Effect of growth regulators on the yield, Physiological and biochemical parameters of medicinal solanum (*Solanum viarum* Dunal)

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ABSTRACT

An experiment was carried out in the Medicinal Plant Unit, Department of Horticulture, Annamalai University to study the effect of plant growth regulators on the yield, Physiological and biochemical parameters of medicinal solanum. The experiment was carried out by following the principles of Completely Randomized Design with ten treatments in three replications. Growth regulators such as GA_3 (250, 500 and 1000 ppm), NAA (50,100 and 200 ppm), and Cycocel (250, 500 and 1000 ppm), were applied as foliar spray at 30, 45 and 60 DAP. Among the growth regulators tried, GA_3 500 ppm improved yield characters like flower production, number of fruits per plant, fruit set percentage, fruit size, fruit diameter, fruit weight and fruit yield per plant, Physiological attributes like chlorophyll content index (CCI) , dry matter production (DMP) and biochemical parameter like solasodine content when compared to NAA and Cycocel.

Keywords: Medicinal Solanum, GA_3, NAA, Cycocel

INTRODUCTION

The use of plants as a source of drugs is well recognized in modern medicine. Among the plant based drugs, steroids rank foremost in the world. Steroids are extensively used in the manufacture of contraceptive pills, corticosteroids and sex hormones and thereby, have achieved importance in the field of medicine, being next only to the antibiotics as life saving drugs. Among the natural sources, *Dioscorea* and *Costus Sp* contain diosgenin, while *Solanum* sp contain solasodine which are used commercially in the preparation of steroids and sex hormones. Diosgenin obtained from the underground tubers of *Dioscorea species* is the main plant source of steroids. The rapid depletion of

natural stands of these *Dioscorea species* due to excessive collection has led to search for an alternative plant source to meet the expanding global requirement of steroids. In meeting these demands *Solanum viarum* has the potential to play a greater role than steroid bearing *Dioscorea* species.

Synthetic growth regulatory chemicals are being extremely important and valuable for manipulating the growth and yield of medicinal plants. Their effect varies with plant species, variety, concentration used, frequency of application and various other factors which influence the uptake and translocation of the chemicals (Singh *et al.*, 1990 and Phookan *et al.*, 1991). The present study was conducted with an objective of finding out the effect of growth regulators on the growth and yield of Medicinal Solanum.

MATERIALS AND METHODS

The investigation was conducted in the medicinal plant unit, Department of Horticulture, Annamalai University. The experiment was set up in a Completely Randomized Design with ten treatments in three replications. Plant growth regulators like GA_3 (250, 500 and 1000 ppm), NAA (50,100 and 200 ppm) and Cycocel (250, 500 and 1000 ppm) were used along with a control (water spray). The growth regulators were sprayed thrice (30, 45 and 60 DAP). The observations on yield characters like flower production, number of fruits per plant, fruit set percentage, fruit size, fruit diameter, fruit weight and fruit yield per plant, Physiological attributes like chlorophyll content index (CCI),dry matter production (DMP) and biochemical parameter like solasodine content were recorded at 150 days after planting and the results were analyzed statistically (Panse and Sukhatme, 1985).

RESULTS AND DISCUSSION

Application of growth regulators was found to produce significant effects on the yield characters of medicinal solanum (Table 1). Application of GA_3 500 ppm resulted in earlier flowering (45.73days), while Cycocel 1000 ppm took the longest time for first flower appearance (60.88 days). Increased production of leaves might help to elaborate more photosynthates and induce flowering stimulus, thus, effecting early initiation of flower buds. This is in close conformity with the findings of Bharat Singh *et al.*, (1998) in Bhendi and Gavaskar (2001) in brinjal.

The present study revealed that application of GA_3 500 ppm registered the highest number of flowers per plant (92.58), while the least number of flowers per plant was observed in the control (38.11).

Application of GA_3 500 ppm registered the highest number of flowers plant^{-1}, while the least number of flowers plant^{-1} was observed in the control. This may be due to the increase in the number of leaves as a result of treatment with growth regulators, which might have helped in the synthesis of more florigen and carbohydrates, thereby inducing higher production of flowers as observed by Sadawarte and Gupta, (1968). Similar results have also been recorded by Bhosle *et al.*, (2002) in tomato cv. Rajashree.

The fruit set percentage and fruit production were found to be significantly influenced by the application of GA_3 500 ppm (74.05 and 68.56 respectively). The least values (43.18 and 16.46) were observed in the control. The increased fruit set percentage may be due to the higher percentage of productive flowers and the production of growth hormones within the pollen leading to higher fruit set (Gavaskar 2001). Similar findings were also reported by Durvesh Singh and Gulshan Lal (2001) in tomato.

