



Evaluation of Liquid Organic Manures on Growth, Yield and Quality in Oriental Pickling Melon under Organic Farming in Kerala

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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

A field experiment was conducted to evaluate the liquid formulations for production of organic oriental pickling melon (*Cucumis melo* var. *conomon* L.) was carried out at College of Horticulture, Kerala Agricultural University, Vellanikkara, Thrissur during 2013- 2014. Among the liquid formulations, weekly foliar application of Jeevamrutham (100%) and Panchagavyam (3 %) recorded the highest growth and yield attributes such as germination percentage (81.67 % and 85 %) length of vine (110.83 and 110.00 cm), number of leaves (37.00 and 36.00), dry matter production (96.40 and 87.00 g/plant), number of fruits per plant (3.83 and 3.73), volume of the fruits (770 and 751.66 cm³), weight of fruits (2.5 and 2.43 kg/plant), and yield (30.33 and 29.50 t/ha). While, lowest growth and yield attributes recorded in POP (POP recommendations of KAU) and Cow urine. Among the liquid formulations, the NPK content was more in the liquid extract of composite organic manures and fish amino acid. The highest fungal and bacterial count was recorded in Panchagavyam treated plots. Jeevamrutham treatment reported the highest B: C ratio of 2.09 followed by Green leaf extracts (2.02).

Keywords: Fish amino acid; *Cucumis melo*; liquid formulation; panchagavyam and jeevamrutham.

1. INTRODUCTION

Organic farming is gaining importance in recent years due to realization of inherent advantages it confers in sustainable crop production and also in maintaining dynamic soil nutrient status and safe environment. Continuous usage of chemical fertilizers has hardened the soil, reduced fertility, polluted air and water and released harmful gases, thus bringing threat to soil, plant and ultimately human health. Usage of organic manures can satisfy the food and nutrition needs of the society and will pave the way for sustainable production. Among the manures, organic liquid manures are promising and they are twenty per cent more effective than others. Usage of traditional liquid organic manures such as Jeevamrutham, Panchagavyam, Fish amino acid, Green leaf extract, Vermiwash, Cow urine is considered as viable means for enhancing crop growth and production. Liquid formulations add much needed organic and mineral matter to the soil and play an important role in the buildup of soil organic matter, beneficial microbes and enzymes besides improving physical and chemical properties of soil.

Among the different vegetables cultivated in Kerala, oriental pickling melon (*Cucumis melo var. conomon* L.) gained its own place because of its nutritional value and benefits. Considering the challenges and importance of vegetable production without compromising environmental safety, we are at the border to adopt organic manner of cultivation. Finding new perspectives for reducing chemical inputs in agriculture and their residues in food has become one of the major thrust areas of research. Research studies on effect of liquid formulations in organic farming system were rare in availability. Hence, the present investigation was taken up to evaluation of the effect of organic liquid formulations on growth and yield attributes of oriental pickling melon.

2. MATERIALS AND METHODS

The experiment was carried in the Agronomy Farm of College of Horticulture, Vellanikkara in Thrissur district during December, 2013 to March, 2014. Soubhagya variety was selected because high yielding and most grown variety in the Thrissur. Fruits are small to medium in size, golden yellow color with short duration. Experimental treatments are in 11 numbers in Randomized block design (RCBD) with 4 m X 3 m plot measurements.

All the crops were grown as per the Package of Practices of Kerala Adhoc Agricultural University for organic farming: Crops (KAU 2009). Liquid organic manures were listed as Jeevamrutham, Panchagavyam, Fish amino acid, Green leaf extract were sprayed sequentially at fifteen days interval after sowing. Experimental observations were recorded and then subjected to the statistical analysis. Data pertaining to different characters were subjected to statistical analysis using the MSTAT-C package [1]. The score of organoleptic evaluation was analyzed by Kendall's test. F - Test is followed in ANOVA for testing the significance of treatments. Critical difference was calculated for the treatments that were found significant.

