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Effect of integrated nutrient management on germination parameters of ambrette (*Abelmoschus moschatus* Medic.) during *Kharif* and *Rabi* seasons

S Mounika, M Padma, M Raj Kumar, KB Suneetha Devi and S Narender Reddy

Abstract
The present investigation entitled on "Effect of integrated nutrient management on germination parameters of Ambrette (*Abelmoschus moschatus* Medic.) during *Kharif* and *Rabi* seasons" was carried out at the Medicinal & Aromatic Crop Research Station, Rajendranagar, Hyderabad during *Kharif* and *Rabi* seasons of 2016 - 2017. The experiment (INM) was carried out with 17 treatments in Randomized Block Design (RBD) and replicated thrice. With respect to the effect of integrated nutrient management on ambrette, less number of days (4.67 and 5.67 respectively) taken for sprouting and maximum percentage of germination (97.08 and 93.75 respectively) was recorded at T_{11}, whereas T_{17} observed more number of days (6.33 and 6.67 respectively) taken for sprouting and minimum percentage of germination (79.17 and 77.92 respectively) as compared to other treatments during *Kharif* and *Rabi* seasons.

Keywords: ambrette, nutrients, sprouting, germination, *Kharif, Rabi*

1. Introduction
It is a well-known fact that fertilization either in organic or inorganic form is the utmost important factor for exploiting inherent potential of crops to the maximum possible extent. Continuous use of inorganic fertilizers, insecticides, and fungicides in the absence of organic manure pollutes the environment, particularly in the soil, decreasing its fertility over time (Subramaniyan *et al*., 2001) [7]. The use of organic manures in combination with inorganic manures to crops has been suggested for maintaining optimum land production and increasing soil fertility. It is completely obvious that the supply of organic manures in modern agriculture is severely limited (Annadurai *et al*., 2001) [1]. The use of organic manures in combination with inorganic fertilizers not only boosts crop yields, but also enhances the soil's physical and biological qualities. The integrated nutrient management method is essential for maintaining high-quality plant production while avoiding the negative impacts of inorganic fertilizer application on soil.
Medicinal and aromatic plants play a vital role in the medicine and perfumery industry. In India because of varied climatic conditions, more than 2000 species of medicinal and aromatic plants have been reported. The use of medicinal and aromatic plants and their products is as old as history. Due to harmful side effects associated with the use of synthetic drugs and antibiotics, there is good scope for these plants in Ayurvedic as well as Unani medicines. Among the several medicinal and aromatic plant species, Ambrette has a prominent place and is used in medicinal as well as in the perfumery industry. Ambrette (*Abelmoschus moschatus* Medic.) belonging to the family Malvaceae, is a close relative to okra, a popular vegetable crop. It is universally known as Ambrette and the oil extracted from the seed is called Ambrette oil. It is also known as Musk mallow. The crop is native to India and grows throughout the tropical regions. With this background in view, the present investigation was undertaken to study the effect of integrated nutrient management on germination parameters of Ambrette.

2. Material and Methods
The investigation on "Effect of integrated nutrient management on germination parameters of Ambrette (*Abelmoschus Moschatus* Medic.) during *Kharif* and *Rabi* seasons" was carried out at the Medicinal & Aromatic Crop Research Station, Rajendranagar, Hyderabad during *Kharif*

and *Rabi* seasons of 2016 - 2017. The experimental site is situated at an altitude of 530.38 meters above mean sea level and geographically lies at a latitude of 17°20‟ N and a longitude of 78°25‟ E. The details of the materials used, the techniques adopted and observations noted during this study are presented in the paper.

The College of Horticulture, Rajendranagar, Hyderabad, Telangana where the experiment was carried out falls in a semiarid climate. The meteorological data on rainfall, relative humidity, minimum and maximum temperatures and sunshine hours were obtained from records of the meteorological observatory of PJTSAU.

The experimental area was ploughed and harrowed. The land was made into plots each measuring 5.0 × 4.0 m with an adjoining bund of 30 cm width and laid out as per the plan. The treatments were allocated to individual plots at random. Ridges and furrows were formed giving a spacing of 50 × 50 cm in experiment.

