overbeek at al. (85) found that the application of indolebutyric acid in talc (Hormodin) to seed pieces

generally increased the number of set roots especially on slow-rooting varieties, such as Bayberry [22]. They pointed out that auxin applications made to seedpieces will promote root growth from the root band, but will inhibit the development of the buds.

Loh, Tsao and Cheng (44) applied indolesecetic acid and 2,4-dichlorophenoxyacetic acid to single-bud seedpieces by soaking in solutions ranging from 10 to 100 ppm. IAA at 100 ppm. induced formation and elongation of the set roots. Shoot growth was slightly retarded during the first week, but caught up during the second week. Fast-growing varieties gave better response to applications than slow-growing clones. 2,4-Dichlorophenoxyacetic acid at 100 ppm. had toxic effects. The set roots took a short clubbed form apparently from injury to the terminal portions.

Stamper et al. (72) working in Louisiana arrayed cane with 2,4-D and maleic hydrazide at the rate of 1 lb. per acre 10 and 40 days before harvesting for seed. Germination and stand counts showed that maleic hydrazide gave an increase in germination of tall planted sugarcane and better stands the following spring. 2,4-Dichlorophenoxyacetic acid did not seem to have any effect on the germination or density of stands.

Experiment 1: Treatment of seedpieces in the furrow.

This experiment was designed to test the desirability of applying growth-regulating substances to cane seedpieces in the field just prior to planting.

Materials and Methods

The experimental layout consisted of plots 19' x 19' (approximately 1/120 acre) each in a 4 x 4 Latin Square design. Each plot included four furrows which had been opened the previous day.

Freshly cut P.O.J. 2878 seedpieces were used for this trial. The seedpieces were laid out and sprayed thoroughly with solutions consisting of (1) 0.005% 2,4-D acid equivalent (Isopropyl Ester), (2) 0.05% indolebutyric acid, (3) 0.05% naphthaleneacetic acid, and (4) control (distilled water). Eclipse "Warley" Knapsack-type sprayers were used for this purpose at a pressure of 45 pounds. The seed was covered to a depth of approximately one inch.

Results

One month after planting, the plots treated with naphthaleneacetic acid and with 2,4-D seemed to be retarded in growth. No effects were observed on the indolebutyric acid and control plots. At one and one-half months, counts of the number of primary and secondary

Experiment 1: Treatment of seedpieces in the furrow.

This experiment was designed to test the desirability of applying growth-regulating substances to cane seedpieces in the field just prior to planting.

Materials and Methods

The experimental layout consisted of plots 15' x 15' (approximately 1/150 acre) each in a 4 x 4 latin square design. Each plot included four furrows which had been opened the previous day.

Freshly cut I.C.T. 2876 seedpieces were used for this trial. The seedpieces were laid out and sprayed thoroughly with solutions consisting of (1) 0.05% 2,4-D acid equivalent (Isopropyl ester), (2) 0.05% indolebutyric acid, (3) 0.05% naphthaleneacetic acid, and (4) control (distilled water). Solitpse "Farley" transpack-type sprayers were used for this purpose at a pressure of 45 pounds. The seed was covered to a depth of approximately one inch.

Results

One month after planting, the plots treated with naphthaleneacetic acid and with 2,4-D seemed to be retarded in growth. No effects were observed on the indolebutyric acid and control plots. At one and one-half months, counts of the number of primary and secondary

shoots in each plot were made. Results are presented in table 1.

Table 1. Stooling count one and one-half months after treatment.

Number of primary and secondary shoots per plot.

Treatments		Replications 1	2	3	4	Total	Ave.
0.005% 2,4-D	Prim.	106	62	73	122	363	91
	Sec.	55	26	28	46	155	39
0.05% IBA	Prim.	92	86	94	99	371	93
	Sec.	30	35	55	52	172	43
0.05% NAA	Prim.	137	63	87	94	381	95
	Sec.	46	21	38	43	148	37
Control	Prim.	107	104	96	89	396	99
	Sec.	40	45	46	35	166	42

At this time the control plots had a larger number of primary shoots, but the indolebutyric acid plots had the greatest number of secondary shoots per plot. However, these differences were not significant.

At three and a half months after treatment another count was made of the total number of shoots in each plot (table 2). No differences could be observed at this time.

At six and a half months after planting a last count was made, but this time only vigorous shoots were taken

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	Sec.	30	35	55	52	172	43
0.05% NAA	Prim.	137	63	87	94	381	95
	Sec.	46	21	36	43	148	37
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Table 2. Number of shoots per plot three and one-half months after treatment.

Treatments	Total number of shoots per plot				Total# Shoots	Ave.# Shoots
	Plot 1	Plot 2	Plot 3	Plot 4		
0.005% 2,4-D	145	115	105	162	527	132
0.05% IBA	144	120	126	126	516	129
0.05% NAA	152	114	130	129	525	131
Control No treatment	149	131	130	127	537	134

Table 3. Number of vigorous shoots per plot six and one-half months after treatment.

Treatments	Total number of shoots per plot				Total# Shoots	Ave.# Shoots
	Plot 1	Plot 2	Plot 3	Plot 4		
0.005% 2,4-D	114	99	88	120	421	105
0.05% IBA	109	104	110	101	427	107
0.05% NAA	114	97	113	108	429	107
Control No treatment	113	102	100	102	417	104

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Control No treatment	113	102	100	102	417 104

Experiment 2: Application of growth-regulating substances to the upper cut end of terminal, middle, and basal single-bud cuttings.

Materials and Methods

The following hormone-type materials were used for this test:

1. b-Naphthoxyacetic Acid. . . . . .3,000 ppm.
2. a-2,4-Dichlorophenoxypropionic Acid . . 200 ppm.
3. Maleic Hydrazide. . . . . .1,000 ppm.
4. a-Naphthaleneacetic Acid. . . . . .3,000 ppm.
5. 2,3,5-Triiodobenzoic Acid . . . . . 500 ppm.
6. Indole-3-acetic Acid. . . . . 10,000 ppm.
7. Naphthaleneacetamide. . . . . .2,000 ppm.
8. Indolebutyric Acid. . . . . .4,500 ppm.
9. a-(2-Chlorophenoxy)propionic Acid . . .2,000 ppm.
10. Trans-cinnamic Acid . . . . . .1,000 ppm.

The concentrations employed were derived from a review of the literature on the use of growth regulators for the rooting of cuttings of various types.

Each material was incorporated into three different carriers, lanolin, talcum and quick-dip solution.

Two seedbeds measuring 5' x 35' were used for planting. Both beds had been treated with Shell Emulsible CBP-55 soil fumigant two weeks prior to planting.

Experiment 2: Application of growth-regulating substances to the upper cut end of terminal, middle, and basal single-bud cuttings.

Materials and Methods

The following pre-emergence-type materials were used for this test:

1. p-Isopropoxyacetic acid. . . . . 4,000 ppm.
2. α-(2,4-Dichlorophenoxy)propionic acid . . 500 ppm.
3. Maleic Hydrazide. . . . . 1,000 ppm.
4. α-Naphthaleneacetic acid. . . . . 3,000 ppm.
5. 2,3,5-Triiodobenzoic Acid . . . . . 500 ppm.
6. Indole-3-acetic Acid. . . . . 10,000 ppm.
7. Naphthaleneacetamide. . . . . 4,000 ppm.
8. Indolebutyric acid. . . . . 4,500 ppm.
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Two seedbeds measuring 5' x 35' were used for planting. Both beds had been treated with Shell Multiple CBP-55 soil fumigant two weeks prior to planting.

Sixty-six stalks of P.O.J. 2878 one-year-old plant cane were collected in the morning and kept in the shade until sectioning and treatment. Three single-node seedpieces were cut from each stalk as follows: One terminal seedpiece (node No. 2 or 3 from the top of the harvested cane stalk), one from the middle section of the stalk, and one basal seedpiece (node No. 2 or 3 from ground level). The seedpieces were obtained by cutting the stalk approximately 1/2 inch above the desired bud, and near the base of the internode below this bud. The seedpieces were cut, weighed individually, treated, and planted immediately. In all cases the material was applied to the uppermost cut end of the seedpieces.

The method of application varied somewhat for the different treatments. For the talcum applications the upper cut end of the pieces were dipped in distilled water, excess water allowed to drain and then dipped in the talc preparation. The pieces were then tapped gently against the side of the container to remove excess material. The material in lanolin form was applied to the upper cut end of the seed by means of a steel spatula. For the quick-dip treatments the seedpieces were immersed in the solution for approximately 10 seconds, and then allowed to drain for a few seconds before planting.

All cuttings were planted horizontally with the bud

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All cuttings were planted horizontally with the bud

to the side at a depth of 2 inches. The distance between cuttings within the bed was one foot laterally and eight inches longitudinally. Both materials and treatments were randomized. All treatments were replicated twice.

A record sheet was kept for each individual seedpiece. Growth measurements were taken 14, 28, 42, and 56 days after treatment. The number of secondary shoots was recorded. On the last date of measurement the plants were removed carefully from the bed, washed under a stream of water and taken to the laboratory where surface moisture was removed. The plants were then segregated into set roots, shoot roots, aerial parts, and seedpiece, and fresh weights recorded. All material was placed in a forced-draft oven where it was dried to constant weight at a temperature of 80° C. The per cent dry weight was calculated from these figures.

Results

Table 4 shows the per cent germination and the number of days required for germination by each treatment presented according to carrier. This data shows that the carrier effect was negligible, since none of the materials employed as carriers exhibits consistent differences. For this reason the per cent germination and number of days required for germination are compared on the basis of the

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Table 4. Per cent germination and number of days required for germination of terminal, middle and basal single-bud pieces, by treatment.

Treatment	% Germination				No. days for germ.			
	Talc	Lan.	Dip	Ave.	Talc	Lan.	Dip	Ave.
b-Naphthoxy-acetic acid	67	100	50	72	12	15	17	15
á-2,4-Dichloro-phenoxy-propionic acid	50	83	83	72	14	13	14	14
Maleic hydrazide	83	83	83	83	14	12	13	13
a-Naphthalene-acetic acid	67	67	67	67	18	14	16	16
2,3,5-Triiodo-benzoic acid	50	50	100	67	18	13	16	16
Indole-3-acetic acid	83	50	100	78	17	15	21	18
á-Naphthalene-acetamide	100	83	100	94	14	14	14	14
Indolebutyric acid	67	83	33	61	15	17	16	16
á-(2-Chloro-phenoxy)-propionic acid	67	83	67	72	13	18	19	17
Trans-cinnamic acid	33	100	67	67	15	14	17	15
Control	67	100	100	89	16	14	15	15

Table 4. Per cent germination and number of days required for germination of terminal, middle and basal single-bud pieces, by treatment.

Treatment	% Germination				No. days for germ.			
	Term.	Mid.	Bas.	Ave.	Term.	Mid.	Bas.	Ave.
Control	67	100	100	89	16	14	17	15
Trans-cinnamic acid	33	100	67	67	15	14	17	15
α-(2-Chloro-phenoxy)-propionic acid	67	33	67	72	13	18	19	17
Indolebutyric acid	67	33	33	61	15	17	16	16
α-Naphthalene-acetamide	100	33	100	94	14	14	14	14
Indole-3-acetic acid	33	50	100	76	17	15	21	18
2,3,5-Triiodo-benzoic acid	50	50	100	67	16	13	16	16
α-Naphthalene-acetic acid	67	67	67	67	16	14	16	16
Maleic hydrazide	83	83	83	83	14	12	13	13
β-Naphthoxy-acetic acid	67	100	50	72	12	15	17	15
α,β-Dichloro-phenoxy-propionic acid	50	33	33	72	14	13	14	14

average for each treatment.

Seedpieces treated with naphthaleneacetamide had the highest germination with 94%, while the control ranked second with 89%. Maleic hydrazide and indoleacetic acid treatments ranked third and fourth with 83 and 78%, respectively. All other materials were about the same, with indolebutyric acid treatment showing the lowest per cent germination, 61. These differences are not significant, however.

Seedpieces treated with maleic hydrazide required the least average number of days for germination with 13, followed by alpha-2,4-dichlorophenoxypropionic acid and naphthaleneacetamide with 14 days, respectively. The control required 15 days to germinate, as well as the naphthoxyacetic acid and trans-cinnamic acid treatments. The seed treated with indoleacetic acid required 18 days to germinate, the longest for all treatments.

Per cent germination and number of days required for germination are presented according to origin of seed in table 5. Terminal pieces exhibited the highest per cent germination, while the basal pieces showed the lowest. The same held true for the number of days required for germination, top pieces requiring 13 and basal pieces 17 days.

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Seedpieces treated with naphthaleneacetamide had the highest germination with 94%, while the control ranked second with 89%. Malic hydrazide and indoleacetic acid treatments ranked third and fourth with 83 and 7[illegible], respectively. All other materials were about the same, with indolebutyric acid treatment showing the lowest per cent germination, 61. These differences are not significant, however.

Seedpieces treated with malic hydrazide required the least average number of days for germination with 13, followed by alpha-2,4-dichlorophenoxypropionic acid and naphthaleneacetamide with 14 days, respectively. The control required 15 days to germinate, as well as the naphthoxyacetic acid and trans-cinnamic acid treatments. The seed treated with indoleacetic acid required 16 days to germinate, the longest for all treatments.

Per cent germination and number of days required for germination are presented according to origin of seed in table 5. Terminal pieces exhibited the highest per cent germination, while the basal pieces showed the lowest. The same held true for the number of days required for germination, top pieces requiring 13 and basal pieces 17 days.

Table 5. Per cent germination and average number of days required for germination of terminal, middle and basal single-bud pieces, by origin.

Origin of Seed	% Germination				No. days for germ.			
	Talc	Lan.	Dip	Ave.	Talc	Lan.	Dip	Ave.
Terminal	77	100	96	91	13	12	14	13
Middle	68	82	73	74	16	15	17	16
Basal	55	59	64	59	15	17	17	17

Average height per plant in centimeters at 14, 28, 42 and 56 days after planting, and the number of secondary shoots produced during this period are shown in table 6. At two weeks the control was superior to all of the treatments in average height per plant. At four weeks, however, naphthaleneacetamide and trans-cinnamic acid treatments were higher than the control. At six weeks only one treatment, maleic hydrazide equalled the control. At the end of the experiment (8 weeks) three treatments showed superiority. These were maleic hydrazide, with an average height per plant of 15.3 cm., and naphthaleneacetamide and naphthaleneacetic acid, both with 14.8 cm. against 14.3 cm. for the control. The lowest growth at this time was exhibited by indoleacetic acid with an average height per plant of 11.9 cm. These differences were not significant, however.

