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EFFECT OF INTEGRATED NUTRIENT MANAGEMENT PRACTICES ON YIELD CHARACTERS OF AMBRETTE (*ABELMOSCHUS MOSCHATUS* MEDIC.)

R. Rajeswari and Arumugam Shakila

Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar-608 002 (Tamilnadu), India.

Abstract

An investigation was undertaken to study the effect of integrated nutrient management practices on yield characters of Ambrette (*Abelmoschus moschatus* Medic.). The design followed was randomized block design with three replications. The trial was conducted with recommended dose of fertilizers (120 : 30 : 40 kg NPK ha^{-1}) along with combination of FYM (25 t ha^{-1}), neem cake (1 t ha^{-1}) and biofertilizers (azospirillum and phosphobacteria each @ 2 kg ha^{-1}). The observations on number of pods per plant, pod length, pod girth, mean pod weight, pod yield per plant, pod yield per hectare, number of seeds per pod, seed yield per plant and seed yield per hectare were recorded and analysed statistically. The results revealed that the treatment combination of 50% RDF + 50% FYM + 50% biofertilizers (azospirillum and phosphobacteria) recorded maximum values for yield characters in ambrette.

Key words : Ambrette, nutrients, FYM, neem cake, biofertilizers, yield.

Introduction

Abelmoschus moschatus Medik. is an aromatic and medicinal plant in the Malvaceae family, which is native to India. The genus Abelmoschus has six species distributed in South East Asia and North Australia. *Abelmoschus manihot*, *Abelmoschus esculentus* and *Abelmoschus moschatus* contain wild and cultivated forms, while *Abelmoschus ficulneus*, *Abelmoschus crinitus* and *Abelmoschus angulosus* are only wild. It is an erect hispid herbaceous trailing herb that grows up to 1.5 m tall with a long slender tap root. The seeds have a sweet, flowery, heavy fragrance similar to that of musk. Every part of this medicinal plant is used in one or the other way. In India, roots, leaves (rarely) and seeds of ambrette are considered valuable traditional medicines. The bitter, sweet, acrid, aromatic seeds are used as a tonic and are considered to possess cooling, aphrodisiac, ophthalmic, cardiotonic, digestive, stomachic, carminative, pectoral, diuretic, stimulant, antispasmodic and deodorant properties. The seeds yield an essential oil which gives a strong flowery musky brandy odour of remarkable tenacity because of the presence of ambrettolide, a macrocyclic lactone in the seed coat. Ambrette seeds are exported to Canada, France, Nepal, Spain, UAE and United Kingdom to the extent of about 116 quintals in a year because of its diversified uses (Oudhia and Tripathi, 2000). Besides, seeds are also used to protect woollen garments against moth and imparts a musky odour to sachets, hair powder, pan masala, agarbatti, etc. The oil extracted from this crop has a great national and international demand. In the national and international drug markets, the oil is known as Ambrette oil. This increasing demand has motivated the farmers to cultivate this important medicinal crop in fairly large areas. However, they often do not adopt scientific cultivation practices. The commercial cultivation of medicinal plants requires intensive care and management.

It is an established fact that fertilization either in organic or inorganic form is the most important factor for exploiting inherent potential of crops to the maximum possible extent. Continuous use of inorganic fertilizers, pesticides and fungicides without any organic manure cause environmental pollution especially, in soil thereby affecting its fertility on long term basis (Subramaniyan *et al*., 2001). For maintaining optimum productivity of the land and building up of soil fertility, the use of organic manures along with inorganic manures to crops has been suggested. It is a well known fact that the availability of organic manures is very much limited in the present day agriculture (Annadurai *et al*., 2001). Combined application

of organic manures with inorganic fertilizers not only increases the crop yield, but also improves the physical and biological properties of soil. The integrated nutrient management approach is indispensable for sustaining high quality plant production without causing detrimental effects on soil caused by inorganic fertilizer application. With this background in view, the present investigation was undertaken to study the effect of integrated nutrient management practices on yield parameters of *Abelmoschus moschatus*.