3. RESULTS AND DISCUSSION

3.1 An Evaluation of Liquid Organic Manures on Growth and Yield of Oriental Pickling Melon during Rabi, 2013-14

The physiological characteristics (growth, yield, quality attributes and economics), chemical and biological properties of oriental pickling melon results were postulated in Table 1 and Table 2. The graphical data of yield and oriental pickling melon was depicted in Fig. 1 and Fig. 2.

The Panchagavyam + *Pseudomonas* (all the treatments except POP) enhanced the growth (germination and seedling vigour) due to the presence of hormones, enzymes and other growth promoters and same results were supported by Natarajan [2]. The T₃ (Fish amino acid) had the maximum vine length (114.16cm), whereas T₉ (POP) recorded the minimum vein length of all stages of the growth. In the T₅ (Green leaf extract) and T₃ (Fish amino acid) recorded the highest number of leaves (37.66) while treatment T₈ (Control without water spray) recorded a 29.33 number of leaves during crop period. 29.33. These results agreed with the findings of Mohanalakshmi and Vadivel [3].

The treatments T₃ fish amino acid and T₁ Jeevamrutham were noticed an early flowering 22.66 days but late flowering was noticed in T₉ (POP) 31 days. These results were tallied with the observations of Abhilash [4] in red amaranthus and Palekar [5] in okra, tomato and brinjal. Treatment T₅ (Green leaf extract) recorded the highest crop duration i.e., 80 days and the lowest was noticed T₉ (POP) with 63.33 days were supported with results of Mali et al.(2005) and Prabhakaran [6].

Table 1. Growth, yield, quality attributes and economics of oriental pickling melon under liquid organic farming during Rabi, 2013-14