Table 5. Per cent germination and average number of days required for germination of terminal, middle and basal single-bud pieces, by origin.

Origin of seed	% Germination				No. days for germ.			
	Yale	Lan.	Dip.	Ave.	Yale	Lan.	Dip	Ave.
Terminal	77	100	96	91	13	12	14	13
Middle	66	82	73	74	14	15	17	16
Basal	55	59	64	59	15	17	17	17

Average height per plant in centimeters at 14, 28, 42 and 56 days after planting, and the number of secondary shoots produced during this period are shown in table 6. At two weeks the control was superior to all of the treatments in average height per plant. At four weeks, however, naphthaleneacetamide and trans-cinnamic acid treatments were higher than the control. At six weeks only one treatment, maleic hydrazide equalled the control. At the end of the experiment (8 weeks) three treatments showed superiority. These were maleic hydrazide, with an average height per plant of 19.3 cm., and naphthaleneacetamide and naphthaleneacetic acid, both with 14.6 cm. against 14.3 cm. for the control. The lowest growth at this time was exhibited by indoleacetic acid with an average height per plant of 11.9 cm. These differences were not significant, however.

Table 6. Growth and number of seconda
middle and basal single-bud

Treatments		Growth in c 14	28
b-Naphthoxy-	Ter.	5.8	11.0
acetic acid	Midd.	2.5	12.0
	Basal	5.0	7.8
	Ave.	4.4	10.3
a-2,4-Dichloro-	Ter.	8.0	13.5
phenoxy-	Midd.	2.9	11.7
propionic acid	Basal	2.5	6.7
	Ave.	4.5	10.6
Maleic	Ter.	7.5	12.4
hydrazide	Midd.	3.1	11.5
	Basal	4.6	9.0
	Ave.	5.1	11.0
a-Naphthalene-	Ter.	7.8	12.5
acetic acid	Midd.	2.1	10.8
	Basal	0.0	8.8
	Ave.	3.3	10.7
Triiodobenzoic	Ter.	6.4	12.2
acid	Midd.	4.7	10.7
	Basal	1.9	10.0
	Ave.	4.3	11.0
Indole-3-	Ter.	4.0	8.5
acetic acid	Midd.	2.2	8.5
	Basal	0.3	8.6
	Ave.	2.2	8.5
Naphthalene-	Ter.	6.9	12.9
acetamide	Midd.	3.5	12.1
	Basal	1.7	9.5
	Ave.	4.0	11.5
Indolebutyric	Ter.	7.0	11.7
acid	Midd.	0.0	11.6
	Basal	0.0	9.1
	Ave.	2.3	10.8
a-(2-Chloro-	Ter.	7.7	13.4
phenoxy)-	Midd.	3.7	10.5
propionic acid	Basal	3.2	8.4
	Ave.	4.9	10.8
Trans-cinnamic	Ter.	4.2	12.0
acid	Midd.	3.9	10.9
	Basal	3.5	10.6
	Ave.	3.9	11.2
Control	Ter.	9.2	11.3
	Midd.	5.3	10.5
	Basal	2.9	10.5
	Ave.	5.8	10.8

Table 6. Zone diameter and number of secondary shoots produced by the middle and basal single-bud pieces, according to ori

Treatments		Zones in cm. (Days)			No. Secon
		10	20	30	By origin
p-Hydroxy-	Per.	9.8	11.0	12.2	6
acetic acid	Ind.	9.6	12.0	12.4	
	Basal			11	4
	Ave.		10.3	11.2	
α-2,4-Dichlor-	Per.		12	14	
phenoxy-	Ind.	12.0	11.7	11.6	6
propionic acid	Basal	8.2	9.2	10.2	
	Ave.	10.1	10.6	11.4	
Maleic	Per.	9.2	12	12.3	15
hydrazide	Ind.	11.2	13.0	13.0	12
	Basal	7.0	11.0	11.0	18
	Ave.	9.1	12	12	
α-Naphthalene-	Per.	7	12	12.7	16
acetic acid	Ind.	9.2	10.0	11.1	12.1
	Basal	0.0	9	11.5	7
	Ave.	5.1	10.5	12.1	11.8
Trichlorbenzoic	Per.	9	12.2	13.0	16
acid	Ind.	9.7	10.7	11.0	12.4
	Basal	3.0	10.0	10.2	12
	Ave.	7.2	11.1	11.7	13.2
Indole-3-	Per.	7	9	10	11
acetic acid	Ind.	7.2	9	10.2	11.6
	Basal	2.0	8	9.2	11.2
	Ave.	5.2	8.5	10.0	11.3
Naphthalene-	Per.	8	12	13.1	15
acetic acid	Ind.	9.2	12.1	13.2	15.2
	Basal	4	8	10	13
	Ave.	7	10.7	12.1	14.3
Indoleacrylic	Per.	9.0	11.4	12.3	14.2
acid	Ind.	9.0	11.6	12.5	14.0
	Basal	6.0	9.0	10.4	12.4
	Ave.	8.0	10.7	11.7	13.5
α-(2-Chloro-	Per.	8	11	12	12
phenoxy)-	Ind.	8.2	10.8	12.0	12.6
propionic acid	Basal	5.0	8	9.0	11.0
	Ave.	7.1	10.0	11.0	12.0
Trans-Cinnamic	Per.	8	11	12	13
acid	Ind.	8.0	11	12.4	14.1
	Basal	5.0	10.0	11.0	12.6
	Ave.	7.0	10.7	11.8	13.2
Control	Per.	7.0	11.0	12.1	13.1
	Ind.	7.0	10.0	12.0	12.0
	Basal	5.0	9.0	10.0	11.0
	Ave.	6.3	10.0	11.0	12.0

The control produced 34 secondary shoots during the experiment. Three treatments compared closely, maleic hydrazide and alpha-(2-chlorophenoxy)propionic acid with 30 secondary shoots each, and naphthaleneacetamide with 28. Treatment with indolebutyric acid seemed to inhibit the development of secondary shoots with a total of 7, as did naphthoxyacetic acid, trans-cinnamic acid and triiodobenzoic acid with 14, 15 and 17 secondary shoots, respectively.

Yield data is presented in table 7 according to treatment and origin of the seedpieces.

Several treatments stimulated the production of set roots. Seedpieces treated with IAA showed the greatest effect, producing 4.6 grams of fresh set roots per plant. Alpha-2,4-dichlorophenoxypropionic acid and triiodobenzoic acid treatments were second with 3.6 gm. each, while the control had 3.0 gm. When comparing the data for fresh weight of set roots by position, the normal growth ratio is reversed. With two exceptions, all treatments including the control show greater production of set roots by basal pieces, with middle pieces intermediate, and terminal pieces lowest.

The control produced 3½ secondary shoots during the experiment. Three treatments compared closely, maleic hydrazide at 1 alpha-(2-chlorophenoxy)propionic acid with 3% secondary shoots each, are naphthaleneacetamide with 2%. Treatment with indolebutyric acid proved to inhibit the development of secondary shoots with a total of 7, as did naphthoxyacetic acid, trans-cinnamic acid and trifluorobenzoic acid with 14, 15 and 17 secondary shoots, respectively.

Yield data is presented in table 7 according to treatment and origin of the seedpieces.

Several treatments stimulated the production of set roots. Seedpieces treated with 154 showed the greatest effect, producing 4.6 grams of fresh set roots per plant. Alpha-2,4-dichlorophenoxypropionic acid and trifluorobenzoic acid treatments were second with 3.6 gm. each, while the control had 3.0 gm. When comparing the data for fresh weight of set roots by position, the normal growth ratio is reversed. With two exceptions, all treatments including the control show greater production of set roots by basal pieces, with middle pieces intermediate, and terminal pieces lowest.

Table 7.

Treatments									
Naphthoxya	17.6	6.4	5.8	7.3	4.5	47.6	53.2	43.7	57.2
alpha-2,4-phenoxypr	18.4	12.6	10.0	10.0	16.3	76.9	63.4	64.1	35.1
Maleic hyd	15.2	11.6	10.7	14.7	11.9	72.4	64.0	56.1	76.3
Naphthalen	16.0	11.3	8.9	9.9	13.6	73.7	57.0	63.3	23.6
Triiodoben	1.0	3.6	7.0	10.3	11.3	61.5	47.4	69.2	75.4
Indoleacet	15.5	7.8	6.5	6.0	8.5	50.3	53.0	29.2	55.9
Naphthalen	16.6	10.-	6.-	11.4	13.0	68.5	60.2	63.7	73.9
Indolebuty	20.1	9.2	10.6	6.4	10.2	66.2	84.0	39.5	57.-
alpha-(2-C phenoxy)p acid	17.2	9.6	5.6	7.9	13.1	56.9	32.-	60.2	74.5
Trans-cinn	15.6	10.7	7.4	10.8	12.2	66.6	50.3	71.4	73.6
Control -	16.0	11.9	8.5	9.11	11.2	74.6	52.4	75.3	6.2

Table 7. Yield data obtained from application of growth regula

Treatments		Green weight cut roots per plant, in grams			
		[illegible]	[illegible]	[illegible]	Ave.
Naphthoxyacetic acid	3,000 ppm.	2.0	3.1	4.4	3.1
alpha-2,4-Dichloro-phenoxypropionic acid	200 ppm.	1.9	4.6	4.2	3.6
Maleic hydrazide	1,000 ppm.	2.2	3.0	4.3	3.2
Naphthaleneacetic acid	3,000 ppm.	2.1	3.0	4.7	3.2
Triiodobenzoic acid	500 ppm.	2.[illegible]	[illegible]	5.6	3.6
Indoleacetic acid	10,000 ppm.	3.4	4.6	5.6	4.6
Naphthaleneacetamide	2,000 ppm.	1.7	3.7	4.3	3.2
Indolebutyric acid	4,000 ppm.	1.6	3.6	4.4	3.2
alpha-(2-Chloro-phenoxy)propionic acid	2,000 ppm.	[illegible]	3.2	4.8	3.4
Trans-cinnamic acid	1,000 ppm.	1.7	[illegible]	4.4	3.2
Control - no treatment		2.1	3.1	3.[illegible]	[illegible]

The average fresh weight, average dry weight and per cent dry matter per plant for the aerial parts is presented. There was considerable variation between treatments as to the amount of fresh matter produced on a per plant basis. Only two treatments showed a slight superiority over the control: maleic hydrazide, with an average fresh weight per plant of 77.4 gm., and alpha-2,4-dichlorophenoxypropionic acid with 76.9 gm. The control averaged 74.6 gm., while naphthoxyacetic acid was the lowest with 47.6 gm. These differences are not significant, however.

The same relation was maintained when the treatments were ranked on the basis of dry weight of aerial parts per plant. The per cent dry matter varied from 14.9 to 20.1. In general, those treatments which produced the least amount of dry matter per plant had higher per cent dry matter, while those which ranked highest in the amount of dry matter produced per plant had a lower per cent dry matter. With the exception of a-2,4-dichlorophenoxypropionic acid, it can be said that those treatments which stimulated the production of set roots had less growth of aerial parts on a per plant basis.

The production of shoot roots is correlated very closely with the primary shoot growth.

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The production of shoot roots is correlated very closely with the dry shoot growth.

Experiment 3: Effects of lanolin application of naphthaleneacetamide and maleic hydrazide on the germination of terminal, middle and basal single-bud seedpieces.

A third experiment was undertaken using the two materials which had given the most promising results.

Materials and Methods

Maleic hydrazide and naphthaleneacetamide were applied in lanolin to the bud of P.O.J. 2878 single-bud pieces from the terminal, middle and basal sections of cane stalks.

The treatments were as follows:

1. Maleic hydrazide in lanolin at 500, 1,000, 2,000, and 4,000 parts per million.
2. Naphthaleneacetamide in lanolin at 500, 1,000, 2,000 and 4,000 parts per million.
3. Control - straight lanolin.

Each treatment was replicated four times. The material was applied to the bud by means of a steel spatula and planted immediately at a depth of 1 inch with the bud to the side. Distance between cuttings within the bed was 1 foot laterally and 8 inches longitudinally.

The per cent germination was taken 2 and 4 weeks after planting. Following the last germination count the plants were dug out, washed, and taken to the laboratory

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3. Control - straight lanolin.

Each treatment was replicated four times. The material was applied to the bud by means of a steel spatula and planted immediately at a depth of 1 inch with the bud to the side. Distance between cuttings within the row was 1 foot laterally and 3 inches longitudinally.

The per cent germination was taken 2 and 4 weeks after planting. Following the last germination count the plants were dug out, washed, and taken to the laboratory

where the aerial parts plus shoot roots were placed in paper bags. The fresh weights were recorded. All material then was placed in a forced-draft oven where it was dried to constant weight at a temperature of 80° C. The per cent dry weight was calculated from these figures.

Results

Table 8 shows per cent germination two and four weeks after treatment. At 2 weeks all treatments except maleic hydrazide at 500 and 2,000 ppm. were superior to the control in number of plants germinated. At four weeks all treatments showed superiority in germination over the control. However, these differences are not significant statistically.

The fresh and dry weights of the aerial parts plus shoot roots are presented in table 9. Of the maleic hydrazide treatments, 2,000 ppm. gave the best results with an average fresh weight per plant of 17.6 gm. At 4,000 ppm. the weight per plant was the same as that of the control, 14.3 gm. Of the naphthaleneacetamide treatments, 500 ppm. gave best results with an average fresh weight per plant of 21.4 gm. while 1,000 ppm. with 15.0 gm. was slightly better than the control.

Data for the dry weight per plant fall in the same order, and are not significant statistically.

where the aerial parts plus shoot roots were placed in paper bags. The fresh weights were recorded. All material then was placed in a forced-draft oven where it was dried to constant weight at a temperature of 60° C. The per cent dry weight was calculated from these figures.

Results

Table 6 shows per cent germination two and four weeks after treatment. At 2 weeks all treatments except malaic hydrazide at 500 and 2,000 ppm. were superior to the control in number of plants germinated. At four weeks all treatments showed superiority in germination over the control. However, these differences are not significant statistically.

