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Effect of Organic Sources on Vegetative Growth, Fruit Quality and Yield of Phalsa (*Grewia subinaequalis* D.C.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Phalsa (*Grewia subinaequalis* D.C.) is a native plant with nutritionally rich fruits, yet it faces challenges like uneven ripening and small fruit size. This study assessed the efficacy of organic nutrient sources, including Farm Yard Manure (F.Y.M.), Poultry Manure, and Jeevamrit, in improving Phalsa growth and fruit quality. Results revealed that the combination of F.Y.M. and Poultry Manure with Jeevamrit significantly enhanced vegetative growth, increasing shoot length, number of shoots per plant, and inter-nodal length. These benefits are attributed to the nutrient-rich organic sources, which stimulate cell elongation and division, leading to accelerated plant growth. Furthermore, organic sources positively impacted fruit yield, with the highest yield observed under F.Y.M. and Poultry Manure with Jeevamrit treatment. Additionally, there were increased fruiting nodes and extended harvesting periods, contributing to enhanced fruit production. Phalsa fruit size and quality improved substantially due to organic source applications, resulting in larger fruit dimensions and elevated total soluble solids content. Jeevamrit and F.Y.M. facilitated better nutrient transport to developing fruits, enhancing metabolic processes and fruit size. Regarding sugar content, organic sources significantly influenced non-reducing and reducing sugars. F.Y.M. with Jeevamrit yielded higher non-reducing sugar content, while reducing sugar content increased with F.Y.M. and Jeeva Ghanamrit. Phalsa fruit acidity was not significantly affected by organic sources, but there was a non-significant increase in ascorbic acid content under various combination treatments. Economically, the benefit-cost ratio was most favourable with F.Y.M. and Poultry Manure combined with Jeevamrit, showcasing the economic viability of these organic nutrient sources in Phalsa cultivation. In conclusion, this study demonstrates the positive impact of organic nutrient sources, particularly F.Y.M., Poultry Manure, and Jeevamrit, on Phalsa plant growth, fruit yield, and fruit quality. These findings provide valuable insights into sustainable and organic methods for enhancing Phalsa cultivation, potentially leading to increased production and improved fruit quality in this indigenous crop. Further research should explore the applicability of these organic sources in different crops and regions.

Keywords: Organic nutrient sources; fruit quality; vegetative growth; benefit-cost ratio.

1. INTRODUCTION

Phalsa (*Grewia subinaequalis* D.C.) is an indigenous plant (2n=2x=36). Phalsa fruits have a high carbohydrate content (6.8% to 25.8%), total sugar content (5.73 to 9.75%), protein content (1.5%), fat content (0.9%), and acid content (0.9%). (0.42 to 2.5%) fruit have citric acid, with amounts of malic acid, high in vitamin A and minerals. Flavonoids, carotenoids, and anthocyanins are abundant in phalsa fruits. The Phalsa plant is a midsize, drooping shrub that can grow to be 4 meters tall if left unpruned. When ripe, the fruits are very tiny and purple to crimson red in hue. The fruits are grown in bunches and have a peduncle that is 2 to 3 cm long. Fruits measure 1.0 to 2.0 cm in diameter, 1.0 to 1.5 cm in length, and weigh 1.0 to 2.0 gm on average. 45 to 55 days after blossoming, the fruits ripen. A cluster of fruits does not ripen at the same time. The fruits transform from bright green to cherry red to purplish red, then dark purple as they ripen. The fruit normally has one seed, and some time two which is hemispheric and is 5–7 mm in diameter. The best growth for Phalsa plants, on the other hand, are those with a distinct summer and winter season. Because there is no discernible change of seasons, the plant does not shed its leaves, blooms are produced all year, and the plant produces mediocre fruit. Its fruit ripening, or the production of appropriate fruit colour and taste, requires enough sunlight and high temperatures. Plants of the genus *Grewia* can be grown by seed. Uneven ripening, small fruits, and a high perishability of fruits are among of the issues that limit its popularity. To enhance vegetative growth through control and pruning development, fruit size, ripening uniformity, fruit yield, and quality.

The cooling impact of ripe fruits is felt throughout the body. The fruits alleviate thirst and burning sensations, as well as removing and treating inflammations. Phalsa fruit can be used in a variety of ways. It is a minor fruit crop grown in limited quantities in each state contains all of the macro and micronutrients necessary for plant growth, although nitrogen, phosphorus, and potassium have the most impact. Because it has a high organic matter content paired with available minerals for plant growth, poultry manure is an effective soil supplement that offers nutrients for growing crops while also improving soil quality when used appropriately. the area under phalsa in Punjab is barely 30 hectares, producing 196 tonnes annually, 150 tonnes in Haryana, and 100 tonnes in Uttar Pradesh. There are less than 1000 hectares of cultivable land [1].

