Qatar Univ. Sci. Bull. (1989), 9: 105-112

EFFECT OF SUGAR BEET SEED TREATMENTS WITH SOME GROWTH REGULATORS ON DAMPING OFF INCIDENCE, TOTAL SOLUBLE SUGARS AND YIELD

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Key words: Damping off, sugar beet, growth regulators.

ABSTRACT

Seven seed borne fungi were isolated from sugar beet seeds viz. *Alternaria alternata, Helminthosporium* sp., *Rhizopus stolonifer, Epicoccum* sp., *Rhizoctonia solani, Phoma betae* and *Fusarium oxysporium f.* sp. *betae.* The last three fungi were found internal, while the others were external on seed surface. The internal fungi caused root-rot disease to sugar beet plants. Treatment of seeds with each of gibberellic acid (GA_3), indole acetic acid (IAA) and α-naphthol (α-N) as 50 and 100 ppm gave a pronounced reduction in root-rot infection.

No significant effect had occurred against *R. solani* at 100 ppm seed treatment with IAA and α-N, and for *Phoma betae* in the post emergence damping off at 100 ppm of α-N.

Growth regulators at 50 ppm used as seed treatment caused an increase in the average of yield in the two growing seasons of sugar beet plants.

Similar findings were recorded for total soluble sugars (TSS) with IAA and GA_3 treatments. At 100 ppm seed treatments, no effect was recorded on both yield and TSS of growing plants, except for IAA which caused an increase in the average of yield.

INTRODUCTION

Studies on the relation between growth regulators and plant diseases were directed to diseases incidence rather than to the basic aspects of the role of growth regulators on pathogenesis. Cruen (1959) reviewed in considerable detail the production of auxin by fungi and its effect on the rate of fungal growth.

Comprehensive reviews are also available on the formation and action of gibberellin in bean root-rot infection (Rackham and Vangha, 1959), as well as on certain practical aspects of growth regulators in relation to disease control (Morth and Mitchell, 1952 and Malcolm and Dimond, 1959). Serramo (1955) stated that all tested growth regulator substances, i.e. indole-3-acetic acid (500 ppm), α - naphthalene acetic acid (50 ppm) and indole-3-butyric salt induced some degree of resistance in tomato plants to *Phytophthora infestans* infection. Also, Davis and Dimond (1953) reported that tomato plants treated with naphthalene acetic acid were resistant to *Fusarium* wilt. Kiraly *et al.* (1962) reported that gibberellins decreased the susceptibility of wheat to *Tilletia foetida* infection.

Several studies concerend with the effect of growth regulator substances on yield and TSS had been carried out. Dure and Gensen (1959) stated that gibberellin affects cell division of cotton and increased its growth under low soil temperature. Liverman *et al.* (1958) reported an increase in cotton yield when seeds were immersed in 10 to 100 ppm of gibberellin. Johanson *et al.* (1959) mentioned that germination of cotton seeds was increased when they were treated with gibberellin at a range from 10 to 250 ppm. Hammouda and Bakr (1969) noticed that 1% of gibberellin increased the germination of maize seeds.

This work has been conducted to study the effect of growth regulators on damping-off incidence, TSS and yield of sugar beet plants.

MATERIALS AND METHODS

Isolation from seeds

Seeds of sugar beet, variety Trirave were obtained for the present work from the sugar crop Inst., Ministry of Agric. A group of 100 seeds was disinfected with sodium hypochlorite, and another group was left without disinfection. Isolation from both groups was carried out by planting seeds on wet blotting paper in sterilized Petri dishes (9 cm). Ten seeds/plate were used in 10 replicates for each group of seeds. Plates were incubated at 28±1°C for 8 days. Growing fungi were picked up from seeds and then transferred onto PDA medium. Hyphal tips from growing colonies were transferred to slopes of PDA. Purified fungi were identified and verified according to Booth (1971) and Barnette and Hunter (1972).

Pathogenicity tests

Each fungus isolated from disinfected seeds was inoculated on autoclaved barley grain medium and incubated at 30±1°C for 2 weeks. Inoculum was added at the rate of 5% to autoclaved sandy soil in pots (15 cm) which were sterilized previously with 5% formalin. Seeds were disinfected with 0.5% sodium hypochlorite for 2 min. and washed with sterilized water, then planted in infested soil at the rate of 5 seeds/pot, in four replicates for each fungus. Non-infested soil was used for control.

