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Effect of substrate Dynamics for IPNM in Mango cv. Sunderja for Growth Yield and quality in Kymore Plateau of Madhya Pradesh

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ABSTRACT: A field experiment was laid out in 2016-17 to 2020-21. Under All India Coordinated Research Project on Fruits cv. Sunderja with the objectives. (A) To study the effect of organic, inorganic and bio fertilizers on yield & quality of Mango. (B) To determine the effect of IPNM package for Mango quality fruit production. The experiment was laid out in Randomized Block Design (RBD) comprising 10 treatments, which were replicated thrice. The treatments were comprised IPNM methods namely Thus, the ten treatment combinations T_1 1000: 500: 500g NPK/tree (as control), T_2; T_1 + Zn (0.5%), + B (0.2%), + Mn (1.0%) + Ca (0.6%) as foliar twice (Aug. & Oct.), T_3; T_1 + Organic mulching @ 10 cm thick, T_4; T_2 + Organic Mulching @ 10 cm Thick., T_5; ½ T_1 + 50 kg. FYM + enriched 250 g. Trichoderma, T_6; ½ T_1 + 50kg. FYM + 250g. Azospirillum. T_7; ½ T_1 + Azotobacter (250g) + 50kg. FYM, T_8; ½ T_1 + 50kg FYM + 5kg vermi compost, T_9; ½ T_1+ 50kg FYM + 250g pseudomonas florescence, T_{10}; ½ RDF + 50kg FYM + Trichoderma (250g) + pseudomonas (250g). The maximum tree height (7.40 m) were observed in treatment T_8 - ½ T_1+ 50kg FYM + 5kg vermin Which is at par under treatment T_2 (7.34 m) noted in T_2; T_1 + Zn (0.5%), + B (0.2%), + Mn (1.0%) + Ca (0.6%) as foliar twice (Aug. & Oct.), Tree spread E-W and N-S (11.53m and 11.26m), were recorded with the treatments T_7; ½ T_1 +Azotobacter (250g) + 50kg. FYM. The higher Number of fruit/tree 212.35 was noted in treatment T_3T_1 + Organic mulching @ 10 cm. thick. Maximum fruit weight (312.52 g) in treatment T_5; ½ T_1 + 50 kg. FYM + enriched 250 g. Trichoderma. Here it is mention that the results related to vegetative and quality parameters on the basis of only 1 year data. The pooled yield data 5 years clearly indicated that fruit yield tree^{-1} and yield ha^{-1} (57.76 and 57.76 qt.) have been registered with the treatment T_5; 500g:250:250g NPK + 50kg. FYM enriched with trichoderma (250g)/tree, followed by (53.56kg/tree) and 53.56 qt) recorded with the treatments T_3; T_1 + Organic mulching @ 10 cm. thick. The benefit cost ratio was also found higher with the treatment T_5; 500g:250:250g NPK+ 50kg. FYM enriched with Trichoderma (250g)/tree. The maximum TSS were recorded (22.8°B) treatment T_8 - ½ T_1 + 50kg FYM + 5kg vermi, Maximum acidity % were recorded (0.32) treatment T_9; ½ T_1+ 50kg FYM + 250g pseudomonas florescence.

Keywords: Mango, Growth, Yield, Quality, Kymore Plateau, INM.

INTRODUCTION

The mango (*Mangifera indica* L.) belongs to family "Anacardiaceae" is one of the most important fruit crops of the country and originated in South-East Asia at an early date. It is the premier and choicest fruit of India and undoubtedly one of the best fruit of the world. Mango is being grown in more than 87 countries of the world and India ranks first in the world with respect to 1.60 million hectares area and 10.78 million tonnes production. India contributes to more than 70 per cent of the total worlds production and this offers bright prospect for furthers boosting exports. It is called 'the King of fruits', 'heavenly fruit' and 'super fruit', due to its sweetness potential health values, excellent flavour, attractive appearance and popularity among the masses. Nutrition of trees is an important part of mango orchard management practices and fertilizer is one of the major inputs accounting for nearly 35 percent of the cost of cultivation. Indiscriminate use of inorganic chemical fertilizers resulted in high amount of chemical residues in field as well as in the crop produces leading to various environmental and heat hazards along with socio-economic problem (Kundu *et al*., 2011). In order to maintain soil health and to obtain yield of better quality fruits, it is essential to adopt integrated nutrient management (INM) approach. Integrated nutrient management (INM) refers to maintenance of soil fertility and plant nutrient supply to an optimum level for sustaining the desired crop productivity through optimization of the benefits from all possible sources of plant nutrients in an integrated manner. It involves the combined use of inorganic, organic and biological sources of essential plant nutrients to sustain optimum crop yield and also improve or maintain the physico-chemical properties of soil. It provides crop nutrition packages which are technically sound, economically attractive, practically feasible and environmentally safe. The principal aim of the integrated approach is to utilize all the possible sources of plant nutrition in a