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Data for the dry weight per plant fall in the same order, and are not significant statistically.

Table 8. Germination of terminal, middle, and basal single-bud seedpieces, according to treatment and origin.

Treatments		PER CENT GERMINATION							
		2 Weeks				4 Weeks			
		Term.	Midd.	Basal	Ave.	Term.	Midd.	Basal	Ave.
Maleic hydrazide	500 ppm.	100	50	0	50	100	100	100	100
	1,000 ppm.	100	100	25	75	100	100	75	92
	2,000 ppm.	100	100	50	83	100	100	75	92
	4,000 ppm.	75	75	0	50	100	100	100	100
Naphthaleneacetamide	500 ppm.	100	100	50	83	100	100	75	92
	1,000 ppm.	100	75	25	67	100	100	50	83
	2,000 ppm.	100	75	25	67	100	100	50	83
	4,000 ppm.	75	100	50	75	100	100	100	100
Control	Lanolin	100	50	25	58	100	75	25	67

Table 8. Germination of terminal, middle, and basal single-bud seedpieces, according to treatment and origin.

Treatments		PERCENT GERMINATION: 2 Weeks, Term.	2 Weeks, Midd.	2 Weeks, Basal	2 Weeks, Ave.	4 Weeks, Term.	4 Weeks, Midd.	4 Weeks, Basal	4 Weeks, Ave.
Maleic hydrazide	500 ppm.	100	50	0	50	100	100	100	100
	1,000 ppm.	100	100	25	75	100	100	75	92
	2,000 ppm.	100	100	50	83	100	100	75	92
	4,000 ppm.	75	75	0	50	100	100	100	100
Naphthaleneacetamide	500 ppm.	100	100	50	83	100	100	75	92
	1,000 ppm.	100	75	25	67	100	100	50	83
	2,000 ppm.	100	75	25	67	100	100	50	83
	4,000 ppm.	75	100	50	75	100	100	100	100
Control	Lanolin	100	50	25	58	100	75	25	67

Table 9. Yield data for terminal, middle, and basal single-bud seedpieces, according to treatment and origin.

Treatments		Weight of aerial parts plus shoot roots: Fr. wt. in gm. per pl. Term.	Midd.	Basal	Ave.	Dry wt. in gm. per pl. Term.	Midd.	Basal	Ave.	% Dry Weight
Maleic hydrazide	500 ppm.	18.3	9.9	10.4	12.9	2.2	1.3	1.2	1.5	11.9
	1,000 ppm.	15.9	12.8	4.8	11.8	2.0	1.7	0.6	1.5	12.9
	2,000 ppm.	19.2	21.1	10.7	17.6	2.5	2.6	1.4	2.3	12.8
	4,000 ppm.	13.8	20.2	3.3	14.3	1.7	2.5	0.6	1.8	12.5
Naphthalene-acetamide	500 ppm.	23.1	22.9	17.2	21.4	3.0	3.0	2.0	2.7	12.5
	1,000 ppm.	22.1	11.2	8.3	15.0	2.8	1.6	1.4	2.0	13.6
	2,000 ppm.	13.0	15.3	11.6	13.6	1.7	2.0	1.4	1.7	12.8
	4,000 ppm.	15.6	13.3	4.8	11.2	2.0	1.6	0.8	1.5	13.1
Control	Lanolin	13.5	15.4	13.9	14.3	2.0	2.0	1.7	2.0	13.7

Table 9. Yield data for terminal, middle, and basal single-bud seedpieces, according to treatment and origin.

Treatments		Weight of aerial parts plus shoot roots: Fr. wt. in gm. per pl. Term.	Mid.	Basal	Ave.	Dry wt. in gm. per pl. Term.	Mid.	Basal	Ave.	% Dry Weight
Maleic hydrazide	500 ppm.	16.3	9.9	10.4	12.9	2.2	1.3	1.2	1.5	11.9
	1,000 ppm.	15.9	12.8	4.6	11.0	2.0	1.7	0.6	1.5	12.9
	2,000 ppm.	19.2	23.1	10.7	17.6	2.5	2.6	1.4	2.3	12.8
	4,000 ppm.	13.8	20.2	3.3	14.3	1.7	2.5	0.6	1.8	12.5
Naphthalene-acetamide	500 ppm.	25.1	22.9	17.2	21.4	3.0	3.0	2.0	2.7	12.5
	1,000 ppm.	22.1	11.2	8.3	15.0	2.6	1.6	1.4	2.0	13.6
	2,000 ppm.	13.0	15.3	11.6	13.6	1.7	2.0	1.4	1.7	12.8
	4,000 ppm.	15.6	13.3	4.8	11.2	2.0	1.6	0.8	1.5	13.1
Control	Lanolin	13.5	15.4	13.9	14.3	2.0	2.0	1.7	2.0	13.7

Experiment 4: Effects of lanolin applications of maleic hydrazide and naphthaleneacetamide on the germination of terminal, middle and basal single-bud seedpieces.

This experiment was designed to find the optimum concentrations for maleic hydrazide and naphthaleneacetamide when applied in lanolin to the bud of single-bud seedpieces.

Materials and Methods

Materials and methods were the same as for Experiment 3 except for the treatments, which included a larger number of concentrations and an untreated control.

These were: (1) maleic hydrazide at 125, 250 and 8,000 ppm., (2) naphthaleneacetamide at concentrations of 125, 250, and 8,000 ppm.

Results

Per cent germination at two and four weeks is shown in table 10. At two weeks five maleic hydrazide treatments (125, 250, 4,000 and 8,000 ppm.) were superior to the lanolin control, while four (125, 250, 2,000 and 4,000 ppm.) were superior to the untreated control. Five naphthaleneacetamide treatments were superior to the lanolin control at this time: 250, 1,000, 2,000, 4,000 and 8,000 ppm. Four (250, 1,000, 2,000 and 8,000 ppm.) were superior

Experiment 4: Effects of Jamolin applications of maleic hydrazide and naphthaleneacetamide on the termination of terminal, middle and basal single-bud specimens.

This experiment was designed to find the optimum concentrations for maleic hydrazide and naphthaleneacetamide when applied in Jamolin to the bud of single-bud seedpieces.

Materials and Methods

Materials and methods were the same as for Experiment 3 except for the treatments, which included a larger number of concentrations and an untreated control.

These were: (1) maleic hydrazide at 125, 250 and 5,000 ppm., (2) naphthaleneacetamide at concentrations of 125, 250, and 5,000 ppm.

Results

Per cent germination at two and four weeks is shown in table 10. At two weeks five maleic hydrazide treatments (125, 250, 1,000 and 5,000 ppm.) were superior to the Jamolin control, while four (125, 250, 1,000 and 4,000 ppm.) were superior to the untreated control. Five naphthaleneacetamide treatments were superior to the Jamolin control at this time: 125, 1,000, 2,000, 4,000 and 5,000 ppm. Four (250, 1,000, 4,000 and 5,000 ppm.) were superior

Table 10. Germination of terminal, middle, and basal single-bud seedpieces, according to treatment and origin.

Treatments		PER CENT GERMINATION							
		2 Weeks				4 Weeks			
		Term.	Midd.	Basal	Ave.	Term.	Midd.	Basal	Ave.
Maleic hydrazide	125 ppm.	100	75	50	75	100	100	100	100
	250 ppm.	100	100	50	83	100	100	75	92
	500 ppm.	50	0	25	25	100	75	100	92
	1,000 ppm.	50	0	0	17	100	50	100	83
	2,000 ppm.	100	50	0	50	100	100	100	100
	4,000 ppm.	75	25	25	42	75	100	100	92
	8,000 ppm.	100	50	25	58	100	100	75	92
Naphthaleneacetamide	125 ppm.	25	25	25	25	50	100	75	75
	250 ppm.	100	50	25	58	100	100	100	100
	500 ppm.	50	0	25	25	100	100	100	100
	1,000 ppm.	100	50	75	75	100	75	75	83
	2,000 ppm.	100	50	0	50	100	100	75	92
	4,000 ppm.	75	25	0	33	100	50	75	75
	8,000 ppm.	75	100	50	75	75	100	100	83
Control	Lanolin	50	25	0	25	100	100	100	100
	Untreated	100	25	0	42	100	75	50	75

Table 10. Germination of terminal, middle, and basal single-bud seedpieces, according to treatment and origin.

Treatments		PERCENT GERMINATION 2 weeks Term.	Mid.	Basal	Ave.	4 weeks Term.	Mid.	Basal	Ave.
Maleic hydrazide	125 ppm.	100	75	50	75	100	100	100	100
	250 ppm.	100	100	50	83	100	100	75	92
	500 ppm.	50	0	25	25	100	75	100	92
	1,000 ppm.	50	0	0	17	100	50	100	83
	2,000 ppm.	100	50	0	50	100	100	100	100
	4,000 ppm.	75	25	25	42	75	100	100	92
	8,000 ppm.	100	50	25	58	100	100	75	92
Naphthaleneacetamide	125 ppm.	25	25	25	25	50	100	75	75
	250 ppm.	100	50	25	58	100	100	100	100
	500 ppm.	50	0	25	25	100	100	100	100
	1,000 ppm.	100	50	75	75	100	75	75	83
	2,000 ppm.	100	50	0	50	100	100	75	92
	4,000 ppm.	75	25	0	33	100	50	75	75
	8,000 ppm.	75	100	50	75	75	100	100	83
Control	Lanolin	50	25	0	25	100	100	100	100
	Untreated	100	25	0	42	100	75	50	75

to the untreated check.

At two weeks it seemed that germination was somewhat inhibited in the control by the application of pure lanolin to the bud. However, at four weeks the lanolin control had reached 100% germination, while the untreated control remained at 75%. Two maleic hydrazide treatments, 125 and 2,000 ppm., equalled the lanolin check in germination, although all seven concentrations were superior to the untreated control. Two naphthaleneacetamide treatments, 250 and 5,000 ppm., equalled the lanolin check in germination with 100%, and five out of seven concentrations tried were superior to the untreated control. None of the aforementioned differences are significant, however.

Similar results were obtained from the yield data expressed in fresh and dry weight of aerial parts plus shoot roots (table 11).

Although the untreated control had lower per cent germination, the fresh weight on a per plant basis was higher (10.1 gm.) than that of the lanolin control (6.5 gm.) Five concentrations of maleic hydrazide gave yields superior to that of the lanolin control, while four were superior to the untreated check. All concentrations of naphthaleneacetamide were superior to the lanolin check, while only three gave higher yields per plant than the untreated control. The same relations held true when the

to the untreated check.

At two weeks it seemed that germination was somewhat inhibited in the control by the application of pure Ianolin to the bud. However, at four weeks the Ianolin control had reached 100% germination, while the untreated control reached 74%. Two maleic hydrazide treatments, 125 and 250 ppm., equalled the Ianolin check in germination, although all seven concentrations were superior to the untreated control. Two naphthaleneacetamide treatments, 250 and 500 ppm., equalled the Ianolin check in germination with 100%, and five out of seven concentrations tried were superior to the untreated control. None of the aforementioned differences are significant, however.

Similar results were obtained from the viable buds excised in fresh and dry weight of aerial parts plus shoot roots (table II).

Although the untreated control had lower per cent germination, the fresh wet bud and plant yields was higher (10.1 gm.) than that of the Ianolin control (6.5 gm.) Five concentrations of maleic hydrazide gave yields superior to that of the Ianolin control, while four were superior to the untreated check. All concentrations of naphthaleneacetamide were up prior to the Ianolin check, while only three gave higher yields per plant than the untreated control. The same relations held true when the

Table 11. Yield date for terminal, middle, and basal single-bud seedpieces, according to treatment and origin.

Treatments		Weight of aerial parts plus shoot roots: Fr. wt. in gm. per pl. Term.	Midd.	Basal	Ave.	Dry wt. in gm. per pl. Term.	Midd.	Basal	Ave.	% Dry Weight
Maleic hydrazide	125 ppm.	15.5	11.3	8.9	11.9	2.1	1.5	1.2	1.6	13.4
	250 ppm.	16.6	17.0	14.5	16.2	2.5	2.4	2.4	2.4	14.8
	500 ppm.	8.6	0.6	3.9	4.7	1.5	0.1	0.6	0.8	17.0
	1,000 ppm.	10.1	3.2	2.2	5.6	1.5	0.5	0.4	0.8	14.2
	2,000 ppm.	16.5	15.9	3.1	11.8	2.5	2.7	0.4	1.8	15.3
	4,000 ppm.	21.8	6.8	4.6	10.1	3.0	1.0	0.7	1.4	13.9
	8,000 ppm.	17.8	16.6	16.5	17.0	2.6	2.3	2.1	2.3	13.5
Naphthalene-acetamide	125 ppm.	7.5	7.4	6.6	7.6	1.1	1.2	0.9	1.1	14.5
	250 ppm.	11.7	9.7	8.2	9.8	2.4	1.4	1.1	1.6	16.3
	500 ppm.	10.8	4.8	9.2	8.3	1.5	0.6	1.3	1.1	13.3
	1,000 ppm.	21.9	18.4	21.7	20.8	3.2	2.9	3.0	3.1	14.9
	2,000 ppm.	18.4	15.9	9.2	15.0	2.7	2.1	1.1	1.7	11.3
	4,000 ppm.	10.3	10.6	5.1	8.2	1.4	1.4	0.8	1.2	14.6
	8,000 ppm.	18.9	8.6	7.4	11.0	2.9	1.7	1.0	1.8	16.3
Control	Lanolin	7.1	6.9	5.5	6.5	1.0	0.9	0.9	0.9	13.8
	Untreated	13.9	10.5	4.0	10.1	2.0	1.4	0.5	1.4	13.9

Table 11. Yield data for terminal, middle, and basal single-bud seedpieces, according to treatment and origin.

