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EFFECT OF SOME GROWTH REGULATORS ON FOLIAR AND POST-HARVEST DISEASES OF ONION

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Abstract

Cycocel, ethrel and GA_3 were the most effective growth regulators in reducing severity of downy mildew and purple blotch, while Pix was less effective.

Growth regulators significantly increased bulbs weight. Ethrel at 240 ug/ml showed highest effect, followed by ethrel at 480, Pix at 75 and GA_3 at 125 µg/ml.

Cycocel at 800 and Pix at 75 µg/ml were the most effective in reducing infection of onion bulbs, when artificially inoculated with *Botrytis allii* and *Aspergillus niger*, and kept in storage. The same trend was observed for bulbs naturally infected with *A. niger*.

Generally, sprouting was reduced by applying growth regulators. Stored bulbs of onion plants sprayed with Cycocel and Pix contained lower sugar contents and vitamin C compared with untreated ones, while T. S. S. and titratable acidity showed the opposite.

Total and free phenols increased in stored bulbs, resulting from plants sprayed with Pix at 75 µg/ml, as compared with untreated ones, while free phenols decreased in bulbs of plants sprayed with Cycocel at 800 µg/ml.

Phenols contents were higher in bulbs inoculated with *B. allii* and *A. niger* and obtained from plants treated with pix and cycocel than untreated ones.

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important field crops in A.R.E.. Onion is usually attacked by several fungal diseases, such as purple blotch (*Alternaria porrii* Ell.), downy mildew (*Peronospora destructor* Berk.), neck rot (*Botrytis allii* Munn.) and white rot *Sclerotium cepivoum* Berk. Several attempts were made to reduce disease severity and increase yield.

In Egypt, Gamal El-Din *et al.* (1980) reported that percentage of infection with *B. allii* on onion decreased with gibberellic acid (GA_3), Cycocel (CCC), naphthaline acetic acid (NAA) and Alar (B-9). Moreover, seed production was increased with the same treatments. Metwally (1986) found that GA_3, CCC, B-9 and NAA decreased infection with *Fusarium oxysporum* f. *cepa* Synd. and Hansen increased the fresh weight of onion bulbs. Garlic purple blotch and downy mildew were significantly reduced by spraying growth regulators, while yield was increased (Metwally *et al.* 1990 and Elian *et al.* 1990). Also, post-harvest losses of onion and garlic were reduced by means of growth regulators (Sinclair 1984 and Loszner 1987).

The aim of this research was to study the effect of GA_3, CCC, Ethrel and Pix on some foliar and storage diseases of onion and their effects on quantitative and qualitative losses in bulbs.

MATERIALS AND METHODS

Field experiments were carried out in Dakahlia Governorate during two successive seasons 1989 and 1990. Onion plants, cultivar Giza 20, were sprayed with growth regulators after 45, 75 and 105 days from transplanting. Three levels of each growth regulator were used as follow (a.i.); GA_3 (125, 250 and 500 µg/ml), Pix (75, 125 and 175 µg/ml), CCC (200, 400 and 800 µg/ml) and Ethrel (240, 480 and 960 µg/ml). A check was left without spraying. The experiment was in a complete randomized block design with four replicates for each treatment.

Disease severity of downy mildew and purple leaf blotch were recorded after the last spray using randomized sample of one hundred leaves from every plot (Horsfall and Barrat 1945). Fifteen days after harvesting, 20 bulbs from each treatment were inoculated with each of *B. allii* and *A. niger* and compared with each

20 other uninoculated bulbs. The percent of rots was calculated during harvesting and two months after storage at 20-22 C. Yield (Ton/feddan) was calculated after curing. Chemical components were determined in bulbs of onion plants sprayed with Cycocel (800 µg/ml) and Pix (75 µg/ml) after storage. Sugar contents, phenolic compounds, aromatic amino acids, vitamin C contents and titratable acidity were determined according to Thomas and Dutcher (1924), Snell and Snell (1953), Anon. (1951), and AOAC (1960), respectively. Total soluble solids was also determined by hand-refractometer.

