Journal of Pharmacognosy and Phytochemistry 2020; 9(4): 1703-1706

Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(4): 1703-1706
Received: 05-04-2020
Accepted: 08-05-2020

Bhagyaresha R Gajbhiye
Department of Soil Science and Agricultural Chemistry, Banana Research Station, Nanded Vasantrao Naik Marathawada Krishi Vidyapeeth, Parbhani, Maharashtra, India

VD Patil
Department of Soil Science and Agricultural Chemistry, Banana Research Station, Nanded Vasantrao Naik Marathawada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Tejswini R Kachave
Department of Soil Science and Agricultural Chemistry, Banana Research Station, Nanded Vasantrao Naik Marathawada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
Bhagyaresha R Gajbhiye
Department of Soil Science and Agricultural Chemistry, Banana Research Station, Nanded Vasantrao Naik Marathawada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Effect of integrated nutrient management on growth and yield of pomegranate (*Punica granatum* L.)

Bhagyaresha R Gajbhiye, VD Patil and Tejswini R Kachave

Abstract
A field experiment was conducted on "Effect of Integrated Nutrient Management on Disease Resistance of Pomegranate (*Punica granatum* L.) Orchards" during 2017-18 and 2018-19 at College of Agriculture, Golegaon, VNMKV, Parbhani. The experiment was laid out in randomized block design with seven treatments i. e. T_1- Absolute Control, T_2- Farmer's Practices (½ RDF), T_3- RDF (625:250:250 g N, P_2O_5, K_2O tree^{-1}), T_4- INM (15 kg FYM + 8 ml *Azotobactor*, 8 ml PSB, 100 g *Trichoderma* + RDF), T_5- RDF + Antibiotics (Streptocycline @ 250 ppm), T_6- T_4 + Antibiotics, T_7- T_4 + Umber (*Ficus racemosa)* Rhizosphere Hybridised Soil (URHS @ 25 kg per tree) and four replications.
The growth parameter, height of pomegranate plant at flowering and harvesting showed statistical significance with application of FYM @ 15 kg, *Azotobacter* @ 8 ml per tree, PSB@ 8 ml per tree and *Trichoderma* @ 100 g per tree, 625:250:250 g N, P_2O_5 and K_2O per tree and 25 kg URHS per tree (T_7) except treatment INM (FYM @ 15 kg + *Azotobacter* @ 8 ml per tree, PSB @ 8 ml per tree and *Trichoderma* @ 100 g per tree + 625:250:250 g N, P_2O_5 and K_2O per tree)+ Antibiotics (Streptocycline @ 250 ppm per tree) (T_6). It was ranged between 159.88 to 171.88 cm. The spread of pomegranate tree was not found significant with Integrated Nutrient Management practices (FYM, Solubilizers, RDF, Antibiotics and URHS).
Yield attributes *viz*., number of flowers (204.75), number of fruits (172.88), fruit set (84.39%), fruit weight (244.82 g) and yield (41.21 kg tree^{-1}) of pomegranate were significantly increased due to application of treatment T_7 and found to be at par with treatment T_6.

Keywords: INM, plant height, fruit set, yield, pomegranate

Introduction
Pomegranate regarded as 'fruit of paradise', an ancient favorite fruit of tropical and sub-tropical regions of the world. The fruit rind, seeds and pulp comprises of rich medicinal properties. Present global pomegranate consumption ranks18th place annually and expected to move onto 10th place within the decade in view of its innumerable nutraceutical importance. The fruit contains nearly about 153 phytochemicals like ellagic acid, catechin and procyandins, fatty acids and triglycerides, sterols and terpenoids, flavonols etc. The fruit juice contains tannins, anthocyanin, polyphenols and antioxidants A, E and C which plays major role in maintenance of heart blood vessels and proper blood circulation. Pomegranate is rich in biflavonoides and organic acids such as anthocyanins, ascorbic acid, ellagic acid, gallic acid, Caffiec acid, catechin, minerals, amino acids, quercetin and rutin (Jurenka, 2008) [6].
The continuous unbalanced use of chemical fertilizers particularly N, P and K has impaired the soil fertility and decreased the factor productivity. The increasing cost of fertilizers with poor purchasing capacity and their negative effect on soil health has led to intensified attempts to the use of bio-fertilizers and organic matter along with inorganic fertilizers. Integrated Nutrient Management (INM) is a system that helps to restore and sustain crop productivity.

