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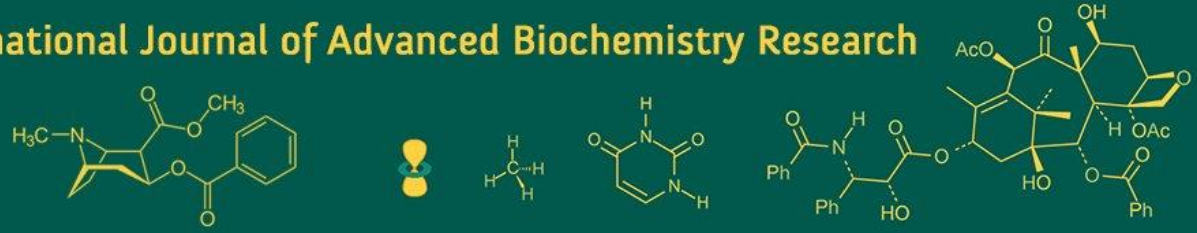

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HA Prajapati
Department of Fruit Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

RV Tank
Department of Fruit Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

AB Parmar
Polytechnic in Agriculture, Junagadh Agricultural University, Halwad, Gujarat, India

VK Parmar
Department of Horticulture, College of Agriculture, Navsari Agricultural University, Bharuch, Gujarat, India

Dixita Prajapati
Department of Fruit Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

Corresponding Author:
HA Prajapati
Department of Fruit Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India

Effect of organics on growth of strawberry (*Fragaria* × *ananassa*) var. Winter Dawn

HA Prajapati, RV Tank, AB Parmar, VK Parmar and Dixita Prajapati

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Abstract
The experiment was carried out at *Rajendrapur* farm, Krishi Vigyan Kendra, Navsari Agricultural University, Waghai (Dang), Gujarat during the years 2022-23 and 2023-24. The experiment was laid out in Randomized Complete Block Design with ten treatments *viz.*, T_1: 100% RDN through FYM, T_2: 100% RDN through vermicompost, T_3: 50% RDN through FYM + 50% RDN through vermicompost, T_4: 50% RDN through FYM + 50% RDN through vermicompost + *jeevamrut* foliar spray 5%, T_5: 50% RDN through FYM + 50% RDN through vermicompost + *jeevamrut* soil application 500 l ha^{-1}, T_6: 50% RDN through FYM + 50% RDN through vermicompost + *jeevamrut* foliar spray 5% + *jeevamrut* soil application 500 l ha^{-1}, T_7: 50% RDN through FYM + 50% RDN through vermicompost + *G. amrut* extract foliar spray 5%, T_8: 50% RDN through FYM + 50% RDN through vermicompost + *G. amrut* extract spray 5% + *G. amrut* extract soil application 500 l ha^{-1}, T_9: 50% RDN through FYM + 50% RDN through vermicompost + Novel Organic Liquid Nutrient (NOLN) spray 1% and T_{10}: control with three replications. The results of experiment revealed that the maximum growth parameters *viz.* leaf area (27.05, 28.49 and 27.77 cm^2), number of leaves (43.30, 44.10 and 43.70 $plant^{-1}$), number of crowns (4.47, 4.60 and 4.53 $plant^{-1}$), plant spread E-W (28.99, 28.85 and 28.92 cm) and N-S (27.84, 27.92 and 27.88 cm) were obtained due to the application of 50% RDN through FYM + 50% RDN through vermicompost + *jeevamrut* foliar spray 5% + *jeevamrut* soil application 500 l ha^{-1} (T_6) during the year *i.e.* 2022-23, 2023-24 and pooled analysis, respectively.