Treatments		Weight of aerial parts plus shoot roots: Fr. wt. in gm. per pl. Term.	Mid.	Basal	Ave.	Dry wt. in gm. per pl. Term.	Mid.	Basal	Ave.	% dry weight
Maleic hydrazide	125 ppm.	15.5	11.3	8.9	11.9	2.1	1.5	1.2	1.6	13.4
	250 ppm.	16.6	17.0	14.5	16.2	2.5	2.4	2.4	2.4	14.8
	500 ppm.	6.6	3.6	3.9	4.7	1.5	0.1	0.6	0.8	17.0
	1,000 ppm.	10.1	3.2	2.2	5.6	1.5	0.5	0.4	0.8	14.2
	2,000 ppm.	16.5	15.9	3.1	11.8	2.5	2.7	0.4	1.8	15.3
	4,000 ppm.	21.3	6.8	4.6	10.1	3.0	1.0	0.7	1.4	13.9
	8,000 ppm.	17.8	16.6	16.5	17.0	2.6	2.3	2.1	2.3	13.5
Naphthalene-acetamide	125 ppm.	7.5	7.4	6.6	7.6	1.1	1.2	0.9	1.1	14.5
	250 ppm.	11.7	9.7	8.2	9.9	2.4	1.4	1.1	1.6	16.3
	500 ppm.	10.8	4.8	9.2	8.3	1.5	0.6	1.3	1.1	13.3
	1,000 ppm.	21.5	18.4	21.7	20.6	3.2	[illegible]	3.0	3.1	14.9
	2,000 ppm.	13.4	15.9	[illegible]	15.0	2.7	1.3	1.1	1.7	11.3
	4,000 ppm.	10.5	10.6	5.1	[illegible]	1.4	1.4	0.8	1.2	14.6
	8,000 ppm.	16.9	8.6	7.4	11.0	2.9	1.7	1.0	1.8	16.3
Control	Lanolin	7.1	6.9	5.5	6.5	1.0	0.9	0.9	0.9	13.8
	Untreated	13.9	10.5	4.0	10.1	2.0	1.4	0.5	1.4	13.9

treatments were compared on a dry weight per plant basis. These differences are not significant, however.

Summary and Discussion

When applied to the cut end of the seedpieces at the concentrations used, maleic hydrazide and naphthaleneacetamide increased the rate of germination, but the differences obtained were not significant. Indolebutyric acid exhibited an inhibitory effect over both per cent and rate of germination. This is an agreement with the findings of Van Overbeek (85). Naphthaleneacetic acid also seemed to have an inhibitory effect on germination. Similar effects were obtained by Brandes and Van Overbeek (14). When seedpieces were grouped according to origin a germination gradient was observed. Terminal pieces exhibited the highest per cent and rate of germination, with lowered rates from middle and basal pieces. This agrees closely with the findings of Clements (18).

Growth measurements taken during the early stages of the experiment showed that the control was superior to all treatments in overall height per plant. At four weeks, however, some treatments equalled or were slightly better, and at eight weeks three treatments, maleic hydrazide, naphthaleneacetamide and naphthaleneacetic acid were superior, although not significantly so. Similar results

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Summary and Discussion

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were obtained by Loh, Tseng and Cheng (44), where shoot growth was slightly retarded during the first week by the application of 100 ppm. indoleacetic acid by soaking, but caught up during the second week. These initial differences, however, may be temporary in nature.

Except for maleic hydrazide and naphthaleneacetamide, all treatments inhibited the development of secondary shoots to some extent. Indoleacetic acid reduced the number of secondary shoots by 80% as compared to the control.

For all materials used the fresh weight of the set roots was equal to or superior to the control. At the concentration used indoleacetic acid was superior to all treatments, although not significantly so. This effect of indoleacetic acid is in agreement with the findings of Loh, Tseng and Cheng (44), who induced formation and elongation of set roots by the application of 100 ppm. indoleacetic acid to single-bud seedpieces by soaking. Indolebutyric acid at 4,500 ppm. did not stimulate the production of set roots. This might be due to the high concentration used in this experiment. Van Overbeek (85), using this material obtained root stimulation and but inhibition. Irrespective of treatment, basal pieces produced the greatest amount of set roots, followed by middle pieces, with the least amount emerging from terminal pieces.

In general, the application of maleic hydrazide and

were obtained by Loh, Tseng and Cheng (44), where shoot growth was slightly retarded during the first week by the application of 100 ppm. indoleacetic acid by soaking, but caught up during the second week. These initial differences, however, may be temporary in nature.

Except for maleic hydrazide and naphthaleneacetamide, all treatments inhibited the development of secondary shoots to some extent. Indoleacetic acid reduced the number of secondary shoots by 60% as compared to the control.

For all materials used the fresh weight of the set roots was equal to or superior to the control. At the concentration used indoleacetic acid was superior to all treatments, although not significantly so. This effect of indoleacetic acid is in agreement with the findings of Loh, Tseng and Cheng (44), who induced formation and elongation of set roots by the application of 100 ppm. indoleacetic acid to single-bud seedpieces by soaking. Indolebutyric acid at 4,500 ppm. did not stimulate the production of set roots. This might be due to the high concentration used in this experiment. Van Overbeek (65), using this material obtained root stimulation and but inhibition. Irrespective of treatment, basal pieces produced the greatest amount of set roots, followed by middle pieces, with the least amount emerging from terminal pieces.

In general, the application of maleic hydrazide and

naphthaleneacetamide in lanolin to the bud of single-bud pieces resulted in increased germination. As pointed out before, results from the last experiments were not consistent. While 4,000 ppm. maleic hydrazide seemed to cause some inhibition in the third experiment, 8,000 ppm. maleic hydrazide gave the highest yields in Experiment 4. Possibly the optimum concentration for maleic hydrazide when applied in this manner lies at or beyond this point. For naphthaleneacetamide the optimum concentration seems to lie between 750 and 2,000 ppm. If so, the application of naphthaleneacetamide for increasing the rate of germination does not seem to be effective.

If advantages are found from the application of growth-regulating substances to sugarcane seedpieces, other methods of application should be investigated.

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If advantages are found from application of growth-regulating substances to sugarcane seedpieces, other methods of application should be investigated.

EFFECTS OF HERBICIDAL AND HORMONAL APPLICATIONS OF GROWTH-REGULATING SUBSTANCES ON THE GROWTH OF RATOON CANE

Review of Literature

The use of growth-regulating substances for the control of weeds in sugarcane has created interest in relation to their effect on the cane plant.

The introduction of 2,4-D as a selective herbicide gave cane growers an effective tool with which to combat the large variety of weeds typical of the areas where sugarcane is grown. Its use was so rapidly adopted as a general practice in many areas that little attention was paid to possible toxic effects on the cane plant (59).

Of the materials used for the control of weeds in sugarcane the salts and esters of 2,4-dichlorophenoxyacetic acid are the most outstanding (9, 11, 20, 28, 57, 58). Trichloroacetic acid as the sodium or ammonium salts has proven effective in the control of grass weeds (46, 70). More recently maleic hydrazide has been introduced which shows selectivity for grass weeds (21, 76).

In 1946 Van Overbeek and Vélez (83) reporting on the use of 2,4-D in Puerto Rico stated that this material had no effect on the growth or stooling of young plant cane in concentrations as high as 0.3%. In other publications

EFFECTS OF HERBICIDAL AND NON-CHEMICAL APPLICATIONS OF GROWTH-REGULATING SUBSTANCES ON CANE GROWTH

Review of Literature

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that same year (82, 84). Van Overbeek, et al, again reported that concentrations up to 0.3% were entirely harmless to sugarcane.

In 1947 (80) Van Overbeek stated that "the selective action of 2,4-D as herbicide for sugarcane is such that it would require special conditions, which rarely exist in practical agriculture, to kill or even seriously damage a cane plant with 2,4-D." That same year Brown and Holdeman (15) reported injury to sugarcane from the use of 2,4-D. They found that some formulations were more toxic than others and that sprays of the esters at concentrations of 0.5% into the spindle of cane 18 inches tall produced chlorotic lesions. Abnormal nodes resulted from applications of the ethyl and butyl esters at 0.2% four days after flame cultivation.

Arceneaux (4) reported an average reduction of 9% in yield and a corresponding decrease in the rate of stalk elongation from sprays at the rate of 3 lbs. of 2,4-D per acre repeated three times. Guiscafré-Arrillaga (29) found that the injection of 2,4-D into the terminal bud of cane produced galls at the base of the youngest leaves visible in the spindle and in the mature internodes.

Nolla (59) found that 2,4-D injury to sugarcane is exhibited in various ways, bending of the stalks at the point of injury on the growth ring being the most common.

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(12) reported injury to sugarcane from the use of 2,4-D.
They found that some formulations were more toxic than
others and that sprays of the esters at concentrations of
0.5% into the spindle of cane 10 inches tall produced
chlorotic lesions. Abnormal nodes resulted from applica-
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exhibited in various ways, bending of the stalks at the
point of injury on the growth ring being the most common.

Hypertrophy of the root bank occurred when the tops of cane were soaked with a solution consisting of 50 ml. of 0.1% 2,4-D. Temporary dwarfing of the plant always followed injury, the affected culms being set back as much as 6 inches in the 4 weeks subsequent to treatment. He found that cane is most susceptible to injury after 3 months of age and that younger plants seem to be more resistant to injury, the reason being largely mechanical. When two-month-old plant cane was treated with 0.1% 2,4-D and measured for a period of eleven months it was shown that even when no symptoms of injury were apparent the growth was retarded significantly.

Havis (32) found that the isopropyl ester and triethanolamine salt of 2,4-D at 2 lbs. per acre had an adverse effect on the growth of one-month-old plant cane when sprayed over the tops. Greatest effects were exhibited two to three weeks after treatment. However, the same rates applied to the base of the plants had almost no effect on the growth rate.

Burr and Ashton (16) reported that the roots of sugarcane are quite sensitive to 2,4-D. Akamine (1) reported that pre-emergence applications to ratoon crops did not interfere with the emergence of the cane. When used on plant cane, however, the emergence of the cane was somewhat hindered. Arceneaux (4) found an unfavorable effect

Hypertrophy of the root bank occurred when the tops of cane were soaked with a solution consisting of 50 ml. of 0.1% 2,4-D. Temporary dwarfing of the plant always followed injury, the affected culms being set back as much as 6 inches in the 4 weeks subsequent to treatment. He found that cane is most susceptible to injury after 3 months of age and that younger plants seem to be more resistant to injury, the reason being largely mechanical. When two-month-old plant cane was treated with 0.1% 2,4-D and measured for a period of eleven months it was shown that even when no symptoms of injury were apparent the growth was retarded significantly.

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on the germination of the cane in pre-emergence treatments with 2,4-D if the material was placed less than 4 inches from the cuttings.

Hance (31) reported that the effects of pre-emergence applications of 2,4-D were dependent on soil characteristics, climatic conditions, and type of solution applied. On some Hawaiian soils application of 2 lbs. of 2,4-D to the soil surface with seed planted at a depth of 3 inches may arrest the germination of the seed pieces or destroy the young cane shoots. On other soils, however, as much as 25 lbs. of 2,4-D applied similarly will have no visible effect on the germination and growth of the cane.

Injury to corn from 2,4-D applications has also been reported (2, 37, 40, 63, 66, 67), the effects ranging from morphological abnormalities such as severe stalk bending, leaf rolling and brace-root stimulation to stalk brittleness, temporary retardation of growth with reduced stands, stunting, chlorosis and death of seedlings in pre-emergence applications.

On the effect of trichloroacetic acid on sugarcane and related plants, Leonard (43) found that the application of 40 lbs. of TCA per acre to corn produced no injury, but the plants looked somewhat smaller and lighter green. Stamper and Chilton (71), working in Louisiana, found that TCA at 15 lbs. in pre-emergence applications to

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Mance (31) reported that the effects of pre-emergence applications of $2,4$-D were dependent on soil characteristics, climatic conditions, and type of solution applied. On some Hawaiian soils application of 3 lbs. of $2,4$-D to the soil surface with seed planted at a depth of 3 inches may affect the germination of the seed pieces or destroy the young cane shoots. On other soils, however, as much as 25 lbs. of $2,4$-D applied similarly will have no visible effect on the germination and growth of the cane.

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On the effect of trichloroacetic acid on sugarcane and related plants, Leonard (43) found that the application of 40 lbs. of TCA per acre to corn produced no injury, but the plants looked somewhat smaller and lighter green. Stamper and Chilton (71), working in Louisiana, found that TCA at 15 lbs. in pre-emergence application to

sugarcane followed by 30 lbs. in the spring and 30 lbs. at layby gave sufficiently lower yields in some of the plots to indicate a possible injurious effect. Hagood (30) working with TCA on cane at rates of 20, 27 and 36 lbs. per acre found that sugar per ton of cane was lower in the treated plots. He interpreted this in part as a delay in maturity due to the retarded growth of sugarcane in the 2 months subsequent to application of the chemical. Loustalot (46) reported no injurious effects on the germination of seedpieces from pre-emergence applications of TCA at the rate of 100 lbs. per acre.

Maleic hydrazide has shown some selectivity for grass weeds. Crafts (21) found MH particularly toxic to grass species, affecting plants at concentrations ranging from 0.1 to 0.8% and producing growth abnormalities. Eskew and Willard (26) found that MH applied to corn at 2, 4, 6 and 8 lbs. per acre produced growth inhibition, while Beard (6) found that 0.05% MH applied at different growth stages produced effects ranging from complete inhibition of growth to no observable effect. Tatum and Curme (75) sprayed MH into the leaf whorl of corn 25 days old at concentrations ranging from 1,000 to 8,000 ppm. (0.1 to 0.8%). The lowest concentration inhibited the growth of all strains tested during the period of measurement, the effect increasing with the concentration. At 0.8% growth

effect increasing with the concentration. At 0.6% growth strains tested during the period of measurement, the lowest concentration inhibited the growth of all centrations ranging from 1,000 to 5,000 ppm. (0.1 to 0.6%). sprayed MH into the leaf whorl of corn 25 days old at con- growth to no observable effect. Tatum and Cowie (75) stages produced effects ranging from complete inhibition of Beard (6) found that 0.05% MH applied at different growth and 8 lbs. per acre produced growth inhibition, while and Willard (66) found the 1 H applied to corn at 4, 6, 0.1 to 0.6% and producing growth abnormalities. Naew weeds. Crafts (21) found MH particularly toxic to grass species, affecting plants at concentrations ranging from

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was almost completely inhibited and most plants died before the end of the experiment.

The following experiment was undertaken to determine the effect of herbicidal applications of 2,4-D and TCA alone and in combination, and the effect of hormonal applications of maleic hydrazide alone and in combination with 2,4-D directly on the cane foliage.