Materials and Methods
The present research programme entitled "Studies on Effect of Integrated Nutrient Management on Soil Health, Disease Resistance and Nutrition of Pomegranate (*Punica granatum* L.) Orchards" was carried out during the year 2017-18 and 2018-19 on the research farm of College of Agriculture, Golegaon, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani. The experimental soil is characterized by strong brown colour. The soil is dominated with smectite clays particularly montmorillonite mixed with chlorite, albite and quartz. The domination of montmorillonite leads to deep cracks on drying and expansion on wetting due to high coefficient of expansion and shrinkage.
Before execution of trial, the tree height was measured with the help of measuring tape.

The readings were taken in between and finally noted after the completion of the experiment. The average increase in tree height was computed by subtracting final and initial values and expressed in centimeters as incremental height. The average increase in tree spread was measured with the help of a measuring tape and computed by subtracting final and initial values for tree spread and expressed in centimeters as incremental spread on done for tree height. Average of East-West and North-South direction were taken as tree spread. Eight branches in all the directions were selected during flowering. The numbers of flowers on these branches were counted and after ten days full bloom, the numbers of fruits were counted. The per cent fruit set was calculated as under:

$$\text{Per cent fruit set} = \frac{\text{Total number of fruits}}{\text{Total number of flowers}} \times 100$$

Result and Discussion

Growth Parameters

Height of tree

The pooled data (Table 1) of two years revealed that the initial height of pomegranate tree was not reach to the level of significance due to application of different treatments. It was ranged between 159.88 to 171.88 cm. However, the height of pomegranate plant at flowering and harvesting was increased significantly.

The data revealed that the height of pomegranate plant was increased at flowering and harvesting stage. The incremental growth of plant at flowering stage clearly shows that application of INM + URHS recorded maximum incremental growth to the extent of 84.87 cm over initial plant height. Further it was noticed that treatment INM coupled with antibiotic spray stood second in plant height increase followed by only INM, RDF + antibiotics, only RDF and Farmer's practice. Absolute control treatment (T_1) showed lowest improvement of growth of pomegranate (29.75 cm) at flowering stage. The similar trend was recorded at harvesting stage. The treatment T_7 (INM + URHS) showed statistical significance at 5% probability level over T_3, T_2 and T_1 treatments at flowering stage. However, said treatment showed statistical improvement in plant height over all treatments except T_6 (INM + Antibiotics) which was at par.

Spread of tree

It is evident from the result (Table 2) that the spread of pomegranate tree was not found significant with Integrated Nutrient Management practices during both the years of study and in pooled. The initial plant spread of pomegranate tree was varied from 242.00 to 298.38 cm. The maximum (523.50 and 611.75 cm) plant spread was recorded with treatment T_7 [INM (compost + solubilizers + RDF) + Umber *(Ficus racemosa)* rhizosphere hybridised soil] while, the minimum (453.63 and 567.25 cm) was recorded with absolute control (T_1) at flowering and harvesting, respectively.

Improvement in the plant height and spread of pomegranate due to Umber *(Ficus racemosa)* rhizosphere soil was attributed to the secretion of acidic root exudates, enzymes, protons and mucilages. These substances produced by tree roots might be responsible for multiplication and development of microbes and their activities around the roots. These processes are responsible for transfer of water and nutrients to the functional roots due to which congenial environment around the roots results in vigorous growth of pomegranate tree. Further, the activity of microbes might be improved due to application of compost and solubilizers.

The synergetic effect of rhizhosphere soil making the soil condition favorable for plant growth as reported by Srivastava *et al.* (2002) [15]. Cheke *et al.* (2018) [3] also reported that URHS improved the growth parameters of sweet orange seedlings by improving the soil properties. Besides enhancing the rhizosphere microbial activity and concentration of various metabolites and nutrients, these bio-inoculants helped in better significant improvement in the plant height, plant canopy of 5-year-old pomegranate plants in field conditions (Aseri *et al.*, 2008) [2].