| Treatments | % of Germination | Length of vine (cm) | Number of leaves at 45 Days | Dry matter Production (g/plant) | Crop Duration (days) | Shelf life of the fruit (days) | Organoleptic overall qualities of fruit | No of fruits per plant | Yield (t/ ha) | Total cost of cultivation (Rs) | Gross return (Rs) | Net return (Rs) | B: C ratio |
|--|------------------|----------------------|-----------------------------|---------------------------------|-----------------------|--------------------------------|---|------------------------|---------------------|--------------------------------|-------------------|-----------------|------------|
| T1- Jeevamrutham | 81.67 | 110.83 ^{ab} | 37.33 ^{ab} | 96.4 ^a | 75.66 ^{abc} | 18.33 ^b | 7.5 | 3.83 ^a | 30.33 ^a | 3,62,500 | 7,58,250 | 3,95,750 | 2.09 |
| T2- Panchagavyam | 85 | 110.00 ^{ab} | 36.00 ^{abc} | 87.2 ^{bc} | 74.00 ^{bc} | 19.33 ^a | 7.5 | 3.73 ^a | 29.50 ^a | 3,79,166 | 7,37,500 | 3,58,334 | 1.94 |
| T3 - Fish amino acid | 88.33 | 114.16 ^a | 37.66 ^a | 84.7 ^{cd} | 76.33 ^{ab} | 19.66 ^a | 8.25 | 3.39 ^a | 27.13 ^a | 3,51,388 | 6,78,250 | 3,26,862 | 1.93 |
| T4 - Cow urine | 83.33 | 89.53 ^c | 31.66 ^d | 80.06 ^{de} | 68.00 ^{de} | 17.66 ^{bc} | 6.42 | 2.93 ^b | 23.00 ^b | 3,44,444 | 5,75,000 | 2,30,556 | 1.66 |
| T5- Green leaf extract | 85 | 106.25 ^{ab} | 37.66 ^a | 90.13 ^b | 80.00 ^a | 19.33 ^a | 7.42 | 3.47 ^a | 27.5 ^a | 3,40,277 | 6,87,500 | 3,47,223 | 2.02 |
| T6 - (T2 + T3 + T5) | 83.33 | 105.83 ^b | 35.33 ^{bc} | 80.16 ^{de} | 74.66 ^{bc} | 18.33 ^b | 6.75 | 2.88 ^b | 22.83 ^b | 3,55,555 | 5,70,750 | 2,15,195 | 1.6 |
| T7- Control (with water spray) | 81.67 | 90.83 ^c | 31.66 ^d | 71.73 ^f | 68.00 ^{de} | 17.66 ^{bc} | 5.33 | 2.29 ^c | 18.33 ^c | 3,37,500 | 4,58,250 | 1,20,750 | 1.35 |
| T8 - Control (without water spray) | 86.67 | 84.08 ^{cd} | 29.33 ^e | 67.73 ^f | 67.00 ^{de} | 17.00 ^c | 5.5 | 2.24 ^c | 17.83 ^c | 3,37,500 | 4,45,750 | 1,08,250 | 1.32 |
| T9 - POP (POP recommendations of KAU) | 80.5 | 90.33 ^d | 30.66 ^e | 60.33 ^f | 66.33 ^e | 10.66 ^d | 3.5 | 2.66 ^{bc} | 20.50 ^{bc} | 2,88,888 | 5,12,500 | 2,23,612 | 1.77 |
| T10- Liquid extract of composite organic manures | 85 | 107.91 ^{ab} | 35.33 ^{bc} | 83.80 ^{cd} | 77.66 ^{ab} | 18.33 ^b | 6.25 | 3.62 ^a | 28.66 ^a | 4,25,000 | 7,16,500 | 2,91,500 | 1.68 |
| T11 - Commercial formulation (Biozyme) | 81.67 | 106.6 ^{ab} | 34.00 ^c | 78.16 ^e | 71.33 ^{cd} | 15.33 ^c | 6.92 | 2.68 ^{bc} | 21.66 ^{bc} | 4,04,166 | 5,41,500 | 1,37,334 | 1.33 |
| CD (0.05) | NS | 7.12 | 2.11 | 5.26 | 4.79 | 1.27 | 0.81 | 0.45 | 3.56 | | | | |

Table 2. Physiological and chemical properties, microbial population in soil of oriental pickling melon under liquid organic manures formulations during rabi, 2013-14

