Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2017; 6(6): 2092-2095
Received: 25-09-2017
Accepted: 27-10-2017

Sandhya Bhat
Department of Horticulture
GBPUA&T, Pantnagar,
Uttarakhand, India

RL Lal
Department of Horticulture
GBPUA&T, Pantnagar,
Uttarakhand, India

KK Misra
Department of Horticulture
GBPUA&T, Pantnagar,
Uttarakhand, India

DK Singh
Department of Agronomy
GBPUA&T, Pantnagar,
Uttarakhand, India

Correspondence
Sandhya Bhat
Department of Horticulture
GBPUA&T, Pantnagar,
Uttarakhand, India

Response of organic formulations on fruiting and yield of litchi (*Litchi chinensis* Sonn.) cv. Rose Scented

Sandhya Bhat, RL Lal, KK Misra and DK Singh

Abstract
Litchi (*Litchi chinensis* Sonn.) is an important subtropical fruit crop of India. It is known as queen of the fruit due to its attractive deep pink/red colour and fragrant aril. It has high nutritive value and suitable for geotropic weak persons. There is a great demand for fresh litchi in the domestic markets as well as international market. In India unless the country makes a rapid swing towards organic farming, the cost in terms of environmental degradation and health hazards caused by the agricultural chemicals could sharply increase. The influence of organic manures/biofertilizers has been well recognized in many fruit crops; while such studies are scantily available in litchi. So keeping the necessity of new age farming system in mind and keeping in view of the above limitations, an investigation was carried out at Horticultural Research Centre, Patharchatta, G.B. Pant University of Agriculture and Technology, Pantnagar to study the response of organic formulations on fruiting and yield of litchi cv. Rose Scented. The treatments consisting of different organic formulations with different doses *viz.*, FYM, Vermicompost, Cow urine, Vermiwash, Nutrisol along with chemical control and absolute control. Different treatments involving the use of organic formulations had a significant effect on post-harvest quality. Trees applied with FYM (100 kg/tree) + Vermicompost (50 kg/tree) + 10% Cow urine/tree + 10% Vermiwash/tree + Nutrisol 2.5 ml/l resulted in maximum fruit set, fruit retention, fruit yield, minimum fruit drop and fruit cracking.

Keywords: FYM, Vermiwash, *Trichoderma harzianum*, *Pseudomonas fluorescens*, Nutrisol

Introduction
Litchi (*Litchi chinensis* Sonn) is known as queen of the subtropical fruits of India. The pleasant aroma, attractive colour, white translucent fleshy and fragrant aril makes the fruit delicious. Globally litchi production is around 2.11 million tons, with more than 95 per cent of the area and production share accounted by Asia. India is the second largest producer of litchi next to China with the highest productivity and contributing about 25% of total world production. Litchi flourishes well in a moist atmosphere, having profuse rainfall and ice free environment. It is successfully cultivated in sub-tropical and sub mountainous districts of Uttarakhand, Uttar Pradesh, Himachal Pradesh and Bihar. In Uttarakhand, litchi cv. Rose Scented is cultivated in Dehradun, Nainital, U.S. Nagar, Pithoragarh and Haridwar districts. Nutrient management is one of the most important considerations under organic production system. The high cost of chemical fertilizers and their ill effects on the soil health is also an important consideration for the use of organic nutrients. Organic manures are the major source of nutrients under organic production system but the rate of releasing nutrients to the soil is very slow. The beneficial soil micro-organisms further enhance this release rate and helps in subsequent uptake of nutrients by the plants. Micro-organisms are also responsible for the better nutrient availability to the tree and also to the active sink (Singh *et al*., 2004) [9]. The application of high amount of nitrogenous fertilizers has resulted in accumulation of more quantities of nitrates in water resources near orchards making them unfit for cultivation. In the current system of organic agriculture, bio-fertilizers, microbial inoculants are the choice of the orchardists. They also provide an eco-friendly and need based use of chemical fertilizers with increased soil fertility and high yield of plant. Bio-fertilizers are farmer friendly renewable sources of low cost and non-bulky organic agricultural inputs improve the soil health. Among the biofertilizers, PSB, *Azotobacter* and Arbascular Mycorrhizal fungi play significant role in the production and broad spectrum application. There is a great demand for fresh litchi in the domestic as well as international markets. In India unless the country makes a rapid swing towards organic farming, the cost in terms of environmental degradation and health hazards caused by the agricultural chemicals could sharply increase. The influence of organic manures/ biofertilizers has been well recognized in many fruit crops; while such studies are scantily available in litchi.