Materials and Methods

The field selected for this experiment consisted of 0.85 hectare of two-month-old first-year ratoon C.P. 29-116 cane. The cane was planted in single rows 5½ feet apart with alternate clean and trash rows. Plots 19' x 19' (1/120 acre each) in a randomized block design included 3 rows of cane.

Two stools at approximately one-third and two-thirds the length of the center row of cane in each plot were marked. In order to obtain a representative selection of plants from each of these two stools, the largest, third, fifth and seventh plants in size were tagged. This gave a total of four plants per stool or eight plants per plot, with a total of 32 plants per treatment.

The treatments consisted of:

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The following experiment was undertaken to determine the effect of hormonal applications of $2,4$-D and TCA alone and in combination, on the effect of hormonal applications of maleic hydrazide alone and in combination with $2,4$-D directly on the cane foliage.

Materials and Methods

The field selected for this experiment consisted of (.6) hectare of two-month-old first-year ratoon C.P. 29-116 cane. The cane was planted in single rows 5½ feet apart with alternate clean and trash rows. Plots 15' x 15' (1/120 acre each) in a randomized block design included 3 rows of cane.

Two stools at approximately one-third and two-thirds the length of the center row of cane in each plot were marked. In order to obtain a representative selection of plants from each of these two stools, the largest, third, fifth and seventh plants in size were tagged. This gave a total of four plants per stool or eight plants per plot, with a total of 32 plants per treatment.

The treatments consisted of:

1. 30 lbs. TCA per acre.[a]
2. 60 lbs. TCA per acre.
3. 2 lbs. 2,4-D per acre.[b]
4. 2 lbs. 2,4-D plus 30 lbs. TCA per acre.
5. 0.05% maleic hydrazide.[c]
6. 0.1% maleic hydrazide.
7. 0.2% maleic hydrazide.
8. 0.1% maleic hydrazide plus 0.05% 2,4-D.
9. Control - No treatment.

DuPont Spreader-Sticker was added to the sprays at the rate of 0.05%. Each treatment was replicated four times. Treatments 1 to 4 were applied as in weed control practices, while treatments 5 to 8 were applied directly to the cane foliage. Knapsack-type sprayers equipped with Spraying Systems 650015 tips were used at a pressure of 45 lbs.

The 288 plants tagged for growth measurements were measured the day following treatment, and every week thereafter for a period of three months, when the measurements

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[a] Sodium trichloroacetate (90%). Dow Chemical Co., Midland, Mich.

[b] Esteron 44 (Isopropyl ester of 2,4-dichlorophenoxyacetic acid, 44% by weight acid equiv.) Dow Chemical Co., Midland, Michigan.

[c] MH-30, maleic hydrazide, diethanolamine salt 50% (30% maleic hydrazide). United States Rubber Co., Naugatuck Chemical Division, Naugatuck, Conn.

1. 30 lbs. TCA per acre.[a]
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The 24 plants tagged for growth measurements were measured the day following treatment, and every week thereafter for a period of three months, when the measurements

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[a] Sodium trichloroacetate (90%). Dow Chemical Co., Midland, Mich.

[b] Esteron 44 (isopropyl ester of 2,4-dichlorophenoxyacetic acid, 44% by weight acid equiv.) Dow Chemical Co., Midland, Michigan.

[c] MH-30, maleic hydrazide, diethanolamine salt 30% (30% maleic hydrazide). United States Rubber Co., Naugatuck Chemical Division, Naugatuck, Conn.

were continued on a bi-weekly basis for four additional months. Overall height was recorded by measuring the distance from ground level to the last visible ligule on the stalk. Notes were taken on the weed control obtained from the herbicidal treatments.

Results

Good control of both broad-leaved weeds and grasses was obtained with 60 lbs. TCA to the acre and with the mixture of 2,4-D and TCA. Fair control was obtained with 30 lbs. TCA, and with 2 lbs. 2,4-D to the acre. However, these results may have been influenced by the dry weather experienced during the period following treatment which delayed germination and growth of the weed population.

Mortality among selected plants at the end of the experiment is presented in table 12. The plots treated with TCA at 60 lbs., and with 2,4-D at 2 lbs. had the highest mortality with 56.3 and 40.6 per cent respectively. Control plots had the least number of dead plants, 12.5 per cent. Although some of these deaths were undoubtedly caused by competition and/or disease, the differences in mortality observed especially at the higher rates of application appear to be due in a large part to the effects of the treatments.

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Table 12. Plant mortality 26 weeks after treatment.

Treatments	No. of Dead Plants	Per cent Mortality
30 lbs. TCA	12	37.5
60 lbs. TCA	18	56.3
2 lbs. 2,4-D	13	40.6
2 lbs. 2,4-D plus 30 lbs. TCA	12	37.5
0.05% MH	7	21.9
0.1% MH	7	21.9
0.2% MH	10	31.3
0.1% MH plus 0.05% 2,4-D	12	37.5
Control	4	12.5

Figure 1 shows cumulative growth for the herbicidal treatments at bi-weekly intervals based on all of the plants initially selected for measurement. Although the average height of the plants in the control plots was lower at the beginning of the experiment, they were superior in height to those treated with TCA, and with the mixture of 2,4-D and TCA 7 weeks after treatment, and to those treated with 2,4-D fifteen weeks after treatment. These differences, however, are not significant.

Figure 2 also shows cumulative growth for the herbi-

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Treatments	No. of dead Plants	Per cent mortality
30 lbs. TCA	17	37.8
60 lbs. TCA	18	40.0
2 lbs. $2,4$-D	15	33.3
2 lbs. $2,4$-D plus 30 lbs. TCA	12	26.7
0.05% IH	7	15.6
0.1% IH	7	15.6
0.2% IH	10	22.2
0.1% IH plus 0.05% $2,4$-D	12	26.7
Control	4	8.9

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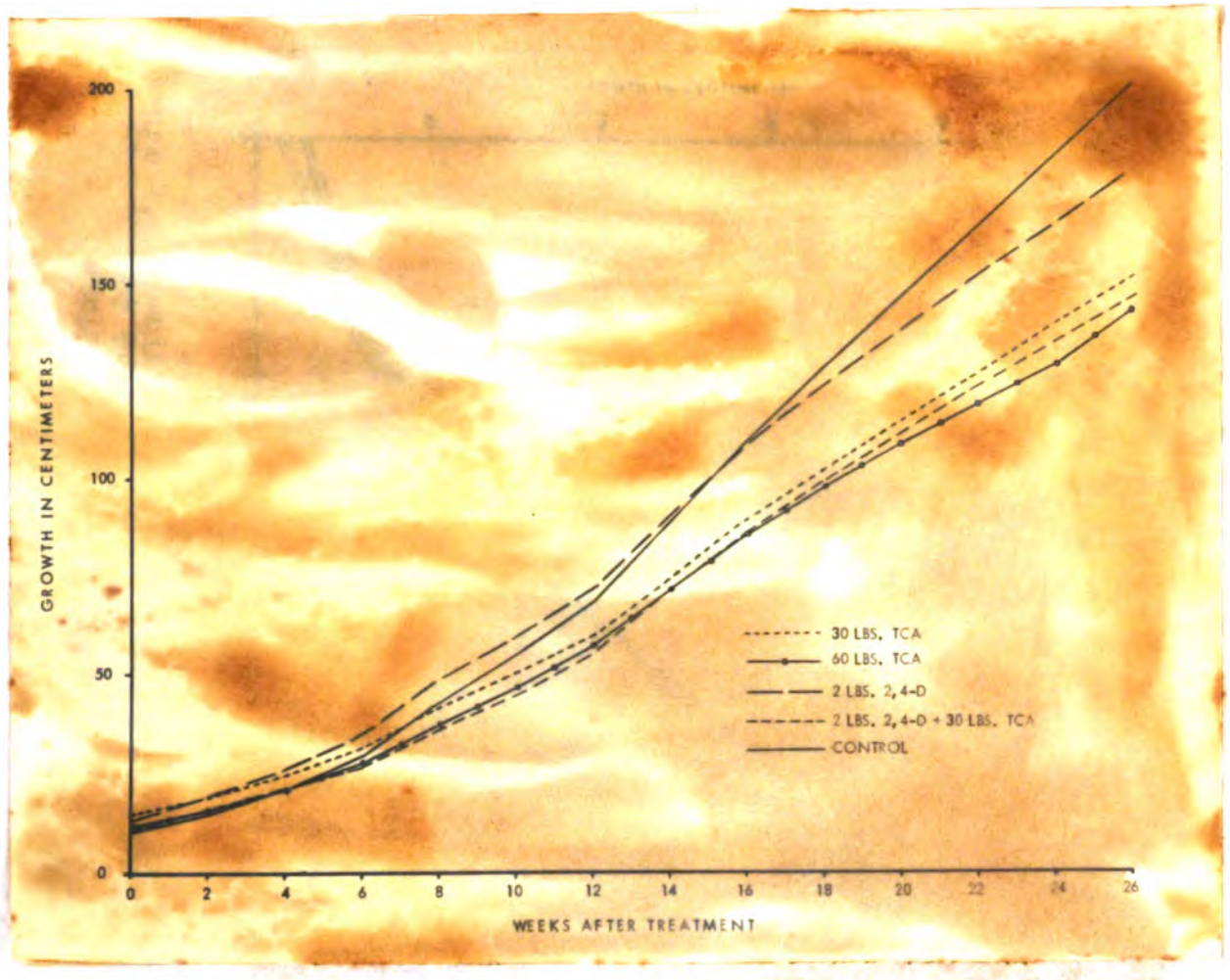

Figure 1. Cumulative growth at bi-weekly intervals for herbicidal treatments. All plants included.

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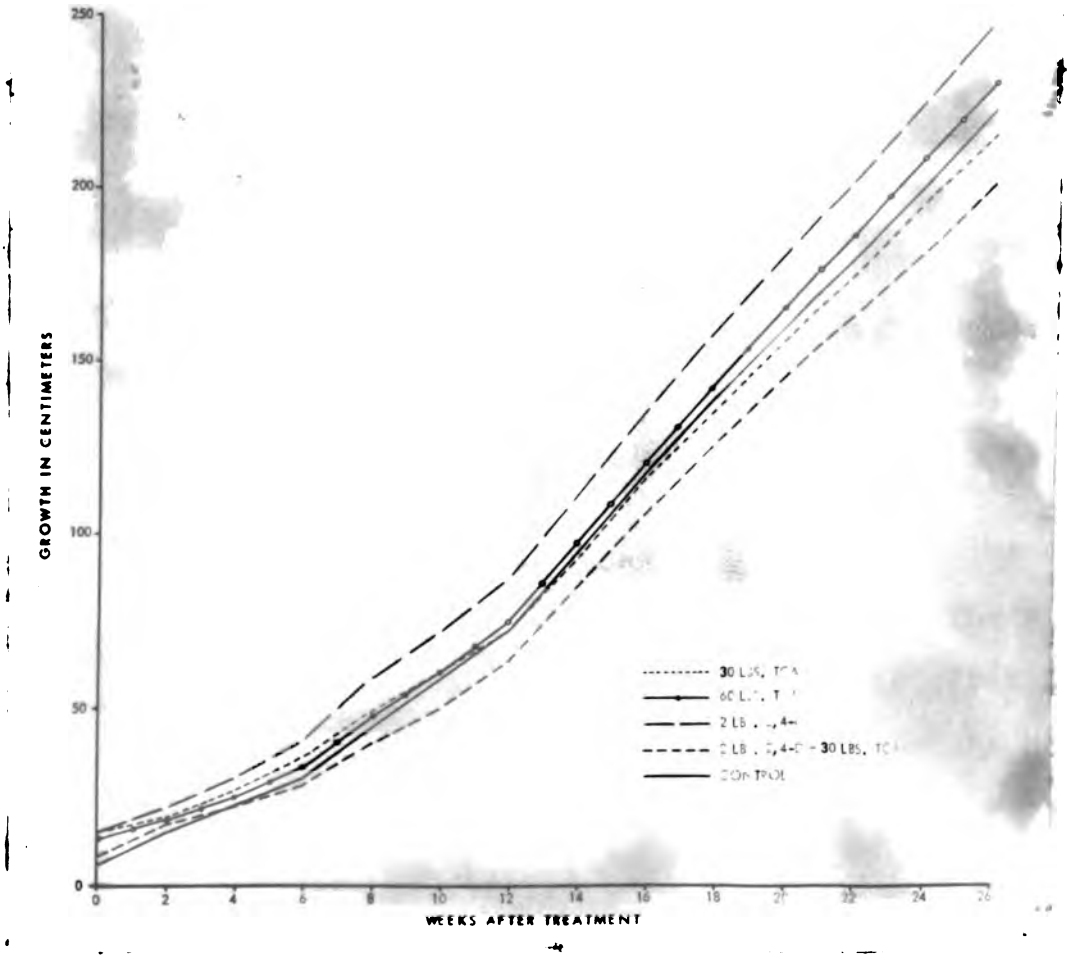

Figure 2. Cumulative growth at bi-weekly intervals for herbicidal treatments. All dead plants excluded.

Figure 7. Cumulative rewards at bi-weekly intervals for herbicide treatments. All crop plants excluded.

cidal treatments at bi-weekly intervals, but all dead plants have been excluded. When calculated on this basis the average height per plant for all treatments was greater, and the final arrangement of the growth curves is quite different. However, the variation in plant height between treatments at the end of the experiment was not significant.

Figure 3 shows the same data expressed as the bi-weekly growth increment in per cent of ultimate height. All of the plants initially selected for measurement were included. These curves show two peaks, one at 8 weeks and another at 14 weeks after treatment. These peaks are correlated with the amount of rainfall registered during this period. No great differences in growth could be observed during the early part of the experiment. The control plants registered higher growth increments after 14 weeks with an increase in elongation at 24 weeks which resulted in flowering. Flowering for the chemical treatments was retarded, especially for TCA applied at 30 and 60 lbs. to the acre. The same results were observed when the growth increment was calculated on the basis of actively growing plants at the end of the experiment.