| Treatments | Chlorophyll a (mg/g) | Chlorophyll b (mg/g) | Total Chlorophyll (mg/g) | Organic carbon (%) | Nitrogen (kg/ha) | Phosphorous (kg/ha) | Potassium (kg/ha) | pH | EC (dS m ⁻¹) | Bacterial count (X 10 ⁶ cfu /g) | Fungal count (X 10 ⁴ cfu /g) | Actinomycetes count (X 10 ⁵ cfu /g) |
|--|----------------------|----------------------|--------------------------|---------------------|---------------------|----------------------|-----------------------|---------------------|--------------------------|---|--|---|
| T1- Jeevamrutham | 1.15 ^b | 0.45 ^a | 1.60a | 1.56 ^{ab} | 489.0 ^a | 24.3 ^{abc} | 305.76 ^a | 5.97 ^{abc} | 0.03 ^e | 70.66 ^a | 45.00 ^{cd} | 38.66 ^a |
| T2- Panchagavyam | 1.27 ^a | 0.28 ^b | 1.56ab | 1.35 ^{cde} | 460.2 ^{bc} | 22.94 ^{cd} | 302.02 ^{abc} | 5.85 ^{abc} | 0.02 ^g | 69.00 ^a | 51.66 ^{ab} | 30.66 ^{bc} |
| T3 - Fish amino acid | 1.17 ^b | 0.27 ^b | 1.45abc | 1.45 ^{bc} | 447.7 ^{cd} | 23.38 ^{bcd} | 293.06 ^{cd} | 6.21 ^a | 0.02 ^{fg} | 62.00 ^{bc} | 49.00 ^{bc} | 32.33 ^{abc} |
| T4 - Cow urine | 1.04 ^d | 0.29 ^b | 1.30c | 1.26 ^e | 426.3 ^e | 20.97 ^e | 281.8 ^{de} | 5.39 ^{de} | 0.04 ^d | 39.66 ^{cd} | 35.33 ^{cde} | 24.00 ^{cde} |
| T5- Green leaf extract | 1.32 ^a | 0.29 ^b | 1.62a | 1.58 ^a | 472.7 ^{ab} | 24.99 ^{ab} | 309.49 ^a | 5.81 ^{bc} | 0.03 ^{ef} | 65.00 ^{ab} | 51.66 ^{ab} | 38.66 ^a |
| T6 - (T2 + T3 + T5) | 1.03 ^d | 0.26 ^b | 1.29c | 1.41 ^c | 447.8 ^{cd} | 22.94 ^{cd} | 285.97 ^{de} | 5.75 ^{bcd} | 0.03 ^e | 50.33 ^{de} | 55.00 ^{ab} | 29.33 ^{bcd} |
| T7- Control (with water spray) | 1.18 ^b | 0.29 ^b | 1.47abc | 1.45 ^{bc} | 434.7 ^{de} | 22.36 ^{de} | 285.6 ^{de} | 5.25 ^{cd} | 0.04 ^c | 44.66 ^{ef} | 37.66 ^{ef} | 22.00 ^{de} |
| T8 - Control (without water spray) | 0.97 ^e | 0.34 ^{ab} | 1.32c | 1.43 ^c | 429.0 ^f | 20.75 ^e | 278.13 ^e | 5.65 ^{cd} | 0.056 ^a | 41.00 ^f | 40.00 ^{def} | 21.00 ^e |
| T9 - POP (POP recommendations of KAU) | 0.77 ^f | 0.27 ^b | 1.04d | 1.23 ^f | 389.9g | 18.19f | 251.62 ^f | 5.06 ^e | 0.05 ^{ab} | 27.33 ^g | 18.66 ^g | 13.00 ^f |
| T10- Liquid extract of composite organic manures | 1.21 ^b | 0.37 ^{ab} | 1.58a | 1.38 ^{cd} | 447.3 ^{cd} | 25.42 ^a | 302.77 ^{abc} | 5.74 ^{bcd} | 0.05 ^{bc} | 70.00 ^a | 57.00 ^a | 35.00 ^{ab} |
| T11 - Commercial formulation (Biozyme) | 1.10 ^c | 0.29 ^b | 1.39bc | 1.28 ^{de} | 435.0 ^{de} | 22.58 ^{cde} | 293.81 ^{bcd} | 5.65 ^{cd} | 0.04 ^{cd} | 48.00 ^e | 36.66 ^f | 29.33 ^{bcd} |
| CD (0.05) | 0.053 | 0.12 | 0.17 | 0.11 | 16.4 | 1.87 | 12.27 | 0.36 | 0.05 | 5.83 | 6.063 | 8.32 |
| Initial value | | | | 1.22 | 313.5 | 15.17 | | 5.03 | 0.07 | 16 | 10 | 8 |