So keeping the necessity of new age farming system in mind an investigation was carried out at Horticultural Research Centre, Patharchatta, G.B. Pant University of Agriculture and Technology, Pantnagar to study the "Response of organic formulations on fruiting and yield of litchi cv. Rose Scented".

Materials and Methods

Experimental materials and design

The experiment was conducted on 30 years old bearing 30 uniform trees of litchi cv. Rose Scented and maintained under uniform cultural practices. Trees were planted at 10 × 10 m distance in square system of planting. The experiment included 10 treatments and 3 replications. The design of the experiment was Randomized Block Design.

Details of treatments

The treatments included FYM @ 200 kg/tree (T_1), FYM @ 200 kg/tree + 10% cow urine/tree (T_2), Vermicompost 100 kg/tree (T_3), Vermicompost 100 kg/tree + 10% Vermiwash/tree (T_4), FYM 100 kg/tree + Vermicompost 50 kg/tree (T_5), FYM 100 kg/tree + Vermicompost 50 kg/tree + 10% Cow urine/tree + 10% Vermiwash/tree + Nutrisol 2.5 ml/l (T_6), FYM 75 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens)*10 g/kg + Vermicompost 37.5 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens)*10 g/kg (T_7), FYM 75 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens)*10 g/kg + Vermicompost 37.5 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens)*10 g/kg + 10% cow urine + 10% vermiwash + (*Trichoderma harzianum* + *Pseudomonas fluorescens)*10 g/kg (T_8), Chemical control (NPK – 1200:500:600 g/tree) + (Micronutrients: ZnSO4 – 0.5% + Boric acid – 0.2% + MnSO4 – 1% + CaCl2 -0.6%) (T_9) and control (T_{10}). The treatments were given in the month of November in the tree basin at 1.0-1.5 m away from tree trunk and 15 days after fruit set in the month of March (foliar sprays).

Observations recorded

Fruit set (%): It was recorded on the basis on number of female flowers and in terms of number of fruit set per panicle. Four branches of one meter length were selected on each tree in all the four directions. The number of flowers present on these branches was counted 20 days after full bloom. The number of fruits was also counted at fruit set. The per cent fruit set was calculated as under:

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

Fruit drop (%): Fruit drop was recorded as weekly interval upto harvesting time. The per cent fruit drop was calculated on the basis of initial fruit set. Fruit drop percentage at different stages of fruit growth over the initial fruit set per panicle was calculated by the following formula and expressed in per cent.

$$\text{Fruit Drop} = \frac{\text{Number of fruits set per panicle at initial stage - Number of fruits set per panicle at next subsequent stage (\%)}}{\text{Number of fruits set per panicle at initial stage}} \times 100$$

Fruit retention (%): The per cent fruit retention was calculated on basis of total fruit set and retained at harvesting.

Fruit cracking (%): The per cent fruit cracking was calculated by counting the total number of fruits and cracked fruits/panicle.

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

Fruit yield (kg/tree): The fruits are harvested in the form of bunches and weighted in balance for observing yield in kg /tree.

