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Effect of liquid manures on yield (Yield contributing attributes), quality, economics and beneficial insect ecology of tomato (*Solanum lycopersicum* L.) in comparison with conventional farming

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Abstract
Natural farming is a holistic approach to meet the nutritious and chemical free food produce. Horticulture produce are highly perishable in nature and thus natural or organic farming approaches are emphasized since they are having good keeping quality than that of conventionally grown products. Field experiment was conducted at The Regional Horticulture Research and Extension Center, Kumbapur, Dharwad. Significantly the maximum number of fruits per plant were recorded in farmers practice treatment (167.63) and the minimum number of fruits per plant were observed in natural farming treatment (65.65). The maximum fruit length was recorded in package of practice and farmers practice treatment (4.24 & 4.23 cm) respectively. Organic and natural farming treatment were noticed significantly minimum fruit length (4.01 & 4.05 cm) respectively. The higher fruit yield (33.396 t/ha) was recorded in farmers practice treatment and the lower fruit yield (10.88 t/ha) was observed in natural farming treatment. Significantly higher fruit firmness (2.70 & 1.58 kg/cm^2 @ green & light red stages), TSS (4.58 ^{0} Brix) and acidity (1.06 mg/100 g) were recorded in natural farming treatment. Fruits grown under natural and organic farming were stored as long as 17.1 and 16.2 days respectively as compared to chemical farming treatments (6.7 and 6.6 days). Incidence of natural enemies were significantly higher in natural farming treatment at 30, 60 and harvest (1.95, 1.65 & 1.15 respectively). Significantly the higher gross (Rs. 6678), net returns (Rs. 435191) and higher benefit cost ratio (2.82) were recorded in farmers practice treatment.

Keywords: Farmers practice, natural farming, organic farming, chemical farming and insect ecology

Introduction
Natural farming is a holistic approach to meet the nutritious and chemical free food produce. After green revolution, the agricultural lands continue to shrink and there is a greater threat to global environment and soil resources and thus, this kind of farming systems need to be focused and practiced with the aim of conserving the natural resources, soil fertility status and sustainability of existing lands. Horticulture produce are highly perishable in nature and thus natural or organic farming approaches are emphasized since they are having good keeping quality than that of conventionally grown products. Sustainable agriculture practices can effectively prevent the entry of pesticides and toxicants in the food chain and prevent soil and water pollution (Boraiah *et al*., 2017) [2]. The cost of inorganic fertilizers is increasing enormously to an extent that they are out of reach of small and marginal farmers. Use of inorganic fertilizers and insecticides, the population of beneficial organisms decrease and natural regeneration of nutrition in the soil cease. Soil becomes barren and soil fertility decreases. The use of fermented liquid manures in such situation is, therefore practically a paying proposal. In these liquid manures, beneficial organisms survive and are helpful in phosphate solubilization, nitrogen fixation etc. Application of these organic liquid formulations will enhance the soil microbial activity and population to a larger extent. This in turn has a positive effect on growth and yield of crops Jeevamrutha is an organic liquid manure which is an excellent source of nitrogen, phosphorus, potassium, natural carbon and lot of other micronutrients which are required for plant. Jeevamrut increase the microbial count and beneficial bacteria in soil. Application of jeevamrut will help to increase earthworm population in soil. Tomato is one of most economically important vegetable crop in the world. Fruit is rich in nutrients and contains vitamin C, calcium, iron, phosphorus and other minerals

involved in cardiovascular protection. Tomato lycopene and carotene are powerful antioxidants that can effectively reduce the incidence of various cancers (Martínezvalverde *et al*. 2002, Pinela *et al*. 2012) [11, 12]. With the expansion of the tomato cultivation area and the continuous increase in consumption level, consumers place more demands on the quality, nutritional content and taste of tomatoes. Sungro fruits are flattish round in shape with average weight of 80 gm and shining red colour, fruits can be harvested after 75-80 days of transplanting. The hybrid is tolerant to Leaf Curl Virus and thus can be grown even during rainy season. Some insects actually help us by keeping the pests in check. Beneficial insects provide natural ecosystem services as biological control and pollination of plants of pests belong to the categories of predators, parasitoids, and pollinators likes ladybird beetles, lacewing bug, Syrphid fly larvae, Praying mantids, Minute pirate bug, Aphid midge, Bigeyed bug, Honey bee, Bumble bee, Mason bee, Leafcutter bee and Butterfly. Awareness of management techniques bring the beneficial insects in the crop fields is a method forward to enhance agro ecosystems for tomato crop production. Hence present study carried out to observe the effect of liquid manures on yield, quality, economics and beneficial insect ecology of tomato in comparision with conventional farming systems.

