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Effect of sodium para nitrophenolate on flowering and yield of cucumber (*Cucumis sativus* L.)

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Abstract
An experiment was conducted at College of Agriculture, Vijayapura, University of Agricultural Sciences, Dharwad during the year 2019 to know the influence of Sodium para nitrophenolate on flowering and yield of cucumber variety of Dharwad local. Temperature influences the genes responsible the synthesis of hormones leading to flower formation. Exogenous application of growth regulators at appropriate stage alters the sex ratio. Among the treatments of sodium para nitrophenolate at 0.3% SL @ 2ml/L of water recorded low sex ratio as well as high yield.

Keywords: Sodium para nitrophenolate, cucumber, sex ratio

Introduction
Cucumber (*Cucumis sativus* L.) is a widely cultivated plant belonging to the family Cucurbitaceae. It exhibits a fascinating flowering pattern with staminate, pistillate and hermaphrodite. It is an annual, dioecious creeping vine that grows up trellises or other supports, wrapping around them with thin, spiral tendrils. The plant has large leaves that form a canopy over the fruit. The fruit of the cucumber is roughly cylindrical, elongated with tapered ends.

Cucumber is used as salad, pickle and also as cooked vegetable because of its low calorie content. Tender leaves are also used as vegetables. Fruits help in the cure of constipation, jaundice and indigestion. Seeds have a number of ayurvedic uses. The fruits and seeds possess cooling properties, hence used as astringent and antipyretic. Cucumber has originated from India, but is now grown in most continents. Many different varieties are traded on the global market.

The fruits are highly nutritive and have very high water content and very low calories. The fruit is used as a vegetable or salad. It is rich in minerals, thiamine, niacin and vitamin C. (0.38 g, 0.3 mg, 0.2 mg and 78 mg, respectively per 100 g of edible fruit). Fruits consist about 80 percent of edible portion which contains 95% water, 0.7% protein, 0.1% fat, 3.4% carbohydrates, 0.4% fiber and 0.4% ash (Aykroyd, 1963) [1].

The sex expression of cucumber is determined by genetics as well as environmental factors such as photoperiod and temperature. Along with the environment endogenous levels of phytohormones like auxin and gibberllins at time and set of ontogeny determine the sex ratio and sequence of flowering (Dey et al., 2005) [2]. Among the plant growth regulators GA3 and NAA have a great importance on sex modification in various cucurbitaceous crops (Hilli,2010) [3]. Exogenous application of plant growth regulators can alter the sex ratio and sequence, if applied at two and four leaf stages which are critical stages to promote or suppress either of the sex (Hossain 2006) [4].

Material and Methods: The experiment was conducted at the College of Agriculture, Vijayapura, UAS, Dharwad. The experiment was laid out in randomized block design with three replications and eight treatments were imposed on cucumber variety of Dharwad local. The plot size was 4m X 6m with spacing of 1.5 m. between row to row and 0.75m between plants. Along with farm yard manure (20 t/ha) was applied before the preparation of bed. Nitrogen, phosphorous and potash were applied at rate of 60:50:80 kg/ha and also sowing was done in the month of August with two seeds per hill at 2-3 cm depth. Later, gap filling and thinning were carried out and maintained one plant per hill.

The treatments consist of six different levels of sodium para nitrophenolate ($C_6H_4NNaO_3$) @ 0.3% SL, ethrel @ 250 ppm and control (water spray) and also treatments of three foliar sprays were imposed at 20, 35 and 50 days after sowing. The observations were recorded such as number of primary branches per plant, days to first male flowering, days to first female flowering, days to 50% flowering, total number of male flowers per plant, total number of female flowers per plant, fruit length, fruit diameter, number of fruits per plant, weight of fruits, average fruit weight per plant and fruit yield per hectare from the five tagged plants from each of the treatment.

Treatment Details

Sl. No	Treatments	Dosage
T1	Sodium para nitrophenolate 0.3% SL	1ml/l
T2	Sodium para nitrophenolate 0.3% SL	2ml/l
T3	Sodium para nitrophenolate 0.3% SL	3ml/l
T4	Sodium para nitrophenolate 0.3% SL	4ml/l
T5	Sodium para nitrophenolate 0.3% SL	5ml/l
6	Sodium para nitrophenolate 0.3% SL	6ml/l
7	Ethrel	250 ppm
8	Untreated control –Water spray	Water

Results and Discussion

Effect of sodium paranitrophenolate on phenology of cucumber

Cucumbers are known for their plasticity in sex expression. The photoperiod significantly influences the flower development processes, while temperature strongly stimulate phytohormone-pathway-related genes (Lai, et.al, 2018) [6].

In the present study number primary branches differed significantly among the treatments. Highest number of primary branches per plant (4.8) was observed in 3 ml/l C6H4NNaO3 followed by ethrel 250 ppm (4.7). There was no significant difference in days to first flowering as well as days to 50% flowering. Days to first flowering and 50% flowering were lowest in the 3 ml/l C6H4NNaO3 treatment (32.7 and 39.7 days respectively). (Table 1)

Days to first female flower appearance differed significantly among the treatments. Days to first female flower to form was lowest in Ethrel 250 ppm (39.0) followed by 3 ml/l $C_6H_4NNaO_3$ (40.7). Whereas, untreated control (water) had recorded highest number of days (46.0).

Growth regulators have tremendous effects on sex expression and flowering in various cucurbits leading to either suppression of male flowers or increasing in the number of female flowers (Mosum and Masri, 1999) [7] without affecting environment and human health.