Results and Discussion

1. Fruit set

Data presented in the Table 1 revealed that fruit set differed significantly among the treatments during both the years of investigation. Maximum fruit set (44.50% and 48.0%) was observed in treatment T_6 (FYM 100 kg/tree + Vermicompost 50 kg/tree + 10% Cow urine/tree + 10% Vermiwash/tree + Nutrisol 2.5 ml/l) followed by T_8 ((FYM 75 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens)*10 g/kg + Vermicompost 37.5 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens)*10 g/kg + 10% cow urine + 10% vermiwash + (*Trichoderma harzianum* + *Pseudomonas fluorescens)*10 g/kg), while minimum fruit set (36.0% and 37.50%) was observed in T_{10} (control) during both the year of investigation. Results are in close conformity with the findings of Anubha Rani (2008) [1] who reported in litchi cv. Rose Scented that the maximum fruit set (42.87%) was found in (FYM 150 kg/tree + 10% spray of vermiwash). Results are also in close conformity with the findings of Dheware and Waghmare (2009) [4] in sweet orange. The increased nutrient availability from the organic matter and FYM might have increased the various endogenous hormonal levels in the plant tissues which might be responsible for enhanced pollen germination and pollen tube growth, ultimately increased the fruit set as well as number of fruit per plant (Sumner, 1990) [10]. Chaudhary *et al.,* (1975) [2] had reported that the number of flowers per branch and number of fruit set per branch in guava were higher with the application of 45 kg FYM/tree along with the recommended dose of fertilizers and lower in chemical fertilizers alone.

2. Fruit retention

It is evident from the data given in Table 1 that fruit retention differed significantly among the treatments during both the years of investigation. Maximum fruit retention (42.5% and 46.0%) was observed in treatment T_6 (FYM 100 kg/tree + Vermicompost 50 kg/tree + 10% Cow urine/tree + 10% Vermiwash/tree + Nutrisol 2.5 ml/l) followed by T_8 (FYM 75 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens*) 10 g/kg + Vermicompost 37.5 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens*) 10 g/kg + 10% cow urine + 10% vermiwash + (*Trichoderma harzianum* + *Pseudomonas fluorescens*) 10 g/kg, while minimum fruit retention (26.5% and 27.5%) was observed in treatment T_{10} (control) during both the years. Results are in close conformity with the findings of Anubha Rani [1] (2008) who found in litchi cv. Rose Scented that the maximum fruit retention (41.86%) was found in (FYM @150kg/tree + 10% spray of vermiwash) and also with the findings of Dheware and Waghmare (2009) [4] in sweet orange. The increased nutrient availability from the organic matter and FYM might have increased the various endogenous hormonal levels in the plant tissues which might be responsible for enhanced pollen germination and pollen tube growth, ultimately increased the fruit set as well as fruit retention per plant (Sumner, 1990) [10].

3. Fruit drop

It is revealed from the data presented in Table 1 that fruit drop differ significantly among the treatments during both the years of investigation. Maximum fruit drop (73.50% and 73.0%) was observed in T_{10} (control), while minimum fruit drop (55.0% and 52.50%) was observed in treatment T_6 (FYM 100 kg/tree + Vermicompost 50 kg/tree + 10% Cow urine/tree + 10% Vermiwash/tree + Nutrisol 2.5 ml/l) followed by T_8 ((FYM 75 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens*) 10 g/kg + Vermicompost 37.5 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens*) 10 g/kg + 10% cow urine + 10% vermiwash + (*Trichoderma harzianum* + *Pseudomonas fluorescens)*10 g/kg) during the year 2016 and 2017. Results are in close conformity with the findings of Kaur *et al.* (2007) [6] who studied the effect of organic manures on flowering and fruiting of litchi cv. Rose Scented and observed that the fruit drop (87.54%) was maximum under control while the minimum fruit drop (82.41%) was recorded with 100 kg FYM/tree. Anubha Rani [1] (2008) reported in litchi cv. Rose Scented that the minimum fruit drop (58.13%) was found in (FYM at the rate of 150 kg/tree + 10% spray of vermiwash).