Material and Methods

Field experiment was conducted at The Regional Horticulture Research and Extension Center, Kumbapur, Dharwad (Block-I). Altitude of experimental block is 678 m above the mean sea level. Experiment was conducted during *rabi* seasons of 2019, 2020 and 2021. Tomato seedlings were brought from authenticated nursery farm of Kalpataru 'Ghataprabha'. Four different treatments were imposed *viz*., T_1 (Package of Practice: FYM @ 25 t/ha, 115:100:60 NPK Kg/ha), T_2 (Farmers Practice: FYM @ 12.5 t/ha, 164:150:90 Kg/ha), T_3 (Natural Farming: Ghanajeevamrutha @ 1000 Kg/ha and liquid jeevamrtha @ 500 l/ha every fortnightly interval + organic mulching *i.e* locally available crop residues) and T_4 (Organic Farming: FYM @ 48 t/ha). 30 days old seedlings for natural farming were treated with beejamrutha as per the procedure and organic farming were treated with *Azospirillum* + PSB (2.5 kg/ha of seedslings). Planting was done at spacing of 90 × 45 cm. Ghanajeevamrutha was prepared by spreading 100 kg of desi cow dung on ground uniformly in the form of layer and added 2 kg powdered Jaggery, 2 kg pulse flour, required quantity of cow urine (for easy mixing) and handful of undisturbed farm soil and mixed properly. Thus made cow dung covered by jute bag for 48 hours and allowed for fermentation. Next spread on the floor and dried in the shade. Thus dried ghanajeevamrutha can be applied before planting. Jeevamrutha was prepared by mixing 10 kg desi cow dung, 10 litre cow urine, 2 kg local jaggery, 2 kg pulse flour and hand full of soil collected from farm. All these were put in 200 litre capacity plastic drum and mixed thoroughly and volume was made up to 200 litre. The mixture was stirred well in clock wise direction and kept in shade covered with wet jute bag. The solution was regularly stirred clockwise in the morning and in the evening continuously and it was used after 3-5 days of preparation during summer and 5-7 days of preparation in winter season for soil application near the plant roots. Jeevamrutha was applied as per the treatments and schedule regularly. Number of fruits per plant was recorded by counting total number of fruits per plant of tagged plants, fruit length and diameter were recorded by digital vernier caliper, fruit firmness was recorded at green and light red stage by hand penetrometer (kg/cm^2), TSS was recorded by hand refractometer (^{0} Brix) and acidity ((mg/100 g) by titration method. Count of beneficial insects per plant among the different treatment were observed and recorded.

Result and Discussion

Pooled data of three years revealed that, among four different farming practices, significantly the maximum number of fruits per plant were recorded in farmers practice treatment (167.63) and which was followed by package of practice treatment (149.90). The minimum number of fruits per plant were observed in natural farming treatment (65.65). This may be due to increase in height of the plant as well as earliness in the production of fruits. The partitioning efficiency *viz.*, an increased allocation of photosynthates towards the economic part due to increased leaf area might be due to increase in the synthesis as well as accumulation of cytokinin in the active sinks namely the productive flowers due to better root activity might have caused increased number of fruits. These observations were in conformity with the findings of Patil (1995) [7].

The maximum fruit length was recorded in package of practice and farmers practice treatment (4.24 & 4.23 cm) respectively. Organic and natural farming treatment were noticed significantly minimum fruit length (4.01 & 4.05 cm) respectively. These results might be occurred due to higher and ready availability of nutrients. Similar results were recorded by Nathakumar and Veeragavathatham, (1996) [5]. Organic farming treatment was recorded the significantly maximum average individual fruit weight of 69 g as compared to other treatments. The highest fruit weight in these treatment might have been due to accelerated mobility of photosynthates from the source to the sink as influenced by the growth harmone released or synthesized due to the organic sources of fertilizers. These results were in conformity with the findings of Sutagundi (2000) and Sudhakar (2000) in chilli crop. Significantly the higher yield (33.396 t/ha) was recorded in farmers practice treatment and the lower yield (10.88 t/ha) was observed in natural farming treatment. The higher fruit yield in the treatment receiving RDF along with FYM was attributed to higher leaf area index, chlorophyll content and more number of flowers per plant as these parameters had a positive influence on fruit yield of tomato. The beneficial response of organic manures like FYM on fruit yield in tomato might be due to the availability of sufficient amount of plant nutrients throughout the growth period of crop resulting in better uptake of nutrients, plant vigour and improved yield attributes. These observations are in close conformity with the findings of Patil *et al*. (2004) [6] and Rodge and Yadlod (2009) [8] in tomato. The lower fruit yield of tomato recorded in the natural farming treatment receiving only liquid organic manures might be due to less number of leaves, branches, flowers and fruits and also lower fruit yield per plant. This might be due to the lower nutrients content and their addition to the soil causing starvation of plants for nutrients. These results corroborate with the findings of Bhardwaj *et al*., 2010 [1].