Figure 4 shows cumulative growth for the hormonal treatments at bi-weekly intervals. All of the plants initially selected for measurement were included. Again,

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Figure 4 shows cumulative growth for the bi-monthly treatments at bi-weekly intervals. All of the plants initially selected for measurement were included. Again,

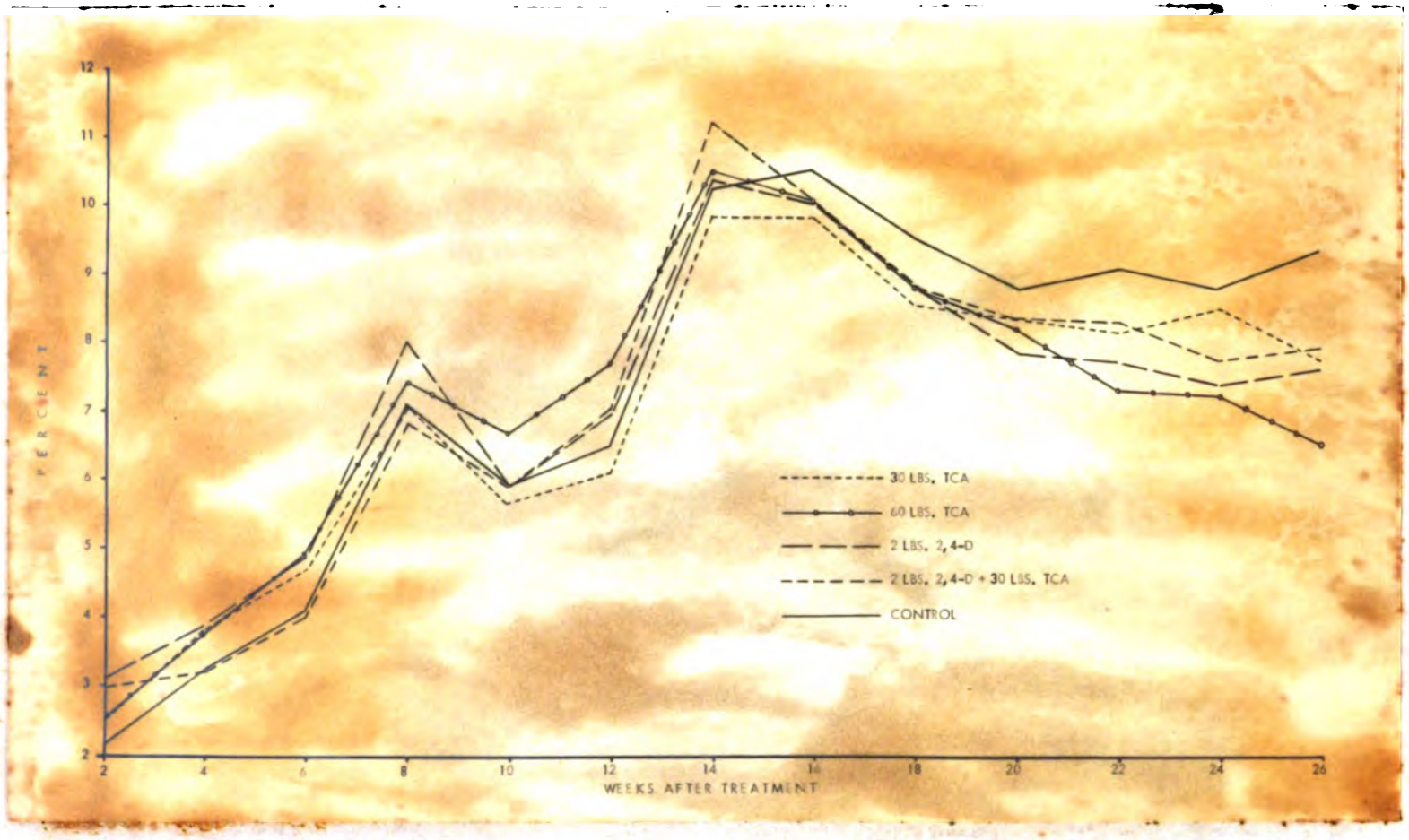

Figure 3. Bi-weekly growth increment for herbicidal treatments expressed as per cent of ultimate length. All plants included.

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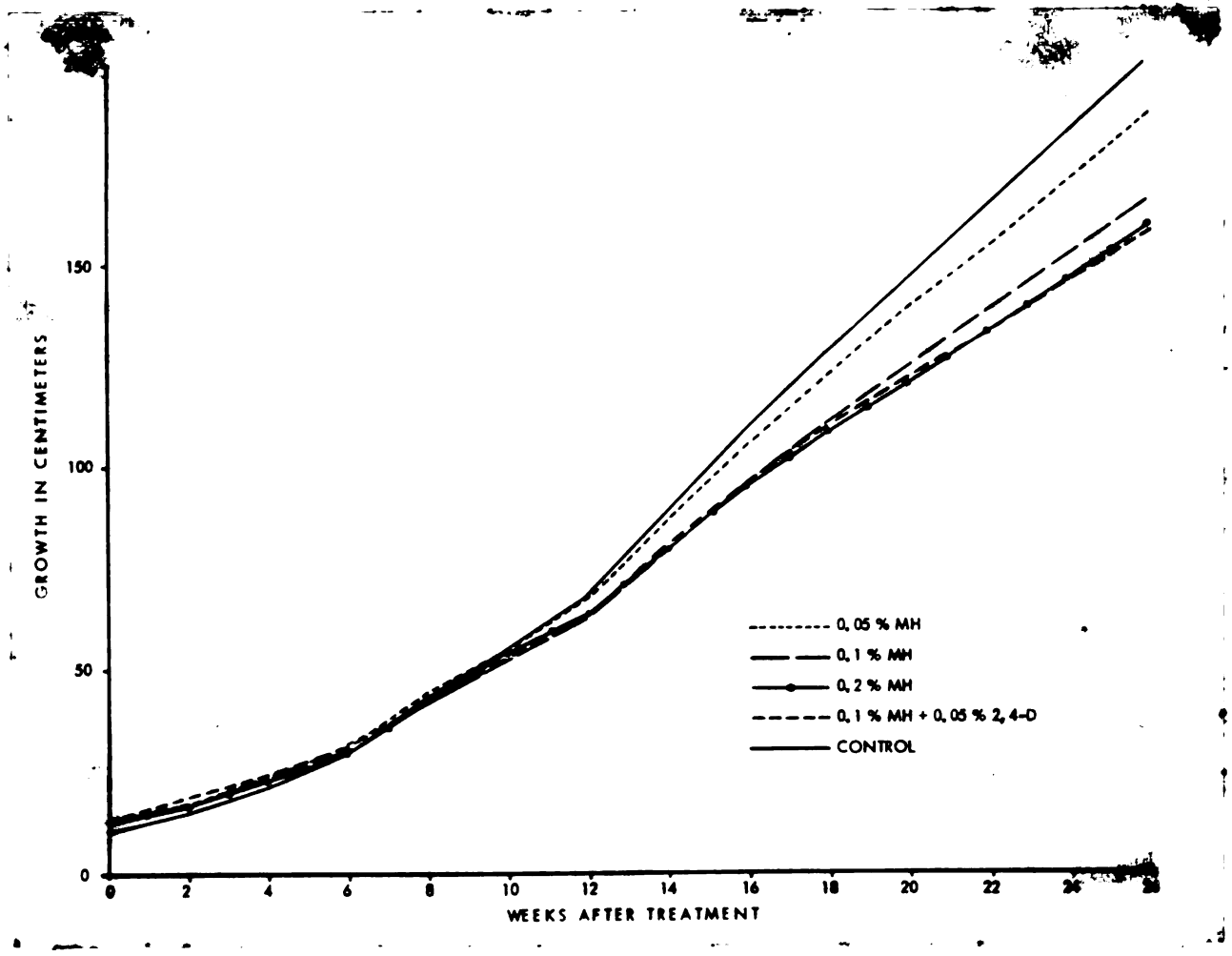

Figure 4. Cumulative growth at bi-weekly intervals for hormonal treatments. All plants included.

although the average height of the plants in the control plots was lower at the beginning of the experiment, control plants were superior in height to all treatments 10 weeks after application. When average plant height was calculated, excluding all dead plants, there was practically no variation between treatments.

Figure 5 shows the same data for the hormone treatments expressed as the bi-weekly growth increment in per cent of ultimate height. All of the plants initially selected for measurement were included. The same general pattern of growth obtained for the herbicidal treatments can be observed and again is correlated with the amount of rainfall registered during this period. The growth increment for the control is superior to all treatments after 14 weeks. Contrary to the results obtained for the herbicidal treatments, none of the hormone-type applications seemed to delay flowering.

Summary and Discussion

For both herbicidal and hormonal treatments the degree of plant mortality is in line with the concentrations used. However, since other factors such as competition and/or disease undoubtedly affected the growth of some plants directly or indirectly, we cannot assume that all deaths were due entirely to the effect of the

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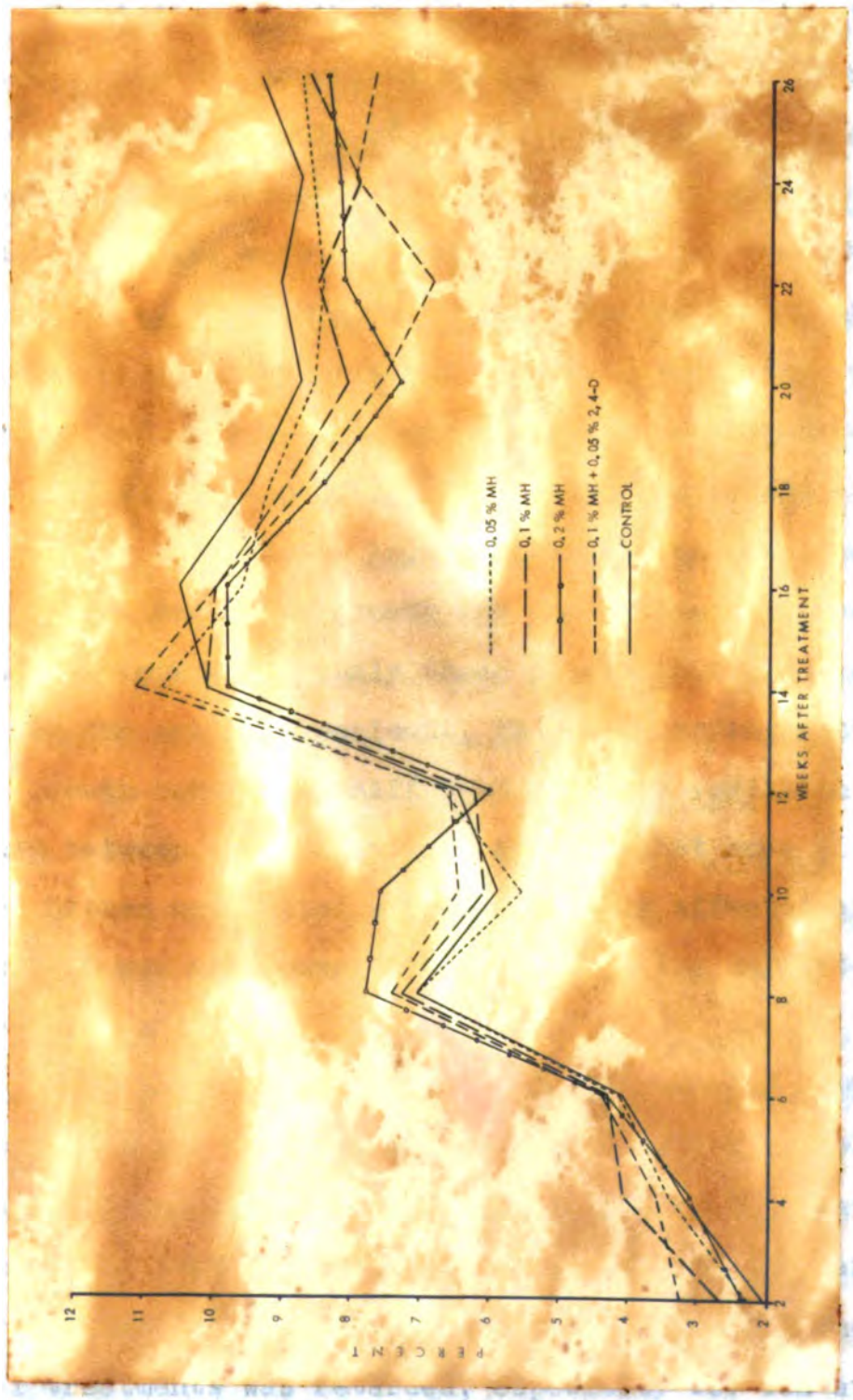

Figure 5. Bi-weekly growth increment for hormonal treatments expressed as per cent of ultimate length. All plants included.

Figure 2. Fluorescent micrograph of a cross section of a tumor-bearing mouse kidney. All glomeruli are perfused with fluorescent dye-labeled albumin.

treatments.

Cumulative growth for the herbicidal treatments based on all of the plants initially selected for measurement shows that all of the chemical treatments affected growth to some extent, although not significantly so. Similar results were obtained by Nolla (59) who found that when cane two months old was treated with 0.1% 2,4-D and measured for a period of 11 months the growth was retarded even when no symptoms of injury were apparent. Stamper and Chilton (71) working with TCA obtained lower yields due possibly to injurious effect on the cane.

When cumulative growth for the herbicidal treatments was calculated using only those plants that grew actively during the entire experiment, the final arrangement of the growth curves was different and less variation was found between treatments. It appears that some plants were either unaffected or only slightly affected and that their growth was comparable to that of the untreated plants.

When this data was expressed in bi-weekly growth increment in per cent of ultimate height using all plants initially selected for measurement, no great differences could be observed in the growth rate during the early part of the experiment. However, flowering for the chemical treatments was retarded, especially for TCA at 30 and

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From the results obtained in this experiment, it appears that the application of selective herbicides, especially at higher concentrations, may affect plant population and yields due to delayed maturity of the cane as a result of retarded growth. This would be particularly true in weed control programs where application of one or more materials are made at different stages during the growth of the cane.

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EFFECT OF PRE-HARVEST FOLIAGE SPRAYS WITH MALEIC HYDRAZIDE ON THE SUCROSE CONTENT OF SUGARCANE AND INVERSION OF SUCROSE IN HARVESTED CANE

Review of Literature

It has been found that some growth-regulators influence carbohydrate metabolism. Sell, et al. (65) reported that the application of 2,4-D to red kidney beans reduced the content of reducing and non-reducing sugars in the stems, while Weller, et al. (88) observed a reduced percentage of non-reducing sugars in the leaves and roots of treated kidney bean plants, but no change in reducing sugars.