4. Fruit cracking

Data depicted in the Table 1 reveals that fruit cracking differed significantly among the treatments. Minimum fruit cracking (4.50% and 2.50%) was observed in treatment T_6 (FYM 100 kg/tree + Vermicompost 50 kg/tree + 10% Cow urine/tree + 10% Vermiwash/tree + Nutrisol 2.5 ml/l) followed by T_8 (FYM 75 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens*) 10 g/kg + Vermicompost 37.5 kg/tree + (*Trichoderma harzianum* + *Pseudomonas fluorescens*) 10 g/kg + 10% cow urine + 10% vermiwash + (*Trichoderma harzianum* + *Pseudomonas fluorescens*) 10 g/kg) while maximum fruit cracking (10.50% and 9.50%) was observed in T_{10} (control) during both the years of study. Results are in close conformity with the findings of Kaur *et al.* (2007) [6] who studied the effect of organic manures on flowering and fruiting of litchi cv. Rose Scented and observed that the fruit cracking (12.77%) was maximum under control while the minimum fruit drop (82.41%) was recorded with 100 kg FYM/tree. Anubha Rani (2008) [1] reported in litchi cv. Rose Scented that the minimum fruit cracking (4.21%) was found with the application of vermicompost 75 kg/tree compared to control (9.4%).

Table 1: Effect of various treatments on fruit set, fruit retention, fruit drop and fruit cracking.

Treatments	Fruit set (%)		Fruit retention (%)		Fruit drop (%)		Fruit cracking (%)		Fruit yield (kg/tree)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
T_1	38.0	41.0	28.0	30.5	69.0	67.5	9.5	8.0	77.83	86.5
T_2	41.5	44.0	35.0	37.5	61.5	59.5	6.5	5.5	102.0	105.5
T_3	35.5	39.0	27.0	29.0	72.5	71.0	10.0	9.0	79.5	81.0
T_4	40.0	43.5	32.5	34.0	63.0	62.5	7.5	6.0	96.5	99.0
T_5	38.5	42.0	29.0	31.5	67.5	66.0	8.0	6.5	90.0	93.5
T_6	44.5	48.0	42.5	46.0	55.0	52.5	4.5	2.5	120.5	125.0
T_7	42.5	45.0	38.5	41.5	59.5	57.5	6.0	4.0	109.5	112.5
T_8	43.0	46.5	40.0	43.5	57.5	55.0	5.0	3.0	116.5	119.0
T_9	38.5	40.0	32.5	34.5	68.5	67.5	8.5	7.0	91.5	93.5
T_{10}	36.0	37.5	26.5	27.5	73.5	73.0	10.5	9.5	76.67	77.5
S. Em.±	1.28	1.0	0.77	0.91	1.06	0.92	0.18	0.14	2.75	2.33
C.D. at 5%	3.81	2.98	2.3	2.73	3.15	2.73	0.54	0.42	8.19	6.92

5. Fruit yield

It is evident from the Table 1 that fruit yield differed significantly among each other during both the years of investigation. Maximum fruit yield (120.5 and 125.0 kg/tree) was observed in treatment T_6 followed by treatment T_8 while minimum fruit yield (76.67 and 77.50 kg/tree) was observed in treatment T_{10} (control) during both the years. The fruit yield differed significantly among the treatments during the course of investigation. The increase in fruit set was due to the better vegetative growth due to organics might have reflected in increased production of flowers and resulted in higher per cent fruit set and fruit yield. FYM along with biofertilizers showed better results other than non biofertilizer treatments. Biofertilizers provides nitrogen to the plant beside it provides growth promoting substances *viz.*, Indole acetic acid, Gibberlic acid, vitamin B and some antifungal substances. They also provide phosphorus and are very efficient mobilization and uptake of nitrogen, potassium, magnesium, copper, zinc, boron, sulphur and other elements that are transported to the plant which ultimately reflect on the fruit set of the tree. Although genetic composition of a litchi cultivar is the primary determinant of its yield potential, the manifestation of morphological, physiological and biochemical processes ultimately decide the productivity. Yield is a complex character which involves the interaction of several intrinsic and external factors. It largely depends upon the production and mobilization of carbohydrates, uptake of nutrients and water from the soil and the hormonal balance, in addition to several environmental factors to which tree is exposed during the growing period. Yield has been significantly affected by various treatments during the course of investigation. Trees been treated with FYM 100 kg/tree + Vermicompost 50 kg/tree + 10% Cow urine/tree + 10% Vermiwash/tree + Nutrisol 2.5 ml/l have shown significant effect on yield during both the years of study. It is due to huge number of flowers and fruit set under this treatment during both the years. The beneficial effect of organic formulations to yield might also attributed to the availability of sufficient amounts of plant nutrients throughout the growth period and especially at critical growth periods of crops resulting in better uptake, plant vigour and superior yield attributes.