Jeevamrit improves the quality of fruits and vegetables, increases leaf size, enriches soil and plant growth, balances nutrition, and increases disease resistance. It has the potential to reduce the over dosage of chemical fertilizers in the soil, which contributes to low soil fertility. The fermentation process produces an efficient living soil microbe that increases plant growth, productivity, and nutrient supply. have been shown to be superior to other treatments in terms of phalsa growth, yield, and quality. It aids in the activation of available nutrients and microbes in the soil, making them available for the crop planted in that region. This will increase output by increasing nutrient availability by hastening the decomposition of bulky organic manures and increasing microbial activity in the soil. Poultry manure nutrient content and environmental contaminants, its value as a nutrient source and soil amendment to improve soil fertility, alternative uses for FYM such as animal feed and fuel, and cost-effective innovative technologies for increasing the beneficial value of poultry litter are all discussed.

2. MATERIALS AND METHODS

The area of Ayodhya district comes under sub humid & subtropical Uttar Pradesh. The maximum temperature of the location reaches up to 46º C – 48º C and seldom falls as low as 4o C – 5 o C. The relative humidity 85 percent. The average rainfall in this area is around 1200 mm annually. Winter months are cool and dry and occasional frost occurs during this period. The experiment was conducted at the Main Experiment Station Fruit science, Acharya Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya during 2021-1022. Treatments namely, T0 (Control) , T1 (F.Y.M30 ton/ha), T2 (Poultry manure 15 ton/ha), T3 (Jeevamrit 10%) , T4 (Jeeva ghanamrit 10%), T5 (F.Y.M. 15ton/ha + 5%jeevamrit), T6 (Poultry manure 7.5-ton/ha + 5% jeevamrit), T7 (F.Y.M. 7.5ton/ha + 5% jeeva ghanamrit), T8 (Poultry manure7.5-ton/ha+ 5% jeeva ganamrut) , T9 (F.Y.M. 20 ton+ 7.5-ton poultry manure/ha + 5% jeevamrit), T10 (F.Y.M. 10-ton + 10-ton poultry manure/ha + 5% jeeva ghanamrit) , T11 (F.Y.M. 5 ton + 7.5-ton poultry manure/ha + 5% jeevamrit + 5% jeeva ghanamrit), were tested in randomized block design with three replications. The observations were recorded on three randomly selected plants from each treatment. Vegetative characters [average shoot Lenth (m), Number of shoot per plant, number of leaves per shoot, inter-nodal length], yield and economic attributes [Number of fruiting per node per shoot, number of fruits per node, date of first picking, date of late picking, number of picking, fruit yield per plant(kg), fruit yield per hectare (qtl)], physical attributes [weight of 50 fruit (g), fruit size (Lenth & breadth),pulp stone ratio], chemical characters [TSS (°Brix), Acidity (%), Ascorbic Acid (mg/100ml), sugars, reducing sugar(%), Non-reducing sugars(%), total invert sugar(%), cost benefit ratio]. The data recorded during investigation was subjected to statistical analysis.