Increase in the sucrose content of plants as a result of application of 2,4-D has been reported in buckwheat (92, 93), in tomato (94), and in cotton (25).

In 1949 (77) it was reported that apart from weed elimination, treatment with 2,4-D might increase the sucrose content of sugarcane. Beauchamp (7) reported an average increase in sucrose of 1.38% from the application of 2,4-D prior to harvest in tests carried out during 1947-1949. However, Loustalot, et al. (47) did not obtain significant increases in sucrose content in a similar experiment. Cerighelli (17) reviewing the work of these investigators, pointed out the need for further work along

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this line. Lugo and Grant (48) failed to obtain any increase in sucrose content from heavy applications of 2,4-D to sugarcane prior to harvesting. Beauchamp (8) demonstrated his technique in Brazil with promising results. More recently Lugo, Samuels and Grant (49) failed to obtain an increase in the sucrose content of sugarcane from the pre-harvest application of 2,4-D.

The possibility that maleic hydrazide may influence carbohydrate metabolism has been suggested by Naylor and Davis (56). Currier, et al. (22) found that MH-treated barley had a lower fresh weight but higher dry weight due to accumulation of fructosan. Analysis of exudate from the leaves showed a predominance of sucrose. McIlrath (50) reports that the chemical analysis of the leaves of cotton treated with MH showed an increase in sucrose and a marked increase in starch over the checks. He suggests that the accumulation of carbohydrates might be due to damage to phloem sieve tubes. In vitro experiments with carrots by Phouphas (61) showed that MH produced a rapid increase in sucrose content, with a subsequent rapid decline. MH also inhibited the transformation of glucose to fructose.

Corn sprayed with MH at 0.1% showed exudate rich in sugar on the underside of the leaves (56). Naylor (55) obtained similar results from application to corn at 0.05

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Ririe and Mikkelsen (62) found that foliage sprays of sugar beets with maleic hydrazide at 0.025 and 0.3% prior to harvest produced significantly higher sucrose content, with the maximum increase registered during the first 21 days following treatment. Similar results were obtained by Wittwer and Hansen (90), who found that the application of sodium and diethanolamine salts of MH significantly increased the sucrose content of sugar beets at the time of harvest. Mikkelsen, et al.(54) harvested beets 30 and 44 days subsequent to treatment at rates of 0.75, 1.5 and 3 lbs. MH to the acre. Per cent sucrose increased with the higher rates of application. They suggest that increase in sucrose may be due to interference with mitotic development of tops and partial inhibition of root growth resulting in higher sucrose content of roots with little increase in root size.

Lugo, Samuels and Grant (49) applied maleic hydrazide to sugarcane at concentrations ranging from 0.025 to 2.0%. Daily samples showed no significant differences in Brix, polarization or purity.

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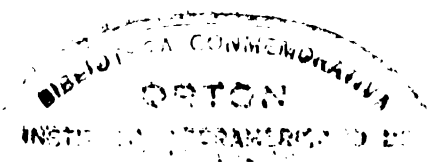
Balch, et al. calculated that there is a loss in weight of 1% per day for cane stored in the field under Louisiana conditions, a daily loss of about 45,000 tons of cane over the State (5).

Sucrose losses are due primarily to the inversion of sucrose to reducing sugars and secondarily to a consumption of sugars through respiration. The most important factor controlling the inversion of sucrose in cane during storage under Louisiana conditions is moisture balance, while temperature is of secondary importance (5).

Lauritzen and Balch (41) found that in entire stalks there tended to be a gradient in the loss of moisture, increase in Brix, drop in purity and loss of sucrose, and that these changes were greatest in the top, next greatest in the middle and least in the basal sections of the stalk.

Lauritzen, Balch and Fort (42) found no relation between the invertase content of the stalk and its resistance to inversion of sucrose. Varietal differences in loss of weight by evaporation are related to the thickness of the waxy covering of the stalk which differs among varieties.

The use of maleic hydrazide to prevent storage losses in sugar beets has been investigated. Peto, et al. (60)



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found that treated beets harvested and stored for 34 days were 0.25% higher in sucrose at the beginning of storage and 0.38% higher at removal. Wittwer and Hansen (91) found that although there was no change in the sugar composition of beets treated before storage, per cent sugar in control beets was reduced by more than 4% at the end of storage. Weight losses also were high in control as compared to treated beets, giving a total loss of 13.06% of the total original sugar content as compared to 0.72% in the treated beets. The average temperature of the bins where the treated beets were stored ran several degrees cooler during the experiment. They suggest that MH might inhibit respiratory losses through the partial inactivation of one or more of the dehydrogenases, as reported by Isenberg, et al. (39).

An experiment was undertaken to study the effect of maleic hydrazide on the sucrose content of sugarcane and the inversion of sucrose in harvested sugarcane.

Materials and Methods

Sample size study.

A sample size study was undertaken to determine the number of stalks that would constitute a representative sample. The method employed by the Division of Sugar Plant Investigations, United States Department of Agriculture,

found that treated beets harvested and stored for 3½ days were 0.25% higher in sucrose at the beginning of storage and 0.38% higher at removal. Wittwer and Hansen (21) found that although there was no change in the sugar composition of beets treated before storage, per cent sugar in control beets was reduced by more than 1% at the end of storage. Weight losses also were high in control as compared to treated beets, giving a total loss of 13.6% of the total original sugar content as compared to 6.72% in the treated beets. The average temperature of the bins where the treated beets were stored ran several degrees cooler during the experiment. They suggest that H might inhibit respiratory losses through the partial inactivation of one or more of the dehydrogenases, as reported by Isenberg, et al. (39).

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for conducting variety tests in Louisiana (34) furnished part of the needed information. In sampling studies they have found that although individual stalks in a stool vary considerably, individual stools taken as a unit show little variation over a 1/40 acre plot (33).

The following test was conducted in the same field selected for the maleic hydrazide treatments. This was 14-month-old P.O.J. 2878 plant cane. From rows selected at random 40 stalks were cut in the same order in which they stood in the field and segregated into two 5-stalk and three 10-stalk units in the order cut. These units were milled separately in that order so as to obtain aliquots from 5, 10, 20, 30, and 40-stalk bundles. Four replications were used.

Milling was done in a 3" x 4-3/4" 3-roller laboratory mill giving 66% extraction with the variety used in this trial. Brix was determined by hydrometer, and initial reducing value and sucrose following invertase hydrolysis by a modification of the Shaffer-Somogyi semi-micro method (35). The resulting glucose equivalent was then read from a table prepared from the analysis of standard glucose solutions. Conversion to sucrose was made using the factor 0.95 (45).

Results of the analyses are shown in table 13.

for conducting variety tests in Louisiana (34) furnished part of the needed information. In sampling studies they have found that although individual stalks in a stool vary considerably, individual stools taken as a unit show little variation over a 1/4¢ acre plot (33).

The following test was conducted in the same field selected for the maleic hydrazide treatments. This was 14-month-old P.O.J. 2878 plant cane. From rows selected at random 40 stalks were cut in the same order in which they stood in the field and segregated into two 5-stalk and three 10-stalk units in the order cut. These units were milled separately in that order so as to obtain aliquots from 5, 10, 20, and 40-stalk bundles. Four replications were used.

Milling was done in a 3" x 4-3/4" 3-roller laboratory mill giving 66% extraction with the variety used in this trial. Brix was determined by hydrometer, and initial reducing value and sucrose following invertase hydrolysis by a modification of the Shaffer-Somogyi semi-micro method (35). The resulting glucose equivalent was then read from a table prepared from the analysis of standard glucose solutions. Conversion to sucrose was made using the factor 0.95 (45).

Results of the analyses are shown in table 13.

Table 13. Analyses of various size samples for determining the variation in sucrose content.

Number of stalks	% Sucrose by Weight					Max. var. between Replic.	% var.
	1	2	3	4	Ave.		
5	16.5	18.4	20.8	19.9	18.9	4.3	22.6
10	18.1	18.6	20.3	19.1	19.1	2.3	11.9
20	18.6	19.1	19.8	19.7	19.3	1.3	6.8
30	18.9	19.3	19.4	19.4	19.2	0.5	2.7
40	19.0	19.1	19.7	19.4	19.3	0.8	4.1

These figures show that the per cent variation decreased as the number of stalks in a sample increased up to 30 stalks. From these results it was decided that 20 stalks would constitute a representative sample for a 1/40 acre plot when collected from the same length of row under local conditions. Increased accuracy obtained by the collection of a larger sample would be offset by the increased time and labor necessary to grind samples of this size.

Experiment 1: Effect of pre-harvest foliage sprays with maleic hydrazide on the inversion of sucrose in harvested cane.

This experiment was undertaken to determine the effect of maleic hydrazide on the inversion of sucrose in cut cane

Table 13. Analyses of various size samples for determining the variation in sucrose content.

Number of splits	Sucrose by weight					Max. var. between %	
	1	2	3	4	Ave.	max. var.	var.
5	16.5	17.4	20.8	19.9	18.9	4.3	22.6
10	16.1	16.6	20.3	19.1	19.1	2.3	11.9
20	16.6	19.1	19.6	19.7	19.3	1.3	6.6
30	16.9	19.3	19.4	19.4	19.2	0.5	2.7
40	19.0	19.1	19.7	19.4	19.3	0.6	4.1

These figures show that the per cent variation decreased as the number of splits in a sample increased up to 30 splits. From these results it was decided that 20 splits would constitute a representative sample for a 1/4 acre plot when collected from the same length of row under local conditions. Increased accuracy obtained by the collection of a larger sample would be offset by the increased time and labor necessary to grind samples of this size.

Experiment 1: Effect of pre-harvest foliage sprays with maleic hydrazide on the inversion of sucrose in harvested cane.

This experiment was undertaken to determine the effect of maleic hydrazide on the inversion of sucrose in cut cane

subjected to field conditions for different periods of time.

Materials and Methods

Twenty plots 40' x 27' (approximately 1/40 acre each) were set out in a 4 x 5 randomized block design. Each plot included four rows of cane 40' long. Alleys were cleared around the plots to facilitate spraying. Two rows of standing cane were left as buffers between plots.

Five treatments were included:

1. Maleic hydrazide at 750 ppm. (0.8 lbs. per acre)
2. " " " 1500 " (1.6 " " ")
3. " " " 3000 " (3.2 " " ")
4. " " " 6000 " (6.4 " " ")
5. Control - no treatment.

ESSO experimental sticker RDA-156 was added to the sprays at the rate of 0.125%. The materials were applied to the cane foliage by means of knapsack sprayers equipped with a 9-foot hose at a pressure of 55 lbs. By having one man carry the tank and another operating the boom, the applications were made with little difficulty.

All treatments were applied in the morning. Light rain amounting to 0.36 inch was recorded that afternoon, followed by 0.16 inch the next day.

Five days after treatment three 20-stalk samples were

subjected to field conditions for different periods of time.

Materials and Methods

Twenty plots 40' x 27' (approximately 1/4C acre each) were set out in a 4 x 5 randomized block design. Each plot included four rows of cane 40' long. Alleys were cleared around the plots to facilitate spraying. Two rows of standing cane were left as buffers between plots.

Five treatments were included:

1. Cadmic Hydrazide at 750 ppm. (0.6 lbs. per acre)
2. " " " 1500 " (1.6 " " ")
3. " " " 3000 " (3.2 " " ")
4. " " " 6000 " (6.4 " " ")
5. Control - no treatment.

1550 experimental sticker 4A-1JC was added to the sprays at the rate of 0.1%. The materials were applied to the cane foliage by means of Jacobsen sprayers equipped with a 9-foot hose at a pressure of 55 lbs. By having one man carry the tank and another operating the boom, the applications were made with little difficulty.

All treatments were applied in the morning. Light rain amounting to 0.36 inch was recorded that afternoon, followed by 0.16 inch the next day.

Five days after treatment three SC-stalk samples were

collected from each plot using the technique described in the sample-size study. These were tied into separate bundles and marked 0, 3, and 9. All 0 samples were milled and analyzed that same day, while samples 3 and 9 were left in the field and milled three and nine days after harvesting.

The weight of each sample, the weight of the juice extracted, the Brix, and the initial reducing value as well as total reducing value after hydrolysis with invertase were determined for each sample.

Results

Results for this experiment are presented in table 14. The analysis for 0-day samples (milled same day harvested) shows an increase in Brix for MH applied at the rates of 3,000 and 6,000 ppm. However, the differences are not significant. Difficulties were experienced in determining initial reducing values for this series, and these are omitted from the table. Other data presented have been calculated on the basis of total reducing value, giving slightly higher values for per cent sucrose. Total reducing value expressed as per cent sucrose was superior for MH applied at the rate of 1,500, 3,000 and 6,000 ppm. However, none of these differences are significant.

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The weight of each sample, the weight of the juice extracted, the brix, and the initial reducing value as well as total reducing value after hydrolysis with invertase were determined for each sample.

Results

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Table 14. Analysis of samples collected five days after treatment and milled at 0, 3, and 9 days subsequent to harvest.

Treatments	0-Day Samples			3-Day Samples				9-Day Samples			
		% Sucrose[x]			% Red. Sug.in	% Sucrose			% Red. Sug.in	% Sucrose	
	Brix	Juice	Cane	Brix	Sample	Juice	Cane	Brix	Sample	Juice	Cane
750 ppm. MH (0.8 lb./acre)	20.4	18.9	12.7	21.1	1.6	20.8	13.3	20.8	5.7	19.0	12.7
1500 ppm. MH (1.6 lb./acre)	20.7	20.0	13.8	20.6	1.9	19.3	12.9	20.2	5.9	18.4	12.1
3000 ppm. MH (3.2 lb./acre)	21.6	21.1	14.3	20.9	1.8	19.8	13.6	21.7	5.8	19.8	13.3
6000 ppm. MH (6.4 lb./acre)	21.3	20.6	13.8	20.9	1.9	19.9	12.7	21.0	5.0	19.7	13.1
Control - no treatment	20.2	19.3	13.1	21.0	1.6	19.8	13.3	21.0	3.2	20.0	13.3

[x] Calculated on the basis of total reducing value, since initial reducing value was not obtained for 0-Day samples.

