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Effect of fertilization through fortified cow dung slurry on the performance of mandarin orange

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Abstract
The experiment was conducted at Dr. PDKV, Akola during Mrig season 2015-16 and 2016-17. Fourteen-year-old healthy plants of uniform growth of Nagpur mandarin were selected from the field of All India Coordinated Research Project (Fruits). The experiment was conducted in Randomized Block Design with ten treatments which were replicated three times. The experiment consisted of different treatments of cow dung slurry, biogas slurry, fermented cow dung slurry, bio-fertilizers and NPK. The highest fruit yield (36.99 tons ha^{-1}) was recorded in treatment of fermented cow dung slurry @ 60 L $plant^{-1}$ + 75 per cent RDF *i.e.* 900:300:300 g NPK $plant^{-1}$ (T_8) followed by T_7 (34.22 tons ha^{-1}). The minimum fruit yield was obtained from treatment of fresh cow dung slurry @ 120 L $plant^{-1}$ + *Azotobacter* + PSB (22.66 tons ha^{-1}). Economic analysis also revealed that the gross returns (Rs. 1108550/ha) and net returns (Rs. 849423/ha) were higher in T_8. Benefit-cost ratio (BCR) was also higher in T_8 (3.28).

Keywords: cow dung slurry, fermented cow dung slurry, biogas slurry, mandarin orange

Introduction
Citrus fruits are originated in Southeast Asia. In India, the important citrus fruits grown are mandarin, sweet orange and acid lime sharing 37 per cent, 27 per cent and 22 per cent, respectively of total citrus fruit production in the country. Nagpur mandarin is described as orange cultivated in the Vidarbha region of Maharashtra and some parts in adjoining regions of Madhya Pradesh. Cultivation of Nagpur mandarin is mostly concentrated in Amravati, Nagpur, Wardha, Yeotmal, Akola and Buldhana districts of Vidarbha region over an area of about 80,000 hectares with five lakh tons production (Kasabe Nanda, 2015) [6].

Performance of mandarin orchard is directly related to physical characteristics and chemical composition of soils. Poor growth of mandarin orchard is due to presence of high clay, silt, $CaCO_3$ in sub-soil, low organic carbon, available nitrogen, phosphorus, low exchangeable Mg, salinity and ESP in the surface. Conceptually integrated nutrient management would essentially mean rational use of fertilizers and organic manures for supply of nutrients for production in such a manner that would ensure maximum efficiency of fertilizer use, harnessing best possible positive and synergistic interactions amongst the various factors of production, least adverse effect on environment by minimizing nutrient losses, maintaining soil productivity and sustaining high yields commensurate with the biological potential of the crop variety under the unique soil, climate and agroecological set-up. Balance has to be maintained in the soil-crop system and it has also to take care of all other factors of production and make allowances for residual effects of past fertilizer applications, N fixation etc., and to ensure that there is no toxicity or deficiency of any element (Ganeshamurthy *et al.*, 2015) [3].

To ensure maximum productivity and quality of fruits, it is essential to enrich the soil fertility by using integrated approach of inorganic fertilizers with different bio-organics such as cow dung slurries, organic manures and biofertilizers *viz*., *Azotobacter*, PSB, *Azospirilum*, VAM etc. New strategy of fertilization depends on using recycled animal waste to produce different form of slurries for enhancing biological cycles, improving soil fertility, and avoiding all forms of pollution that may result from conventional agricultural techniques.

Cow dung slurry contains organic nitrogen (mainly amino acids), abundant mineral elements and low-molecular-mass bioactive substances such as hormones, humic acids, vitamins, etc. (Liu *et al*., 2008) [7]. Biogas slurry is a by-product obtained from the biogas plant after the digestion of dung or other biomass for generation of biogas. It contains appreciable amounts of organic matter (20 to 30%). It has been reported by many researcher that the use of biogas slurry as manure improves soil fertility and increases crop yield. The fermented slurry which contains relatively high percentage of readily available nutrients and huge quantity of microbial load can be directly applied in liquid form to the plants both for basal and top dressing.

Fortified slurry is the combination of slurry and nutrients or nutrient carriers. Fortification of the slurry becomes more important for two reasons: firstly, the need for continued increase in agricultural production can be fulfilled by promoting the application of chemical nutrients and organic nutrients to compensate the loss of soil nutrients due to uptake by plants and leaching, and secondly, the reports from a number of experiments reveals that neither chemical nor organic fertilizers alone, when applied exclusively as nutrient sources can maintain fertility of soil as well as crop production under high intensive cropping systems.