RESULTS AND DISCUSSION

I- Effect of growth regulators on some field diseases of onion

The growth regulators (CCC, Pix, Ethrel and GA_3) were applied to study their effect on downy mildew and purple blotch of onion plants, cultivar Giza 20,as well as on bulbs fresh weight, under field conditions. Data in Table (1) indicate that severity of infection increased with increasing the growth regulator concentrations tested. However, infection decreased by spraying growth regulators compared with check. Cycocel, Ethrel and Ga_3 were the most effective in reducing disease severity of downy mildew and purple blotch, while Pix was less effective in reducing disease severity. Percentages of infection with rots during harvesting tended to decrease by increasing the growth regulator concentrations, except with Pix treatments, which increased infection with increasing concentrations.

Similar results were obtained by Gamal El-Din *et al.* (1980), who reported that percentage of infection with neck rot disease decreased with all tested concentrations of the growth regulators, GA_3, NAA and B-9. Abd El-Megied (1988) obtained the same trend applying growth regulators against garlic rust. As for bulbs fresh weight, growth regulators significantly increased bulbs weight as compared with control. Ethrel at 240 µg/ml showed highest effect followed by Ethrel at 480, Pix at 75 and GA_3 at 125 µg/ml. Such results may be due to the stimulatory effect of growth regulators on cell division and elongation (Paleg 1965). Abd-El-Fatah (1989) found that spraying garlic plants with CCC up to 1000 µg/ml increased total yield.

Table 1. Effect of spraying onion plants with growth regulators on downy mildew , purple blotch and bulb rot incidence and fresh weight of bulbs under field conditions duirng 1989 amd 1990 seasons.

Growth regulators	Conc. (ug / ml)	1989			1990		
		Severity %	Rot (%) at harvest	Yield (ton/ fedd.	Severity %	Rot (%) at harvest	Yield (ton/ fedd.
CCC	200	9.5	3.5	13.8	8.75	2.84	13.34
	400	15.0	2.7	14.0	12.50	2.34	14.44
	800	16.0	1.7	15.1	11.25	1.75	15.07
Pix	75	25.7	1.9	16.3	21.75	2.00	15.38
	125	27.0	2.7	15.7	25.75	2.17	15.28
	175	41.7	3.7	13.2	37.00	4.17	13.97
Ethrel	240	12.0	3.3	17.5	12.00	3.33	17.33
	480	14.0	3.0	15.8	12.50	2.67	16.38
	960	26.3	0.6	15.3	24.25	0.33	15.23
GA3	125	11.7	0.7	16.1	9.75	0.67	15.44
	250	22.0	0.1	14.5	18.00	0.20	14.70
	500	30.3	0.0	13.7	25.50	0.17	14.44
Control		65.3	2.4	12.3	47.00	2.17	12.71
L.S.D. at 5%		4.4	0.7	0.8	4.77	0.79	1.47

II- Effect of growth regulators on major post-harvest rots of onion bulbs :

Four growth regulators, namely, Cycocel, Pix, Ethrel and gibberellic acid were used at three concentrations to study their effect on the incidence of onion bulb rots, as well as the effect on sprouting. Results in Table (2) show that percentage of natural infection by bacteria and *A. niger* as compared with control were lower at the lower concentrations of the growth regulators.

On the other hand, infection with *B. allii* was higher with growth regulators treatments, except Pix treatment at 75 and CCC at 800 µg/ml, which showed lower neck rot incidence. On the contrary, black mold rot decreased in stored bulbs of plants sprayed with growth regulators and inoculated with *A. niger* as compared with control. Percentages of infection tended to be higher at the higher concentrations.

Results indicated that percentage of sprouting decreased, non-significantly, with growth regulator treatments as compared with unsprayed bulbs. Results are in agreement with Loszner (1987), who reported that the use of growthr egulators reduced post-harvest losses of onion and garlic.