The experiment (INM) was carried out with 17 treatments i.e. T_1 (100% RDF), T_2 (100% RDN through FYM), T_3 (100% RDN through VC), T_4 (100% RDN through NC), T_5 (BF : *Azato* + PSB each @ 2kg ha^{-1}), T_6 (50% RDN through FYM + 50% RDF), T_7 (50% RDN through VC + 50% RDF), T_8 (50% RDN through NC + 50% RDF), T_9 (BF : *Azato* + PSB each @ 1kg ha^{-1}) + 50% RDF), T_{10} (50% RDN through FYM + 50% RDF + BF : *Azato* + PSB each @ 1kg ha^{-1}), T_{11} (50% RDN through VC + 50% RDF + BF : *Azato* + PSB each @ 1kg ha^{-1}), T_{12} (50% RDN through NC + 50% RDF + BF : *Azato* + PSB each @ 1kg ha^{-1}), T_{13} (100% RDN through FYM + BF : *Azato* + PSB each @ 2kg ha^{-1}), T_{14} (100% RDN through VC + BF : *Azato* + PSB each @ 2 kg ha^{-1}), T_{15} (100% RDN through NC + BF : *Azato* + PSB each @ 2kg ha^{-1}), T_{16} (100% RDF + BF : *Azato* + PSB each @ 2kg ha^{-1}) and T_{17} (Absolute control) in Randomized Block Design (RBD) and replicated thrice in *Kharif* and *Rabi* seasons and the experiment was carried out in open condition.

The number of days taken for the first initiation of germination was recorded. The number of days taken from sowing of seeds to initiation of germination seedling for each plot was observed and recorded separately. Germination is the numerical ratio of normally germinated seed to the total number of seeds sown and expressed in percentage. The germination percentage was recorded separately for each plot.

$$\text{Germination } \% = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds sown}} \times 100 \quad (1)$$

The statistical analysis of data was analyzed as per ANOVA outlined by Panse and Sukhatme (1985) [5].

3. Results and Discussion

The data presented in Table 1 observed that, integrated nutrient management were produce significant effect on the number of days taken for sprouting and percentage of germination in Ambrette studied in this experiment.

3.1 Number of days taken for sprouting

The effect of integrated nutrient management on the number of days taken for sprouting in Ambrette is presented in Table 1 and depicted in Fig. 1.

In *Kharif* 2016, the number of days taken for sprouting was significantly influenced by integrated nutrient management. The minimum number of days taken for sprouting (4.33) was recorded with T_{11} (50% RDN through VC + 50% RDF + BF: *Azato* + PSB each @ 1kg ha^{-1}) which was on par with T_6 (4.67), T_{13} (4.67) and T_{16} (5.00), while the maximum number of days taken for sprouting (6.33) was found with T_{17} (Absolute control), T_{15}, T_9, T_5 and T_4 (6.33 each) and on par with T_2 (6.00), T_{12} (6.00), T_1 (5.67), T_3 (5.67) and T_{14} (5.67).

In *Rabi* 2016-17, the number of days taken for sprouting was significantly influenced by integrated nutrient management. The minimum number of days taken for sprouting (5.33) was recorded with T_{11} (50% RDN through VC + 50% RDF + BF: *Azato* + PSB each @ 1kg ha^{-1}) which was on par with T_6, T_7 (5.67), T_8, T_{10}, T_{13}, T_{16} (5.67 each) followed by T_1 and T_3 (6.00 each). While the maximum number of days taken for sprouting (6.67) was found with T_{17} (Absolute control), T_2, T_4, T_5, T_9, T_{12} and T_{15} (6.67 each) and on par with T_{14} (6.33), T_1 and T_3 (6.00 each).

In *Kharif* and *Rabi* 2016-17, the minimum number of days taken for germination was recorded with T_{11} (50% RDN through VC + 50% RDF + BF: *Azato* + PSB each @ 1kg ha^{-1}).

3.2 Percentage of germination

The effect of integrated nutrient management on the percentage of germination in Ambrette is presented in Table 1 and Fig. 2.

In *Kharif* 2016, the percentage of germination was significantly influenced by integrated nutrient management. The maximum percentage of germination (97.08%) was recorded with T_{11} (50% RDN through VC + 50% RDF + BF: *Azato* + PSB each @ 1kg ha^{-1}) which was on par with T_{13} (100% RDN through FYM + BF: *Azato* + PSB each @ 2kg ha^{-1}) (95%), T_6 (50% RDN through FYM + 50% RDF) (94.17%), T_{10} (50% RDN through FYM + 50% RDF + BF: *Azato* + PSB each @ 1kg ha^{-1}) (93.75%), T_{16} (100% RDF + BF: *Azato* + PSB each @ 2kg ha^{-1}) (92.92%), followed by T_7 (50% RDN through VC + 50% RDF) (92.08%). The minimum percentage of germination (79.17%) was found with T_{17} (Absolute control), followed by T_4 (79.58%) and T_5 (80.83%) which were comparable with each other.