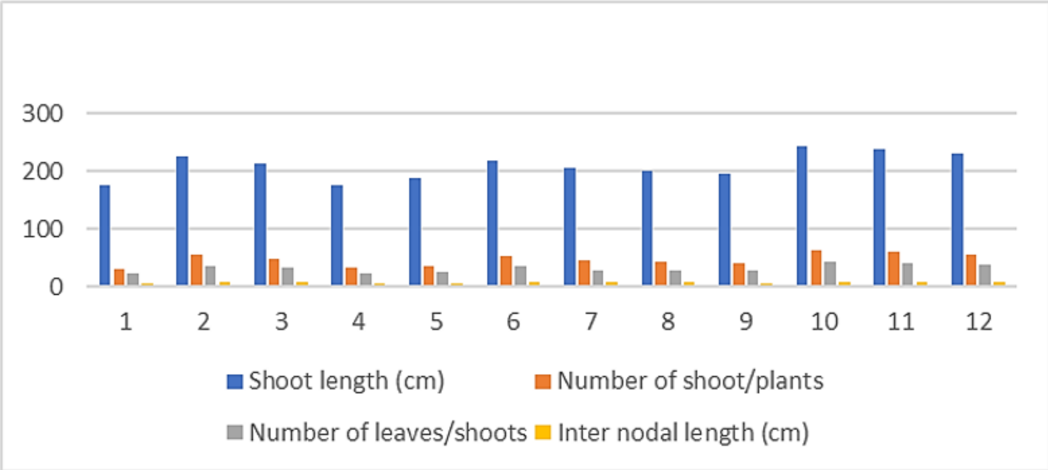
3. RESULTS AND DISCUSSION

3.1 Vegetative Characters

It is clear from the table 1 and graph 1 that the average shoot Lenth (242 cm), Number of shoots per plant (61), number of leaves per shoot (42), inter-nodal length (6.77 cm) was obtained in T9 (F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit) treated plant which were significantly and statistically at par to T10 (F.Y.M. 10-ton + 10-ton Poultry manure /ha. + 5% jeeva ghanamrit). Kumar et al*.,* [2] and Dudi et al*.,* [3] reported significant growth of kinnow mandarin by applying FYM to phalsa and guava. The combination of organic nutrients was found to be helpful in cell elongation in the meristematic region of plants, leading to increased plant growth rate. Verma et al*.,* [4] observed similar findings on vegetative growth in guava and phalsa. The combination of organic sources significantly impacted the number of shoots per plant, with the maximum number (61.67) recorded with F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit and followed by F.Y.M. 10-ton + 10-ton Poultry manure /ha. + 5% jeeva ghanamrit (59.33). The increase in plant development boundaries may be due to the nutrient-helping in cell elongation of shoots, which is essential for cell division and rapid cell division. Pelakar [5], Vasanthkumar [6], and Devakumar et al*.* [7] also reported the beneficial effects of Jeevamrit on soil biomass, sustaining the availability and uptake of applied and native soil nutrients. The higher inter-nodal length achieved might be due to growth-enhancing properties of nitrogen, phosphorus, and potassium. These findings align with previous research by Gochar et al*.* [8] in phalsa and Audi et al*.* [9] in pomegranate.

Table 1. Vegetative characters

Treatments	Shoot length (cm)	Number of shoot/plants	Number of leaves/shoots	Inter nodal length (cm)
T_0 : Control	174.33	30.00	22.33	6.02
T_1 : F.Y.M30 ton/ha.	224.33	54.00	36.00	6.45
T_2 : Poultry manure 15 ton/ha.	213.00	48.33	32.33	6.34
T_3 : Jeevamrit10%	175.67	32.00	23.33	6.08
T_4 : Jeeva ghanamrit 10%	187.67	35.00	25.33	6.14
T_5 : F.Y.M.15ton/ha. + 5% jeevamrit	218.67	51.33	34.00	6.41
T_6 : Poultry manure 7.5-ton/ha. + 5% jeevamrit	206.33	44.67	28.33	6.26
T_7 : F.Y.M. 7.5ton/ha.+ 5% jeeva ghanamrit	200.67	42.00	27.67	6.23
T_8 : Poultry manure 7.5-ton/ha.+ 5% jeeva ghanamrit	195.67	39.67	26.33	6.18
T_9 : F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit	242.00	61.67	42.33	6.77
T_{10} : F.Y.M. 10-ton + 10-ton Poultry manure /ha. + 5% jeeva ghanamrit	237.33	59.33	40.33	6.57
T_{11} : F.Y.M. 5 ton + 7.5-ton Poultry manure/ha. + 5% jeevamrit + 5% jeeva ghanamrit	230.67	56.00	38.33	6.52
SEm±	**2.14**	**1.48**	**1.03**	**0.02**
CD at 5%	**6.29**	**4.35**	**3.03**	**0.06**