As concern to quality parameters, significantly higher fruit firmness (2.70 & 1.58 kg/cm^2 @ green & light red stages), TSS (4.58 ^{0} Brix) and acidity (1.06 mg/100 g) were recorded in natural farming treatment. Fruits grown under natural and organic farming were stored as long as 17.1 and 16.2 days

respectively as compared to chemical farming treatments (6.7 and 6.6 days). Organoleptic/sensory evaluation of tomatoes grown under these four farming systems was conducted under 10 experts panel. Results reveled that natural and organic farming treatments were noticed superior colour, taste and flavor, texture and overall acceptability (Fig. 1). The improvement in quality of fruits in the said treatment might be ascribed to better availability and uptake of plant nutrients and also favorable conditions resulted by the applied organic nutrients. These organic suppliments especially ghanajeevamrutha and liquid jeevamrutha play a vital role in enhancing quality of crops (Table 1). In pooled dataof three years, incidence of natural enemies were significantly higher in natural farming treatment at 30, 60 and harvest (1.95, 1.65 & 1.15 natural enemies/plant respectively) and was statistically on par with the organic farming (1.69, 1.44 & 0.95 respectively).. However, a significantly lower incidence of natural enemies was observed in farmer's practice treatment. This lower incidence of natural enemies in famer's practice treatment and package of practice treatment can be attributed to the use of chemical control measure which are proven to be toxic to sensitive the natural enemies. However, natural enemies incidence was higher in ZBNF and organic farming treatments indicating that the control measures undertaken are relatively non toxic to the natural enemies (Table 2).

Cost of cultivation of three years were calculated separately and exhibited pooled results for these farming systems (Fig. 2). Among the four farming systems, significantly lower cost for cultivation (Rs. 117365) was recorded in natural farming. Since natural farming is completely avoids the cost incurred on FYM, inorganic fertilizers and chemicals. However, significantly the higher gross (Rs. 6678) and net returns (Rs. 435191) was recorded in farmers practice treatment. Significantly the higher benefit cost ratio (2.82) was also recorded in farmers practice treatment. The lowest net return of Rs. 83145 was recorded in the organic farming treatment which is receiving higher quantity of FYM. Lower fruit yield was recorded in natural farming treatment which marginally influenced the net returns in tomato. These findings were in agreement with Naidu *et al*., (2010) [4] and Kavitha *et al*. (2011) [3] in brinjal and tomato, respectively.

Table 1: Yield contributing, yield and quality attributes of tomato as influenced by natural farming and other farming practices (pooled of three years)

Treatment	No of fruits per plant	Fruit length (cm)	Fruit diameter (mm)	Average individual fruit weight (g/pl)	Yield (t/ha)	Fruit Firmness (kg/cm^2)		TSS (^{0} Brix)	Acidity (mg/100 g)	Shelf life (days)
						Green stage	Light Red stage			
T_1 : Package of Practice	149.90^b	4.24^a	50.66	66.80^a	25.51^b	1.91^b	1.07^b	4.02^c	0.72^b	6.7^b
T_2 : Farmers' Practice	167.63^a	4.23^a	49.31	54.40^b	33.39^a	2.01^b	1.06^b	4.43^b	0.74^b	6.6^b
T_3 : Natural Farming	65.65^d	4.05^{ab}	50.46	50.56^b	10.88^d	2.70^a	1.58^a	4.58^a	1.06^a	17.1^a
T_4 : Organic Farming	80.64^c	4.01^b	50.64	69.00^a	15.71^c	2.61^a	1.40^a	4.46^{ab}	0.76^b	16.2^a
S.Em. ±	2.62	3.40	0.80	3.39	0.90	0.04	0.07	0.06	0.04	0.25
CD(p=0.05)	8.10	0.19	NS	10.19	2.77	0.16	0.23	0.14	0.12	0.77
CV (%)	5.06	10.07	3.60	12.29	9.42	5.13	13.47	12.37	10.89	8.82

