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Response of integrated nutrient management on sustainable productivity of yield parameter in tomato

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Abstract
The study was meant to assess the Response of integrated nutrient management on sustainable productivity of Tomato. The experiment laid out in Randomised Block Design in 14 treatments with 03 replications at department of horticulture Rajaula farm of MGCGV, Chitrakoot, Satna, (M.P.) during 2019-20 in rabi season. Data revealed that effect of integrated nutrient management on performance of tomato present Investigation, treatment T_{11} 25% N equivalent from organic manures source + 75% RDF (NPK) + Bio-inoculants emerged as superior over all other treatments, in relation to yield and showed the most excellent results with respect of Number of fruits cluster, Average weight of fruit (g), Fruit yield per plant (kg), fruit Yield t ha.

Keywords: Bio fertilizer, organic manure, NPK, tomato, yield

Introduction
Tomato (*Lycopersicon esculentum* L.) is Solanaceous annual vegetable crop grown worldwide and ranks 2nd important vegetable crop after potato. Tomato having chromosome no 2n=24. It is herbaceous annual which propagated by seed. It is worn as salad oil and in the manufacture of margarine. It is grown in minute home gardens and market gardens for fresh utilization as well as processing purpose. It is addicted raw, cooked or processed as puree, ketchup, sauce etc. Although, a ripe tomato has 93% moisture, being a fine source of vit. A and B and tremendous source of vit C and has good nutritive value. It is very appetizing, removes constipation and has a pleasing taste. In India, tomato is cultured in almost all parts of country. Tomato ranks 1st position among the processed vegetables. It is a extremely good source of income to marginal and small farmers. There are different types of flavouring compounds create in fruits, which enrich the taste. Tomatoes are used directly as raw vegetables in sandwiches, salad etc. And several processed products like paste, ketchup, whole peeled tomatoes, sauces, puree, soup, juices, drinks, and chutneys are prepared on large scale. The pulp and juice are digestible, a advocate of gastric discharge and blood filter. It is report to have antiseptic property beside intestinal disease. For tomato sustenance is one of the most vital factors which oversee the tomato production. The nutrients required for tomato crop are abounding through organic, inorganic source and through micronutrients and bio fertilizers (INM) is a holistic, approach that considers all the available farm resources that can be used as plant nutrients. Integrated nutrient management (INM) is an approach to soil fertility management that combines organic and mineral methods of soil fertilization with physical and biological measures for soil and water conservation.

Materials and Methods
The research was conducted at Rajaula experiment Farm, MGCGV, Chitrakoot, Satna, (M.P.) during 2019-2020. The trial was laid out in Randomised Block Design with 14 treatments replicated thrice. The treatment were T_1 FYM @ 20 t ha^{-1}, T_2 RDF (N_2, P_2O_5, K_2O 100: 80: 80), T_3 SPNF Seed treatment with Bijamrut + soil supplication of Jivamrut 3 times 1 + 2 as irrigation water ring at 30 days, T_4 Bio-fertilizer consortium (Azotobacter + Phosphate Solubilizing Bacteria) + Bio enhancer (Panchagavya) Spyays at 15 days interval from 20 days + seedling treatment, T_5 50% FYM + 50% RDF (N_2, P_2O_5, K_2O 50: 40: 40), T_6 50% FYM + T_4, T_7 RDF (N_2, P_2O_5, K_2O 100: 80: 80) + T_4, T_8 25% N_2 equal from organic source + 75% RDF (75: 60: 60 kg), T_9 25% Nitrogen from organic source + T_4, T_{10} 50% N equivalent from organic manures + 50% from chemical fertilizer + T_4, T_{11} 25% Nitrogen equivalent from organic manures source + 75% RDF (N_2, P_2O_5, K_2O) + T_4, T_{12} Zero budget (SPNF) + T_4, T_{13}

FYM @ 20 t ha^{-1} + T_4, T_{14} Farmer practices farm yard manure @ 1 t ha^{-1} + Urea + DAP (approximate 100: 40). Plant planted in spacing 50×50 cm in plot size 6.25m^2 consisted number of plant per treatment is 25. Half dose of nitrogen, total phosphorus and potash were well mixed and applied as basal dose before transplanting, according to the treatment. Balance half quantity of N_2 was applied as top dressing at 30 DAP. 3 plants were randomly selected from each treatment and observation regarding growth and corm production were recorded.