Sodium para nitrophenolate significantly affected the formation of number of male and female flowers. Highest number male flowers per plant were observed in the treatment 2ml/l $C_6H_4NNaO_3$ (70.7) followed by 5 ml/l $C_6H_4NNaO_3$ (62.1) compared to control (water) which recorded the least (47.8). Number of female flowers per plant were highest (18.7) in 2 ml/l $C_6H_4NNaO_3$ followed by Ethrel 250 ppm (17.7) compared to control (water spray) which recorded the least number of female flowers per plant (10.0). The ratio of male to female flowers was lowest (4.52) in 3ml/L followed by 2ml/L $C_6H_4NNaO_3$ (4.52) compared to control (6.03).

Effect of sodium paranitrophenolate on yield components of cucumber

Foliar spray of sodium paranitrophenolate increased the fruit length, size as well as yield (Hussein et al 2019) [5]. The cucumber fruit length differed significantly among the treatments. Ethrel 250 ppm had recorded highest fruit length (31.0 cm) followed by 1 ml /L $C_6H_4NNaO_3$ (28.0cm).Whereas, fruit length was least (18.0cm) in control. The fruit diameter differed significantly. It was highest (7.7 cm) in 1ml/L C6H4NNaO3 followed by 3 ml/L $C_6H_4NNaO_3$ and ethrel 250 ppm. The average fruit weight was highest in 3 ml/l C6H4NNaO3 followed by 6 ml/L $C_6H_4NNaO_3$ treatment (Table 2).

Number of fruits per plant and yield were influenced by sodium para nitrophenolate spray (Hussein et al 2019) [5]. Highest number of fruits per plant (15.0) was observed in 2ml/L $C_6H_4NNaO_3$ treatment followed by 3 ml/L $C_6H_4NNaO_3$ (12.7) compared to control which recorded the least (6.0). The fruit yield differed significantly among the treatments. Highest fruit yield per plant was recorded in 3 ml/L $C_6H_4NNaO_3$ (2.55kg) followed by 2 ml/L $C_6H_4NNaO_3$ (2.35 kg) compared to control (0.86 kg). Fruit yield per hectare also differed significantly. Highest fruit yield of 300 q/ha was recorded in 2 ml/L $C_6H_4NNaO_3$followed by 3ml/L $C_6H_4NNaO_3$ (266 q/ha) when compared to control (90 q/ha).

Table 1: Effect of Sodium para nitrophenolate on phenology of cucumber

Treatments	Particulars	Primary branches per plant	Days to first flowering	Days to 50% flowering	Days to First female flower	No. of male flower per plant	No. of female flower Per plant	Male to Female ratio
T_1	Sodium para nitrophenolate at 0.3% SL @ 1ml/L	3.3	33.7	39.7	43.3	59.2	13.7	5.49
T_2	Sodium para nitrophenolate at 0.3% SL @2ml/L	3.8	34.7	40.3	43.0	70.7	18.7	4.73
T_3	Sodium para nitrophenolate at 0.3% SL@ 3ml/L	4.8	32.7	39.7	40.7	55.9	15.7	4.52
T_4	Sodium para nitrophenolate at 0.3% SL @ 4ml/L	4.3	32.0	42.0	44.7	58.6	14.3	5.18
T_5	Sodium para nitrophenolate at 0.3% SL @ 5ml/L	4.4	33.3	39.7	43.3	62.1	14.3	5.46
T_6	Sodium para nitrophenolate at 0.3% SL @ 6ml/l	3.7	33.7	41.7	46.0	57.3	14.0	5.17
T_7	Ethrel @ 250 ppm	4.7	33.0	40.0	39.0	60.4	17.7	4.88
T_8	water spray	3.4	32.7	41.3	46.0	47.8	10.0	6.03
	S.Em ±	0.2	1.3	1.0	0.9	2.2	1.0	
	CV	8.9	6.6	4.1	3.7	5.3	11.8	
	CD @ 5%	0.6	3.8	2.9	2.8	6.8	3.0	

Table 2: Effect of Sodium para nitrophenolate on fruit and fruit yield of cucumber

Treatments	Particulars	Fruit length (cm)	Fruit Diameter (cm)	Avg. fruit weight (g/fruit)	No. of fruits/plant	Fruit weight (kg/plant)	Fruit yield (q /ha)
T_1	Sodium para nitrophenolate at 0.3% SL @ 1ml/L	28.0	7.7	136	10.7	1.44	150
T_2	Sodium para nitrophenolate at 0.3% SL @ 2ml/L	19.0	6.5	168	15.0	2.35	300
T_3	Sodium para nitrophenolate at 0.3% SL @ 3ml/L	27.0	7.2	202	12.7	2.55	266
T_4	Sodium para nitrophenolate at 0.3% SL @ 4ml/L	23.0	6.3	158	11.0	1.75	183
T_5	Sodium para nitrophenolate at 0.3% SL @ 5ml/L	20.0	5.0	186	11.3	2.11	220
T_6	Sodium para nitrophenolate at 0.3% SL@ 6ml/L	19.0	5.5	168	10.3	1.74	182
T_7	Ethrel @ 250 ppm	31.0	7.2	151	12.0	1.80	212
T_8	water spray	18.0	5.5	144	6.0	0.86	90
	S. Em $\pm$	1.7	0.7	12.3	0.9	0.20	18
	CV	12.5	18.6	13.0	14.3	14.38	16
	CD @ 5%	5.1	2.1	37.2	2.8	0.46	56

Conclusion: The overall results of present investigation, concluded that among the different doses of Sodium para nitrophenolate @ 2 ml/L of water found to be superior in terms of days to first female flower formation, low sex ratio and yield as compare to control.

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