Height and spread of pomegranate tree increase with application of rhizosphere soil along with organic manure might be due to enhanced release of growth factors like auxins, gibberellins and cytokinin in pomegranate (Mir *et al.*, 2011) [10]. Sangeeta Kurer *et al.* (2017) [13] reported that 100% RDN through vermicompost recorded significantly highest plant height of pomegranate. These results are also in confirmation with the result of Prasad *et al.* (2017) [11]. Similarly, vegetative parameters such as plant height and stem girth were affected by various applications of organic manures, inorganic fertilizers and biofertilizers in combination significantly influenced plant growth characters of papaya (Srinu *et al.*, 2017) [14].

Yield attributes

Number of flowers

Pooled data (Table 3) of both the years showed that the higher (204.75) number of flowers were recorded with treatment T_7 (INM: Compost + Solubilizers + RDF + Umber *(Ficus racemosa)* Rhizosphere hybridised soil) over other treatments under study. Whereas, the lower (61.25) number of flowers were found with the absolute control (T_1) treatment

Number of fruits

The average number of fruits during 2017-18 and 2018-19 were 120.43 and 131.07, respectively. The pooled data of both the years showed that the maximum number of fruits (172.88) were recorded with the application of compost, solubilizers and RDF along with Umber *(Ficus racemosa)* Rhizosphere hybridised soil (T_7) and minimum numbers of fruits (41.75) were recorded with treatment T_1 (Absolute control). The second best treatment was T_6 followed by T_4, T_5, T_3 and T_2.

Fruit set

Maximum fruit set 84.39 per cent was recorded in INM (Compost + Solubilizers + RDF) + Umber *(Ficus racemosa)* Rhizosphere hybridised soil (T_7) which was found to be statistically at par with the treatment T_6 (INM: Compost + Solubilizers + RDF + Antibiotics) recording 82.08 per cent and closely followed by treatment T_4 (INM: Compost + Solubilizers + RDF) recording 79.64 per cent. Whereas, minimum fruit set 68.15 per cent was recorded in absolute control (T_1).

Fruit weight

The results (Table 4) showed that the maximum fruit weight (244.82 g) was recorded at application of INM (compost + solubilizers + RDF) practices along with Umber *(Ficus racemosa)* rhizosphere hybridised soil (T_7) which was found to be statistically at par with INM (compost + solubilizers + RDF) + Antibiotics (T_6) with value 240.49 g and followed by treatment T_4 (INM (Compost + Solubilizers + RDF) with value 233.71 g. However, the minimum fruit weight was recorded with absolute control (T_1) with value 188.38 g.

Fruit yield

Two years pooled data indicated the maximum fruit yield of 41.21 kg tree^{-1} recorded at treatment T_7 (INM : Compost + Solubilizers + RDF) + Umber *(Ficus racemosa)* Rhizosphere hybridized soil) which was found to be statistically at par with treatment T_6 (INM : compost + solubilizers + RDF) + Antibiotics) and T_4 (Compost + Solubilizers + RDF) with values 37.53 and 21.30 kg tree^{-1}, respectively. Whereas, the minimum (9.08 kg tree^{-1}) fruit yield was recorded at absolute control (T_1) treatment.

The results interpreted above clearly shown that there was significant increase in yield attributes *viz*., number of flowers, number of fruits, fruit set, fruit weight and fruit yield of pomegranate due to treatment T_7 i.e. FYM + solubilizers + RDF + Umber Rhizosphere Hybridised Soil (URHS). The combined beneficial effects of FYM, various nutrient solubilizers with Umber Rhizosphere Hybridised Soil (URHS) might have attributed to improvement in yield and yield attributing factors. There was continuos soil enrichment offered by FYM and Umber Rhizosphere Hybridised Soil (URHS) influenced the 'P' solubilisation and in turn 'P' helps to produce more flowers and fruits. These results corroborated with Sangeeta Kurer *et al.* (2017) [13] who reported that higher number of productive flowers (85.15 plant^{-1}) recorded by the plants supplied with 100% RDP through poultry manure in pomegranate.

