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Plant geometry and nutrients on herbage yield and alkaloid content in Makoi (*Solanum nigrum* L.) under northern dry zone of Karnataka

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Abstract

An investigation was carried out to study the effect of plant density and different nutrients on growth, biomass yield and alkaloid content in makoi (*Solanum nigrum* L.) at the Department of Medicinal and Aromatic Plants, Kittur Rani Channamma college of horticulture, Arabhavi, University of Agricultural Sciences, Dharwad during July 2006 to October 2006. Spacing of 60x30cm and application of 125:60:60 kg NPK/ha was found beneficial for better growth and yield in makoi.

Keywords: Makoi, nutrition, spacing, solamargine and solasodine

Introduction

Makoi (*Solanum nigrum* L.) is an annual herb native to India is a one of important medicinal crop belongs to the family Solanaceae. It is also referred as black night shade, makoi, kasi, kakamachi, manathakkali etc. The leaves, green berries as well as the whole plant are medicinally important. The leaves contain the glycol-alkaloids solamargine and solasonine. The immature green berries contain solasonine, solamargine, aipla solanigrine and the beta solanigrine, which yield solasodine as a glycone.

The whole plant is credited for its emollient, antispasmodic, diuretic and laxative properties. Leaves have diuretic, antiseptic and antidyenteric properties, used in invirulent gonorrhoea, wounds sores, malaria. The berries are used for appetite, in pains, dysentery, asthma, vomiting, leucoderma, and bronchitis. They also have diaphoretic properties and help in reduction of blood pressure and as to cure ulcers, epilepsy and eye troubles.

Although much work has been done on the therapeutic uses of this crop, the information on the cultural practices suited to the dry zones of northern parts of Karnataka. Hence, the present investigation was planned to standardize the optimum spacing and nutrient requirement of this crop for enhancing the herbage and alkaloid yield.

Material and Methods

The present investigation was carried out during July-October 2006 at the Department of Medicinal and Aromatic Plants, Kittur Rani Channamma College of Horticulture, Arabhavi, to study the effect of plant density and inorganic nutrients on herbage yield and total alkaloid content in makoi. In all, there were sixteen treatments comprised of 4 levels each of spacing and fertilizers. The spacing levels used in the study were S1: 60x45cm (37,037 plants/ha), S2: 60x30 cm (55,555 plants/ha), S3: 45x45cm (49,382 plants/ha), S4: 45 x 30 cm (74,074 plants/ha) and the fertilizer doses were F0: Control, F1: 75:40:40 kg NPK/ha, F2: 100:50:50 Kg NPK/ha, F3: 125:60:60 kg NPK/ha.

Thirty days old healthy and uniform seedlings were used for transplanting. Transplanting was done according to the spacing in a uniform plot size of 3x2.7m. The treatments in respect of fertilizers were imposed at the time of transplanting. Fertilizers were applied in the form of urea, super phosphate and murate of potash as a source of nitrogen, phosphorus and potassium, respectively. In case of nitrogen, 50 percent of the dose was given as basal dose at the time of transplanting and the remaining 50 percent was given after 30 days of planting as top dressing. The gap filling was done seven days after planting with fresh seedlings in order to maintain 100 percent population in all the plots as per the treatments.

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Five plants at random from each plot were selected and tagged for the purpose of taking observations on herbage yield and total alkaloid content.

Total alkaloid content of the whole plant was estimated by using composite samples from each treatment. The procedure suggested by Guseva *et al.* (1965) [3] and Harborne (1973) [4] was followed with modifications. Shade dried whole plant was ground to a fine powder using grinder. Thirty gram of powder was taken and dissolved in 90 per cent alcohol and kept overnight. Further, it was extracted and concentrated to a syrup residue. Then it was treated with 25, 20, 15, and 10 ml portions of 5 per cent sulphuric acid until the complete extraction of alkaloid. To the combined acid extracts, excess

of dragendorff's reagent was added, filtered the residue and dissolved in acetone. The solution was filtered and the precipitate was washed with acetone, alcohol and water in that order. Sufficient hydrogen sulphide was passed through the filtrate. The solution was boiled for 10 minutes. Then, it was filtered and evaporated under vacuum in a tarred flask. Five ml of ethyl alcohol was added and evaporated to dryness. The process was repeated once again and the residue was weighed to constant weight in a vacuum desiccator and expressed as percent total alkaloid (w/w). The observations were recorded at 90 days (at harvest). The data collected were subjected to statistical analysis.

