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EFFECT OF F, W-450 ON GROWTH, POLLEN GERMINATION, YIELD AND FRUIT-QUALITY IN *LYCOPERSICON ESCULENTUM* MILL.

A.K. BISARIA, G.R. RASTOGI, V.K. BHATNAGAR AND RANJANA NARANG

Department of Botany, Hindu College, Moradabad-244001 (U.P) India

Abstract

Plants of tomato *(Lycopersicon esculentum* Mill.) cv 'Pusa Ruby' were given four foliar sprays of F, W-450 at 500, 1000, 1500 and 2000 ppm. FW-450 reduced the height of plant and increased the circular growth. The formation of flowers and fruits was enhanced up to a concentration of 1500 ppm and was drastically reduced at 2000 ppm. F,W-450 inhibited pollen viability and germination. The yield was increased upto 1500 ppm and reduced at 2000 ppm. Total soluble solids acidity and ascorbic acid contents increased up to a concentration of 1500 ppm and decreased at 2000 ppm.

Introduction

Sodium-2, 3-dichloroisobutyrate (F,W-450) syn. Mendok is a synthetic bioregulant and has been used as a male gametocide in several crop plants (Eaton, 1957; 1958; Mayer et al., 1958; Moor, 1959; Pate & Duccan, 1960; Kumar, 1963; Nair, 1964; Singh & Kaul, 1967; Pillai & Srinivasan, 1972; Sharma, 1978), but no information is available on the effect of F,W-450 on growth, pollen germination and yield in tomato. The present study was therefore, undertaken to determine the effect of F,W-450 on vegetative growth, pollen germination, yield and fruit-quality in tomato as it is one of the important fruit-vegetable crops of the family Solanaceae and cultivated throughout the world.

Materials and Methods

The present investigation was carried out during January to April, 1977. Seeds of tomato *(Lycopersicon esculentum* Mill.) cultivar 'Pusa Ruby' were sown in seed-bed on January 1, 1977. Out-door experimental plots (8mx6m) were prepared by incorporating with farm-yard-manure and the seedlings were transplanted on January 15, 1977. The distance between plants and rows was 50 cm and 60 cm respectively, Four-week-old plants were sprayed with an aqueous solution of F, W-450 (Sodium-2, 2-dichloroisobutyrate) at 0, 500, 1000, 1500 and 2000 ppm four times regularly at weekly intervals by a manual atomizer. Tween 20 at 0.05% was used as a wetting agent. A randomised block of four replicates consisting of five plants for each treatment was taken into consideration. All the plants were grown under identical conditions of temperature (18.5-31.8°C) and day-length (11-13 hours). Plants were weeded and irrigated regularly at weekly intervals. Pollen viability was determined by tetrazolium trichloride at 0.5% (w/v). Pollen germination was assessed on an artificial medium of 10% sucrose (w/v), 2% agar (w/v) and 001% boric acid (w/v) on cavity slides. Pollen diameter and pollen tube-length were measured by an ocular micrometer. Five slides were considered for each treatment.

Sugars, total acidity and ascorbic acid contents in fruit were estimated according to A.O.A.C. methods (1975). All the data was analysed statistically and the significance was tested by 't' test.

Results

Foliar application of F,W-450 inhibited the height of plant, increased the number and growth of lateral branches, thickness of stem and number of leves progressively with increasing concentration (Table 1). Presence of F,W-450 in the solution enhanced the production of flowers per plant and the flower drop and induced formation of abnormal pollen grains.

TABLE 1. Effect of F,W-450 on growth, number of flowers and pollen grains in *Lycopersicon esculentum* Mill.

Observations	Control	Concentration of F,W-450 in ppm.			
		500	1000	1500	2000
Final height of plant (cm)	53.9	49.5	46.2	39.3	30.7
No. of lateral branches	6.1	8.6	11.3	15.7	21.5
Thickness of stem (mm)	8.2	11.9	12.5	14.8	17.4
No. of leaves per plant	37.5	42.1	45.8	51.4	58.1
Av. No. of flowers	30.4	35.3	40.6	47.8	18.3
Av. No. of flowers abscised	10.2	11.5 N.S.	14.1	18.5	22.6
Total No. of flowers per plant	40.6	46.8	54.7	66.3	40.9 N.S.
Abnormal pollen (%)	3.8	5.7 N.S.	8.5	10.9	14.5
Viability of pollen (%)	96.2	78.3	63.7	46.5	28.1
Germination of pollen (%)	59.5	65.9	50.2	31.8	18.4
Diameter of pollen (u)	37.9	20.5	16.2	14.1	10.8
Length of pollen tube (u)	215.4	197.3	175.1	160.5	149.3

Values for each parameter differ significantly at P = 0.05 except those marked with 'N.S.'