Keywords: FYM, vermicompost, *Jeevamrut*, *G. amrut* extract, DAP, RDN

Introduction
The modern cultivated strawberry, scientifically known as *Fragaria* × *ananassa* Duchesne, is the result of a natural hybridization between two wild strawberry species: *Fragaria chiloensis* and *Fragaria virginiana*. In India, strawberry cultivation has expanded in recent years with several states emerging as important production regions. The total area under strawberry cultivation in India is approximately 2420 hectares resulting in an annual production of about 18870 MT with 7.79 MT ha^{-1} productivity (Anon., 2025) [1, 2]. The major strawberry producing states include Maharashtra, Haryana, Jharkhand, Mizoram, Jammu & Kashmir, Meghalaya, Madhya Pradesh and Tamil Nadu. Among these, Maharashtra (particularly the Mahabaleshwar region) is well-known for its commercial strawberry farming and large contribution to domestic production. In Gujarat, strawberry is cultivated in 29.0 hectare area with production of 202.0 MT and 6.97 MT ha^{-1} productivity (Anon., 2025) [1, 2]. Dang district having maximum area of strawberry in Gujarat, with 28.0 hectare area, 196.0 MT production and 7.0 MT ha^{-1} productivity (Anon., 2025) [1, 2]. Organic farming is an alternative agricultural approach that prioritizes sustainable practices, soil health, environmental conservation and human well-being. This system intentionally minimizes or eliminates the use of synthetic chemical inputs such as artificial fertilizers, pesticides, herbicides and growth regulators. Organic farming emphasizes on utilization of compost, farmyard manure, green manures, biofertilizers and other organic amendments to maintain soil fertility and plant health. It offers solutions to many environmental and sustainability challenges associated with conventional agriculture. Organic farming practices reduce energy consumption and lower carbon dioxide (CO_2) emissions, contributing to the mitigation of climate change impacts (Reganold *et al.*, 2001 and Stockdale *et al.*, 2001) [11, 15]. Farmyard manure contributes to lowering bulk density, making the soil less compact and easier for plant roots to penetrate (Chahal *et al.*, 2020) [3].

Vermicompost is effective organic fertilizers surpassing traditional composts in both nutrient content and biological activity. *Jeevamrut* is a microbial formulation made from cow dung and cow urine, commonly used in organic farming to enhance crop nutrition. Novel Organic Liquid Nutrients is rich in a wide range of essential macro and micronutrients required for healthy plant growth and development. The *Gliricidia* extract includes a significant number of flavonoids, tannins, alkaloids and saponins which acts as a primary contributor to the antimicrobial effects (Pradeep *et al.*, 2025) [10]. It was therefore felt necessary to evaluate the suitable organic and liquid organic manure for obtaining better growth of strawberry var. Winter Dawn.

Materials and Methods

The field experiment was carried out at *Rajendrapur* farm, Krishi Vigyan Kendra, Navsari Agricultural University, Waghai (Dang) during the years 2022-23 and 2023-24. The experiment was laid out in Randomized Complete Block Design with ten different treatments *viz.*, T_1:100% RDN through FYM, T_2:100% RDN through vermicompost, T_3: 50% RDN through FYM + 50% RDN through vermicompost, T_4: 50% RDN through FYM + 50% RDN through vermicompost + *jeevamrut* foliar spray 5%, T_5: 50% RDN through FYM + 50% RDN through vermicompost + *jeevamrut* soil application 500 l ha^{-1}, T_6:50% RDN through FYM + 50% RDN through vermicompost + *jeevamrut* foliar spray 5% + *jeevamrut* soil application 500 l ha^{-1}, T_7: 50% RDN through FYM + 50% RDN through vermicompost + *G. amrut* extract foliar spray 5%, T_8: 50% RDN through FYM + 50% RDN through vermicompost + *G. amrut* extract spray 5% + *G. amrut* extract soil application 500 l ha^{-1}, T_9: 50% RDN through FYM + 50% RDN through vermicompost + Novel Organic Liquid Nutrient (NOLN) spray 1% and T_{10}: control with three replications. FYM and vermicompost were applied at the time of soil preparation on the basis of RDN. Foliar spray of *jeevamrut, Gliricidea amrut* and Novel Organic Liquid Nutrient was done at 30, 60 and 90 DAP and soil application of *jeevamrut* and *Gliricidea amrut* was done at 20, 50 and 80 DAP. Organic munures like FYM and vermicompost were applied at the time of bed preparation on the basis of RDN (120 kg ha^{-1}). Beds of 3.6 m × 1.8 m size was prepared and drip irrigation systems were installed according to the layout of the experiment. Silver black plastic mulch was spread manually on the beds and fixed tightly into the soil. Holes of 10 cm diameter were made at 60 cm × 30 cm spacing by using a plastic pipe and the drip system was laid below the polythylene films. For the preparation of *jeevamrut*, 10 kg fresh cow dung and 10 liters of cow urine were added in 50 l of water in the barrel. This mixture was properly mixed by using wooden stick and then, 2 kg jaggery, 2 kg pulse flour and 50 g *sajiv soil* was added to this solution and again stirred properly for preparing proper mixture and final volume made up to 200 l of water. This solution was kept for 5 to 7 days for the fermentation. The solution was stirred twice in a day at regular interval in a clockwise direction *i.e.* in morning and evening. For the preparation of *Gliricidia* based formulation, 10 kg chopped *Gliricidia* leaves and 10 litres of cow urine was properly mixed using the wooden stick and volume made up to 200 l of water in the barrel. This solution was kept for 45 days for the fermentation. Neem oil 1000 ppm was sprayed five times to prevent incidence of insect-pest. Strawberry fruits were harvested carefully at commercial maturity stage (> 75% of the fruit surface turned to red colour) by hand picking in the early morning at an interval of 3 to 4 days during the harvesting period. Leaf area was measured with the help of leaf area meter at 100 DAP. Number of leaves and crowns per plant was measured at 100 DAP. The plant spread was measured at 100 DAP in two directions (E-W and N-S) at right angles to each other. The experimental data collected on growth parameters were statistically analyzed as per the guidelines suggested by Panse and Sukhatme (1985) [8].