In *Rabi* 2016-17, the germination percentage was significantly influenced by integrated nutrient management. The maximum percentage of germination (95.42) was recorded with T_{11} (50% RDN through VC + 50% RDF + BF: *Azato* + PSB each @ 1kg ha^{-1}) followed by T_{13} (100% RDN through FYM + BF: *Azato* + PSB each @ 2kg ha^{-1}) (92.08) and was at par with T_6 (91.25), T_{10} (91.25) and T_{16} (90.83), while the minimum percentage of germination (77.92) was found with T_{17} (Absolute control), followed by T_4 (78.75%) and T_5 (79.58%) which were comparable with each other.

In *Kharif* and *Rabi* 2016-17, the minimum number of days taken for sprouting and more percentage of germination was recorded with T_{11} (50% RDN through VC + 50% RDF + BF: *Azato* + PSB each @ 1kg ha^{-1}). This might be due to the combined effect of organic, inorganic fertilizers, nitrogen-fixing biofertilizers and phosphate solubilizing bacteria's which enhanced the availability of nitrogen and phosphate in the rhizosphere and uptake by the plants. The growth-promoting effect of vermicompost as a source of plant nutrients increases better water holding capacity, improves germination, seedling growth, the physical status of soil and humus, improved physiological conditions of the soil in terms of good aeration and proliferation microbial activity. Similar results were also reported by Patel *et al.* (2010) [6] in fenugreek, Kalidasu *et al.* (2008) [3] in coriander. Babaleshwar and Shetty (2017) [2], Naveen (2010) [4], and Sunanda *et al.* (2014) [8] in Kasuri methi.

Table 1: Effect of integrated nutrient management on number of days taken for sprouting and germination percentage in Ambrette during *Kharif* and *Rabi* 2016-17.

	No. of Days Taken for Sprouting		Germination %	
Treatments	*Kharif*	*Rabi*	*Kharif*	*Rabi*
T_1 = 100% RDF	5.67	6.00	89.17	87.08
T_2 = 100% RDN through FYM	6.00	6.67	86.25	84.58
T_3 = 100% RDN through VC	5.67	6.00	90.00	88.33
T_4 = 100% RDN through NC	6.33	6.67	79.58	78.75
T_5 = BF (*Azato+PSB* each @ 2kg/ha)	6.33	6.67	80.83	79.58
T_6 = 50% RDN through FYM + 50% RDF	4.67	5.67	94.17	91.25
T_7 = 50% RDN through VC+ 50% RDF	5.33	5.67	92.08	90.42
T_8 = 50% RDN through NC+ 50% RDF	5.33	5.67	91.67	89.17
T_9 = BF (*Azato+PSB* each @ 1kg/ha)	6.33	6.67	82.92	82.50
T_{10} = 50% RDN through FYM + 50% RDF + BF (*Azato+PSB* each @ 1kg/ha)	4.67	5.67	93.75	90.83
T_{11} = 50% RDN through VC + 50% RDF + BF (*Azato+PSB* each @ 1kg/ha)	4.33	5.33	97.08	93.75
T_{12} = 50% RDN through NC + 50% RDF + BF (*Azato+PSB* each @ 1kg/ha)	6.00	6.67	85.00	84.17
T_{13} = 100% RDN through FYM + BF (*Azato+PSB* each @ 2kg/ha)	4.67	5.67	95.00	91.25
T_{14} = 100% RDN through VC+ BF (*Azato+PSB* each @ 2kg/ha)	5.67	6.33	86.67	86.25
T_{15} = 100% RDN through NC + BF (*Azato+PSB* each @ 2kg/ha)	6.33	6.67	83.75	82.92
T_{16} = 100% RDF + BF (*Azato+PSB* each @ 2kg/ha	5.00	5.67	92.92	90.42
T_{17} = Absolute Control	6.33	6.67	79.17	77.92
S.Em±	0.33	0.35	1.57	0.69
CD at 5%	0.97	1.00	4.54	2.01

Azato-Azotobacter; BF-Bio Fertilizers; FYM-Farm Manure Yard; NC-Neem Cake; PSB- Phosphorus Solubilizing Bacteria; RDF-Recommended Dose of Fertilizer; RDN- Recommended Dose of Nitrogen; VC-Vermi Compost; 100% RDF-100:50:50 N, P&K Kg ha^{-1}