Graph 1. Vegetative characters

3.2 Yield Attributes

The study analysed the effects of organic sources on fruit yield in a variety of crops, including phalsa, guava, [10,11] and citrus. The results showed that the number of days of first picking was significantly influenced by the combination of organic sources. The maximum number of days (41) of fruit picking was recorded with the application of (T9) F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit, which was found to be significantly superior over the rest of the treatments. The combination of F.Y.M., Poultry manure, and jeevamrit significantly influenced the number of fruiting nodes, with the maximum number of fruiting per nodes (8.10) recorded with (T9) F.Y.M. + 5% jeevamrit. The interaction between F.Y.M., Poultry manure, and jeevamrit on the number of fruiting nodes was found to be significant, with the maximum number of fruiting nodes (10.07) recorded with (T9) F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit. It being found significantly superior over the rest of the treatments. We can see from the table 2 and graph 2, the minimum number of fruiting node (6) was recorded with the control. The organic sources application was found to significantly influence the duration of fruit picking, with the maximum picking days (26.67 days) being recorded with (T9) F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit. However, values with respect to days of fruit picking were noticed minimum (15.33 days) under the control. This could be due to increased nutrient availability from NPK, FYM, and Jeevamrit, which increase photosynthesis at critical stages and induce late ripening. The interaction effect between different organic nutrients on fruit yield per hectare was also found significant, possibly due to increased vegetative and reproductive growth of the plant and better nutrient supply as a result of the application of FYM. This application not only adds organic matter and macro and micro nutrients to soil but also improves the physico-chemical properties of soil, providing better conditions for plant growth and development. Same results were also obtained by Hiwale et al*.* [12] in sapota and Kashyap et al*.* [13] in pomegranate. The data collected towards fruit yield in q/ha as significantly affected by various organic sources. The maximum fruit yield per ha (25.36q) and with maximum (2.54 kg) fruit yield per plant was recorded with (T9) F.Y.M. 20 ton + 7.5-ton Poultry manure /ha. + 5% jeevamrit, followed by (T10) F.Y.M. 10-ton + 10-ton Poultry manure /ha. + 5% jeeva ghanamrit. In conclusion, the use of organic sources in phalsa, guava, Godage et al*.* [14] and citrus has shown significant benefits in fruit yield and development. Further research is needed to understand the effects of these organic sources on fruit yield and their potential applications in various crops. Similar types of results were also obtained by Ram et al*.* [15] in phalsa, Musmade et al*.* [16] in acid lime and Bhaviskar et al*.* [17].

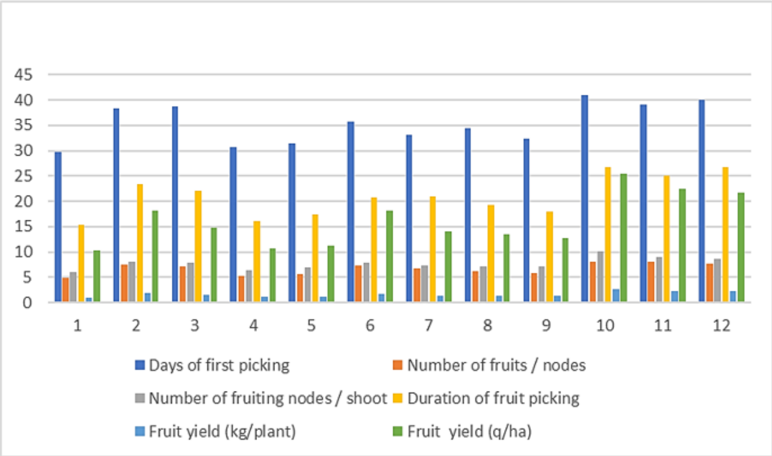
3.3 Physical Characters of Fruits

The study analysed the effects of various organic sources on of phalsa's fruit length maximum (1.26cm), fruit breadth maximum (1.18 cm), was at par with treatment T10 and lowest in T0 (control) and nutrient availability in phalsa with same finding effects of Prasad et al*.* [18] in pomegranate and in guava. It is clear from the table 3 and graph 3 that the application of organic sources increased the efficiency of metabolic processes, encouraging plant growth and increasing fruit size. This could be due to the greater mobility of nutrients to developing fruits, which act as strong metabolic sinks. The beneficial effect of organic sources of nutrient and fertilizers on yield was also reported by Wange et al*.* [19] and Tripathi et al*.* [20] in strawberry. The combination of organic sources was found significant for the weight of 50 phalsa fruits, with the maximum weight of 43.93g recorded with application of 5% jeevamrit. This was followed by the application of 5% jeeva ghanamrit, which was found to be significantly prevalent from different treatments. This result aligns with findings from Ram et al*.* [15] in Phalsa and Bhaviskar et al*.* [17] in Sapota.

The pulp/stone ratio was significantly influenced by organic sources, with the maximum (1.39) pulp stone ratio recorded with application of 5% jeevamrit, was found to be significantly superior. The interaction between different organic sources was found to be significant, possibly due to increased growth regulators in the cell system and the action of growth regulators in the plant system, leading to better yield. The effects were more pronounced when combined with Jeevamrit and FYM, as reported by Gochar et al*.* [8] in phalsa and Audi et al*.* [9] in pomegranate.

