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COBALT AND SILVER AS POTENT INHIBITORS OF FLOWER ABSCISSION IN *CAPSICUM ANNUUM* L.

S.S.M. NAQVI, SABA MUMTAZ AND S.M. ALAM

Plant Physiology Division,
Atomic Energy Agricultural Research Centre,
Tando Jam, Sindh, Pakistan.

Abstract

Aqueous sprays of Co^{++} and Ag^{+} and an auxin NAA on chilli plants made at flowering time and 15 days later reduced flower abscission and enhanced pod yields more than 50% over that of control.

Introduction

Ethylene is now widely recognized as a natural component of the phytohormone complex that regulates abscission and controls many other aspects of plant growth and development (Abeles, 1973; Reid, 1985; Sisler & Yang, 1984). Studies to understand the biochemical events leading to the production of ethylene have indicated that silver ion (Ag) enhances the oxidation of ethylene (Beyer, 1979), while auxin regulates the conversion of S-adenosylmethionine (SAM) to 1-aminocyclopropane-1-carboxylic acid (ACC) (Jones & Kende, 1979; Lieberman, 1979; Sisler & Yang, 1984; Yu & Yang, 1979) and cobalt ion (Co) prevents the oxidation of ACC to ethylene (Grover & Purves, 1976; Lau & Yang, 1976; Yu & Yang 1979). Since the auxin 1-naphthaleneacetic acid (NAA) or its various commercial preparations (Planofix, Fruito-fix and Fixes) have been reported to retard flower abscission in a number of chilli cultivars (Chandra *et al.*, 1976; Chandramoney & George, 1976; Menon, 1981; Pandita *et al.*, 1980; Patil & Ballal, 1980; Sharma *et al.*, 1980; Warade & Singh, 1977), we considered it worthwhile to investigate the effect of cobalt and silver ions on this parameter and to compare its effectiveness with NAA using *Capsicum annuum* L., as the test plant.

Materials and Methods

Seeds of chilli (*Capsicum annuum* L. cv. Ghotki), surface sterilized with 2% Na-hypochlorite for 10 minutes and washed thoroughly with distilled water, were sown in sterilized soil: sand mixture (3:1 w/w) in wooden trays and watered with 1/10 Hoagland nutrient solution. The seedlings, at 4-6 leaf stage, were transplanted in the field. Normal culture practices including irrigation, fertilizer application were followed to maximize the yield.

Solutions of 1-naphthaleneacetic acid (NAA) @ 10,15 and 20 mg/l, silver nitrate ($AgNO_3$) @ 50, 100 and 150 mg/l and cobalt nitrate ($Co(NO_3)_2$ @ 50, 100 and 150 mg/l were prepared in distilled water with Tween-80 (0.01%) as surfactant. Ten randomly selected plants, as replicates, were sprayed around 08.00 hours, to the

Table 1. Effect of aqueous spray of chilli plants with NAA, Ag or Co ions on pod yield.

Treatments (mg/l)		Yield/plant (g)	% Increase over control
Control	0	315.7^{d}	---
NAA @	10	487.9^{b}	54.5
	15	472.6^{b}	49.7
	20	484.7^{b}	53.5
$AgNO_3$ @	50	490.3^{b}	68.4
	100	531.6^{a}	55.5
	150	490.8^{b}	37.9
$CO(NO_3)_2$ @	50	435.3^{c}	37.9
	100	487.1^{b}	54.3
	150	490.1^{b}	55.2

Means followed by the same subscript are not significantly different ($P < 0.01$).

point of run-off. The first spraying was done at the time of flower initiation and the second 15 days later. Distilled water spray was used as control. The experiment was further repeated for two consecutive years using only the optimum effective concentration of the chemicals. Pods were harvested at maturity and a total of five pickings were made during the season. Fresh weight of pods at each harvest was recorded and pooled to obtain the yield per plant.

Results and Discussion

Spraying with NAA and Ag or Co ions significantly retarded flower abscission and increased pod yield (Table 1). Highest yield of 532 g/plant was obtained with $AgNO_3$ @ 100 mg/l followed by NAA (at all concentrations), $Co(NO_3)_2$ @ 100 and 150 mg/l. $AgNO_3$ @ 50 and 150 mg/l and $Co(NO_3)_2$ @ 50 mg/l although showed the lowest yield but was greater than the control. Comparing the average of two years data (Table 2) no significant difference in pod yield was observed between the three chemicals which ranged from 52-55%: yield of control was however, significantly lower.

Table 2. Two years average of pod yields from plants treated with NAA, Ag or Co ions.

Treatments (mg/l)		Yield/plant (g)	% Increase
Control	0	403.2[b]	---
NAA @	10	611.3[a]	51.6
$AgNO_3$ @	100	625.0[a]	55.0
$Co(NO_3)_2$ @	100	621.6[a]	54.2

Means followed by the same subscript are not significantly different ($P < 0.01$).

A number of workers, using various cultivars of chilli, have reported that treatment with 'Planofix', a formulation of Na salt of NAA, significantly increased the pod yield when sprayed with 5-50 ppm of the chemical at various stages of reproductive growth (Chandra *et al.*, 1976; Chandramony & George, 1976; Pandita *et al.*, 1980; Patil & Ballal, 1980; Sharma *et al.*, 1980). In most of these studies, it was pointed out that though all the 'Planofix' treatments significantly enhanced the yield over that of the control but 10 ppm was superior amongst them. Warade & Singh (1977) also carried out similar studies but used much higher concentrations of 100, 200 and 300 ppm and concluded that treatment with 200 ppm, applied at flowering stage, gave the highest pod yield (37% higher than the control). Comparing various formulations of NAA (Planofix, Fruito-fix and Fixes) with pure NAA, Menon (1981) concluded that all the treatments enhanced the yield significantly but NAA was superior. Pillai *et al.*, (1977) using 90-150 ppm 'Planofix' although did not observe reduction in the incidence of spike shedding in pepper (*Piper nigrum* L.) but an increase in berry weight and volume was found. Thus our results substantiate the above findings and confirm the superiority of 10 ppm NAA over the other concentrations.

There does not appear to be any report where Ag or Co ions were found effective in enhancing yield in a vegetable crop. Comparing the effect of various salts of silver i.e., nitrate, acetate, lactate as well as $NaNO_3$, Beyer (1976) has shown that it was the Ag ion and not the anions which was effective in inhibiting ethylene action in such studies. The action of these two ions in interfering with the biosynthesis of ethylene is well documented. It is known that Ag ion enhances the oxidation of ethylene (Beyer, 1979) and Co ion prevents the oxidation of ACC to ethylene (Yu & Yang, 1979). Thus our results with Ag or Co ions may be the first to report their antiethylene action in enhancing pod yield in chilli.

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