Materials and Methods

A field experiment was conducted in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar (Tamilnadu), India; during July to December, 2012 with a spacing of 60 × 60 cm. Seeds collected from the University of Agricultural Sciences, Bangalore were used for the study. The experiment was laid out in a randomized block design with three replications. The trial was conducted with recommended dose of fertilizers (RDF) @ 120 : 30 : 40 kg NPK ha^{-1} along with combination of FYM @ 25 t ha^{-1}, neem cake (NC) @ 1 t ha^{-1} and biofertilizers (BF) *viz*., azospirillum and phosphobacteria each @ 2 kg ha^{-1}. The treatments comprised of $\mathbf{T_1}$ – 120: 30: 40 kg NPK ha^{-1} (RDF); $\mathbf{T_2}$ – 50% RDF + 100% FYM; $\mathbf{T_3}$ – 50% RDF + 100% NK; $\mathbf{T_4}$ –50% RDF + 100% BF; $\mathbf{T_5}$ – 50% RDF + 50% FYM + 50% NK, $\mathbf{T_6}$ – 50% RDF + 50% FYM + 50% BF, $\mathbf{T_7}$– 50% RDF + 50% NK + 50% BF and $\mathbf{T_8}$ – 50% RDF + 50% FYM + 50% NK + 50% BF. Half of the nitrogen was applied before sowing and the rest at flowering and fruiting, whereas phosphorus and potash were applied basally. Total quantity of farmyard manure, neem cake and biofertilizers were applied during field preparation. The observations on pod characters like number of pods per plant, pod length, pod girth, mean pod weight, pod yield per plant, pod yield per hectare and seed characters like number of seeds per pod, seed yield per plant and seed yield per hectare were recorded and analysed statistically (Panse and Sukhatme, 1978).

Results and Discussion

The integrated use of organic and chemical fertilizers exhibited significant effects on yield parameters (table 1). Among the different treatments tried, $\mathbf{T_6}$ (50% RDF + 50% FYM + 50% BF) recorded the maximum number of pods per plant (35.00) followed by $\mathbf{T_7}$ (50% RDF + 50% NK + 50% BF), which recorded 32.11 number of pods per plant. The least number of pods (20.11) was recorded in $\mathbf{T_8}$ – 50% RDF + 50% FYM + 50% NK + 50% BF. The application of both organic and inorganic nutrients might have resulted in rapid synthesis, translocation and accumulation of photosynthates from source to sink which might have ultimately contributed to increased number of pods. Similar results were reported by Brajeshwar *et al*. (2007) and Aruw *et al*. (2012) in senna. Further, application of organic manures like FYM was found to increase available NPK and micronutrients resulting in increased pod yield (Sadananthan *et al*., 1998). Moreover, application of FYM decreased the bulk density, increased soil porosity and water holding capacity to a greater extent, which would have been favourable for good crop growth and yield (Maheswarappa *et al*., 1999).

Significant differences were observed among the treatments with regard to pod length and pod girth (table 1). Among the different treatment combinations, combined application of 50% RDF + 50% FYM + 50% BF ($\mathbf{T_6}$) recorded the maximum length (9.03 cm) and girth (8.23 cm) of pods. The next best values for pod length (8.92 cm) and pod girth (8.12 cm) were observed in $\mathbf{T_7}$ (50% RDF + 50% NK + 50% BF). The lowest values were observed in $\mathbf{T_8}$ (50% RDF + 50% FYM + 50% NK + 50% BF), which recorded 7.92 cm pod length and 7.00 cm pod girth. The increase in pod length and girth may be due to the fact that azospirillum increases the production of growth hormones *viz*., IAA, GA and Dehydrozeatin which in turn resulted in the favourable pod characters (Govindan and Nair, 1986). These phytohormones induced cell division and cell elongation and also increased the uptake of nutrients, which resulted in higher pod length and pod girth. Similar results have been reported by Ramesh Babu (1996) in Aswagandha.

With regard to mean pod weight, significant differences were observed among the treatments. $\mathbf{T_6}$ (50% RDF + 50% FYM + 50% BF) recorded the maximum mean pod weight (2.20 g) followed by $\mathbf{T_7}$ (50% RDF + 50% NK + 50% BF), which recorded 2.18 g. The least value (1.88 g) was recorded in $\mathbf{T_8}$ (50% RDF + 50% FYM + 50% NK + 50% BF).

With regard to pod yield per plant and pod yield per hectare, a similar trend was noticed with $\mathbf{T_6}$ (50% RDF + 50% FYM + 50% BF) recording the highest pod yield per plant (77.0 g) and pod yield per hectare (2082.50 kg) followed by $\mathbf{T_7}$ (50% RDF + 50% NK + 50% BF), which recorded 69.80g pod yield per plant and 1915.90 kg pod yield per hectare. The least values were recorded in $\mathbf{T_8}$ (50% RDF + 50% FYM + 50% NK + 50% BF). This might be due to the fact that the availability of the major nutrients which are actively involved in vital processes

Table 1 : Effect of integrated nutrient management practices on pod characters of ambrette.