Table 2. Yield attributes

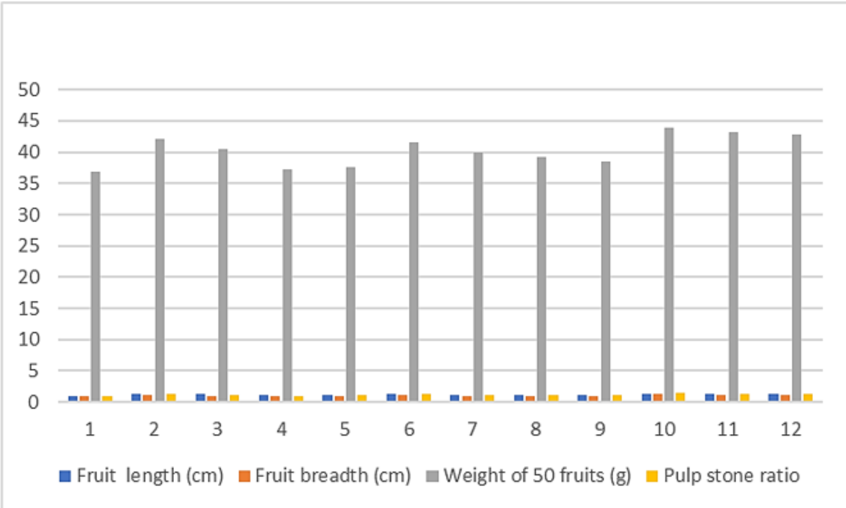
Treatments	Days of first picking	Number of fruits / nodes	Number of fruiting nodes / shoot	Duration of fruit picking (days)	Fruit yield (kg/plant)	Fruit yield (q/ha)
T_0 : Control	29.67	4.93	6.00	15.33	1.02	10.23
T_1 : F.Y.M30 ton/ha.	38.33	7.53	8.03	23.33	1.82	18.16
T_2 : Poultry manure 15 ton/ha.	38.67	7.07	7.77	22.00	1.49	14.86
T_3 : Jeevamrit10%	30.67	5.20	6.33	16.00	1.07	10.67
T_4 : Jeeva ghanamrit 10%	31.33	5.60	7.00	17.33	1.14	11.29
T_5 : F.Y.M.15ton/ha. + 5% jeevamrit	35.67	7.30	7.83	20.67	1.68	18.16
T_6 : Poultry manure 7.5-ton/ha. + 5% jeevamrit	33.00	6.67	7.30	21.00	1.41	14.06
T_7 : F.Y.M. 7.5ton/ha.+ 5% jeeva ghanamrit	34.33	6.20	7.17	19.33	1.35	13.46
T_8 : Poultry manure 7.5-ton/ha.+ 5% jeeva ghanamrit	32.33	5.80	7.07	18.00	1.27	12.72
T_9 : F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit	41.00	8.10	10.07	26.67	2.54	25.36
T_{10} : F.Y.M. 10-ton + 10-ton Poultry manure /ha. + 5% jeeva ghanamrit	39.00	7.97	9.03	25.00	2.25	22.49
T_{11} : F.Y.M. 5 ton + 7.5-ton Poultry manure/ha. + 5% jeevamrit + 5% jeeva ghanamrit	40.00	7.75	8.70	26.67	2.17	21.66
SEm±	**0.85**	**0.10**	**0.26**	**0.75**	**0.11**	**1.13**
CD at 5%	**2.48**	**0.30**	**0.76**	**2.20**	**0.33**	**3.32**



