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Integrated nutrient management response in Brinjal (*Solanum melongena* L.) under Satna condition

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Abstract
An experiment was conducted at Research Field, Department of Horticulture, AKS University, Satna (M.P.) during rabi season (2018-2019) to see the effect of INM on yield of Brinjal (*Solanum melongena* L.). Twelve treatments of integrated nutrient management *viz*., T_1- (no use of fertilizer), T_2 -RDF100% (100:50:50 NPK kg/ha), T_3- FYM (20 tonnes/ha), T_4- Vermicompost (4 tonnes/ha), T_5 -Neem Cake (250 kg/ha), T_6- *Azospirilium* (1250 ml/ha), T_7- PSB (1250 ml/ha), T_8- 50% RDF (50:25:25 NPK kg/ha) + 50% FYM (10 tonnes/ha), T_9- 50% RDF (50:25:25 NPK kg/ha) + 50% Vermicompost (2 tonnes/ha), T_{10}- 50% RDF (50:25:25 NPK kg/ha) + 50% Neem Cake (125 kg/ha), T_{11}- 50% RDF (50:25:25 NPK kg/ha) + 50% *Azospirillium* (625 ml/ha) and T_{12}-50% RDF (50:25:25 NPK kg/ha) + 30% PSB (375 ml/ha) + 20% Vermicompost (0.8 tonnes/ha) were evaluated in Randomized Block Design with three replications with plot sizes of 2.4 m × 1.8 m. Significantly higher values of yield attributes such as number of fruits per plant, fruit yield/plant, fruit yield/plot and fruit yield/ha were observed under T_2. However, significantly minimum values of yield attributes were observed under control T_1 (no use of fertilizer).

Keywords: Brinjal, vermicompost, *Azospirillium*, FYM, neem cake

Introduction
Brinjal (*Solanum melongena* L.) is one of the most common tropical vegetable grown in India and is known by a wide range of nomenclatures such as aubergine (French), egg plant, baingan (Hindi), etc. Immature brinjal fruits are used to prepare a variety of curries and dishes. Fruits are moderate sources of vitamins and minerals like phosphorous, calcium and iron and nutritive value varies from variety to variety. India is the world's second-largest brinjal producer next to China, generating 12.80 mt of a 0.73 mha area (Anonymous, 2018). Cultivation of brinjal is highest in Madhya Pradesh, Gujarat, Chhattisgarh and Bihar and is also distributed in almost all the states.

In India, brinjal cultivated as one of the leading and the second major vegetable crops next to tomato, covering an area of 4.96 lakh ha with a total production of 78.81 lakh tonnes, having productivity of 215.90 tonnes ha-1 (Ahirwar and Hussain, 2015) [1]. West Bengal, Orissa, Bihar and Gujarat are major growing brinjal states.

Brinjal's quality of growth, yield, and fruit depends largely on the number of interacting factors. Among them, the INM framework is both the most crucial and the most essential factor, and it is discovered that it applies an extraordinary influence not just on the quality of brinjal development, yield and organic product, yet additionally on continued efficiency accomplishment. Plant needs 17 essential mineral elements for legitimate development and the completion of a life cycle. Nickel (Ni) is the latest addition to the list of essential nutrients.

Materials and Methods
The present investigation pertaining to the studies on the Integrated Nutrient Management Response in Brinjal (*Solanum Melongena* L.) under Satna Condition was conduct field trial at Horticultural research farm, AKS University, Satna (M.P.) during 2018-2019. Twelve treatments of integrated nutrient management *viz*., T_1- (no use of fertilizer), T_2 - RDF100%(100:50:50 NPK kg/ha), T_3- FYM (20 tonnes/ha), T_4- Vermicompost (4 tonnes/ha), T_5 -Neem Cake (250 kg/ha), T_6- *Azospirilium* (1250 ml/ha), T_7- PSB (1250 ml/ha), T_8- 50% RDF (50:25:25 NPK kg/ha) + 50% FYM (10 tonnes/ha), T_9- 50% RDF (50:25:25 NPK kg/ha) + 50% Vermicompost (2 tonnes/ha), T_{10}- 50% RDF (50:25:25 NPK kg/ha) + 50% Neem Cake (125 kg/ha), T_{11}- 50% RDF (50:25:25 NPK kg/ha) + 50% *Azospirillium* (625 ml/ha) and T_{12}-