judicious & efficient manner. Therefore, it is a holistic approach where we first know what exactly is required by plants for optimum level of production, in what different forms at what different timings in best possible method, and how best these forms can be integrated to obtain highest productivity levels with efficiency at economically acceptable limits in environmental friendly way. Biofertilizers are the living organism which add, conserve and mobilize the plant nutrients in the soil. The beneficial effect of bio-fertilizers is now well established in fruit crops like mango (Kundu *et al.*, 2011), Papaya (Sukhade *et al*., 1995) and banana (Gogoi *et al*., 2004). Therefore, an experiment was conducted on effect of organic, inorganic and biofertilizers on Yield and economics of Mango cv. Sunderja.

MATERIAL AND METHODS

The field investigations were laid out on 15 years old "Sunderja" mango trees which were planted at a distance of 10×10 m All India Coordinated Research Project on Fruits, Fruit Research Station Kuthulia JNKVV, College of Agriculture Rewa (M.P.) during the year 2015-16 to 2020-21. The experiment was laid out in Randomized Block Design (RBD) comprising 10 treatments, which were replicated thrice. The treatments were comprised IPNM methods namely Thus, the ten treatment combinations T_1 1000: 500: 500g NPK/tree (as control), T_2; T_1 + Zn (0.5%), + B (0.2%), + Mn (1.0%) + Ca (0.6%) as foliar twice (Aug. & Oct.), T_3; T_1 + Organic mulching @ 10 cm. thick, T_4; T_2 + Organic Mulching @ 10 cm thick., T_5 ; ½ T_1 + 50 kg. FYM + enriched 250 g. Trichoderma, T_6; ½ T_1 + 50kg. FYM + 250g. Azospirillum. T_7; ½ T_1 + Azotobacter (250g) + 50kg. FYM, T_8; ½ T_1+ 50kg FYM + 5kg vermi compost, T_9; ½ T_1 + 50kg FYM + 250g pseudomonas florescence, T_{10}; ½ RDF + 50kg FYM + Tricoderma (250g) + pseudomonas (250g), were imposed during rest period, Data were recorded on Plant height, Canopy height, Stem girth, tree spread, Canopy volume M^3, Number of fruit, Fruit weight, yield tree^{-1}, yield ha^{-1} and benefit: cost ratio of different treatments. Open pollinated fruits of local mango cultivar Sunderja were collected and seeds extracted for raising seedlings for use as rootstock. Six months old seedlings were utilized as root stock (0.5 to 1.0cm width) for ideal patch budding of all the scion varieties/hybrids. Patch budding method has been standardize Fruit Research Station Kuthulia Rewa (M.P.). Survival percentage of patch budding in Rewa (70 to 80%). Nearly uniform and patch budding plants of all the varieties/hybrids were planted at 10m × 10 spacing during July, 1996 (years). The plants were supplemented with 10 kg Farmyard Manure (FYM) and; 100g nitrogen, 50g phosphorus and 100g potassium per plant per year in the first year. The doses of manures and fertilizers were subsequently increased in each year and stabilized at the age of 10 year of trees. Each tree was supplemented with 100kg Farmyard Manure (FYM) and 1000g nitrogen, 1000g phosphorus and 700g potassium per plant per year. The nitrogen, phosphorus and potassium were supplied in the form of DAP and murate of potash respectively. In the initial two years, all the plants were irrigated individually with eight days interval during summer and at 15 days interval during winter. At three years and onwards, the mango trees were irrigated in basins through check basin method. The plants were trained to modify Central Leader System in the initial two to three years of planting for proper canopy development of trees. Observations were recorded on vegetative growth in terms of total tree height, canopy height, girth of root stock and scion at 10cm below or above budding point. Fruiting was allowed at 4 to 5 years and onwards and accordingly the fruit yield recorded from 3 years up to 5 years after planting. At 10 year of age, all the mango trees were considered to be full grown. Accordingly, in the final year; in addition to fruit yield; observations on physico-chemical and quality of fruits were also recorded. All the plants selected for experiments were almost uniform in growth and vigor and maintained under uniform cultural practices. The yield efficiency was calculated by dividing the fruit yield per plant, Average fruit weight was recorded with the help of physical balance and expressed in the terms of grams. The total soluble solid (TSS) of fruit was measured with the help of hand refractometer and it was expressed in degree brix (°B). The acidity measure by titration and express in percentage. The data was statistically analysed by method of analysis of variance using R.B.D as described by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The results indicate that various level of IPNM exhibited significant effect on vegetative grown yield and quality of the fruits. The maximum tree height was noted (7.42 m) in treatment T_8 - ½ T_1+ 50kg FYM + 5kg vermi compost followed by (7.36 m) was noted in T_2; T_1 + Zn (0.5%), + B (0.2%), + Mn (1.0%) + Ca (0.6%) as foliar twice (Aug. & Oct.) and minimum tree height was recorded (5.34m) in treatment T_3 ; T_1 + Organic mulching @ 10 cm. thick. Whereas maximum tree spread was recorded (Mean of E-W and N-S 11.53m and 11.26m), T_7; ½ T_1 + Azotobacter (250g) + 50kg. FYM, followed by (E-W 10.87m and N-S 11.31m) in treatment T_8; ½ T_1 + 50kg FYM + 5kg vermi compost, and minimum recorded (E-W 9.51m and N-S 10.24m) in T_6; ½ T_1 + 50kg. FYM + 250g. Azospirillum.