Treatments	Number of pods per plant	Pod length (cm)	Pod girth (cm)	Pod weight (g)	Pod yield per plant (g)	Pod yield per hectare (kg)
T_1	25.01	8.31	7.32	1.94	48.52	1332.80
T_2	29.31	8.83	8.00	2.12	62.14	1707.65
T_3	28.00	8.51	7.67	2.00	56.00	1541.05
T_4	26.31	8.35	7.39	1.92	49.84	1399.44
T_5	21.21	8.02	7.21	1.90	40.30	1107.89
T_6	35.00	9.03	8.23	2.20	77.00	2082.50
T_7	32.11	8.92	8.12	2.18	69.80	1915.90
T_8	20.11	7.92	7.00	1.88	37.81	1041.25
SED	0.93	0.01	0.02	0.01	1.45	20.18
CD (P=0.05)	1.86	0.02	0.04	0.02	2.89	40.35

Table 2 : Effect of integrated nutrient management practices on seed characters of ambrette.

Treatments	Number of seeds per pod	Seed yield per plant (g)	Seed yield per hectare (kg)
T_1	99.10	32.95	905.47
T_2	107.11	35.75	982.11
T_3	101.01	34.44	946.29
T_4	97.02	33.21	912.97
T_5	95.21	24.82	682.23
T_6	115.00	45.85	1260.33
T_7	111.03	40.64	1117.05
T_8	92.01	23.13	635.58
S.Ed.	0.42	0.55	7.67
CD (P=0.05)	0.84	1.10	15.33

was enhanced by application of organic manures and biofertilizer inoculations which ultimately resulted in higher yield. The results confirm the findings of Panchabhai *et al*. (2005) and Yadav *et al*. (2013) in ashwagandha. Further, application of organic manures along with inorganic fertilizers not only improves the physical status of soil, but also increases the organic status of the soil, resulting in rapid multiplication of beneficial soil microbes, there by promoting the availability and uptake of nutrients by the plants, which favoured an increase in yield (Gill *et al*., 1999).

Significant differences were observed among the treatments with regard to number of seeds per pod. The maximum number of seeds per pod (115.0) was observed in T_6 (50% RDF + 50% FYM + 50% BF) followed by T_7 (50% RDF + 50% NK + 50% BF) which recorded 111.0 number of seeds per pod. The least number of seeds per pod (92.0) was observed in T_8 (50% RDF + 50% FYM + 50% NK + 50% BF).

Seed yield per plant showed significant differences among the treatments (table 2). The highest values for seed yield per plant (45.85 g) was recorded in T_6 (50% RDF + 50% FYM + 50% BF) followed by T_7 (50% RDF + 50% NK + 50% BF), which recorded a seed yield of 40.64 g per plant. The least value for seed yield per plant (23.13 g) was recorded in the combination of 50% RDF + 50% FYM + 50% NK + 50% BF (T_8). The increase in seed yield might be due to the fact that nutrients released from both organic and inorganic fertilizers would have resulted in the increased nutrient availability, ascribed to improvement in soil health and adequate supply of both macro and micro nutrients, which in turn enhanced the seed yield. Moreover biofertilizers like azospirillum might have served to provide a conducive atmosphere in soil for nitrogen accumulation, besides making increased availability of nutrients. Similar findings have been reported by Hemalatha *et al*. (2008) in kalmegh, Kalyanasundaram *et al*. (2008) in sweet flag and Anuja and Jayasri (2011) in sweet basil.

The highest seed yield per hectare (1260.33 kg) was recorded in T_6 (50% RDF + 50% FYM + 50% BF). The next best value for seed yield per hectare (1117.05 kg) was recorded in T_7 (50% RDF + 50% NK + 50% BF), while the least value was recorded in T_8 (50% RDF + 50% FYM + 50% NK + 50% BF). The combined application of inorganic fertilizers and organic manures might have supplied adequate amounts of nutrients, which favoured higher metabolic rate and auxin activities in the plant, resulting in better yield attributes and higher seed yield. This is in accordance with the findings of Manohar *et al*. (2012) in ashwagandha.

Based on the findings of the present study, it can be concluded that the combination of 50% RDF + 50% FYM + 50% BF recorded maximum values for yield and yield characters in ambrette when compared to the other treatments.

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