Moisture in soil was kept at 42% WHC during the experimental period according to Keen and Raczowsky (1921).

Disease severity was expressed as percentage of pre - and post - emergence damping - off after 2 and 6 weeks from planting.

Effect of seed treatment with growth regulators on damping-off incidence

Sugar beet seeds var. Trirave were soaked for 24 hrs. in each of gibberellic acid, indole acetic acid and α -naphthol growth regulators at 50 and 100 ppm for each one. After soaking for 5 minutes, seeds were planted, 5 seeds/pot in four replicates, in soils infested with each of *F. oxysporium* f. sp. *betae*, *Phoma betae* and *R. solani*. Control treatments included un-soaked seeds planted in infested soil and un-soaked seeds planted in non-infested ones. The same technique and disease assessment previously described in pathogenicity test were followed.

Effect of growth regulators on yield and total soluble sugars

The experiment has been conducted at the farm of Agric. Res. Centre, Giza Governorate, in the two seasons of 1986 and 1987.

Sugar beet seeds treated separately with 50 and 100 ppm of each of the growth regulators GA_3, IAA and α -N were sown in plots (1/200 feddan = 21 m^2) randomized in a complete block design. Five replicates for each concentration of each growth regulator were used. The yield of roots in ton/fed. and the percentage of TSS in collected samples were measured after 6 months from planting. The soluble sugars were extracted using Soxhlet apparatus using 75% ethanol for 6-8 hrs. The sugar contents were colorimetrically determined with picric acid method (Thomas and Dutcher, 1924) and its amount was calculated as glucose according to Snell and Snell (1953).

In all treatments with growth regulators, analysis of variance for obtained data has been carried out according to Little and Hills (1972).

RESULTS AND DISCUSSION

Numerous fungi were found to be associated with sugar beet seeds (Table 1). It is clear that the dominant seed brone fungi were *Alternaria alternata*, *Helminthosporium* sp. and *Fusarium oxysporium* f.sp. *betae*. Three fungi, i.e. *F. oxysporium* f. sp. *betae*, *Phoma betae* and *Rhizoctonia solani* were borne internally, as they were isolated from disinfected seeds. Data also reveal that *Rhizopus stolonifer* and *Epicoccum* sp. appeared externally. Similar finding has been recorded by Neergaard (1977). Opposite results were recorded by Ebner (1960) who found that *Phoma betae* was more prevalent than *Alternaria* and *Fusarium* in tested seeds; contrary to that found in the present study.

Table 1

Frequencies of seed-borne fungi associated with sugar-beet seeds.

Isolated fungi	Frequencies, %	
	disinfected seeds (internal fungi)	non-disinfected seeds
Alternaria alternata	0.0	13.9
Epicoccum sp.	0.0	5.6
Fusarium oxysporium f. sp. *betae*	2.9	8.1
Helminthosporium sp.	0.0	11.2
Phoma betae	0.6	2.1
Rhizoctonia solani	0.2	1.8
Rhizopus stolonifer	0.0	1.9

The three internal seed borne fungi proved to be pathogenic to sugar beet plants, where they caused pre- and post-emergence damping-off (Table 2). Infection has been reduced when seeds were treated with the growth regulators IAA, GA_3, and α -naphtol at 50 ppm for each one (Table 3). It is proved that GA_3 at 100 ppm induced a significant reduction in damping-off caused by each of the three pathogens. Indole acetic acid and α -naphthol at 100 ppm did not affect *Rhizoctonia solani* infection while IAA was active in reducing pre- and post-emergence damping-off caused by *F. oxysporium* and *Phoma betae*. Data are in harmony with those recorded by Stowe and Yamki (1957) and Kiraly *et al.* (1962).

Table 2

Pathogenicity of internal fungi associated with sugar beet seeds.

Isolated fungi	%Damping-off		%Survival plants
	pre-	post-	
Fusarium oxysporium f. sp. *betae*	21	27	52
Phoma betae	23	28	51
Rhizoctonia solani	26	30	56
Control	10	00	90

It could be concluded that the growth regulators may affect disease incidence at certain concentration through different ways: by its direct effect on the pathogen reducing its virulence; increasing the host resistance through changing its enzymatic activity or cell wall structure; by changing the host-parasite relationship. Such claims could be confirmed by the work of Mostafa (1984) who mentioned that plant growth regulators play a role in the fungal disease incidence.