Materials and Methods

The experiment was conducted at All India Coordinated Research Project (Fruits), Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the year 2015-16 and 2016-17. The experiment was conducted in RBD with three replications. There were ten treatments *viz*., T_1- Fresh cow dung slurry (60 L plant^{-1}) + 100% RDF (1200:400:400 g NPK plant^{-1}), T_2- Fresh cow dung slurry (60 L plant^{-1}) + 75% RDF (900:300:300 g NPK plant^{-1}), T_3- Fresh cow dung slurry (120 L plant^{-1}) + Azotobacter (100 g) + Phosphate Solubilizing Bacteria (100 g), T_4- Biogas slurry (60 L plant^{-1}) + 100% RDF, T_5- Biogas slurry (60 L plant^{-1}) + 75% RDF, T_6- Biogas slurry (120 L plant^{-1}) + Azotobacter (100 g) + Phosphate Solubilizing Bacteria (100 g), T_7- Fermented cow dung slurry (60 L plant^{-1}) + 100% RDF, T_8- Fermented cow dung slurry (60 L plant^{-1}) + 75% RDF, T_9- Fermented cow dung slurry (120 L plant^{-1}) + Azotobacter (100 g) + Phosphate Solubilizing Bacteria (100 g) and T_{10}- 900:300:300 g NPK + Azospirillum (100 g) + Phosphate Solubilizing Bacteria (100 g) + VAM (500 g) + Trichoderma (100 g) (control). All treatments were applied in six split doses except control in which half dose of nitrogen and full dose of phosphorus, potassium and full doses of biofertilizers were applied in June and remaining half doses of nitrogen was applied at fruit set stage.

Result and Discussion

The yield and yield contributing characters of Nagpur mandarin differed significantly due to different treatments. The highest fruit yield 36.99 tons ha^{-1} was obtained from Fermented cow dung slurry @ 60 L plant^{-1} + 75% RDF *i.e.* 900:300:300 g NPK plant^{-1}. The cumulative effect of fruit weight, fruit diameter and number of fruits per plant might be contributed to increase yield in T_8. The second highest yield (34.22 tons ha^{-1}) attained from T_7 (Fermented cow dung slurry @ 60 L plant^{-1} + 100% RDF *i.e.* 1200:400:400 g NPK plant^{-1}) which was statistically at par with T_8. The production of more number of fruits might be due to the combined application of inorganic fertilizers with cow dung slurry at different levels could be a result of the improvement in soil physical, biological and chemical properties which in turn, provided required nutrition for conversion of flowers to fruits resulting in higher fruit set and ultimately increased number of fruits per tree. Similarly, Chandra (2017) [1] also reported that the treatment combination of 75 per cent RDF + cow dung slurry @10 L tree^{-1} + *Azospirillum* 100 g tree^{-1} + PSB 100 g tree^{-1} produced the highest yield in guava. The fermented liquid organic manures also contain microbial load and plant growth promoting substances in addition to nutrients that help in improving metabolic activities and plant growth (Gore and Sreenivasa, 2011) [4]. These findings are in agreement with the findings of Naik and Babu (2007) [8] and Ram *et al.* (2007) [9] in guava reported that combined application of organic and inorganic was responsible for better vegetative growth, production of more number of flowers and higher fruit set.

Cost and return analysis

Regarding economic performance, the highest net monitory returns obtained from treatment T_8 (Rs. 8,49,423 ha^{-1}) with the highest benefit cost ratio (3.28) followed by T_7 (Rs. 7,79,626 ha^{-1}) with benefit cost ratio 3.18. While, minimum net monitory returns (Rs. 4,91,245 ha^{-1}) with less benefit cost ratio (2.63) was recorded in treatment T_3. Similar economical returns have been reported by Sahu (2014) [10], Chandra (2017) [1], Hulemale (2016) [5] and Deshmukh *et al*. (2018) [2].

Conclusion

The yield performance of Nagpur mandarin under fertilization of mandarin orchard with fortified cow dung slurries was better. But its impact on soil health is deemed important. Cost and return analysis also revealed that the highest gross return and net monitory returns as well as benefit cost ratio was obtained from the application of fermented cow dung slurry @ 60 L plant^{-1} + 75% RDF *i.e.* 900:300:300 g NPK plant^{-1}. The conclusions drawn are based on the findings of two seasons study only. Hence, these results need further confirmation by long term studies for sustainable and remunerative quality fruit production of Nagpur mandarin.