Results and Discussion

Growth parameters

A perusal of data presented in Fig. 1, 2 and Table 1 revealed that various organic sources had significant impact on leaf area, number of leaves per plant, number of crowns per plant and plant spread (E-W and N-S). The result indicated that the application of 50% RDN through FYM + 50% RDN through vermicompost + *jeevamrut* foliar spray 5% + *jeevamrut* soil application 500 l ha^{-1} (T_6) recorded maximum leaf area (27.05, 28.49 and 27.77 cm^2), number of leaves (43.30, 44.10 and 43.70 $plant^{-1}$), number of crowns (4.47, 4.60 and 4.53 $plant^{-1}$), plant spread E-W (28.99, 28.85 and 28.92 cm) and N-S (27.84, 27.92 and 27.88 cm) for both the year *i.e.* 2022-23, 2023-24 and pooled analysis, respectively. While minimum leaf area (16.77, 17.54 and 17.15 cm^2), number of leaves (32.67, 33.10 and 32.89 $plant^{-1}$), number of crown (3.20, 3.28 and 3.24 $plant^{-1}$), plant spread E-W (21.50, 21.82 and 21.66 cm) and N-S (19.34, 17.99 and 18.67 cm) were observed in control treatment.

The increase in leaf area in strawberry might be due to the application of farmyard manure (FYM) which plays important role in leaf area improvement by supplying essential nutrients, improving soil physical conditions, strengthening the source-sink relationship and converting unavailable forms of nitrogen, bound phosphates, micronutrients and decomposed plant residues into plant available forms. Application of vermicompost may be attributed to improvements in the physicochemical properties of soil, enhanced enzymatic activity, stimulation of microbial diversity and activity which collectively promote the production of plant growth hormones. Incorporation of vermicompost improved bulk density, less compaction and a larger surface area for nutrient adsorption and retention which helpful for the long term nutrient availability. The presence of soluble salts and growth promoting substances like as NAA, cytokinins and gibberellins in vermicompost promotes leaf expansion. The application of *jeevamrut* also boosts soil microbial populations, growth promoting hormones, soil biomass, nutrient availability and absorption of both inherent and supplied nutrients. The results of Hasan (2013) [6], Tudu (2013) [17], Sarkar and Ibotui (2017) [13], Sahana *et al.* (2020) [12] and Chauhan *et al.* (2023) [4] in strawberry are supported to the findings of present investigation. The number of leaves in strawberry was increased in this study could be due to the application of vermicompost and other organics which may enhance microbial population in the rhizosphere and microbial activity stimulates the creation of plant growth regulators such as indole-3-acetic acid (IAA), gibberellic acid (GA) and cytokinins which directly impacting leaf growth and leaf output. Farmyard manure encouraged the vegetative growth of leaves which stimulate