Graph 2. Yield attributes

Table 3. Physical characters of fruits

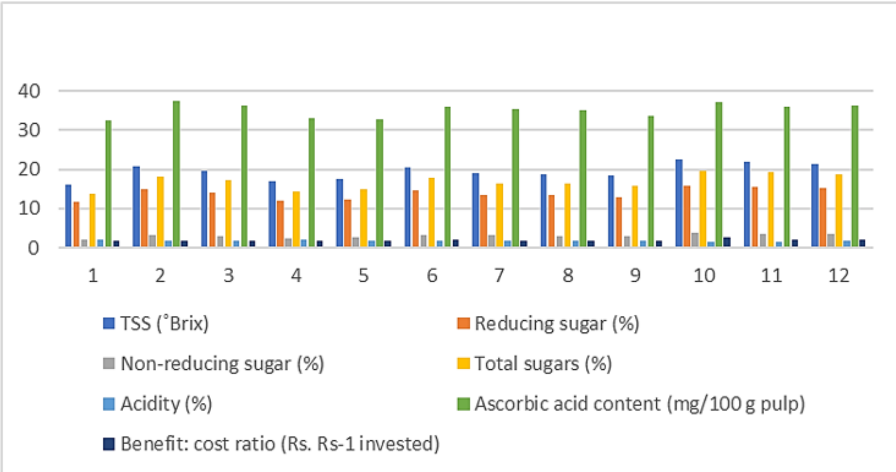
Treatments	Fruit length (cm)	Fruit breadth (cm)	Weight of 50 fruits (g)	Pulp stone ratio
T_0 : Control	0.95	0.84	36.83	0.97
T_1 : F.Y.M30 ton/ha.	1.21	1.08	42.16	1.22
T_2 : Poultry manure 15 ton/ha.	1.18	0.98	40.53	1.16
T_3 : Jeevamrit10%	1.00	0.87	37.16	0.99
T_4 : Jeeva ghanamrit 10%	1.06	0.90	37.66	1.04
T_5 : F.Y.M.15ton/ha. + 5% jeevamrit	1.20	1.07	41.50	1.20
T_6 : Poultry manure 7.5-ton/ha. + 5% jeevamrit	1.17	0.96	40.01	1.12
T_7 : F.Y.M. 7.5ton/ha.+ 5% jeeva ghanamrit	1.12	0.94	39.16	1.09
T_8 : Poultry manure 7.5-ton/ha.+ 5% jeeva ghanamrit	1.08	0.93	38.50	1.06
T_9 : F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit	1.26	1.18	43.93	1.39
T_{10} : F.Y.M. 10-ton + 10-ton Poultry manure /ha. + 5% jeeva ghanamrit	1.25	1.14	43.25	1.30
T_{11} : F.Y.M. 5 ton + 7.5-ton Poultry manure/ha. + 5% jeevamrit + 5% jeeva ghanamrit	1.24	1.11	42.78	1.26
SEm±	**0.01**	**0.01**	**0.40**	**0.02**
CD at 5%	**0.03**	**0.04**	**1.17**	**0.05**



Graph 3. Physical characters of fruits

Table 4. Chemical constituents & economics

Treatments	TSS (˚Brix)	Reducing sugar (%)	Non-reducing sugar (%)	Total sugars (%)	Acidity (%)	Ascorbic acid content (mg/100 g pulp)	Net return (Rs. ha^{-1})	Benefit: cost ratio(Rs. Rs^{-1} invested)
T_0 : Control	16.13	11.61	2.20	13.82	2.04	32.61	191666	1.66
T_1 : F.Y.M30 ton/ha.	20.73	14.96	3.31	18.27	1.72	37.55	354566	1.86
T_2 : Poultry manure 15 ton/ha.	19.60	14.22	3.11	17.33	1.81	36.21	279966	1.69
T_3 : Jeevamrit10%	17.03	12.08	2.35	14.43	1.95	33.02	199866	1.66
T_4 : Jeeva ghanamrit 10%	17.70	12.31	2.56	14.87	1.92	32.77	213066	1.70
T_5 : F.Y.M.15ton/ha. + 5% jeevamrit	20.43	14.71	3.21	17.92	1.77	36.05	367061	2.06
T_6 : Poultry manure 7.5-ton/ha. + 5% jeevamrit	19.17	13.35	3.19	16.55	1.84	35.48	268066	1.74
T_7 : F.Y.M. 7.5ton/ha.+ 5% jeeva ghanamrit	18.77	13.45	2.98	16.43	1.87	35.20	255006	1.71
T_8 : Poultry manure 7.5-ton/ha.+ 5% jeeva ghanamrit	18.37	12.94	2.89	15.83	1.90	33.75	246366	1.82
T_9 : F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit	22.50	15.90	3.73	19.63	1.54	37.18	548551	2.57
T_{10} : F.Y.M. 10-ton + 10-ton Poultry manure /ha. + 5% jeeva ghanamrit	22.00	15.62	3.58	19.20	1.62	36.04	463771	2.19
T_{11} : F.Y.M. 5 ton + 7.5-ton Poultry manure/ha. + 5% jeevamrit + 5% jeeva ghanamrit	21.47	15.25	3.48	18.73	1.68	36.26	445006	2.17
SEm±	**0.29**	**0.22**	**0.14**	**0.21**	**0.17**	**1.69**		
CD at 5%	**0.84**	**0.65**	**0.41**	**0.62**	**NS**	**NS**		



Graph 4. Chemical constituents & economicss

3.4 Chemical Characters and Yield Attributes of Fruits

The application of organic sources combination significantly influences the total soluble solids content of phalsa fruits. The maximum (22.50˚Brix) total soluble solids were recorded with application of (T9), which was found significantly superior over the rest of the treatment. The interaction between different organic sources on total soluble solids was found significant, as adequate dose of nitrogen stimulates the functioning of enzymes in the physiological process, which may have increased the total soluble solid content of the fruits. These results are in conformity with the results obtained by Prasad and Mali [18] in pomegranate and Kashyap et al. [13] in pomegranate. We can tally from the table 4 and graph 4 that the result of reducing sugars content of phalsa fruits revealed that the application of organic sources significantly influenced on non-reducing sugar. The maximum (3.73%) non-reducing sugar was recorded under application of F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit, followed by (T10) F.Y.M. 10-ton + 10-ton Poultry manure /ha. + 5% jeeva ghanamrit (3.58%). The minimum (11.61%) percent reducing sugars were recorded with control. The highest percent reducing sugars was recorded (15.90%) with application of (T9) F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit and followed by (T10) F.Y.M. 10-ton + 10-ton Poultry manure /ha + 5% jeeva ghanamrit (15.62%) with of minimum (11.61%).