Results and Discussion

Number of fruits per plant of tomato

In the current study the highest no. of fruit per plant (27.90) was record in the treatment T_{11}: 25% N equivalent from organic manures source + 75% RDF (NPK) + Bio-inoculants followed by T_1: FYM @ 20 t ha^{-1}, T_2 RDF (NPK 100: 80: 80) T_3: SPNF (Subhas Palekar Natural Farming) Seed treatment with Bijamrut + soil application of Jivamrut 3 times 1 + 2 as irrigation at 30 days, T_4: Bio-fertilizer consortium (Azotobacter + PSB) + Bio-inoculants enhancer (Panchagavya) Spyays at for 15 days interval from 20 days + seedling treatment, T_5: 50% FYM + 50% RDF (NPK 50: 40: 40), T_6: 50% FYM + Bio-enhancer (Panchagavya), T_7: RDF (NPK 100: 80: 80) + Bio-inoculants, T_8: 25% N equivalent from organic source + 75% RDF (75: 60: 60 kg), T_9: 25% N_2 from organic source + Bio inoculants (Panchagavya), T_{10}: 50% N equivalent from organic manures + 50%: From chemical + Bio – inoculants, T_{12}: Zero budget (SPNF) + Bio-inoculants (Panchagavya) and T_{13}: FYM @ 20 t ha^{-1} + Bio inoculants (Panchagavya). Whereas the minimum no. of fruit per plant (19.43) was found in T_{14}: Farmer practices FYM @ 1 t ha^{-1} + Urea + DAP (approx 0 5 10 15 20 25 30 35 40 45 50 days to first fruit setting T_1 to T_{14} Treatments 100: 40). Bahadur *et al*. (2004) [1] also showed that combine effect of organic manures with recommended dose of chemicle fertilizers showed greater performance in tomato.

Fruit weight (g) of tomato

The highest fruit weight (g) (58.48) was observed in the treatment T_{11}: 25% N equivalent from organic manures source + 75% RDF (NPK) + Bio-inoculants followed by T_1: FYM @ 20 t ha^{-1}, T_2 RDF (NPK 100: 80: 80) T_3: Subhas Palekar Natural Farming S.P.N.F. Seed treatment with Bijamrut + soil appliance of Jivamrut 3 times 1 + 2 as irrigation at 30 days, T_4: Bio-fertilizer consortium (Azotobacter + PSB) + Bio-inoculants enhancer (Panchagavya) Spyays at for 15 days interval from 20 days + seedling treatment, T_5: 50% FYM + 50% RDF (NPK 50: 40: 40), T_6: 50% FYM + Bio-enhancer (Panchagavya), T_7: RDF (NPK 100: 80: 80) + Bio-inoculants, T_8: 25% N equivalent from organic source + 75% RDF (75: 60: 60 kg), T_9: 25% N from organic source + Bio inoculants (Panchagavya), T_{10}: 50% N equivalent from organic manures + 50%: From chemical + Bio – inoculants, T_{12}: Zero budget (SPNF) + Bio-inoculants (Panchagavya) and T_{13}: FYM @ 20 t ha^{-1} + Bio inoculants (Panchagavya). Whereas the minimum fruit weight (g) (41.59) was found in T_{14}: Farmer practices FYM @ 1 t ha^{-1} + Urea + DAP (approx 100: 40). This capacity be due to solubilization outcome of plant nutrients by the accumulation of F.Y.M. and V.C. leading to enlarged uptake of N.P.K. as was reported by Subbiah *et al*. (1981) [6].

Fruit yield per plant (kg)