photosynthetic activity and glucose synthesis. The enhanced carbohydrate reserves promoted the production of amino acids, nucleoproteins, chlorophyll, alkaloids and amides which are essential for tissue development, various metabolic processes and eventually favoured vegetative growth. These findings are in agreement with the result of Gupta and Tripathi (2012) [5], Tripathi *et al.* (2014) [16], Pradeep and Saravanan (2018) [9] and Kumar *et al.* (2022) in strawberry. The number of crowns per plant was increased in present investigation might be due to the application of organics which improved plant height and leaf output which permitted greater accumulation of photosynthates and hence increased crown formation. Organic treatments improved the soil physico-chemical properties, enzymatic activity and stimulation of beneficial microbial populations which lead to better nutrient cycling and availability which encourage more number of crowns in plant. Vermicompost may also enhance the production of plant growth hormones therefore boosting vegetative development and leading to an increase in the number of crowns per plant. These results are in conformity with the finding of Gupta and Tripathi (2012) [5], Tripathi *et al.* (2014) [16] and Sahana *et al.* (2020) [12] in strawberry. Increase in plant spread might be due to uses of organic sources may enhanced available soil nitrogen which is primary ingredient of proteins required for protoplasm creation, promotes cell division and enlargement. *Jeevamrut* have a broad microbial load and growth promoting compounds in addition to vital nutrients which collectively boost plant spread. Organic sources may be associated with nitrogen's critical function in amino acid digestion. These amino acids are successively integrated into proteins and nucleic acids therefore boosting photosynthetic efficiency resulting in larger plant spread. The results also got the support with the findings of Sarkar and Ibotui (2017) [13], Soni *et al.* (2018) [14], Sahana *et al.*, (2020) [12] and Kumar *et al.*, (2022) [7] in strawberry.