This might be due to the application of nitrogen [21] which could be attributed due to the involvement of nitrogen in various energy sources like amino acids and amino sugars and confront with findings of Dutta et al. [22] in Pomegranate with application of organic sources. The maximum (19.63%) total sugars were recorded with application of (T_9), while, the minimum (13.82%) of total sugars were recorded with control.

With the findings of Bhandari et al. [23] in Citrus, FYM increased total sugars due to gradual supply of nutrients and organic manures throughout the growth period which increased the metabolites in improvement in soil moisture availability, soil pH, organic carbon and nutrient status of the soil. Similar findings were also reported by Singh and Varu [24], Dutta et al. [25] and Yadav et al. [26]. The data regarding the percent acidity in fruit revealed that the acidity of phalsa fruit non-significantly influenced with organic sources. A perusal of the data shown in above table caused non-significant reduction in acidity of all the treatments as compared with the control. However, the minimum (1.54%) acidity was noted with the (T9) F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit application, followed by (T10) F.Y.M. 10-ton + 10-ton Poultry manure /ha. + 5% jeeva ghanamrit (1.62%). The highest acidity (2.04%) was recorded in control. The ascorbic acid content of phalsa fruit non-significant with combination of organic sources. The maximum (37.18mg/100g pulp) ascorbic acid was recorded with (T9) F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit application, which was discovered non-significantly over the rest of the treatment and confronted with the findings of Maity et al. [27] and Das et al. [28] in guava, Verma et al. [4] in phalsa.

This result shows non-significant effect of the fruit due to the different combination treatment. The maximum benefit cost ratio (1:2.57) was recorded with (T9) F.Y.M. 20 ton+ 7.5-ton Poultry manure /ha. + 5% jeevamrit application, which was superior over the rest of the treatment. This result shows superior benefit cost ratio due to the different combination treatment. These results are in conformity with the findings of Coppola et al. [29] in hazelnut and Jagadeesh et al. [30] in beet root.

4. CONCLUSION

It is evident from the observation above that foliar application F.Y.M. 20 t + 7.5t poultry /ha. + 5% jeevamrit is the most effective combination to increase vegetative growth, yield and quality parameters, respectively in phalsa fruits. Based on the results obtained it can be recommended for phalsa growers in Eastern Uttar Pradesh.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anonymous. Horticulture data base, National horticulture board, Gurugram Haryana, India. 2022
2. Kumar A, Sarvanan S, Lall D. Impact assessment of organic and inorganic fertilizers on growth, yield and fruit quality of phalsa (*Grewia subinaequalis* L.) International Journal of Current