Pollen viability and germination were reduced by F,W-450 gradually with increasing concentration (Table 1). Only 28.1% and 13.4% pollen viability and germination, respectively, were recorded in plants sprayed with F,W-450 at 2000 ppm. It also reduced the diameter of pollen and length of pollen tube. The reduction in diameter of pollen and length of pollen tube was directly proportional to the concentration.

The bioregulant enhanced the total fruit-set up to a concentration of 1500 ppm and reduced it drastically at 2000 ppm (Table 2). It also accelerated the fruit-abscission at 1000, 1500 and 2000 ppm and had no significant effect at 500 ppm. Formation of deformed fruits was also observed in plants treated with F,W-450. Though it enhanced fruit drop and deformation but the foliar application of F,W-450 increased the circumference of fruit, weight of fruit and therefore yield per plant up to 1500 ppm.

TABLE 2. Effect of F,W-450 on fruit-set, yield and quality of fruit in *Lycopersicon esculentum* Mill.

Observation	Control	Concentration of F,W-450 in ppm			
		500	1000	1500	2000
No. of normal fruits	24.6	26.9 N.S.	29.8	31.5	2.8
No. of fruits abscised	4.1	5.9 N.S.	7.1	8.9	10.6
No. of deformed fruits	1.7	2.5	3.7	7.3	4.9
Av. total No. of fruits/plant	30.4	35.3	40.6	47.8	18.3
Av. circumference of fruit (cm)	19.38	21.1 N.S.	23.9	36.2	14.7
Av. weight of fruit (g)	58.5	64.0	69.2	73.8	50.2
Yield/Plant (Kg)	1.421	1.642	1.911	2.237	0.458
Total soluble solids (%)	4.6	5.1 N.S.	5.8	6.3	6.7
Total sugars (g/100 bulp)	2.74	2.51	2.16	1.83	1.35
Acidity (Equi. g/100 ml juice)	1.19	1.28	1.41	1.43	1.46
Ascorbic acid (mg/100 g pulp)	22.7	23.2 N.S.	20.9	28.6	16.1

Values for each parameter differ significantly at P = 0.05 except those marked with 'N.S.'

F,W-450 appreciably increased the total soluble solids in fruit at 1000 and 1500 ppm, but reduced it at 2000 ppm (Table 2). Sugar content in fruit was decreased by F,W-450 gradually with increasing concentration. Total acidity in terms of citric acid and ascorbic acid increased up to a concentration of 1500 ppm and were reduced at 2000 ppm in fruits.

Discussion

The observations that F,W-450 inhibits the height of plant and stimulates the growth of lateral branches are in accordance with those reported for *Gossypium herbaceum* (Pate & Duncan, 1960) *Abelmoschus esculentum* (Nair, 1964), *Cajanus cajan* (Kaul & Singh, 1967) and *Capsicum annuum* (Pillai & Srinivasan, 1972).

This bioregulant reduces pollen viability and also reduces the size of pollen and length of pollen tube. Our observation indicate that F,W-450 is a potent male gametocide which has also been observed in *G. herbaceum* (Eaton, 1957; Pate & Ducan, 1960; Singh, 1964), *L. esculentum* (Morre, 1959), *Zea mays* (Cameron & Eaton, 1959), *Solamum melongena* (Leelama, 1956), *Capsicum annuum* (Pillai & Srinivasan, 1972) and *Pennisetum typhoides* (Sharma, 1978).

The results also indicate that F,W-450 increases the fruit-set and yield in *L. esculentum* similar to those reported for *S. melongena* (Leelama, 1965) and *C. annuum* (Pillai & Srinivasan, 1972).

Enhancement in total soluble solids, acidity and ascorbic acid and reduction in sugars of fruit due to application of F,W-450 is being reported here for the first time.

Our findings are of practical value and could be utilized by horticulturists for imporving the production of crop, quality of fruit and hybrid seeds in *L. esculentum.*

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