III- Effect of growth regulators on chemical components of bulbs :

a) Phenols and amino acids :

Data in Table (3) show that total and free phenols were higher in bulbs obtained from plants treated with Pix at 75 µg/ml than in untreated ones, while the opposite was true with Cycocel at 800 µg/ml. Alanine and Tryptophane increased in stored bulbs resulting from plants sprayed with Cycocel and Pix as compared with bulbs of unsprayed plants. At the same time Tyrosine and Phenylalanine decreased in bulbs obtained from plants sprayed with the same growth regulators. Phenol contents were higher in bulbs inoculated with *A. niger* and *B. allii* and obtained from plants treated with growth regulators. Onion bulbs from plants sprayed with growth regulators and inoculated with *A. niger* and *B. allii* contained lower amounts of aromatic amino acids as compared with bulbs of unsprayed plants, except Phenylaline in bulbs inoculated with *A. niger* and obtained from plants sprayed with Pix and Cycocel, which showed higher amounts. Also, Tyrosine increased in bulbs inoculated with *B. allii* and obtained from plants sprayed with Pix. Metwally (1986) showed that spraying onion plants with growth regulators increased amino acid contents in bulbs, except for CCC at 50 µg/ml and NAA at 25 and 100 µg/ml. Total and free phenol

Table 2. Effect of growth regulators on percentage of onion bulb rots and sprouting after two months storage.

Growth regulators	Conc. (ug / ml)	% of infected bulbs				
		N.I.		A.I.		
		A.niger	*F. oxysporum*	*B. allii*	*A.niger*	% Sprouting
CCC	200	21.66	0.0	72.20	66.66	30.53
	400	12.22	0.0	37.46	66.66	43.33
	800	23.30	0.0	0.00	28.33	43.33
Pix	75	6.66	0.0	0.00	0.00	37.67
	125	0.00	0.0	61.66	61.66	53.33
	175	53.33	3.3	40.00	66.66	26.56
Ethrel	240	6.66	0.0	44.43	25.00	69.33
	480	20.00	0.0	80.00	21.66	46.66
	960	29.00	0.0	18.66	53.33	50.00
GA3	125	16.66	33.3	56.66	46.66	35.00
	250	24.43	3.3	36.48	36.48	52.38
	500	27.76	0.0	56.66	83.33	50.00
Control		33.33	0.0	21.66	85.00	61.06
L.S.D. at 5%		2.74	6.66	8.28	5.69	N.S.

N.I. = Natural infection
A.I. = Artificial inoculation

Table 3. Effect of Cycocel and Pix on phenol contents and aromatic amino acids after two months storage.

Treatments	Conc. (ug/ml)	Inoculated and unicoculated bulbs	mg/g fresh weight						
			Phenol contents			Aromatic amino acids			
			Total	Free	Conjugated	Alanine	Typtophane	Tryptophane	Phenylalanine
Cycocel	800	*A. niger*	34.61	12.53	22.08	28.48	28.58	12.24	23.73
Pix	75	*A. niger*	38.46	16.79	21.67	33.33	7.97	14.14	25.65
Untreated	- -	*A. niger*	32.82	11.20	21.62	35.45	30.80	17.17	20.40
Cycocel	800	*B. allii*	25.64	16.74	8.95	14.34	16.06	10.70	13.33
Pix	75	*B. allii*	25.64	16.69	8.90	17.17	23.83	18.58	16.36
Untreated	- -	*B. allii*	21.87	13.07	8.80	21.11	18.28	21.41	18.78
Cycocel	800	Uninoculated	25.15	8.12	17.03	37.47	19.89	26.26	14.74
Pix	75	Uninoculated	32.05	20.87	11.18	46.06	18.08	26.26	24.24
Untreated	- -	Uninoculated	13.53	13.48	18.05	17.47	22.22	18.48	34.34

contents were higher compared with control (unsprayed).

b) Sugars and quality characters :

Data in Table (4) indicate that bulbs of onion plants sprayed with Cycocel and Pix contained lower sugar contents than did untreated ones.