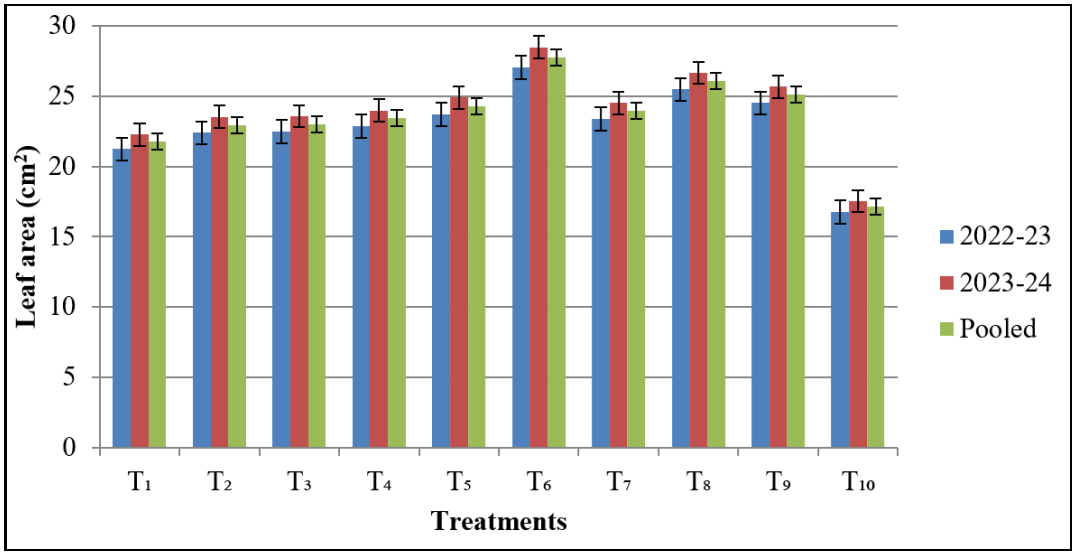

Fig 1: Effect of different organics on leaf area of strawberry

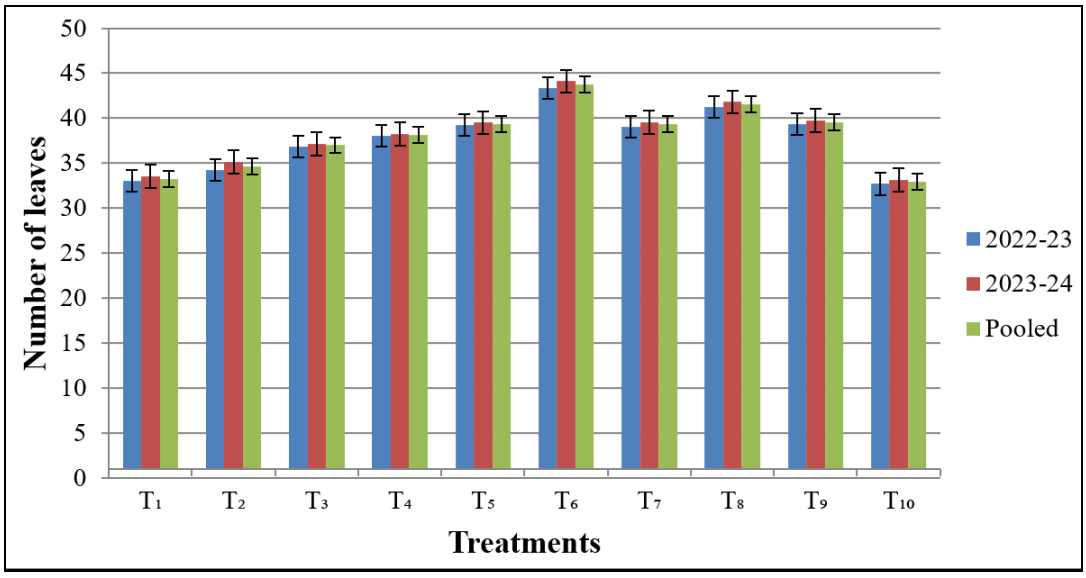

Fig 2: Effect of different organics on number of leaves of strawberry

Table 1: Effect of different organics on number of crowns and plant spread of strawberry

Treatments	Number of crowns plant^{-1}			Plant spread E-W (cm)			Plant spread N-S (cm)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
T_1	3.47	3.54	3.50	22.99	23.05	23.02	21.20	21.31	21.26
T_2	3.47	3.55	3.51	23.21	23.54	23.37	22.44	22.56	22.50
T_3	3.54	3.61	3.57	24.23	24.52	24.37	23.36	23.58	23.47
T_4	3.67	3.77	3.72	25.80	25.90	25.85	24.72	24.81	24.77
T_5	3.93	4.03	3.98	26.00	26.32	26.16	25.05	25.33	25.19
T_6	4.47	4.60	4.53	28.99	28.85	28.92	27.84	27.92	27.88
T_7	3.8	3.89	3.85	25.99	26.12	26.05	24.62	24.97	24.79
T_8	4.05	4.15	4.10	27.10	27.34	27.22	26.10	26.22	26.16
T_9	4.00	4.09	4.05	26.34	26.32	26.33	25.12	25.55	25.34
T_{10}	3.20	3.28	3.24	21.50	21.82	21.66	19.34	17.99	18.67
Mean	3.76	3.85	-	25.22	25.38	-	23.98	24.03	-
S Em ± (T)	0.13	0.13	0.09	0.89	0.85	0.62	0.84	0.79	0.59
CD @ 5% (T)	0.39	0.38	0.27	2.64	2.51	1.79	2.50	2.35	1.69
S Em ± (Y)	-	-	0.04	-	-	0.28	-	-	0.26
S Em ± (Y x T)	-	-	0.13	-	-	0.88	-	-	0.83
CD @ 5% (Y x T)	-	-	NS	-	-	NS	-	-	NS
CV (%)	6.07	5.78	6.02	6.10	5.77	6.02	6.09	5.71	5.99

Conclusion

According to the experimental results, it can be concluded that 50% RDN through FYM + 50% RDN through vermicompost + *jeevamrut* foliar spray 5% + *jeevamrut* soil application 500 l ha^{-1} was found to be most effective for improving growth parameters of strawberry.

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