The maximum canopy height was recorded (6.88m) in treatment T10; ½ RDF + 50kg FYM + Tricoderma (250g) + pseudomonas (250g), followed by (6.80m) in T2 ; T1 + Zn (0.5%), + B (0.2%), + Mn (1.0%) + Ca (0.6%) as foliar twice (Aug. & Oct.) and minimum(5.82m) T3 ; T1 + Organic mulching @ 10 cm. thick. The maximum canopy volume m^3 was recorded (8.62.89m^3) in treatment T_8; ½ T_1+ 50kg FYM + 5kg vermi compost, which is at par under (847.54 m^3) treatment T_7; ½ T_1 +Azotobacter (250g) + 50kg. FYM, and the minimum canopy volume was recorded (513.94 m^3) in T_3; T_1 + Organic mulching @ 10 cm thick (Shukla *et al*., 2009). The Significantly superior fruit weight recorded (312.52 g) in T_3; T_1 + Organic

mulching @ 10 cm. thick. Over other treatment and fallowed by (290.16g). Minimum fruit weight was recorded (221.23g) in T_1 1000: 500: 500g NPK/tree (as control). The results obtained of fruit weight in the present study were also in inline with observations made by Hode and Siingh *et al.* (2003). The critical examination of the indicated that the presence of significant variation for TSS content (Table 1c). The maximum content soluble Total soluble solid (TSS) was recorded (22.81°B) in T_8; ½ T_1 + 50kg FYM + 5kg vermi compost, followed by (21.91°B) in treatment T_5; 500g:250:250g NPK + 50kg. FYM enriched with trichoderma (250g)/tree. It was lowest TSS recorded in (18.59°B). The present findings partially agreed with the results of Bhuyan and Guhe (1995). The maximum acidity % was recorded (0.32%) in T_9; ½ T_1 + 50kg FYM + 250g pseudomonas florescence and minimum was recorded (0.29%) in T_5; 500g:250:250g NPK+ 50kg. FYM enriched with trichoderma (250g)/tree, mean of 5 years data clearly indicated that fruit yield kg/tree was recorded maximum fruit yield and B:C ratio was registered in (57.76kg/tree) in treatment T_5; 500g:250:250g NPK+ 50kg. FYM enriched with trichoderma (250g)/tree, followed by (53.56kg/tree) in treatment T_3; T_1 + Organic mulching @ 10 cm. thick. The minimum fruit yield was noted (41.68kg/tree) in T_1 1000: 500: 500g NPK/tree (as control).

Table 1(a): Soil and leaf nutrient content of IPNM Mango cv Sunderja 2020-2021 at FRS Rewa.

Sr. No.	Sample	Soil nutrient kg/ha			Leaf nutrient		
		Available N	Available P_2O_5	Available K_2O	N	P	K
1.	T_1	112.47	37.50	382.57	2.17	0.35	52.63
2.	T_2	112.55	37.98	381.83	2.03	0.35	51.55
3.	T_3	112.53	37.61	382.02	2.15	0.38	52.16
4.	T_4	113.26	38.01	381.63	2.00	0.38	52.02
5.	T_5	111.65	37.50	381.76	1.99	0.35	51.52
6.	T_6	112.61	37.87	380.90	2.01	0.39	52.10
7.	T_7	113.05	37.99	380.77	2.18	0.39	51.97
8.	T_8	112.49	37.56	381.02	1.98	0.38	52.02
9.	T_9	112.63	37.83	381.08	2.03	0.34	52.08
10.	T_{10}	112.60	37.81	380.94	2.11	0.38	52.04
	SEm ±	**21.67**	**0.12**	**0.14**	**0.033**	**0.016**	**0.066**
	CD at 5%	**NS**	**0.36**	**0.39**	**0.094**	**0.047**	**0.186**

Table 1(b): Growth parameters of Mango cv. Sunderja during 2020-2021 at FRS Rewa.