Non-reducing and total sugars of bulbs produced from plants sprayed with growth regulators and inoculated with *B. allii* decreased as compared with unsprayed ones, while reducing sugar behaved to the contrary. Onion bulbs of plants sprayed with Pix and Cycocel and inoculated with *A. niger* exhibited higher amounts of reducing sugars compared with untreated ones. At the same time, total and non-reducing sugars increased in bulbs of plants sprayed with Cycocel, and decreased with Pix. The same trend was observed by Metwally (1986) working on onion plants inoculated with *F. oxysporum* f. *cepae*. It is also clear (Table 4) that vitamin C decreased in bulbs of plants sprayed with Pix and Cycocel as compared with control, while T.S.S. and titratable acidity increased. On the other hand, bulbs of onion plants sprayed with Pix and Cycocel and infected with *B. allii* contained less amounts of T.S.S., vitamin C and titratable acidity compared with unsprayed onion plants. The same trend was observed for titratable acidity in bulbs inoculated with *A. niger*.

Therefore, it can be concluded that treatment with growth regulators as well as infection with different fungi resulted in some changes in the chemical composition of onion bulbs. This could also, reflect on their storability.

Table4. Effect of growth regulators on sugar contents, T.S.S., vitamin C and acidity in bulbs of cultivar Gizal 20.

Treatments	Conc. (ug/ml)	Inoculated and unicoculated bulbs	Quality characters					
			Sugar contents (mg/g fresh weight)					
			Total	Reducing	Non-reducing	T.S.S. %	mg/g fresh weight	Titratable acidity %
Cycocel	800	*A. niger*	31.16	8.29	22.87	4.6	7.40	0.9856
Pix	75	*A. niger*	9.86	9.23	0.63	5.2	6.20	0.9600
Untreated	- -	*A. niger*	14.67	7.43	7.24	5.2	6.80	1.1072
Cycocel	800	*B. allii*	8.18	6.95	1.23	4.0	5.00	0.7808
Pix	75	*B. allii*	11.26	6.59	4.67	3.2	5.00	0.6784
Untreated	- -	*B. allii*	18.12	3.98	14.14	4.8	6.20	0.9280
Cycocel	800	Uninoculated	19.06	2.33	16.73	5.0	4.20	1.0360
Pix	75	Uninoculated	26.05	2.43	23.62	5.6	3.80	0.9344
Untreated	- -	Uninoculated	28.54	5.26	23.28	3.8	4.80	0.7360

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تأثير بعض منظمات النمو علي أمراض الحقل وما بعد الحصاد فى البصل

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كانت منظمات النمو السيكوسيل والايثريل، حامض الجبريليك أكثر تأثيراً في خفض شدة الاصابة بالبياض الزغبي واللطعة الارجوانية بينما كان البيكس أقل تأثيراً ، وازداد المحصول زيادة معنوية وكان الايثريل بتركيز ٤٨٠ ميكروجرام . مليلتر والبيكس بتركيز ٧٥ حامض الجبريليك بتركيز ١٢٥ ميكروجرام. مللیتر أعلي تأثيرا.

ومن جهة أخري كان رش النباتات بالسيكوسيل بتركيز ٨٠٠ ميكروجرام . مليلتر والبيكس بتركيز ٧٥ أكثر تأثير في خفض اصابة الابصال المحقونه بالفطر *بوترايتس الياى* ، *الاسبرجلس نيجر* أثناء التخزين وأيضا الاصابة الطبيعية بالاسبرجلس ، وعامه خفضت منظمات النمو معدلات التزريع.

تحتوي الابصال المحقونه والناتجة من النباتات المرشوشه بالسيكوسيل والبيكس مستويات منخفضه فى السكريات وفيتامين ج مقارنه بأبصال النباتات غير المعامله بينما المواد الصلبة والحموضه الكلية كان التأثير عليها عكسيا.

ازدادت الفينولات الكلية والحرة في الابصال المخزونه والناتجة من النباتات المرشوشه بالبيكس (٧٥ ميكروجرام/ مليلتر) مقارنه بالغير معاملة وتنقص الفينولات الحرة في حالة الرش بالسيكوسيل بمعدل ٨٠٠ ميكروجرام ./مليلتر. وأظهرت الابصال المحقونه بفطري *بوترايتس الياي* ، *اسبرجلس نيجر* والناتجة من النباتات المرشوشه بالبيكس والسيكوسيل محتويات فينولية أعلي من الابصال الناتجة من النباتات الغير مرشوشة.