Table 2: Population of natural enemies (Coccinellids, Green lace wings, Wasp, lady bugs *etc*) as influenced by different plant protection measures

Treatments	Number of natural enemies per plant											
	30 DAT				60 DAT				At harvest			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled	2019	2020	2021	Pooled
T_1:PoP	0.60 (1.04)^b	0.78^c (1.13)	0.51^b (1.00)	0.63^b (1.06)	0.68^c (1.09)	1.05^c (1.25)	1.35^b (1.36)	1.03^b (1.24)	0.82^b (1.14)	0.78^b (1.13)	0.52^b (1.01)	0.70^b (1.10)
T_2: FP	0.44 (0.96)^b	0.70^c (1.09)	0.63^b (1.06)	0.59^b (1.04)	0.48^{bc} (0.99)	0.96^c (1.21)	1.03^b (1.23)	0.83^b (1.15)	0.79^b (1.13)	0.66^b (1.07)	0.60^b (1.04)	0.68^b (1.09)
T_3 :NF	1.36 (1.36)^a	2.75^a (1.80)	1.76^a (1.50)	1.95^a (1.56)	1.80^a (1.52)	1.43^a (1.39)	1.72^a (1.49)	1.65^a (1.47)	1.08^a (1.25)	1.23^a (1.31)	1.15^a (1.28)	1.15^a (1.29)
T_4 :OF	1.20 (1.30)^a	1.87^b (1.53)	2.02^a (1.58)	1.69^a (1.48)	1.24^{ab} (1.32)	1.28^b (1.34)	1.80^a (1.51)	1.44^a (1.39)	0.98^a (1.21)	0.90^{ab} (1.18)	0.98^{ab} (1.21)	0.95^a (1.20)
S.Em.±	0.03	0.19	0.16	0.07	0.28	0.04	0.11	0.09	0.06	0.13	0.16	0.07
CD(p=0.05)	0.10	0.58	0.51	0.26	0.63	0.13	0.36	0.28	0.15	0.40	0.49	0.21

The figures in parenthesis are subjected to √x+0.5 transformation. DAT-Days after transplanting

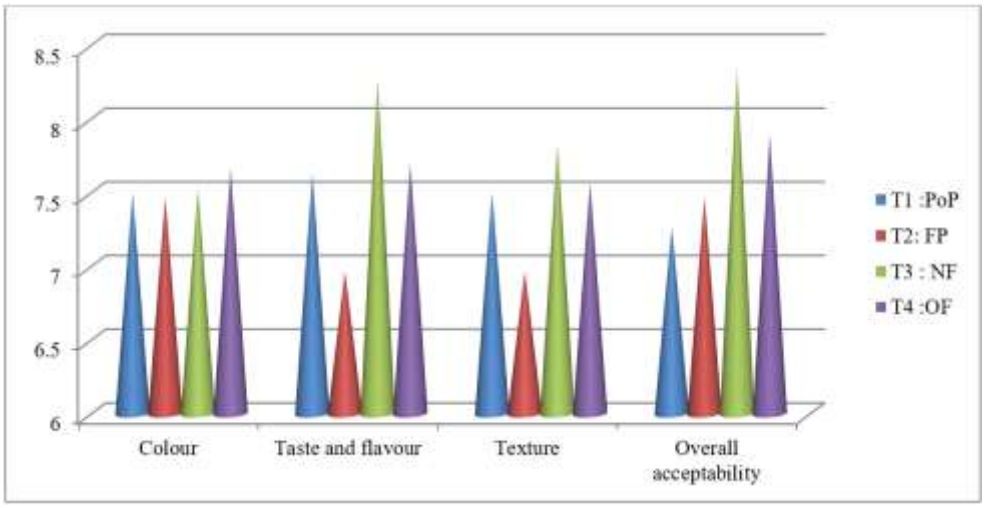

Fig 1: Sensory evaluation of tomato as influenced by natural farming and other farming practices

