沖縄における植物生長ホルモンの予備試験

Preliminary Tests with Plant Growth Regulators in Okinawa

By

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Research and development of agricultural chemicals have made rapid progress during the past decade. In fact, this new upserge in interest and use of chemicals in agriculture practices began several years before this University was founded. Specifically, the plant growth regulating chemicals have become a part of agricultural practices since 1944 when 2, 4-D was first introduced (2).

Since each local has its own conditions of soils, climate, kinds of weeds, and related problems it was imperative that research be initiated here in the basic aspects and use of these chemical regulators. This is a report which deals with the initial tests made at this University using both inhibitory and stimulating plant regulators.

1. Tests with Inhibiting Chemicals

Inhibiting chemicals commonly referred to as herbicides are now widely used to selectively control weeds in horticultural crops, farm crops, forestry, and non-selectively, along roads, around buildings and other non-crop areas (1, 3 and 4). Initial tests here were aimed at controlling the most common and destructive weed in the Ryukyu Islands, namely, *Oxalis violacea* L. or wood-sorrel. This weed grows profusely in both crop and non-crop areas during the cooler season from October to May. Since it produces underground bulblets it is extremely hard to control; however, by repeated chemical applications bulb production may be reduced.

Methods and results Young plants of *Oxalis* were planted in 10-inch crocks and when they were well established they were treated with the chemicals listed in Table 1. The rates per acre were based on the commercial formulations rather that on the active portion contained therein. The herbicides were applied at the rate of 100 gallons of water per acre.

The herbicides Kuron, Esteron 245, and Dalapon were more effective in controlling top growth of the *Oxalis* than were 2, 4-D and SES. It should be noted however that Esteron was used at a much higher rate than the 2, 4-D formulation which may account for some of the difference in control. Dalapon at 20 pounds per acre produced the greatest reduction of top growth and regeneration of the weed was very gradual. The stimulation produced by SES may be accountable to the fact that top growth

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was not effected whereas other germinated weed seeds were killed and competition removed (Table 1).

Table 1. The effects of several herbicides on *Oxalis violacea* L. when treated under controlled conditions.

Herbicide	Rates per acre per 100 gal. H_2O	Degree of control
Kuron	4 quarts	***
Esteron 245	3 quarts	***
Dalapon	20 pounds	****
2, 4-D	1 pounds	**
SES	3 pounds	*
Control	—	Normal

**** Tops were killed within 3 days and new leaves emerged slowly after one month.
*** Tops gradually turned yellow and died, and new leaves emerged in one month.
** Tops were distorted, but soon recovered.
* Top growth stimulated as compared to control plants.

In another test Dalapon, Kuron and Esteron 245 were used in an area badly infested with *Oxalis*. Three months following treatments *Oxalis* bulblets were dug from the replicated areas to see what effects the herbicides had on bulblet production (Table 2).

The results indicate that these materials were very effective in reducing the number and size of *Oxalis* bulblets. Of the three materials, Dalapon at 20 pounds per acre reduced the number of bulblets to 19 per 20 square centimeter of soil as compared to 319 per 20 square centimeter of untreated area. By repeated applications of any one of these chemicals the bulblets apparently could be eliminated entirely. Each application also reduced the vigor of both tops and bulblets.

Indications from these preliminary tests are that *Oxalis* bulblets greatly can be reduced in the soil and that repeated application may totally eliminate the bulblets which are the source of reinfestations. More research is needed to determine if any of these chemicals could be used to selectively control *Oxalis* spp. in various crops, as well as determine the residual characteristics of the chemicals in the soil, and methods, ratest and time of applications.

Table 2. The effects of Dalapon, Kuron and Esteron 245 on *Oxalis* bulblet production dug from 20 centimeter square areas.