Microbiology and Applied Sciences. 2019;8.
3. Dudi OP, Singh D, Dahiya SS, Bhatia SK. Impact of various levels of N and FYM on growth parameters of Kinnow mandarin. Haryana Journal of Horticulture science. 2003;32(1-2):29-31.
4. Verma RS, Singh HK, Verma SS. Effect of integrated nutrient management on plant growth, fruit yield and quality of Phalsa (*Grewia subinaequalis* D.C.) Asian J. Hort. 2015;9(1):48-52.
5. Pelakar S. Shoonya bandovalada naisargika krushi pub. Swamy Anand, Agri Prakashna, Banglore; 2006.
6. Vasantkumar HHR. Jeevamrut slurry preparation. Siri Samruddhi. 2006;4-5.
7. Devakumar N, Rao GGE, Shubha S, Imran Khan Nagraj Gowda SB. Activities of organic farming research centre. Navile Shimoga Univ. Agri. Sci. Bangalore Karnataka; 2008.
8. Gochar R, Koli B, Meena S, Gorder M. Response of nutrient management on growth, yield and quality of phalsa (*Grewia asiatica* L.) in Jammu region. Researchgate; 2013. Available:net/publication/331199526.
9. Audi W, Aguyoh JN, Gao-Qiong JNL. Yield and Quality of Watermelon as affected by Organic and Inorganic Nitrogen Sources. Asian Journal of Agriculture and Food Sciences. 2013;1(4).
10. Athani SI, Revanappa. Alloli TB. Influence of organic and inorganic fertilizers on growth, fruit characters, nutrient content and yield in guava. Journal of Eco biology. 2009;25(2):131-137.
11. Dhomane PA. Effect of different sources of nitrogen on growth, yield and quality of guava (*Psidium guajava* L.) cv. Sardar. M.sc. Thesis, MKV, Parbhani; 2011.
12. Hiwale SS, Apparao VV, Dhandhar DG, Bagle BG. Effect of nutrient replenishment through organic fertilizers in citrus. Indian Journal of Horticulture. 2010;67(2):274-276
13. Kashyap P, Pramanick KK, Meena KK, Meena V. Effect of N and P application on yield and quality of Pomegranate cv. Ganesh under rainfed conditions. Indian J. Hort. 2012;69(3):322-327.
14. Godge SS, Parek, NS, Nehte DS. Influence of biofertilizers in combination with chemical fertilizers on growth, yield and quality of guava. International Journal of Agricultural Science. 2013;9(1):309-313.
15. Ram RB, Kuldeep Meena ML, Lata R, Bharti N. Integrated nutrient management studies for some quality character of Phalsa. The Asian Journal of Horticulture. 2012;66(2):163-168.
16. Musmade AM, Jagtap DD, Pujari CV, Hiray SA. Integrated nutrient management in acid lime cv. Sai Sharbati. The Asian Journal of Horticulture. 2010;4(2):305-308.
17. Bhaviskar MN, Bharad SG, Dod VN, Barne V. Effect of integrated nutrient management on yield and quality of sapota. Plant Archive. 2011;11(2):661-63.
18. Prasad RN, Mali PC. Effect of different levels of nitrogen on quality characters of Pomegranate fruit cv. Jalore seedless, Haryana J. Hort. Sci. 2000;29(3-4):186-187.
19. Wange SS, Patil MT, Singh BR. Cultivar × biofertilizers interaction study in strawberry, Resent Hort. 1998;4:43-49.
20. Tripathi VK, Kumar N, Shukla HS, Mishra AN. Influence of *Azotobacter*, *Azospirillum* and PSB on growth, yield and quality of strawberry cv. Chandler, National symposium on Conservation Hort. 2010;198-199.
21. Gerhwal PC, Yadav PK, Sharma BD, Singh RS, Ramniw RS. Effect of organic manure and nitrogen on growth, yield and quality of kinnow mandarin in sandy solid of hot and arid region, African Journal of Agricultural Research. 2014;9(34):2638-2647.
22. Dutta RSK, Takawale SK, Chatterjee R, Hanmate V. Yield and quality of pomegranate as influenced by organic and inorganic nutrients. The Bioscan. 2014;9(2):617-620.
23. Bhandari J, Kanpure RN, Singh OP, Kachouli B, Patidar DK. Effect of organic and inorganic nutrient sources on growth, yield and quality of acid lime (*Citrus aurantifolia* Swingle). International Journal of Chemical Studies. 2018;6(1):1635-1639.
24. Singh JK, Varu DK. Effect of integrated nutrient management in papaya (Carica papaya) cv. Madhubindu. Asian Journal of Horticulture. 2013;8(2):667-670.
25. Dutta P, Kundu S, Chatterjee S. Effect of biofertilizers on homestead fruit production of papaya cv. Ranchi. Acta Horticulture. 2010;851:385-388.
26. Yadav R, Singh HK, Yadav AL. Effect of INM on plant growth and soil properties of Aonla orchard under sodic soil condition. Plant Archives. 2007;7(2):859-861.

27. Maity PK, Das BC, Kundu S. Effect of different sources of nutrients on yield and quality of guava. Journal of crop and weed. 2006;2(2):17-19.
28. Das K, Roy D, Sengupta D, Datta P. Organic fruit production of guava cv. L-49 in Gangetic alluvial plain of west Bengal. The bioscan. 2015;10(3):1371-1374
29. Coppola G, Costantini M, Orsi L, Facchinetti D, Santoro F, Pessina D, Bacenetti J. A Comparative Cost-Benefit Analysis of Conventional and Organic Hazelnuts Production Systems in Center Italy. Agriculture. 2020;10:409.
30. Jagadeesh C, Madhavi M, Prasad MS, Padmaja VV. Effect of Organic Manures on Benefit Cost Ratio of Beet Root Cv. Crimson Globe, International Journal of Current Microbiology and Applied Sciences. 2018;7. ISSN: 2319-7706.

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