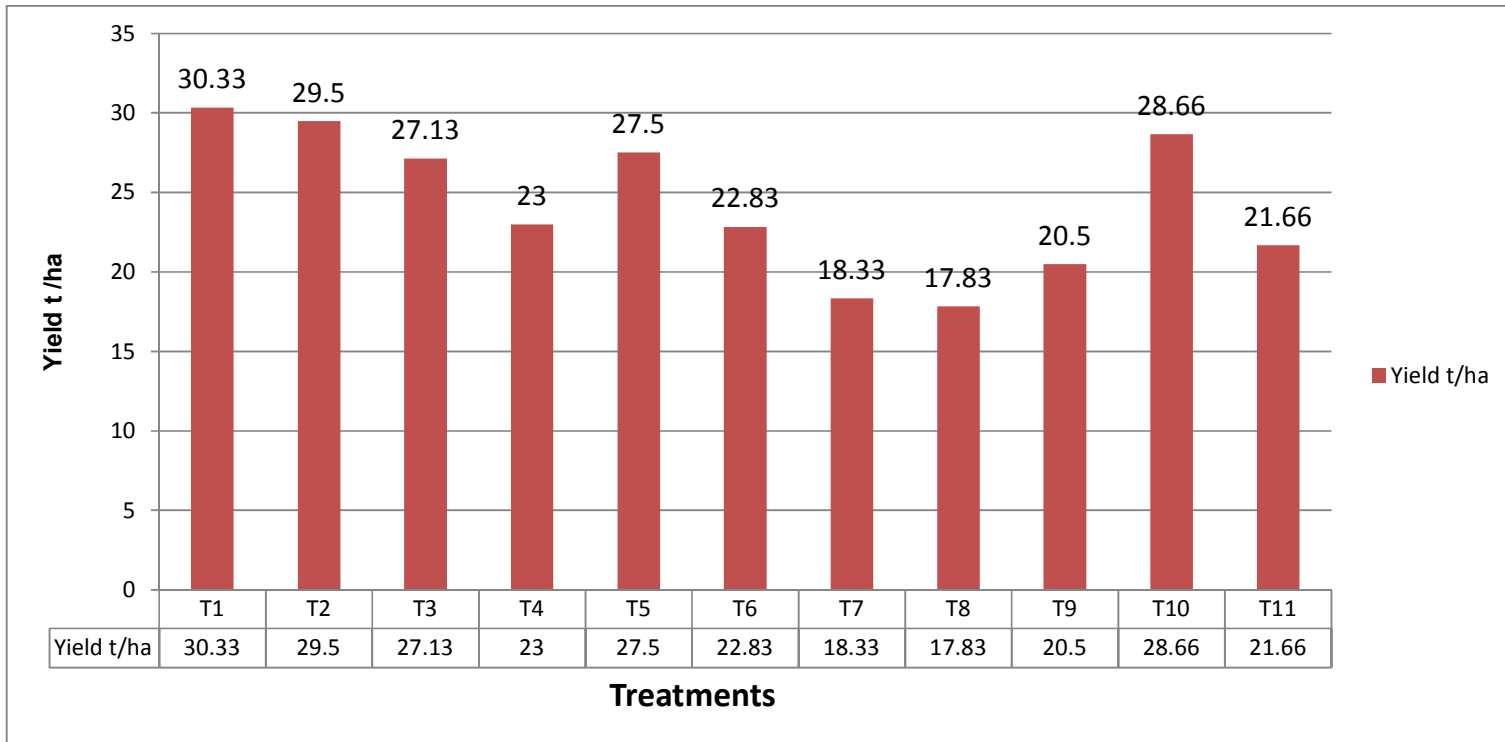


Fig. 1. Yield as influenced by treatments

T₁ Jeevamrutham; T₂ Panchagavyam; T₃ Fish amino acid; T₄ Cow urine; T₅ Green leaves extract; T₆ (T₂ + T₃ + T₅); T₇ Control (with water spray); T₈ Control (without water spray); T₉ POP; T₁₀ Liquid extract of composite organic manure; T₁₁ Commercial formulation (Biozyme)