Similarly, Greeshma Reddy *et al.* (2017) [5] reported that application of organics along with bio-inoculants recorded higher amount of flowers in pomegranate. Application of 100% RDF + vermicompost + poultry manure + *Azospirillum* + PSB + KSB is superior than the other treatments with respect to improvement in yield attributes contributing towards the better yield in Mrigbahar pomegranate cv. Bhagwa (Kirankumar *et al.*, 2018) [7]. On the other hand, Kundu *et al.* (2011) [8] recorded the use of both biofertilizers at a time (VAM + *Azotobacter)* in combination with NPK (100%) responded maximum increase in fruit weight (318.3 g) of mango.

The fruit set in pomegranate depends on number of hermaphrodite flowers (Anonymous, 2011) [1]. Phosphorous is a vital nutrient involved in stimulating and enhancing bud development, blooming and fruit set. More number of productive flowers and higher fruit set helped in increased yield under the treatment T_7. These results are in line of Marathe *et al.*, (2017) [9] who reported that nutrients in organic manures were released slowly and made available throughout the growth period and resulted in better uptake of nutrients, plant vigour and yield of the plants in pomegranate. Also, Gaurav Kumar *et al*, (2017) [4] observed that the highest fruit set, fruit yield, fruit weight, fruit size and fruit volume were observed with 60% nitrogen of recommended dose of fertilizer + 40% organic manure (FYM).

Conclusion

Application of FYM @ 15 kg, *Azotobacter* @ 8 ml per tree, PSB @ 8 ml per tree and *Trichoderma* @ 100 g per tree with 625:250:250 g N, P_2O_5 and K_2O per tree and 25 kg per tree Umber Rhizosphere Hybridised Soil significantly enhanced growth parameters (plant height, spread of tree), Yield attributes (number of flowers, number of fruits, fruit set and fruit weight) and yield of pomegranate.

Table 1: Effect of Integrated Nutrient Management on plant height of pomegranate trees

Treatments	Plant height (cm)										
	Initial			Flowering				Harvesting			
	2017	2018	Pooled	2017	2018	Pooled	IG	2017	2018	Pooled	IG
T_1: Absolute Control	186.25	157.50	171.88	204.00	199.25	201.63	29.75	211.25	213.00	212.13	10.5
T_2: Farmer's practices (1/2 RDF)	173.75	159.25	166.50	197.00	201.75	199.38	32.88	207.75	236.25	222.00	22.62
T_3: RDF (625:250:250 g N, P_2O_5, K_2O tree^{-1})	180.00	161.00	170.50	216.00	207.25	211.63	41.13	229.75	243.50	236.63	25.00
T_4: INM (FYM + Solubilizers + RDF)	167.50	152.25	159.88	255.50	208.50	232.00	72.12	268.50	251.00	259.75	27.75
T_5: RDF + Antibiotics (Streptocycline)	172.50	163.75	168.13	230.00	218.75	224.38	56.25	242.75	255.50	249.13	24.75
T_6: T_4 + Antibiotics	182.50	160.50	171.50	269.00	222.25	245.63	74.13	283.25	267.50	275.38	29.75
T_7: T_4 + Umber *(Ficus racemosa)* Rhizosphere Hybridised Soil (URHS)	178.75	162.50	170.63	275.50	235.50	255.50	84.87	295.25	285.00	290.13	34.63
Average	177.32	159.54	168.43	235.29	213.32	224.30	55.88	248.36	250.25	249.30	25.00
S.Em.±	9.32	6.45	5.67	7.57	6.56	10.93	--	7.93	9.94	6.36	--
CD at 5%	NS	NS	NS	22.48	19.49	37.82	--	23.56	29.52	18.25	--
CV %	10.51	8.09	9.52	6.43	6.15	6.31	--	6.39	7.94	7.21	--