Table 1: Effect of spacing and nutrients on herbage yield and total alkaloid content in Makoi

Treatments	Fresh herbage yield/ha (t)	Dry herbage yield /ha (t)	Total alkaloid content (% w/w)
Spacing (S)			
S1= 60X45 cm (37,037 plants/ha)	16.37	2.90	0.32
S2= 60X30 cm (55,555 plants/ha)	17.47	3.58	0.34
S3= 45X45 cm (49,832 plants/ha)	11.77	2.81	0.32
S4= 60X30 cm (74,074 plants/ha)	15.19	3.44	0.30
S.Em±	0.96	0.22	0.008
CD @ 5%	2.79	0.64	0.02
Fertilizers (F)			
F0 (control)	11.07	2.23	0.25
F1 (75:40:40 Kg NPK/ha)	15.40	3.39	0.33
F2 (100:50:50 Kg NPK/ha)	16.94	3.40	0.34
F1 (125:60:60 Kg NPK/ha)	17.38	3.71	0.36
S.Em±	0.96	0.22	0.008
CD @ 5%	2.79	0.64	0.02
Interaction (S x F)			
S1F0	8.54	1.90	0.24
S1F1	20.10	2.43	0.34
S1F2	16.68	3.73	0.34
S1F3	20.15	3.53	0.37
S2F0	13.62	2.66	0.25
S2F1	15.96	3.70	0.35
S2F2	17.61	3.50	0.36
S2F3	22.68	4.43	0.40
S3F0	8.41	1.96	0.26
S3F1	10.92	3.46	0.33
S3F2	14.79	2.70	0.32
S3F3	12.95	3.10	0.35
S4F0	13.72	2.36	0.26
S4F1	14.62	3.96	0.27
S4F2	18.69	3.66	0.33
S4F3	13.73	3.76	0.32
S.Em±	1.93	0.44	0.017
CD @ 5%	NS	NS	0.05

NS= Non Significant

Results and Discussion

The data pertaining to the effect of spacing and nutrients on herbage yield and total alkaloid content are presented in table 1.

Among the different spacing levels, plant spaced at 60x30cm (S₂) recorded significantly higher fresh yield per hectare (17.47 t). While lower fresh yield per hectare (11.77 t) was noticed in S₃. This might be due to the luxuriant growth of plants during vegetative phase at this spacing resulting in higher yield for hectare. Similar results have been quoted by Pushpalatha *et al.* (2003) [11] in makoi, Balyan and Sobti (1990) [1] in clocimum. Among the different spacing levels, plant spaced at 60 x 30 cm (S₂) recorded significantly higher dry yield per hectare (3.58 t). While lower fresh yield per hectare (2.81 t) was noticed in S₃. This might be due to the fact that the widely spaced plants have accumulated more dry

matter through better utilization of light, moisture and space. These findings are in conformity with those of Pushpalatha *et al.* (2003) [11] in makoi. Application of 125:60:60 kg NPK/ha (F₃) recorded the higher fresh yield per hectare (17.38 t). While lower fresh yield per hectare (11.07 t) noticed in control (F₀). This may be attributed to fact that under increasing fertility levels, there would be luxuriant growth of the plant, which leads to production of more number of leaves, branches and ultimately resulting in higher fresh yield per hectare. The results are similar to the findings of Muniramappa *et al.* (1997) [8] in kalmegh, Pareek *et al.* (1989) [10] in senna and Choudhary *et al.* (1987) [2] in datura. No significant difference was noticed in fresh and dry yield per hectare.

Application of 125:60:60 kg NPK/ha (F₃) recorded the higher dry yield per hectare (3.71 t). While lower dry yield per

hectare (2.23 t) noticed in control (F_0). This was due positive role played by nutrients on growth and metabolism of plants, which increased the accumulation of dry matter in the plant. These results are comparable with the results noticed by Ramesh *et al.* (1996) ^[12] and Muniramappa *et al.* (1997) ^[8] in kalmegh. The effect of different spacing levels on the total alkaloid content was significant. The maximum total alkaloid content (0.34% w/w) was recorded in 60 X 30 cm (S2). While minimum alkaloid content (0.30% w/w) was noticed in S4. This may be due to the ideal growing conditions for plant growth prevailed at this spacing. The similar results with the results obtained by the Muniram *et al.* (1997) ^[7] in *Artemisia annua*, and Subbireddy *et al.* (1991) ^[14] in *Solanum viarum*. The significant variation in alkaloid content was observed due to fertilizer treatments. A linear increase in alkaloid content was observed with increase in fertilizer level. The maximum total alkaloid content (0.36% w/w) was recorded in 125:60:60 kg NPK /ha (F_2). While minimum alkaloid content (0.25% w/w) was noticed in control (F_0). The higher alkaloid content at higher levels of nutrients was due to availability of balanced nutrients. Similar trend was observed by Maheshwari *et al.* (1988) ^[6] in henbane and Sharma and Gupta (1998) ^[13] in *Tylophora indica*. Significant difference was noticed in Total alkaloid content due to interaction of spacing and fertilizers. The S2F3 interaction treatment was recorded the maximum total alkaloid content (0.40% w/w) and the minimum total alkaloid content (0.24% w/w) was observed in S_1F_0 interaction treatment. This may be due to timely nutrient application and utilization of light and space. The results are comparable with Kurnosova and Pikova (1975) ^[5] in *Senna*.

Conclusion

Planting of makoi at 60x30cm spacing and application of 125:60:60 kg NPK/ha is beneficial for obtaining the maximum fresh, dry herbage yield (per hectare) and total alkaloid content (%) under northern dry zone of Karnataka.

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