50% RDF (50:25:25 NPK kg/ha) + 30% PSB (375 ml/ha) + 20% Vermicompost (0.8 tonnes/ha) were evaluated in Randomized Block Design with three replications with plot sizes of 2.4 m × 1.8 m. Organic manures, *viz*. PSB, *Azospirillium*, Farm yard manure, Vermicompost, NPK and Neem Cake was applied on the basis of nitrogen content only, and applied at the time of field preparation. Half dose of N and recommended dose of P and K was applied at the time of transplanting and half dose of N was applied at 30 days after transplanting. Observation on weight of fruit (g plant-1) was recorded from five selected plants in the plot area at each picking time and average was workout. Fruits were harvested at fruit maturity and yield obtained after each harvesting. Treatment wise plant samples were collected as mentioned earlier at 30, 60 DAT and at harvest stages.

Results

Data on various growth and yield characters of Brinjal crop as influenced by the different levels of nitrogen and their combinations are presented in Tables 1. A field experiment was conducted at the Agriculture farm of AKS University, Satna, during rabi season 2019-2020, to study the Integrated Nutrient Management Response in Brinjal (*Solanum Melongena* L.) under Satna Condition. The maximum plant height was recorded at the time of maturity of plants under treatment T_2 (100% RDF) has maximum plant height (95.78) compared to control. The maximum plant height of 93.83 cm recorded under treatment FYM @20 t/h + 75% RDF (Table 1). The highest plant height was recorded in the treatment T_2 at 120 DAT which was significantly different from all other treatments and lowest value (17.11) was recorded in treatment 1 at 120 DAT. Similar results were also obtained by Samadhiya, *et al.* (2015) [8] and Kumar and Gowda (2010) [5] in Brinjal. Number of branches showed highest value (22.95) of treatment 2 was showing at 120 DAT whereas the lowest value (3.05) of treatment 1 was showing at 120 DAT. The formation of flowers per plant was found to derivate up to significant extent due to INM treatments as exhibited in table 1. Similar results were also obtained by Katar, *et al.* (2018) [4] and Selvi, *et al.* (2004) [9] in Brinjal. The maximum flower were formed in treatment T_2 (30.10/plant), this was closely followed by T_{12} (29.93/plant), T_9 (28.86/plant), T_4 (27.12/plant), and then T_8 (25.92/plant). The flowers formation was further declined equally in case of T_{10}, T_{11}, T_3 and T_5 (21.14 to 24.16/plant). The flower formation was found in the maximum range in case of T_6 (19.16/plant), T_7 (17.19/plant), and the control (T_1) treatments (15.25/plant). There was a vast variation between T_1 and T_2 treatments. Where the flowers formation was found twice in case of T_2 over T_1 (control). The critical observation of data in table 1 apparently reveal that this Phenological parameter was influenced significantly due to various INM treatments. The performance of INM treatments *viz*. T_2, T_3, T_4, T_8, T_9, T_{10}, T_{11}, and T_{12} was found statistically identical (20.10 fruits in T_3 T_2 24.22 fruits/plant in T_2) the INM treatments T_5 T_6 and T_7 registered lower number of fruits formation per plant (15.09 to 19.33/plant). The significantly minimum fruits formation (13.49/plant) was noted in case of control (T_1) treatments. Similar results were also obtained by Zainub, *et al.* (2016) [12]; Patidar and Bajpai (2018) [7] in Brinjal. The fruits length of brinjal was found to derivate up to significantly level due to applied INM treatments as revealed from the data in table 1. The treatments T_2, T_4, T_8, T_9, T_{10}, T_{11} and T_{12} registered there equal formation with respect to length of fruits of brinjal (9.55 cm in T_3 to 11.12 cm in T_2). The fruit length was found to decrease almost significantly due to applied T_5, T_6 and T_7 INM treatments (7.12 cm to 9.12 cm). The control (T_1) treatment showed the significantly minimum fruit length (6.10 cm). These results are in agreement with the findings of Anburani, *et al.* (2003) [2]; Singh and Mukherjee (2010) [10] in Brinjal. The data in table 1 indicate that the fresh weight of fruits of brinjal was argumented up to significantly extend (49.31 gm) due to application of 100% RDF (T_2) this was closely followed by T_{12} (50% RDF + PSB + 20%VC), the fresh weight being 46.73 gm. The third position was attend by T_9 (50% RDF + 50% VC) the value being up to 45.36 gm and then T_4 (4 t VC /ha) recorded the fresh weight up to 44.09 gm. The fresh weight was further down in treatments T_3, T_8, T_{10} and T_{11} (39.95 to 43.13 gm) the treatments T_5, T_6 and T_7 recorded the lower value of these parameters (36.16 to 38.60 gm.). The results are in accordance with those reported by Suchitra and Manivannan (2012) [11]; Choudhary, *et al.* (2007) [3] and Najar, *et al.* (2015) [6]. The significantly lowest fresh weight only 34.27 gm was noted from the T_1 (control) treatment. The data exhibited in table 1 apparently indicate that the different INM treatments influenced the fruit yield per ha upto significantly extend. The best INM treatment was T_2 (100% RDF) which recorded maximum brinjal yield upto 33.18 tonnes/ha. The second equally best treatment was T_{12} (50% RDF + PSB + 20% VC) which produced 30.06 t/ha brinjal. The third best treatment was T_9 (50 RDF + 50%VC) producing 28.15 t/ha brinjal. This was followed by T_4 (26.13 t/ha), T_8 (25.14 t/ha) and then T_{10} (24.29 t/ha). The treatments T_3 and T_{11} yielded exact equally (22.30 to 22.96 t/ha). The yield was in a very lower range from T_5, T_6 and T_7 treatment (15.16 to 20.72 t/ha). The significantly lowest yield (12.84t/ha) was found from the control treatment (T_1).