Herbicide	Rate per acre	Number and size of bulblets		
		Large>9 mm*	Medium 4-9mm*	Small<4 mm*
Dalapon	20 pounds	0	3	16
Dalapon	10 pounds	2	2	53
Kuron	4 quarts	2	4	67
Esteron 245	3 quarts	0	2	38
	2 quarts	1	3	56
Control		2	12	305

*=Diameter

2. Tests with Stimulating Plant Regulators

Many different chemicals are now used to stimulate or promote plant growth in the form of root-initiation, fruit-set and bud-break (5). This preliminary experiment deals with root initiation of *Chrysanthemum* cuttings as influenced by chemical treatment. Although vegetative propagation usually is not very difficult in this humid climate, this process can not doubt be speeded up by the use of chemicals, especially so, with hard-to-root plants.

Methods and results Seven growth-promoting chemicals were used, namely; 3-(2, 4-DP), 4-(2, 4-DB), 3-(3-IP), NAd, NAA, Rootone and Hibitorium (Table 1). These chemicals were diluted with water to make three different concentrations of 25,50 and 100 parts per million (ppm) except for 3-(3-IP), being less active, was diluted to 250,500 and 1000 ppm. The powder formulations were used as such. Cuttings from *Chrysanthemum morifolium* were used. After the cuttings were prepared they were dipped in the chemical solution and stuck into sharp sand of uniform moisture. Three weeks following treatment the cuttings were removed from the sand and root formation evaluated on a scale of one to five—one being equal to the least number of roots and five the most number of roots (Table 3).

The results show that 3-(2, 4-DP) at 25 pmm and 4-(2, 4-DB) at 50 pmm produced the most roots. Other concentrations of the same and other materials produced results similar to those of the commercial rooting compounds—Rootone and Hibitorium.

Table 3. The effect of certain chemicals on rooting of *Chrysanthemum* cuttings dipped in water solution and powder prior to sticking.

Chemicals	Rate (ppm)	Degree of rooting 1=few roots. 5=many roots
3-(2, 4-Dichlorophenoxy)	25	5
Proprioulc acid or "3-(2, 4-DP)"	50	2
	100	2
4-(2, 4-Dichlorophenoxy) butyric	25	2
acid or "4-(2, 4-DB)"	50	5
	100	2
3-(Indole) proprionic acid	250	2
or "3-(3-1P)"	500	2
	1000	3
Alfa-Naphthaleneacetamide	25	2
or "NAd"	50	3
	100	4
Naphthaleneacetic acid	25	3
or "NAA"	50	3
	100	4
Rootone (powder)	—	3
Hibitorium (powder)	—	2
Control (water)	—	1

All treatments were superior to the water treatment in that they developed more roots in less time.

In general the phenoxy chemicals produced many short roots whereas the naphthaleme and indole chemicals produced fewer but longer roots. The roots formed on cuttings treated with the latter materials appeared more normal than those treated with phenoxy chemicals. All these chemical materials appear promising for root induction and need further test with other plant materials under these and other conditions.

Summary

Plant growth regulators now play a large roll in agricultural practices in many parts of the world. Since agriculture is a major enterprice in the Ryukyus, it was imperative that this University initiate research with these chemicals so that they also may be used here in the future.

Although there are many of these chemicals which can be used, only a representative number were used in these preliminary tests. These were of two types; namely, inhibitory and stimulatory. The former was used to control *Oxalis violacea* L. and the latter was used to induce roots on cuttings of *Chrysanthemum morifolium*.

The inhibitory chemicals, or herbicides as they are now called, were effective in reducing growth of the *Oxalis* of varying degrees. Dalapon at 20 pound per acre gave excellent control (Table 1). The most significant findings of these test were that, Dalapon, Kuron and Esteron 245 greatly reduced the number and size of *Oxalis* bulblets. In one instance they were reduced from 305 bulblets per 20 square centimeter to 19 per square centmeter (Table 2).

The newer chemicals used to promote roots of *Chrysanthemum* cuttings were just as effective as some of the commercial rooting compounds. The materials "3-(2, 4-DP) and 4-(2, 4-DB)" produced many roots and the naphthaline and indole materials produced fewer but longer roots (Table 3).

These and other plant growth regulators need further testing here before they can be recommended for general use by the farmers and nursery men.

Selected References

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