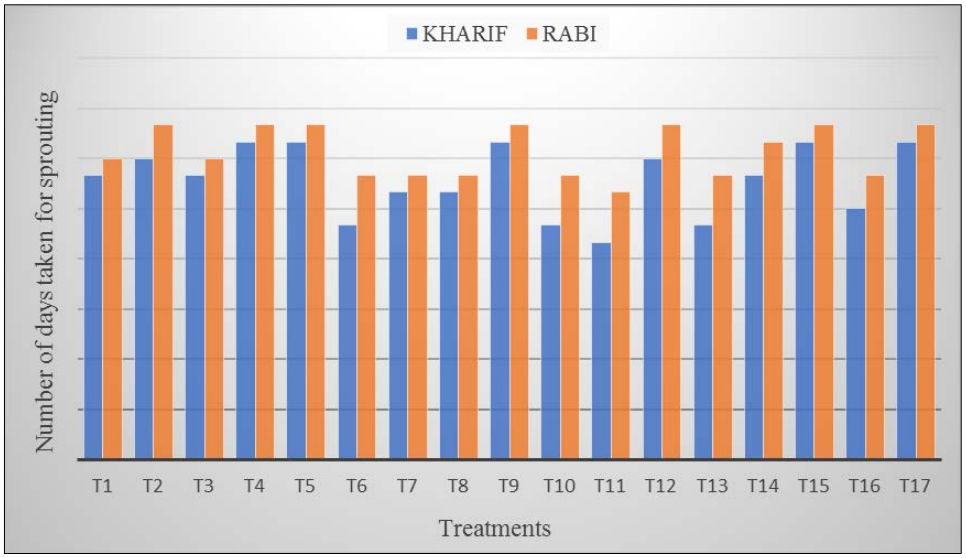

Fig. 1: Effect of integrated nutrient management on number of days taken for sprouting in Ambrette during *Kharif* and *Rabi* 2016-17

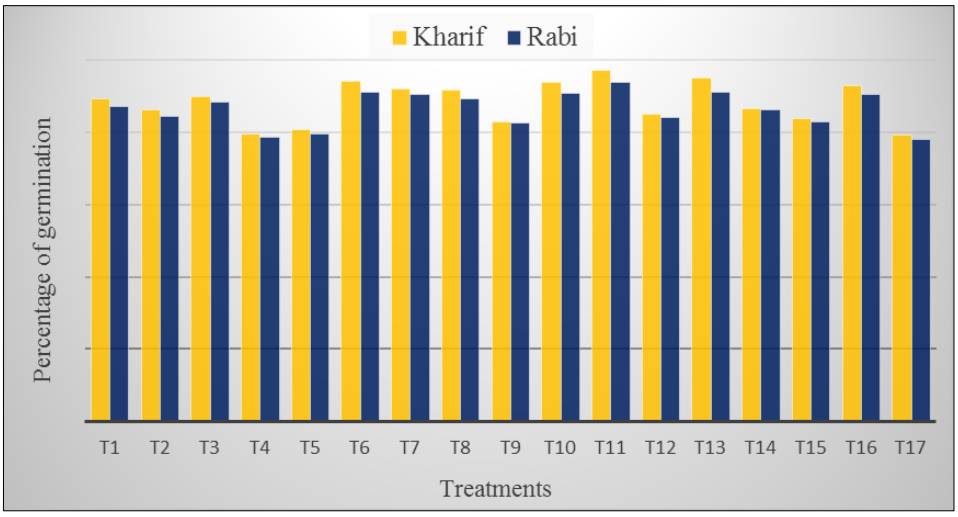

Fig. 2: Effect of integrated nutrient management on percentage of germination in Ambrette during *Kharif* and *Rabi* 2016-17.

4. Conclusions

From the experiments, it can be concluded that the integrated nutrient management were produce significant effect on the number of days taken for sprouting and percentage of germination in Ambrette. In *Kharif* and *Rabi* 2016-17, the minimum number of days taken for sprouting and more percentage of germination was recorded with T_{11} (50% RDN through VC + 50% RDF + BF: *Azato* + PSB each @ 1kg ha^{-1}). This might be due to the combined effect of organic, inorganic fertilizers, nitrogen-fixing biofertilizers and phosphate solubilizing bacteria's which enhanced the availability of nitrogen and phosphate in the rhizosphere and uptake by the plants. Whereas T_{17} observed more number of days (6.33 and 6.67 respectively) taken for sprouting and minimum percentage of germination (79.17 and 77.92 respectively) as compared to other treatments during *Kharif* and *Rabi* seasons.

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