Table 1: Effect of fertilization through fortified cow dung slurry on yield and yield contributing characters of Nagpur mandarin

Treatment	Weight of fruit (g)			Diameter of fruit (cm)			Number of fruits plant^{-1}			Fruit yield (kg plant^{-1})			Fruit yield (tons ha^{-1})		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
T_1	163.17	134.79	148.98	7.19	6.37	6.78	631.67	747.00	689.33	103.08	100.68	101.88	28.55	27.89	28.22
T_2	156.58	131.31	143.95	7.05	6.20	6.63	689.67	734.67	712.17	108.02	96.43	102.23	29.92	26.71	28.32
T_3	132.62	123.97	128.29	6.35	6.10	6.22	604.00	673.67	638.83	80.08	83.54	81.81	22.18	23.14	22.66
T_4	161.03	139.33	150.18	7.13	6.47	6.80	692.00	794.00	743.00	111.48	110.62	111.05	30.88	30.64	30.76
T_5	158.86	138.28	148.57	7.06	6.43	6.75	701.33	769.00	735.17	111.46	106.34	108.90	30.87	29.46	30.17
T_6	132.20	127.87	130.04	6.25	6.13	6.19	604.33	706.33	655.33	79.87	90.28	85.08	22.12	25.01	23.57
T_7	172.28	148.22	160.25	7.22	6.86	7.04	723.00	826.33	774.67	124.56	122.49	123.53	34.50	33.93	34.22
T_8	177.48	155.83	166.66	7.38	7.08	7.23	742.33	868.00	805.17	131.75	135.30	133.52	36.49	37.48	36.99
T_9	145.23	136.30	140.76	6.69	6.46	6.57	643.33	701.67	672.50	93.20	95.62	94.41	25.82	26.49	26.15
T_{10}	156.82	143.46	150.14	7.03	6.64	6.84	698.67	794.67	746.67	109.55	113.78	111.67	30.35	31.52	30.93
'F' Test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) $\pm$	3.76	3.63	3.67	0.09	0.15	0.12	12.42	13.18	12.81	3.09	2.84	2.89	0.86	0.79	0.80
CD at 5%	11.25	10.85	10.56	0.28	0.43	0.35	37.19	39.45	36.83	9.24	8.49	8.30	2.56	2.35	2.30

Table 2: Effect of fertilization with fortified cow dung slurry on economics of treatments

Treatment	Total Cost of Production (Rs. ha^{-1})	Yield (tons ha^{-1})	Gross Returns (Rs. ha^{-1})	Net Returns (Rs. ha^{-1})	B:C Ratio
T_1	214266	28.19	845777	631511	2.95
T_2	214509	28.26	847825	633316	2.95
T_3	187071	22.61	678316	491245	2.63
T_4	226372	30.66	919747	693374	3.06
T_5	223569	30.12	903517	679948	3.04
T_6	191225	23.53	705903	514677	2.69
T_7	245285	34.16	1024911	779626	3.18
T_8	259127	36.95	1108550	849423	3.28
T_9	206853	26.10	783051	576198	2.79
T_{10}	234919	30.90	927072	692153	2.95

References

1. Chandra V. Studies on the response of integrated application of chemical fertilizers with organic and biofertilizers on growth, yield and quality of guava (*Psidium guajava* L.). Ph.D. Thesis (unpub.), College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (CG), 2017.
2. Deshmukh UB, Mishra NK, Bharad SG. Effect of integrated nutrient management practices on soil biological properties in acid lime (*Citrus aurentifolia* Swingle) orchard. International J. Current Microbiology and Applied Sci. 2018; 7(4):713-717.
3. Ganeshamurthy AN, Kalaivanan D, Selvakumar G, Panneerselvam P. Nutrient management in horticultural crops. Indian J. Fert. 2015; 11(12):30-42.
4. Gore NS, Sreenivasa MN. Influence of liquid organic manures on growth, nutrient content and yield of tomato (*Lycopersicon esculentum* Mill.) in the sterilized soil. Karnataka J. Agric. Sci. 2011; 24:153-157.
5. Hulemale PH. Response of acid lime to nutrient management through bio-organics. Ph.D. Thesis (unpub.), Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS), 2016.
6. Kasabe Nanda. Three government agencies join hands to promote exports of Nagpur oranges. Financial Express. September, 2015, 23.
7. Liu WK, LF Du, Yang QC. Biogas slurry added amino acids decreased nitrate concentrations of lettuce in sand culture. Acta Agriculturae Scandinavica, Section B-Soil and Plant Sci. 2008; 58:1-5.
8. Naik MH, Babu SH. Feasibility of organic farming in guava (*Psidium guajava* L.). Acta Hort. 2007; 735:365-372.
9. Ram RA, Bhriguvanshi SR, Pathak RK. Integrated plant nutrient management in guava. (*Psidium guajava* L.) Cv. Sardar. Proc. 1st International Guava Symposium. Acta Hort, 2007, 345-350.
10. Sahu PK. Studies on effect of integrated application of chemical fertilizers, organics and biofertilizers on growth, yield and quality of guava (*Psidium guajava* L.) under Chhattisgarh plains. M.Sc. Thesis (Unpub.), College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.), 2014, 82-83p.