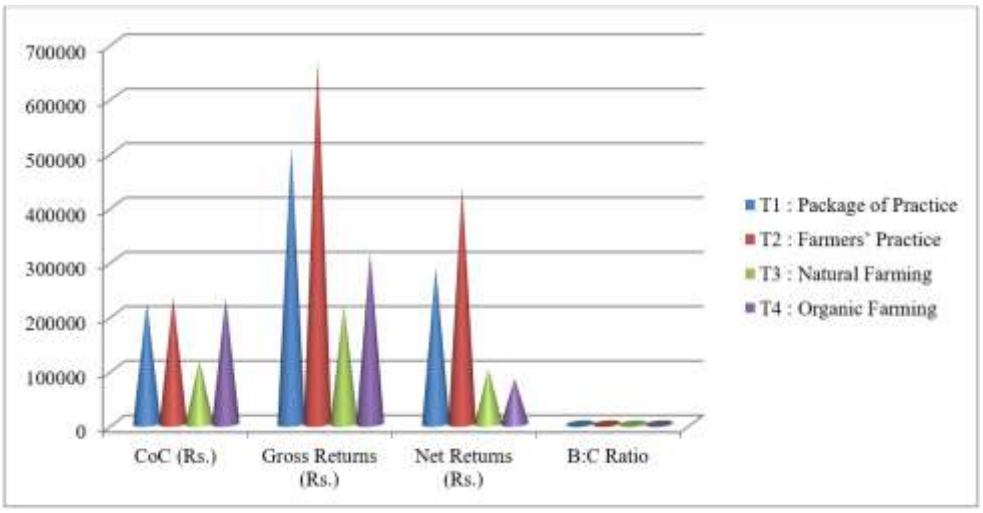

Fig 2: Cost of cultivation, gross returns, net returns and B:C ratio of tomato as influenced by different farming practices

References

1. Bhardwaj SK, Sharma IP, Sharma SD. Effect of integrated nutrient management on soil fertility, yield and quality of tomato and french bean crops in the mid himalayas, J Indian Soc. Soil Sci. 2010;58(4):464-466.
2. Boraiah B, Devakumar N, Shubha S, Palanna KB. Effect of panchagavya, jeevamrutha and cow urine urine on beneficial microorganisms and yield of capsicum (*Capsicum annum* L. var *grossum*). Int. J Curr. Microbiol. App. Sci. 2017;6(9):3226-3234.
3. Kavitha P, Jeevan Rao K, Bhupal Raj G. Comparative studies of sewage sludge, urbancompostand FYM on yield parameters, uptake of heavy metals and economics in tomato (*Lycopersicon esculentum* Mill). Crop Res. 2011;41(1, 2 & 3):139-147.
4. Naidu AK, Kushwah SS, Dwivedi YC. Influence of organic manures, chemical and biofertilizers on growth, yield and economics of brinjal. South Indian Hort. 2010;50(4-6):370-376.
5. Nanthakumar, S, Veeraraghatam. Effect of integrated nutrient management on yield and quality attributes of brinjal. South Indian Hort. 1996,49(special):195-198.
6. Patil MB, Mohammed RG, Ghadge PM. Effect of organic and inorganic fertilizers on growth, yield and quality of tomato. J Maharashtra Agric. Univ. 2004;29(2):124-127.
7. Patil MP. Integrated nutrient management in commercial vegetables. M. Sc. (Agri) Thesis, Univ. Agric. Sci., Dharwad, Karnataka, India, 1995.
8. Rodge BM, Yadlod SS. Effect of organic and inorganic fertilizers on growth, yield and quality of tomato (*Lycopersicon esculentum* Mill.). The Asian J Hort. 2009;4(1):221-224.
9. Sudhakar G. Studies on to identify crop wastes/lowland weed as alternate source to organics to sustain the productivity of rice based system. Ph. D. Thesis, Tamil Nadu Agric. Univ., Coimbatore, India, 2000.
10. Sutagundi RH. Effect of mulches and manures on growth and yield of chilli (*Capsicum annuum* L.). M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka, India, 2000.
11. Martínezvalverde I, Periago JM, Provan G, Chesson A. Phenolic compounds, lycopene and antioxidant activity in commercial varieties of tomato (*Lycopersicum esculentum*). Journal of science of Foos and Agriculture 2002;82(3):323-330.
12. Pinela J, Barros L, Carvalho I. Nutritonal composition and antioxidant activity of four tomato (*Lycopersicon esculentum* L.) Farmer varieties in Northeastern Portugal home gardens. Food and Chemical Toxicology. 2012;50(3-4):829-834.