Table 3

Effect of growth regulator treatments on pre- and post-emergence damping-off caused by internal seed-borne fungi.

Growth regulator	Concentration ppm		Fungi *F. oxysporium*	*P. betae*	*R. solani*
GA_3	50	Pre-	13	16	21
		Post-	20	22	24
	100	Pre-	17	17	22
		Post-	22	24	24
IAA	50	Pre-	19	19	24
		Post-	21	22	25
	100	Pre-	18	17	25
		Post-	20	20	29
α-N	50	Pre-	16	18	23
		Post-	23	23	27
	100	Pre-	19	21	26
		Post-	23	29	30
Control	0.0	Pre-	21	23	26
		Post-	27	28	30
Non-infested soil	90% of healthy plants				

L.S.D. at 5% = 1.9

It is obvious from Table 4 that the three growth regulators had a promising effect on sugar beet yield. The average of two growing seasons for each one was increased significantly than control at 50 ppm treatment. At 100 ppm seed treatment with each growth regulator, the average of yield had increased for IAA only. It is obvious also that GA_3 and IAA increased the average of total soluble sugars in both seasons when seeds were treated before sowing with each one at 50 ppm, while no significant effect could be distinguished at 100 ppm seed treatment. This finding lend a support to the work of Dure and Gensen (1959) and Johanson *et al.* (1959) who studied the effect of hormone treatments on yield, TSS, and infection degree of plant pathogens.

Table 4

Effect of sugar beet seed treatments with growth regulators on yield and total soluble sugars (TSS) of growing plants during 1986 and 1987 seasons.

Growth regulator	Concentration ppm	Yield in ton/fed.			TSS %		
		1st year	2nd year	Mean	1st year	2nd year	Mean
GA_3	50 100	17.8 14.9	20.9 18.7	18.9 16.8	25.6 25.6	21.5 18.6	23.6 22.1
IAA	50 100	17.9 18.6	17.6 19.3	17.8 18.9	23.9 23.6	22.1 22.3	23.0 22.9
α -N	50 100	14.9 14.6	14.6 18.5	14.1 16.6	24.8 24.1	20.3 20.1	22.6 22.1
Control	0.0	14.5	18.4	16.5	22.5	20.8	21.7

L.S.D. at 5% = 1.6

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تأثير معاملة بذور بنجر السكر ببعض منظمات النمو على مرض سقوط البادرات والسكريات الذائبة الكلية والمحصول

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تصاحب بذور بنجر السكر العديد من الفطريات مثل **الترناريا الترناتا** التي تسبب تبقعاً للأوراق ، **فيوزاريوم أوكسي سبورم** ، **فوما بيتي** ، **رايزوكتونيا سولاني** والتي تسبب موتاً للبادرات قبل وبعد الإنبات وتعفناً للجذور ، **رايزوبس استلونيفر** الذي يثبط إنبات الجذور ، بالاضافة إلى عدد من الفطريات غير الضارة مثل **هلمينثوسبورم** ، **ابيكوكم** . وقد عزلت فطريات **الفيوزاريوم** و**الفوما** و**الرايزكتونيا** من داخل وخارج البذور ، أما فطريات **الترناريا** و**ابيكوكم** و**هلمينثوسبورم** و**رايزوبس** فقد عزلت من خارج البذور فقط .

عند معاملة البذور بمنظمات النمو تركيز ١٠٠ جزء في المليون لم يظهر تأثير معنوي ضد الفطر **رايزوكتونيا سولاني** مع اندول حمض الخليك أو الألفانافثول ، كذلك ضد الفطر **فوما بيتي** مع الألفانفثول ، وعند معاملة البذور بمنظمات النمو تركيز ٥٠ جزء في المليون ظهرت زيادة في متوسط محصول البنجر على مدى موسمين متتاليين .

أعطت السكريات الذائبة الكلية نفس النتائج السابقة مع استخدام اندول حمض الخليك وحمض الجبرلليك .

وعند إستخدام منظمات النمو عند تركيز ١٠٠ جزء في المليون لم يظهر تأثير معنوي على كل من محصول البنجر أو السكريات الذائبة الكلية ما عدا في حالة إستخدام أندول حمض الخليك حيث سبب زيادة في متوسط محصول البنجر .