IG- Incremental growth

Table 2: Effect of Integrated Nutrient Management on plant spread (canopy) of pomegranate trees

Treatments	Plant spread (cm)								
	Initial			Flowering			Harvesting		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
T_1: Absolute Control	202.75	281.25	242.00	421.50	485.75	453.63	497.00	637.50	567.25
T_2: Farmer's practices (1/2 RDF)	209.25	298.75	254.00	420.50	493.25	456.88	517.75	617.50	567.63
T_3: RDF (625:250:250 g N, P_2O_5, K_2O tree^{-1})	215.50	306.75	261.13	455.25	505.50	480.38	580.25	630.00	605.13
T_4: INM (FYM + Solubilizers + RDF)	223.00	312.50	267.75	453.25	527.50	490.38	502.75	667.50	585.13
T_5: RDF + Antibiotics (Streptocycline)	202.75	306.25	254.50	437.25	527.75	482.50	536.50	685.00	610.75
T_6: T_4 + Antibiotics	227.75	322.50	275.13	466.25	571.00	518.63	538.75	660.00	599.38
T_7: T_4 + Umber *(Ficus racemosa)* Rhizosphere Hybridised Soil (URHS)	233.00	363.75	298.38	488.75	558.25	523.50	571.00	652.50	611.75
Average	216.29	313.10	264.70	448.96	524.14	486.55	534.86	650.00	592.43
S.Em.±	15.16	23.61	14.03	16.66	36.09	19.87	36.21	35.05	25.20
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	14.02	15.08	14.99	7.42	13.77	11.55	13.54	10.78	12.03

Table 3: Effect of Integrated Nutrient Management on number of flowers, number of fruits and fruit set of pomegranate

Treatments	No. of flowers			No. of fruits			Fruit set (%)		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
T_1: Absolute Control	56.25	66.25	61.25	38.25	45.25	41.75	68.00	68.31	68.15
T_2: Farmer's practices (1/2 RDF)	74.00	84.00	79.00	51.75	58.00	54.88	69.93	69.04	69.49
T_3: RDF (625:250:250 g N, P_2O_5, K_2O tree^{-1})	106.75	119.00	112.88	76.00	86.75	81.38	71.19	72.90	72.05
T_4: INM (FYM + Solubilizers + RDF)	114.25	124.25	119.25	90.25	99.75	95.00	78.99	80.28	79.64
T_5: RDF + Antibiotics (Streptocycline)	109.00	118.25	113.63	80.25	89.75	85.00	73.62	75.90	74.76
T_6: T_4 + Antibiotics	184.50	194.50	189.50	148.75	162.75	155.75	80.62	83.55	82.08
T_7: T_4 + Umber *(Ficus racemosa)* Rhizosphere Hybridized Soil (URHS)	198.25	211.25	204.75	164.75	181.00	172.88	83.10	85.68	84.39
Average	120.43	131.07	125.75	92.86	103.32	98.09	75.06	76.52	75.79
S.Em.±	3.78	4.18	2.82	2.83	3.31	2.18	2.35	2.45	1.70
CD at 5%	11.23	12.43	8.09	8.42	9.84	6.26	6.98	7.28	4.87
CV %	6.28	6.38	6.34	6.10	6.41	6.28	6.26	6.40	6.33

Table 4: Effect of Integrated Nutrient Management on fruit weight and fruit yield of pomegranate

Treatments	Fruit weight (g)			Fruit yield (kg tree^{-1})		
	2017	2018	Pooled	2017	2018	Pooled
T_1: Absolute Control	183.88	192.88	188.38	7.05	8.73	7.89
T_2: Farmer's practices (1/2 RDF)	200.60	208.44	204.52	10.38	12.07	11.22
T_3: RDF (625:250:250 g N, P_2O_5, K_2O tree^{-1})	211.05	228.25	219.65	16.05	19.79	17.92
T_4: INM (FYM + Solubilizers + RDF)	228.85	238.57	233.71	19.64	22.96	21.30
T_5: RDF + Antibiotics (Streptocycline)	217.66	230.08	223.87	18.36	21.42	19.89
T_6: T_4 + Antibiotics	230.66	250.33	240.49	34.31	40.74	37.53
T_7: T_4 + Umber *(Ficus racemosa)* Rhizosphere Hybridized Soil (URHS)	231.29	258.35	244.82	38.10	44.32	41.21
Average	214.86	229.56	222.21	20.56	24.29	22.42
S.Em.±	6.89	8.59	5.50	0.81	1.06	0.67
CD at 5%	20.46	25.51	15.80	2.39	3.15	1.91
CV %	6.41	7.48	7.00	7.84	8.72	8.39