The highest fruit yield per plant (kg) (1.57 kg) was observed in the treatment T_{11}: 25% N equivalent from organic manures source + 75% RDF (NPK) + Bio-inoculants followed by T_1: FYM @ 20 t ha^{-1}, T_2 RDF (NPK 100: 80: 80) T_3: Subhas Palekar Natural Farming S.P.N.F. Seed healing with Bijamrut + soil application of Jivamrut 3 times 1 + 2 as irrigation at 30 days, T_4: Bio-fertilizer consortium (Azotobacter + PSB) + Bio-inoculants 0 10 20 30 40 50 60 Fruit weight (g) T_1 T_2 T_3 T_4 T_5 T_6 T_7 T_8 T_9 T_{10} T_{11} T_{12} T_{13} T_{14} Treatments enhancer (Panchagavya) Spyays at for 15 days interval from 20 days + seedling treatment, T_5: 50% FYM + 50% RDF (NPK 50: 40: 40), T_6: 50% FYM + Bio-enhancer (Panchagavya), T_7: RDF (NPK 100: 80: 80) + Bio-inoculants, T_8: 25% N equivalent from organic source + 75% RDF (75: 60: 60 kg), T_9: 25% N_2 from organic source + Bio inoculants (Panchagavya), T_{10}: 50% N_2 equivalent from organic manures + 50%: From chemical + Bio – inoculants, T_{12}: Zero budget (SPNF) + Bio-inoculants (Panchagavya) and T_{13}: FYM @ 20 t ha^{-1} + Bio inoculants (Panchagavya). Whereas the minimum fruit yield per plant (kg) (0.810 kg) was found in T_{14}: Farmer practices FYM @ 1 t ha^{-1} + Urea + DAP (approx 100: 40). The reasons for improved fruit yield by the application of N.P.K. with F.Y.M. and V.C. leading to better uptake of N.P.K. The results are in conformity with the conclusion of Kumaran *et al*. (1995) [4] who observed an enhance in fruit yield by the appliance of N.P.K. with F.Y.M. and V.C.

Fruit yield (t ha^{-1}) of tomato

The maximum fruit yield (t ha^{-1}) (61.31) was observed in the treatment T_{11}: 25% N_2 equivalent from O.M. source + 75% RDF (N.P.K.) + Bio-inoculants followed by T_1: FYM @ 20 t ha^{-1}, T_2 RDF (NPK 100: 80: 80) T_3: Subhas Palekar Natural Farming S.P.N.F. Seed treatment with Bijamrut + soil application of Jivamrut 3 times 1 + 2 as irrigation at 30 days, T_4: Bio-inoculation consortium (Azotobacter + PSB) + Bio-inoculants enhancer (Panchagavya) Spyays at for 15 days interval from 20 days + seedling treatment, T_5: 50% F.Y.M. + 50% R.D.F. (N.P.K. 50: 40: 40), T_6: 50% FYM + Bio-enhancer (Panchagavya), T_7: RDF (NPK 100: 80: 80) + Bio-inoculants, T_8: 25% N_2 equivalent from organic fertilizer + 75% RDF (75: 60: 60 kg), T_9: 25% N_2 from organic fertilizer + Bio inoculants (Panchagavya), T_{10}: 50% N equivalent from organic manures + 50%: From chemical + Bio – inoculants, T_{12}: Zero budget (SPNF) + Bio-inoculants (Panchagavya) and T_{13}: FYM @ 20 t ha^{-1} + Bio inoculants (Panchagavya). Whereas the minimum fruit yield (t ha^{-1}) (29.47) was found in T_{14}: Farmer practices FYM @ 1 t ha^{-1} + Urea + DAP (approx 0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 Fruit yield per plant (kg) T_1 to T_{14} Treatments 100: 40). The reasons for improved fruit yield by the appliance of N.P.K. with FYM and V.C. leading to better uptake of N.P.K. The outcome are in conformity with the conclusion of Kumaran *et al*. (1995) [4] who observed an increase in fruit yield by the appliance of N.P.K. with FYM and V.C.

Table 1: Response of I.P.M. on sustainable productivity of yield parameter in tomato.

Symbol Treatments	No. of fruit per plant	Fruit weight (g)	Fruit yield per plant (kg)	Fruit yield (t ha)
T_1	24.94	56.26	1.4	53.95
T_2	26.87	56.22	1.51	54.4
T_3	21.89	55.06	1.2	44.15
T_4	25.86	47.57	1.23	49.9
T_5	21.74	48.33	1.05	39.68
T_6	23.57	51.56	1.22	46.19
T_7	24.33	52.37	1.27	48.44
T_8	24.29	51.42	1.25	47.35
T_9	22.2	49.31	1.09	41.61
T_{10}	20.48	47.59	0.97	37.25
T_{11}	27.9	58.48	1.57	61.31
T_{12}	26.43	46.33	1.22	46.69
T_{13}	25.42	47.37	1.2	45.94
T_{14}	19.43	41.59	0.81	29.47
S.Ed. (+)	0.561	1.026	0.042	3.294
C.D. aT_5%	1.153	2.108	0.087	1.603

Conclusion

In view of the experimental results obtained during the investigation, treatment T_{11}: 25% N equivalent with organic manure source + 75% RDF (NPK) + bio-inoculants proved to be superior to all other treatments with respect to yield.

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