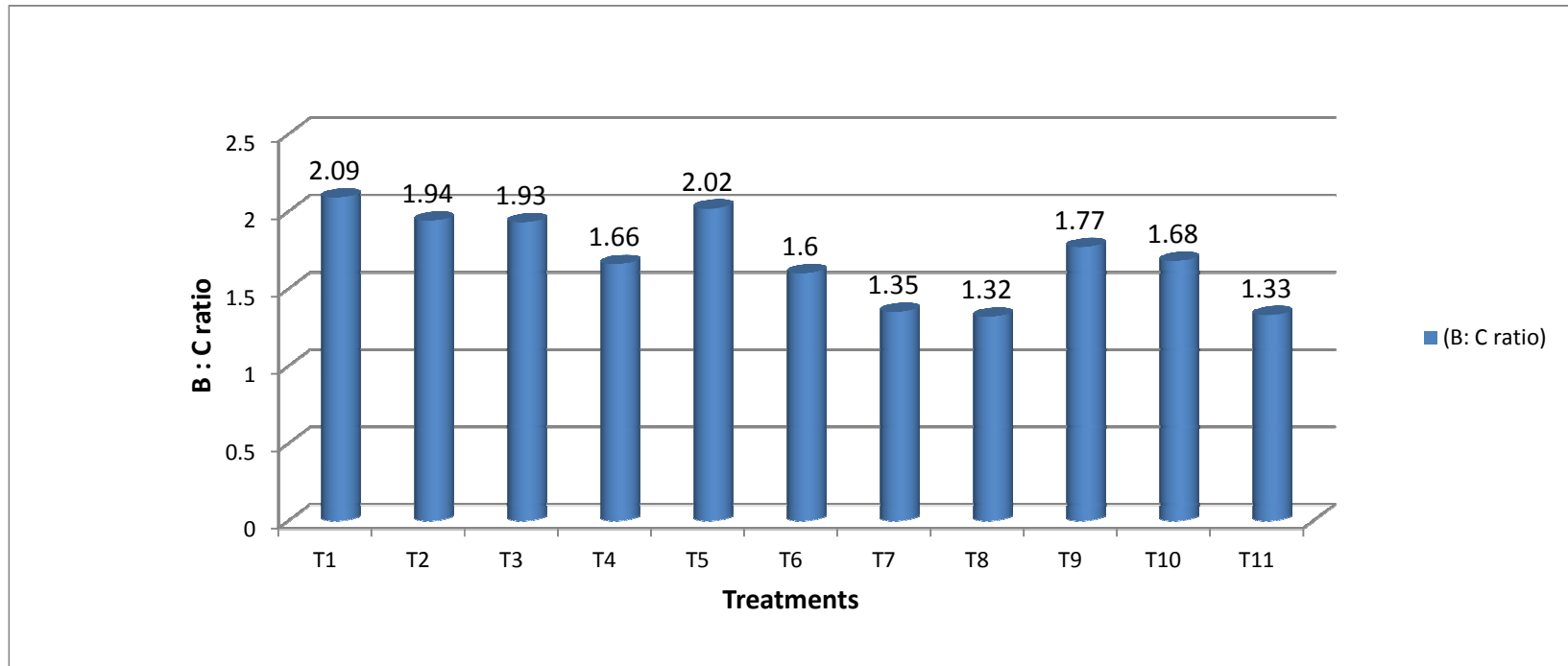


Fig. 2. B:C ratio as influenced by the treatments

T₁ Jeevamrutham; T₂ Panchagavyam; T₃ Fish amino acid; T₄ Cow urine; T₅ Green leaves extract; T₆ (T₂ + T₃ + T₅); T₇ Control (with water spray); T₈ Control (without water spray); T₉ POP; T₁₀ Liquid extract of composite organic manure; T₁₁ Commercial formulation (Biozyme)

Among the treatments, T₁ (Jeevamrutham) recorded the highest dry matter production of 96.4 grams per plant and lowest recorded by T₉ (POP) with 60.33 grams per plant. Similar results were obtained by Babalad [7], Dhananjaya [8] and Shijini [9].

All the fruit characteristics and yield results revealed that T₁ (Jeevamrutham) reported a maximum number of fruits (3) and yield 30.33 tonnes per ha while lowest recorded T₈ (Control without water spray). These results agree with the findings of Thimma [10], Chandrakala [11] and Gore [12].

