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Response of medicinal solanum to graded levels of nitrogen and phosphorus

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ABSTRACT

An investigation was conducted with the objective of finding out the nutrient requirement for *Solanum viarum*. The trial was conducted in Randomized Block Design with three replications. Nitrogen and Phosphorus were applied at three levels (50,100, 150 kg/ha and 40, 60, 80 kg/ha, respectively) along with 40 kg of potassium which was kept constant. The results revealed that application of 100 kg N,60 kg P and 40 kg K per hectare increased the vegetative parameters like plant height, internodal length, number of branches, number of leaves and leaf area and yield attributes *viz.*, flower production, fruit set percentage, fruit production, fruit size and fruit yield per plant when compared to the control.

Key words : *Solanum viarum*, Nitrogen, Phosphorus, Potassium.

Solanum viarum Dunal (Syn. *Solanum khasianum* var. *chatterjeanum* Sengupta) is an important medicinal plant belonging to the Solanaceae family and is used as a supplementary source of raw material for the synthesis of steroids, which ranks next in importance to life saving drugs. Steroids are extensively used in modern medicine as ingredients of contraceptive pills, corticosteroids and sex hormones. Solasodine obtained from berries are converted to 16-dehydroprognenolone, which is an important intermediate in the synthesis of steroid drugs.

The world demand of plant based raw material for drugs is increasing by an average of 7 per cent annually; hence medicinal plants occupy a unique position in the pharmaceutical industry. Steroidal and corticsteroidal drugs alone constitute about 6 per cent of the total production of pharmaceuticals. This demand is particularly met by solasodine.To meet the increasing demand of solasodine, it is required to cultivate *Solanum viarum* more scientifically. Nutrition of *Solanum viarum* has a direct bearing on the amount of solasodine harvested. Therefore, a systematic approach to study the requirement of three major nutrient elements (N, P and K) in the cultivation of *Solanum viarum* has to be followed. Keeping these points in view, the present investigation was conducted in order to improve the yield of *Solanum viarum* by the application of inorganic nutrients.

MATERIALS AND METHODS

The investigation was conducted in the Department of Horticulture, Annamalai University during 2007. The experiment was set up in a Completely Randomized Design, with ten treatments in three replications. The treatments consisted of application of major nutrients like nitrogen (50,100,150 kg/ha), phosphorus (40, 60, 80 kg/ha) along with a constant dose of potassium (40 kg/ha). Half the dose of nitrogen, full dose of phosphorus and potassium was applied as basal, while the remaining 50% of nitrogen was applied in two splits at 30 DAT and at the time of flower bud initiation. The observations on vegetative characters like plant height, number of branches, internodal length, number of leaves and leaf area, yield characters like days taken for first flowering, number of flowers per plant, number of fruits per plant, fruit set percentage, single fruit weight and fruit yield per plant were recorded at 150 DAT and were analysed statistically (Panse and Sukhatme, 1978).

RESULTS AND DISCUSSION

The data presented in Table1 revealed significant effects of the major nutrients on the growth characters like plant height, number of branches, internodal length, number of leaves and leaf area.

The plant height was maximum (89.15 cm) with the application of N and P @ 100:60 kg ha^{-1} (T_6) followed by T_5 (N and P @ 100:40 kg ha^{-1}) which recorded 83.82 cm. The least values of 57.25 cm and 52.09 cm were recorded with the highest dose of N and P application (T_{10}) and in the control (T_1), respectively. Similar findings on the increase in plant height due to application of N and P were reported by Saraf and Tiwari (2004) in ambrette. The internodal length was maximum (4.17 cm) in T_6 (N and P @ 100:60 kg ha^{-1}) followed by T_5 (N and P @ 100:40 kg ha^{-1}) which recorded 3.95 cm. The least internodal length

Table1: Effect of graded levels of nitrogen and phosphorus on vegetative characters of *Solanum viarum* Dunal (150 DAP*)

Treatments (kg/ha)	Plant height (cm)	Number of branches	Internodal length (cm)	Number of leaves	Leaf area (cm^2)
T_1 – Control	52.09	7.19	2.85	58.73	45.12
T_2 – $N_{50}P_{40}$	71.46	11.67	3.59	76.91	50.57
T_3 – $N_{50}P_{60}$	73.31	12.21	3.61	79.68	50.96
T_4 – $N_{50}P_{80}$	56.27	10.19	3.38	71.52	49.06
T_5 – $N_{100}P_{40}$	83.82	15.29	3.95	90.75	54.11
T_6 – $N_{100}P_{60}$	89.15	16.88	4.17	96.38	55.73
T_7 – $N_{100}P_{80}$	78.54	13.74	3.76	85.23	52.55
T_8 – $N_{150}P_{40}$	64.39	9.61	3.34	68.96	48.71
T_9 – $N_{150}P_{60}$	59.20	8.16	3.17	63.52	47.18
T_{10} – $N_{150}P_{80}$	57.25	7.51	3.12	60.59	46.77
S.E. ±	5.95	0.03	0.03	0.02	0.03
C.D. (P=0.05)	12.49	0.06	0.06	0.04	0.06

* - Days after planting

of 2.85 cm was recorded in the control (T_1).