The above finding are in conformity with the finding of Kaur *et al.* (2007) [6] who studied the effect of organic manures on flowering and fruiting of litchi cv. Rose Scented and observed that the maximum fruit yield (55.17 kg/tree) was recorded with the application of FYM at the rate of 100 kg/ tree. Anubha Rani (2008) [1] reported in litchi cv. Rose Scented that (FYM at the rate of 150 kg/tree + 10% spray of vermiwash) resulted in maximum yield (98.99 kg/tree). Maximum fruit yield in grapes (Venkatesh *et al.*, 2000) [11] was obtained with vermicompost application. Singh *et al.* (2008) [8] reported that vermicompost application at 5-10 tonnes/ha increased strawberry yield significantly. Damodhar and Shinde (2010) [3] revealed that, the six foliar sprays of 55 per cent cattle urine

solution resulted highest fruit weight, volume, number of fruits, fruit yield (kg/plant) and yield (t/ha) in mango. Treatment with cow urine at 2.5 per cent dilution increased the fruit yield by 20.12% in pineapple (Gadelha, 2002) [5]

References

1. Anubha Rani. Effect of Organic Manures on yield, quality and post harvest life of litchi (*Litchi chinensis* Sonn.) cv. Rose Scented. Thesis Ph.D., GBPUA&T, Pantnagar (India), 2010.
2. Chaudhary DN, Shyamal NR, Maurya KK. Influence of inorganic and organic manures alone and in combination on growth, yield and chemical qualities of guava (*Psidium guajava*). Indian Food Packer, 1975, 24-26.
3. Damodhar VP, Shinde VV. Effect of cattle urine sprays on yield and quality of mango (*Mangifera indica* L.) cv. Alphonso. The Asian Journal of Horticulture. 2010; 5(2):307-308.
4. Dheware RM, Waghmare MS. Influence of organicinorganic and biofertilizers and their interactions on flowering and fruit set of sweet orange (*Citrus sinesis* Osbeck L.). Asian Journal of Horticulture. 2009; 4(1):194-197.
5. Gadelha RSS, Celestino RCA, Shimoya A. Effect of cow urine application in pineapple. Pesquisa Agropecuariao and Desenvolvimento Sustentavel. 2002; 1(1):91-95.
6. Kaur B, Lal RL, Misra KK. Effect of organic manure on growth and yield of Litchi (*Litchi chinensis Sonn*.) cv. Rose Scented. Progressive Horticulture. 2007; 39(1):28-31.
7. Singh R, Sharma RR, Kumar S, Gupta RK, Patil RT. Vermicompost substitution influences growth, physiological disorders, fruit yield and quality of strawberry (*Fragaria xananassa* Duch). Bioresource Technology. 2008; 99(17):8507- 8511.
8. Singh SK, Minakshi G, Khawale RN, Patel VB. Mycorrhization as an aid for biohardining of *in vitro* raised grape (*Vitis vinifera* L.) plantlets. Acta Horticulturae. 2004; 662:289-295.
9. Sumner ME. Crop response to Azospirillium inoculation. Advances of Soil Science. 1990; 12:53-123.
10. Venkatesh Patil PB, Athani SI, Redddy PN, Patil MP, Dharmatti DR. Quality charecteristics of grape berries as influenced by in situ vermiculture and vermicompost. Advances in Agricultural Research in India. 2000; 10:129-132.