Significant increase in single fruit weight (5.42 g), fruit diameter (2.74 cm) and fruit yield per plant (315.20 g) were obtained by the application of GA_3 500 ppm when compared to the control (2.48 g, 2.62 cm and 71.72 g respectively). Significant increase in single fruit weight and fruit yield was obtained by the application of GA_3, while the least values for these traits were registered in the control. GA_3 application may enhance the source to sink relationship, accumulation of photosynthates and efficient utilization of food reserves for development and retention of flowers and fruits as observed by Muralidharan *et al*. (2002). Higher yield with GA_3 has also been reported by Savita G. Borse and Dhumal (2001) in medicinal solanum. Application of growth regulators like GA_3 and NAA produced higher yields which might be due to the production of more number of fruits and higher fruit set percentage along with greater fruit weight. Earlier reports by Singh and Lal (1994) also suggested that bioregulators increase the uptake of nutrients from the soil and lead to higher accumulation of

carbohydrates/assimilates in the fruits, ultimately increasing the fruit production. These results are in conformity with the findings of Joshi and Singh (2003).

The data presented in Table 2 revealed that the Physiological attributes like chlorophyll content index (CCI) and dry matter production (DMP) were significantly influenced by the growth regulator treatments. The chlorophyll content index (36.72) and dry matter production (294.17 g) were maximum in GA_3 500 ppm (T_2) followed by GA_3 1000 ppm (T_3) which recorded the values of (34.59) and (276.58 g) respectively. The control (T_{10}) registered the least Physiological parameters with the values of (20.44) and (165.64 g) and respectively.The results of the present investigation revealed that the differences in chlorophyll content index was significant due to application of growth regulators and it was observed that plants treated with GA_3 exhibited the highest chlorophyll content index compared to the control. Application of GA_3 increases photosynthetic efficiency of plants by persistence of greenness of leaves for longer time along with an increase in the chlorophyll content and yield as observed by Khurana and Pandita (1987). The results are similar to those reported by Mousa *et al*. (2001) and Rawia A.Eid and Abou-Leila (2006).

The productivity of a crop is a resultant function of dry matter production. Increased dry matter production is the result of better plant growth as reflected by greater plant height, profuse branching, higher number of leaves and increased yield components. Vlahos (1991) observed that GA_3 application increased the weight of aerial plant parts. The results of the present study also revealed that dry matter production increased due to application of GA_3 which is in line with the findings of Ibrahim *et al*., (1992) in mint and Vijayakumari (2002) in Kalmegh.

Regarding the alkaloid content (solasodine), it was observed from the results of the present study (Table 2) that foliar application of growth regulators was found to exert a significant influence on the solasodine content. The highest solasodine content was recorded with the application of GA_3 500 ppm (2.03 %) while the least value (1.64 %) was registered in the control. The results of several workers like Gowda and Krishnan (1992) and Savita Borse and Dhumal (2001) in medicinal solanum also support the present findings.

From the present investigation it can be concluded that foliar application of GA_3 500 ppm at fortnightly intervals was found to be the best for increasing the yield, Physiological and biochemical parameters of Medicinal Solanum.

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Table 1: Effect of growth regulators on the yield characters of medicinal solanum

Treatments	Days takes for first flowering	Number of flowers per plant	Number of fruits per plant	Fruit set (%)	Single fruit weight (g)	Fruit Diameter (cm)	Yield per plant (g)
T_1- GA_3 250 ppm	52.67	71.63	42.05	58.71	3.64	2.84	193.07
T_2- GA_3 500 ppm	**45.73**	**92.58**	**68.56**	**74.05**	**5.42**	**3.36**	**315.20**
T_3- GA_3 1000 ppm	48.14	85.26	58.52	68.64	4.85	3.16	305.60
T_4- NAA 50 ppm	55.46	62.34	32.12	51.53	2.77	2.55	126.78
T_5- NAA 100 ppm	53.31	68.45	38.57	56.35	3.46	2.73	176.81
T_6- NAA 200 ppm	50.30	78.32	50.11	63.98	4.23	2.99	244.62
T_7- Cycocel 250 ppm	55.84	60.36	29.83	49.42	2.54	2.45	111.02
T_8- Cycocel 500 ppm	58.42	52.57	24.97	47.49	2.44	2.26	92.70
T_9- Cycucel 1000 ppm	60.88	45.64	20.22	44.31	2.38	2.24	78.66
T_{10}- Control	56.31	38.11	16.46	43.18	2.48	2.49	71.72
Mean	53.71	65.53	38.14	55.77	3.42	2.71	176.62
SED	0.02	0.03	0.02	0.97	0.02	0.03	1.88
CD (p=0.05)	0.04	0.06	0.04	2.02	0.05	0.06	3.92

Table 2: Effect of growth regulators on the Physiological and biochemical parameters of medicinal solanum

Treatments	Chlorophyll Content Index (CCI)	Dry Matter Production (DMP) (g)	Solasodine content (%)
T_{1}- GA_3 250 ppm	30.56	243.96	1.88
T_{2}- GA_3 500 ppm	36.72	294.17	2.03
T_{3}- GA_3 1000 ppm	34.59	276.58	1.89
T_{4}- NAA 50 ppm	27.69	221.56	1.87
T_{5}- NAA 100 ppm	29.63	236.51	1.88
T_{6}- NAA 200 ppm	32.61	259.93	1.88
T_{7}- Cycocel 250 ppm	26.71	214.41	1.77
T_{8}- Cycocel 500 ppm	24.54	197.48	1.87
T_{9}- Cycocel 1000 ppm	22.53	181.90	1.77
T_{10}- Control	20.44	165.64	1.64
SED	0.07	3.62	0.07
CD (p=0.05)	0.13	7.23	0.13