Table 14. Analysis of samples collected five days after treatment and milled at 0, 3, and 9 days subsequent to harvest.

Treatments	0-Day Samples Brix	0-Day Samples % Sucrose Juice	0-Day Samples % Sucrose[x] Cane	3-Day Samples Brix	3-Day Samples % Red. Sug. in Sample	3-Day Samples % Sucrose Juice	3-Day Samples % Sucrose Cane	9-Day Samples Brix	9-Day Samples % Red. Sug. in Sample	9-Day Samples % Sucrose Juice	9-Day Samples % Sucrose Cane
750 ppm. MH (0.8 lb./acre)	20.4	18.9	12.7	21.1	1.6	20.8	12.3	20.8	5.7	19.0	12.7
1500 ppm. MH (1.6 lb./acre)	20.7	20.0	13.8	20.6	1.9	19.3	12.9	20.2	5.9	18.4	12.1
3000 ppm. MH (3.2 lb./acre)	21.6	21.1	14.3	20.9	1.8	19.8	13.6	21.7	5.8	19.8	13.3
6000 ppm. MH (6.4 lb./acre)	21.3	20.6	13.8	20.9	1.9	19.9	12.7	21.0	5.0	19.7	13.1
Control - no treatment	20.2	19.3	13.1	21.0	1.6	19.8	13.0	21.0	3.2	20.0	13.3

x Calculated on the basis of total reducing value, since initial reducing value was not obtained for 0-Day samples.

Analysis of 3-day samples showed no differences in Brix between treatments. Although no changes in Brix were observed for treatments consisting of 1,500, 3,000 and 6,000 ppm. MH as compared to the 0-day samples, the lowest concentration of MH and the control had the lowest per cent reducing value and showed apparent increases in Brix and per cent sucrose.

At 9 days no changes in Brix were observed. The control was slightly superior in per cent sucrose over all treatments. Inversion of sucrose in all samples had increased. The control had the lowest per cent reducing value, although these differences were not significant.

Experiment 2: Effects of pre-harvest foliage sprays with maleic hydrazide on the sucrose content of sugar cane.

This experiment was run in conjunction with the experiment on the inversion of sucrose in harvested cane.

Materials and Methods

The materials employed in this study were the same. The original plan called for sampling and analysis at one, two, and four weeks subsequent to application of the materials. Due to difficulties with the mill, however, results for only two dates - 5 days and 30 days after treatment - were obtained.

analysis of 3-day samples showed no differences in Brix between treatments. Although no changes in Brix were observed for treatments consisting of 1,500, 3,000 and 6,000 ppm. pH as compared to the 0-day samples, the lowest concentration of 1% and the control had the lowest per cent reducing value and showed apparent increases in Brix and per cent sucrose.

At 7 days no changes in Brix were observed. The control was slightly superior in per cent sucrose over all treatments. Inversion of sucrose in all samples had increased. The control had the lowest per cent reducing value, although these differences were not significant.

Experiment 2: Effects of pre-harvest foliage sprays with maleic hydrazide on the sucrose content of sugar cane.

This experiment was run in conjunction with the experiment on the inversion of sucrose in harvested cane.

Materials and Methods

The materials employed in this study were the same. The original plan called for sampling are analysis at one, two, and four weeks subsequent to application of the materials. Due to difficulties with the mill, however, results were obtained.

Results

Data for this experiment are presented in table 15. Two treatments, maleic hydrazide at 3,000 and 6,000 ppm., were superior in Brix and total reducing value expressed in as per cent sucrose 5 days after treatment. Maleic hydrazide applied at 1,500, 3,000 and 6,000 ppm. gave higher per cent sucrose in the cane than the control.

Data for the series analyzed 30 days subsequent to treatment shows an overall reduction in Brix. MH applied at 3,000 and 6,000 ppm. was superior in Brix and per cent sucrose in the juice to the control. When compared on the basis of per cent sucrose in cane, all treatments were superior to the control.

Summary and Discussion

It was found that under local conditions 20 stalks constitute a representative sample for 1/40 acre plots when collected from the same length of row. This is in agreement with results obtained by the Division of Sugar Plant Investigations in Louisiana (33, 34).

Contrary to results obtained with sugar beets (60, 91) the application of maleic hydrazide to sugarcane prior to harvesting for preventing sucrose losses due to delayed milling does not seem to be effective. When milling was delayed for three days after harvesting, maleic hydrazide

Results

Data for this experiment are presented in table 15. Two treatments, malic hydrazide at 3,000 and 6,000 ppm., were superior in that each produced reducing value expressed in as per cent sucrose 3 days after treatment. Malic hydrazide applied at 1,500, 3,000 and 6,000 ppm. gave higher per cent sucrose in the cane than the control.

Data for the series analyzed 3 days subsequent to treatment shows an overall reduction in purity. Application at 3,000 and 6,000 ppm. was superior in Brix and per cent sucrose in the juice to the control. When considered on the basis of per cent sucrose in cane, all treatments were superior to the control.

Summary and Discussion

It was found that under local conditions 6 weeks constitute a representative sample for 1/4c acre plots when collected from the same portion of row. This is in agreement with results obtained by the division of Sugar Plant Investigations in Louisiana (33, 34).

Contrary to results obtained with sugar beets (60, 71) the application of malic hydrazide to sugarcane prior to harvesting for preventing sucrose losses due to delayed milling does not seem to be effective. When milling was delayed for three days after harvesting, malic hydrazide

Table 15. Analysis of samples milled 5 and 30 days subsequent to applications.

Treatments	5 Days			30 Days		
	Brix	% Sucrose[x] Juice	Cane	Brix	% Sucrose Juice	Cane
750 ppm. MH (0.8 lbs. per acre)	20.4	18.9	12.7	19.6	19.4	13.0
1500 ppm. MH (1.6 lbs. per acre)	20.7	20.0	13.8	19.5	19.7	13.3
3000 ppm. MH (3.2 lbs. per acre)	21.6	21.1	14.3	20.1	20.0	13.2
6000 ppm. MH (6.4 lbs. per acre)	21.3	20.6	13.8	20.1	19.9	12.9
Control - no treatment	20.2	19.3	13.1	19.5	19.5	12.7

[x] Calculated on the basis of total reducing value, since initial reducing value was not obtained for 5-Day samples.

Table 15. Analysis of samples milled 5 and 30 days subsequent to applications.

Treatments	5 Days Brix	5 Days % Sucrose[x] Juice	5 Days % Sucrose[x] Cane	30 Days Brix	30 Days % Sucrose Juice	30 Days % Sucrose Cane
750 ppm. MH ([illegible] lbs. per acre)	20.4	16.9	12.7	19.6	19.4	13.0
1500 ppm. MH (1.6 lbs. per acre)	[illegible]	[illegible]	13.6	19.5	19.7	13.3
3000 ppm. MH (3.2 lbs. per acre)	[illegible]	21.1	[illegible]	20.1	20.0	13.2
6000 ppm. MH (6.4 lbs. per acre)	21.3	20.6	13.6	20.1	19.9	12.9
Control - no treatment	[illegible]	19.3	13.1	19.5	19.5	12.7

[x] Calculated on the basis of total reducing value, since initial reducing value was not obtained for 5-day samples.

treatments in general showed lower Brix and higher per cent reducing value. At nine days no changes in Brix had taken place, but the per cent reducing value of all maleic hydrazide treatments was consistently higher than for the control. Control plots were superior in per cent sucrose to all treatments.

Results obtained from the application of maleic hydrazide to sugarcane prior to harvesting show an increase in Brix and total reducing value for the three higher concentrations of maleic hydrazide five days after application. Analysis of samples collected 30 days after treatment show a general reduction in Brix and per cent sucrose due probably to rather heavy rains recorded during this period, but the aforementioned treatments still exhibit superiority over the control. Samples obtained from sugarcane treated with maleic hydrazide at the rate of 3,000 ppm. gave higher analyses throughout the experiment. However, these differences were not significant. Further work should be undertaken to determine the interaction between concentration and time of application prior to harvest.

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RESUMEN

La aplicación de 2,4-D, ácido indolbutírico, y ácido naftalenoacético en pulverización a trozos de semilla en el surco no dió resultados positivos.

No se encontraron diferencias entre el talco, lanolina y solución acuosa como vehículos para la aplicación de substancias reguladoras del crecimiento al corte superior de trozos de una yema. La aplicación de maleic hydrazide y naftalenoacetamida en la forma indicada aumentó la rapidez de germinación, aunque no significativamente. El ácido indolbutírico mostró un efecto inhibitorio sobre el porcentaje y rapidez de germinación. Cuando los datos fueron agrupados de acuerdo al origen de los trozos en el tallo, los trozos provenientes de la parte terminal del tallo exhibieron mayor porcentaje y rapidez de germinación mientras que aquellos de la parte central y basal mostraron porcentaje y rapidez de germinación reducidos. Con la excepción del maleic hydrazide y del naftalenoacetamida, todos los tratamientos inhibieron el desarrollo de tallos secundarios. El ácido indoleacético redujo el número de tallos secundarios por 80% en comparación al testigo. Este material estimuló la producción de raíces primarias. Cualesquiera que fuese el

RESUMEN

La aplicación de 2,4-D, ácido indolbutírico, y ácido naftalenoacético en pulverización a troncos de semilla en el surco no dió resultados positivos.

No se encontraron diferencias entre el talco, lanolina y solución acuosa como vehículos para la aplicación de substancias reguladoras del crecimiento al corte superior de troncos de una yema. La aplicación de malato hydrazide y naftalenoacetamida en la forma indicada aumentó la rapidez de germinación, aunque no significativamente. El ácido indolbutírico mostró un efecto inhibitorio sobre el porcentaje y rapidez de germinación.

Cuando los cortes fueron sumergidos de acuerdo al origen de los troncos en cultivo, los troncos provenientes de la parte terminal del tallo exhibieron mayor porcentaje y rapidez de germinación mientras que cultivos de la parte central y basal mostraron porcentaje y rapidez de germinación reducidos. Con la excepción del malato hydrazide y del naftalenoacetamida, todos los tratamientos inhibieron el desarrollo de tallos secundarios. El ácido indolacético recogió el número de tallos secundarios por cepa en comparación al testigo. Este material estimuló la producción de raices primarias. Cualesquiera que fuese el

tratamiento, los trozos provenientes de la parte basal del tallo produjeron la mayor cantidad de raíces primarias, seguidos por aquellos provenientes del centro, con la menor cantidad producida por los trozos provenientes de la parte terminal del tallo.

La aplicación de maleic hydrazide y naftalenoacetamida a la yema de trozos de semilla de una yema aumentó la germinación, aunque las diferencias no fueron significativas. / No se logró determinar la concentración óptima para el maleic hydrazide aplicado en esta forma. La concentración óptima para el naftalenoacetamida parece estar entre las 750 y 2,000 ppm.

Cuando se aplicó 2,4-D, TCA, y maleic hydrazide en concentraciones tipo herbicida y tipo hormona a caña de retoño (soca) de dos meses de edad el número de plantas muertas fué mayor para todos los tratamientos químicos que para el testigo. Sin embargo, no se puede asumir que todas las plantas muertas fueron debidas al efecto de los tratamientos. Datos de crecimiento para los tratamientos en concentraciones tipo herbicida y tipo hormona demuestran que todos los materiales afectaron el crecimiento hasta cierto punto. Los tratamientos en concentraciones tipo herbicida, particularmente el TCA a razón de 30 y de 60 libras por acre, retardaron la floración de la caña, mientras que ninguna de las concentraciones tipo hormona

tratamiento, los trozos provenientes de la parte basal del tallo produjeron la mayor cantidad de raíces secundarias, seguidos por aquellos provenientes del centro, con la menor cantidad producida por los trozos provenientes de la parte terminal del tallo.

La aplicación de ácido hydrazide y naftaleneacetamida a la yema o trozos de semilla de una yema aumentó la germinación, aunque las diferencias no fueron significativas. No se logró determinar la concentración óptima para el ácido hydrazide aplicado en esta forma. La concentración óptima para el naftaleneacetamida parece estar entre las 750 y 1,000 ppm.

Cuando se aplicó 2,4-D, TCA, y ácido hydrazide en concentraciones tipo herbicida y tipo hormona a caña de retoño (soca) de dos meses de edad el número de plantas muertas fué mayor para todos los tratamientos químicos que para el testigo. Sin embargo, no se puede asumir que todas las plantas muertas fueron debidas al efecto de los tratamientos. Datos de crecimiento para los tratamientos en concentraciones tipo herbicida y tipo hormona demuestran que todos los materiales afectaron el crecimiento hasta cierto punto. Los tratamientos en concentraciones tipo herbicida, particularmente el TCA a razón de 30 y mientras que ninguna de las concentraciones tipo hormona de 60 libras por acre, retardaron la floración de la caña,

parecieron tener este efecto.

Se encontró que bajo condiciones locales 20 tallos constituyen una muestra representativa para parcelas de 1/40 de acre cuando son tomadas del mismo surco. La aplicación del maleic hydrazide previo a la cosecha para evitar pérdidas de sacarosa ocasionadas por estacionamiento antes de la molienda no parece ser efectiva. La aplicación de maleic hydrazide a la caña de azúcar previa a la cosecha resultó en aumentos en Brix y sacarosa cinco días después de la aplicación, y algunas diferencias eran evidentes a los 30 días después del tratamiento. Aunque estas diferencias no fueron significativas, parece prometedora la aplicación de maleic hydrazide previa a la cosecha para aumentar el contenido de sacarosa.

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Se encontró que bajo condiciones locales 20 tallos constituyen una muestra representativa para parcelas de 1/40 de acre cuando son tomadas del primer surco. La aplicación del malejo hydrazide previo a la cosecha pueden evitar pérdidas de azucres ocasionadas por deterioramiento antes de la molienda no parece ser efectiva. La aplicación de malejo hydrazid e a la caña de azúcar previa a la cosecha resultó en aumentos de trix y azucres cinco días después de la aplicación, y algunas diferencias eran evidentes a los 30 días después del tratamiento. Aunque estas diferencias no fueron significativas, parece procedora la aplicación de malejo hydrazide previa a la cosecha para aumentar el contenido de azucres.

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OCT 13 '71			
OCT 27 '71			
NOV 11 '77			
15 JUN. 1979			
[illegible] JUL. 1979			