Shelf life of the fruits was the maximum in T₃ fish amino acid (19.66 days) followed by Panchagavyam (19.33 days) and minimum shelf life (10.66 days) was observed in T₉ (POP). Similar findings were parallel with the Shijini [9] and Patil et al. [13] in brinjal. Incidence of pests and diseases was noticed in T₉ (POP), T₇ (Control with water spray) and T₈ (Control without water spray). Results were supported by Sangeetha and Vanathan [14] and Krishnan [15].

Total Chlorophyll content was highest in treatment T₅ Green leaf 1.62 micro grams followed by T₁ (Jeevamrutham) with 1.60 micro grams but lowest in T₉ (POP) with 1.04 micro grams. These results agree with the findings of Gathala et al. [16] and Krishnan [15], extracts also more in plants receiving liquid organic manures.

Organoleptic quality test revealed the maximum value in T₃ fish amino acid 8.25 and same time 3.5 minimum values was observed in T₉ (POP). These investigations were observed by Krishnan [15] in salad cucumber.

The treatment (T₃) Fish amino acid recorded the highest pH and EC 6.21 and 0.03 after the experiment, which was followed by Jeevamrutham (T₁) and 0.02 and same time lowest values recorded in T₉ (POP) having 5.05 and 0.05. Same trend was observed in the reports of Lal et al. 2000.

The highest available organic carbon content and nitrogen content was recorded in T₁ 1.56 % and 489 kg/ha and lowest was recorded in T₉ (POP) 1.12 % and 389 kg/ha. This same scenario was observed in findings of Ravishankar et al. (2008) and Kara et al. (2007).

Treatment (T₁₀) Liquid extract of composite organic manure have the maximum available

phosphorus of 25.42 kg per ha and highest potassium content was recorded in T₅ (Green leaf extract) being kg per ha. Simultaneously, the lowest content of K was recorded in T₉ (POP) with a P and K values of 18.19 kg per ha and 251.62 kg per ha, respectively. Similar results were obtained by Magray et al. [17] in tomato.

The Jeevamrutham treatment noticed highest bacterial and actinomycetes population while, fungal population highest in Liquid extract of composite organic manure treatment. At the same time, all the organic manures and formulations applied treatments showed increase in microbial population but T₉ (POP) showed lowest microbial population. Same results were trended in reports of Palekar [5].

The observed data on economic analysis revealed that, T₁ (Jeevamrutham) was found to be significantly superior to other treatments with regard to gross return, net return and B: C ratio followed by T₅ (Green leaf extract). T₁ (Jeevamrutham) achieved a B: C ratio of 2.09 had recommended for best for cultivation of oriental pickling melon.

4. CONCLUSION

The crop seeds treated with *Pseudomonas* + Panchagavyam and organic manures alone as basal dose reported better germination and seedling growth. The length of vine was the highest in Fish amino acid (114.16 cm). The number of leaves were maximum in Fish amino acid (37.66) followed by Jeevamrutham treatments. Early flowering and harvesting could be achieved in Fish amino acid. Maximum duration and shelf life of the crop was noticed in the treatment receiving Fish amino acid (80 days). The highest yield was recorded in Jeevamrutham treated plots (30.33 tha⁻¹) followed by Panchagavyam (29.50tha⁻¹) treated plots. Jeevamrutham, Panchagavyam and Fish amino acid treated plants recorded highest score in organoleptic qualities and produced better quality fruits obtained the among the treatments. The highest chlorophyll content was observed in Green leaf extract (1.62 mg/g) followed by Jeevamrutham (1.60 mg/g). Among the liquid formulations, the NPK content was more in the liquid extract of composite organic manures and fish amino acid. The highest fungal and bacterial count was recorded in Panchagavyam. Jeevamrutham treatment reported the highest B: C ratio of 2.09 followed by Green leaf extracts (2.02).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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