References

1. Anonymous. Pomegranate growing manual, National Research Centre on Pomegranate, 2011.
2. Aseri GK, Jain N, Panwar J, Rao AV, Meghwal PR Biofertilizers improve plant growth, fruit yield, nutrition, metabolism and rhizosphere enzyme activities of pomegranate (*Punica granatum* L.) in Indian Thar Desert. Scientia Horticulturae. 2008; 117:130-135.
3. Cheke AS, Patil VD, Srivastava AK. Studies on rhizhosphere hybridization and nutrient dynamics in sweet orange seedling from pot culture experiment. Journal of Pharmacognosy and Phytochemistry, 2018, 3077-3082.
4. Gaurav Kumar, Thakur N, Singh G, Tomar S. Effect of Integrated Nutrient Management on Growth, Yield and Fruit Quality of Sweet Orange (*Citrus sinensis* L.) cv. Mosambi. International Journal of Current Microbiology and Applied Sciences. 2017; 6(7):2333-2337.
5. Greeshma Reddy BC, Suma R, Nagaraja MS, Kulapati H. Effect of Bio-inoculants and Organic Supplementation on Growth and Yield of Pomegranate. International Journal of Enviromental Sciences and Natural Resources. 2017; 4(4):1-5.
6. Jurenka JS. Therapeutic applications of pomegranate (*Punica granatum* L.): A review. Alternate Medicine Review. 2008; 13(2):128-44.
7. Kiran Kumar KH, Shivakumara BS, Suresha DE, Madaiah D, Sarvjna BS. Effect of integrated nutrient management on quality and biochemical parameters of pomegranate cv. Bhagwa under central dry zone of Karnataka. International Journal of Chemical Studies. 2018; 6(1):05-06.
8. Kundu S, Dutta P, Mishra J, Rashmi K, Ghosh B. Influence of biofertilizer and inorganic fertilizer in pruned mango orchard cv. Amrapali. Journal of Crop and Weed. 2011; 7(2):100-103.
9. Marathe RA, Sharma J, Murkute AA, Dhinesh Babu K. Response of nutrient supplementation through organics on growth, yield and quality of pomegranate. Scientia Horticulturae. 2017; 214:114-121.
10. Mir M. Effect of organic and inorganic fertilizers on soil health and productivity of pomegranate. Ph. D. thesis submitted to Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.), 2011.
11. Prasad H, Sajwan P, Meena Kumari, Solanki SPS. Effect of Organic, 2017.
12. Manures and Biofertilizer on Plant Growth, Yield and Quality of Horticultural Crop: A Review. International Journal of Chemical Studies. 2017; 5(1):217-221.
13. Sangeeta Kurer B, Patil DR, Gandolkar K, Mesta RK, Nagaraj MS, Nadaf AM, Prakash DP. Response of Pomegranate to Different Organic Manures under Northern Dry Zone of Karnataka, India International Journal of Current Microbiology and Applied Sciences. 2017; 6(11):86-90.
14. Srinu B, Rao MA, Veenajoshi K, Narender Reddy S, Sharma H. Effect of Different Integrated Nutrient Management on Growth, Yield and Quality of Papaya (*Carica papaya* L.) *Cv.* Red Lady. Bulletin of Enviroment, Pharmacology and Life Sciences. 2017; 6(1):132-135.
15. Srivastava AK, Singh S, Marathe RA. Organic citrus: Soil fertility and nutrition. Journal of Sustainable Agriculture. 2002; 19:5-29.