Table 1: Effect of Integrated Nutrient Management Response on growth and yield of Brinjal

Symbols	Treatment	Plant height (cm)	Number of branches	Number of flower per plants	Number of fruits per plant	Length of fruits (cm)	Fresh weight of fruits (g)	Fruit yield t/ha
T_1	Control	45.17	6.96	15.25	13.49	6.10	34.27	12.84
T_2	RDF100%(100:50:50 NPK kg/ha)	63.34	22.95	30.10	24.22	11.12	49.31	33.18
T_3	FYM (20 tonnes/ha)	54.13	11.46	23.25	20.10	9.55	39.95	22.30
T_4	Vermicompost (4 tonnes/ha)	61.01	17.54	27.12	21.34	10.60	44.09	26.13
T_5	Neem Cake (250 kg/ha)	52.24	10.18	21.14	19.33	9.12	38.60	20.72
T_6	*Azospirilium* (1250 ml/ha)	50.00	9.24	19.16	17.21	8.59	37.93	18.13
T_7	PSB (1250 ml/ha)	48.02	8.84	17.19	15.09	7.12	36.16	15.16
T_8	50% RDF (50:25:25 NPK kg/ha) + 50% FYM (10 tonnes/ha)	59.87	16.29	25.92	20.99	10.34	43.13	25.14
T_9	50% RDF (50:25:25 NPK kg/ha) + 50% Vermicompost (2 tonnes/ha)	62.07	19.01	28.86	22.35	10.81	45.36	28.15

T_{10}	50% RDF (50:25:25 NPK kg/ha) + 50% Neem Cake (125 kg/ha)	58.04	15.09	24.16	20.74	10.04	42.17	24.29
T_{11}	50% RDF (50:25:25 NPK kg/ha) + 50% *Azospirillium* (625 ml/ha)	56.53	13.37	24.00	20.37	9.94	40.57	22.96
T_{12}	50% RDF (50:25:25 NPK kg/ha) + 30% PSB (375 ml/ha) + 20% Vermicompost (0.8 tonnes/ha)	62.94	21.00	29.93	23.15	10.99	46.73	30.06
S.Em ±		2.29	2.17	1.76	1.14	0.83	1.90	0.58
CD@5%		4.61	4.35	3.54	2.30	1.67	3.81	1.18

Conclusion

It could be concluded from the above investigation that the RDF 100% (100:50:50 NPK kg/ha) was found to be the best treatment of yield attributes such as number of fruits per plant, fruit yield/plant, fruit yield/plot and fruit yield/ha were observed under T_2. However, significantly minimum values of yield attributes were observed under control T_1 (no use of fertilizer).

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