Sr. No.	Hybrid	Growth parameter					
		Plant Height (m)	Canopy Height	Stem Girth (m)	N->S (m)	E->W (m)	Canopy Volume (m^3)
1.	T_1	7.03	5.95	1.43	9.24	10.57	648.39
2.	T_2	7.36	6.80	1.47	10.19	10.40	736.97
3.	T_3	5.34	5.82	1.42	10.18	10.42	513.94
4.	T_4	7.08	6.01	1.41	10.34	10.20	702.56
5.	T_5	7.06	6.28	1.52	10.35	10.37	712.69
6.	T_6	6.86	5.96	1.42	10.24	9.51	627.16
7.	T_7	6.93	5.93	1.52	11.55	11.28	847.54
8.	T_8	7.42	6.03	1.45	11.31	10.87	862.89
9.	T_9	6.47	7.01	1.52	9.93	10.23	612.09
10.	T_{10}	7.20	6.88	1.48	10.07	10.04	686.12
	SEm ±	0.536	0.099	0.039	0.045	0.051	-
	CD at 5%	1.671	0.062	0.042	0.007	0.010	-

Table 1 (c): Yield & Quality parameters of Mango cv. Sunderja during 2020-2021 at FRS Rewa.

Sr. No.	Treatments	No. of Fruit/tree	Fruit Wt.(g)	Fruit Yield (kg/tree)	TSS oB	Acidity(%)
1.	T_1	135.23	221.23	29.92	19.91	0.32
2.	T_2	170.21	274.00	46.64	18.59	0.30
3.	T_3	212.35	272.48	57.86	20.35	0.31
4.	T_4	171.15	290.16	49.66	20.68	0.30
5.	T_5	210.56	312.52	65.80	21.91	0.29
6.	T_6	210.53	280.00	58.95	23.40	0.31
7.	T_7	175.53	285.16	50.05	21.51	0.30
8.	T_8	185.23	260.13	48.18	23.81	0.30
9.	T_9	170.82	270.23	46.16	21.15	0.32
10.	T_{10}	185.92	280.13	52.08	23.22	0.30
	SEm ±	**53.00**	**78.92**	**15.33**	**0.69**	**0.02**
	CD at 5%	**60.51**	**90.29**	**17.21**	**2.20**	**0.06**

Table 1(d): Pooled analysis 2016-17 to 2020-21 IPNM in Mango cv. Sunderja FRS Rewa centre.

Sr. No.	Treatments	2016-17	2017-18	2018-19	2019-20	2020-21	Mean (Tree^{1} kg)	Q/ha	B:C ratio
1.	T_1	66.73	29.05	52.67	30.04	29.92	41.682	41.682	1.02
2.	T_2	66.27	35.77	33.13	46.98	46.64	45.758	45.758	1.07
3.	T_3	66.53	42.25	43.33	57.86	57.86	53.566	53.566	1.43
4.	T_4	66.73	37.24	48.67	49.67	49.66	50.394	50.394	1.29
5.	T_5	66.70	39.65	54.67	65.72	62.10	57.768	57.768	1.62
6.	T_6	65.70	34.81	44.33	59.99	58.95	52.756	52.756	1.39
7.	T_7	74.53	37.44	42.77	50.04	50.05	50.966	50.966	1.31
8.	T_8	75.73	48.33	34.87	48.17	48.18	51.056	51.056	1.32
9.	T_9	73.23	35.26	41.67	46.15	46.16	48.494	48.494	1.20
10.	T_{10}	71.37	40.27	47.03	52.07	52.08	52.564	52.564	1.38
	SEm ±	**3.174**	**4.042**	**3.42**	**15.380**	**15.331**			
	CD at 5%	**6.669**	**12.599**	**10.806**	**17.263**	**17.212**			

CONCLUSIONS

The benefit cost ratio was also found higher with the treatment T_5; 500g:250:250g NPK+ 50kg. FYM enriched with Trichoderma (250g)/tree. The maximum TSS were recorded (22.8^{o}B) treatmentT_8 - ½ T_1 + 50kg FYM + 5kg vermi, Maximum acidity % were recorded (0.32) treatment T_9; ½ T_1 + 50kg FYM + 250g pseudomonas florescence.

FUTURE SCOPE

The promising integrated combination in this study can be utilized commercially to increase production in Mango.

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Conflict of Interest. None.

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