The number of branches produced per plant was found to be maximum (16.88) with the application of N and P @ 100:60 kg ha^{-1}(T_6). The next best treatment was T_5 (N and P @ 100:40 kg ha^{-1}) which registered a value of 15.29, while the control (T_1) recorded the least value of 7.19. The leaf production also showed a similar trend with the application of N and P @ 100:60 kg ha^{-1} (T_6) recorded the maximum number of leaves and leaf area (96.38 and 55.73 cm^2, respectively), while the least values (58.73 and 45.12 cm^2) were registered in the control (T_1).

The increase in vegetative characters like plant height, number of branches, internodal length, number of leaves and leaf area might be due to increased meristamatic activities in the plant and also due to enhanced photosynthesis as reported by Medhi and Borah (1993) in turmeric. Upadhyay and Misra (1999) suggested that one of the possible reasons for maximum leaf production due to application of higher doses of fertilizers could be the increase in chlorophyll content, a component responsible for higher rates of photosynthesis. The adequate net assimilation of photosynthesis resulted in greater leaf area. The other possible reason could be that the enhanced nitrogen supply might have resulted in increased amino acid and protein synthesis, which are ultimately responsible for vigorous vegetative growth of the plant. Similar results have also been reported by Sundharaiya *et al*. (2000) and Bhaskar *et al*. (2002) in *Solanum viarum* and Laxman Singh *et al*. (2005) in bhendi.

Application of inorganic fertilizers significantly influenced the yield and yield characters (Table 2). It was observed that application of N and P @ 100:60 kg ha^{-1}

Table 2: Effect of graded levels of nitrogen and phosphorus on yield characters of *Solanum viarum* Dunal (150 DAP*)

Treatments (kg/ha)	Days taken for first flowering	Number of flowers per plant	Number of fruits per plant	Fruit set percentage	Single fruit weight (g)	Fruit yield per plant (g)
T_1 – Control	60.25	43.63	19.28	44.19	2.45	47.27
T_2 – $N_{50}P_{40}$	53.35	62.49	38.89	62.23	3.79	147.39
T_3 – $N_{50}P_{60}$	52.50	65.22	41.53	63.68	3.87	160.72
T_4 – $N_{50}P_{80}$	55.52	57.08	32.94	57.71	3.25	107.06
T_5 – $N_{100}P_{40}$	48.16	76.02	53.38	70.22	4.93	263.16
T_6 – $N_{100}P_{60}$	45.97	81.45	59.33	72.84	5.46	323.94
T_7 – $N_{100}P_{80}$	50.37	70.57	47.42	67.19	4.38	207.69
T_8 – $N_{150}P_{40}$	56.43	54.39	30.36	55.82	3.14	95.33
T_9 – $N_{150}P_{60}$	58.51	49.01	24.41	49.81	2.62	63.95
T_{10} – $N_{150}P_{80}$	59.39	46.36	21.83	47.09	2.56	55.88
S.E. ±	0.04	0.03	0.02	0.02	0.03	0.14
C.D. (P=0.05)	0.09	0.07	0.05	0.04	0.05	0.30

* - Days after planting

(T_6) followed by N and P @ 100:40 kg ha^{-1} (T_5) resulted in early flowering (45.97 and 48.16 days, respectively). Delayed flowering (60.25 days) was noticed in the control (T_1).T_6 (N and P @ 100:60 kg ha^{-1}) registered the maximum number of flowers per plant (81.45), while the least number of flowers per plant (43.63) was observed in the control (T_1). The effect of N and P interaction on both earliness in flowering and number of flowers per plant clearly indicated the importance of a balanced nutrition for certain important stages of plant growth and development. Similar findings were reported by Mahabaleswar Hedge (1984) in ambrette.

The fruit set percentage and fruit production was found to be significantly influenced by the application of inorganic nutrients. N and P @ 100:60 kg ha^{-1}(T_6) registered the maximum fruit set percentage (72.84) and number of fruits per plant (59.33). The least values (44.19 and 19.28) were observed in the control (T_1). Significant increase in single fruit weight (5.46 g) and fruit yield per plant (323.94 g) were obtained by the application of N and P @ 100: 60 kg ha^{-1}(T_6) when compared to the control (T_1) which recorded the values of 2.45 g and 47.24 g, respectively.

The increase in the yield parameters was due to the favourable influence of both N and P on these characters. Further, improved nutritional environment for growth and development of the crop also resulted in enhancing the yield parameters. With the application of optimum doses of nitrogen, more leaves might have been produced, which in turn resulted in more photosynthesis, resulting in the production of more number of bigger sized fruits and ultimately greater yield. Furthermore, it is an established fact that phosphorus plays an important role in root development, resulting in greater uptake of nutrients and increased shoot development, which thereby increased the branching, leaf production, plant height, flowers and fruit production and ultimately the fruit yield as opined by Amirthalingam (1988) in chillies. The results obtained are in conformity with the findings of Mahabaleswar Hedge (1984) in ambrette, Sundharaiya *et al*., (2000) and Bhaskar *et al*., (2002) in *Solanum viarum* and Tiwari and Kulmi (2004) in *Lepidium sativum*.

From the present investigation it can be concluded that application of N and P @ 100:60 kg ha^{-1} resulted in improving the vegetative and yield characters, thereby enhancing the yield of *Solanum viarum*.

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