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Effect of Organic Formulations and Inorganic Fertilizer on Yield Attributes, Yield and Quality of Tomato

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A B S T R A C T

The field experiments were planned and conducted during *kharif* 2017-18 and 2018-19 to evaluate the "Effect of organic formulations and inorganic fertilizations on yield attributes, yield and quality of tomato at Research Farm, College of Agriculture, Golegaon, Vasantrao Naik Marathwada Krishi Vidyappeth, Parbhani. The experiments were laid out in randomized block design with three replications and twelve treatments comprising of organic formulations and inorganic fertilizers. Yield attributes like number of fruits per plant, fruit diameter, fruit yield per plant were found highest with the treatment RDF + Beejamruth + Jeevamruth + Panchyagavya (T_{10}). The highest tomato yield was obtained by application of RDF + Beejamruth + Jeevamruth + Panchyagavya. Whereas, lowest fruit and dry matter yield were resulted with only Beejamruth application. The quality parameters like ascorbic acid, total soluble solid content, reducing sugar content, non reducing sugar content and total sugar content were found highest with the treatment T_{10} receiving RDF + Beejamruth + Jeevamruth + Panchyagavya as compared to RDF and individual application of organic formulations during both the years. The finding emerged out from the results indicated that combine use of RDF + Beejamruth + Jeevamruth + Panchyagavya significantly enhanced in yield attributes, yield and quality in tomato.

Introduction

Organic farming is a holistic way of farming with the aim of conserving the natural resources. Indian agriculture has a better chance to convert itself as organic agriculture because of the per capita and per hectare consumption of chemical fertilizers and pesticides in the country is much lower than the global estimates. Promoting organic agriculture offers one of the most promising options available for achieving food and nutrition security and other basic needs of humanity apart from conserving natural resources. Application of scientific approaches to organic farming practices holds the possibility of maintaining and in some cases increasing the yield over long run, while

sustaining bio-diversity, soil fertility, soil biological cycles and natural ecosystem processes and services that underpin the agriculture. The organically produced fruits and vegetables have good keeping quality than that of conventionally grown products. The balanced use of organic formulations with inorganic fertilizations affect the nutrients uptake on tomato plants that may helps to increase the yield of tomato (Tejswini *et al.*, 2020). The sustainable agriculture practices can effectively prevent the entry of pesticides and toxicants in the food chain and prevent soil and water pollution. It is adopted with a blend of ecologically safe modern technologies. The organic agriculture, though not in its orthodox version, has the potential to be accepted by the farmers (Sreenivasa *et al.*, 2009, Natarajan K. 2002 and Pathak and Ram, 2007). The good quality organic inputs with the recommended dose of fertilizers have a potential to augment soil enzyme activities and improve microbial count (Tejswini *et al.*, 2020). In this paper we are going to discuss how the combination of organic formulations with inorganic fertilizers affect on yield attributes, yield and quality of tomato.

Materials and Methods

The research trials were carried out during *kharif* 2017-18 and 2018-19 using tomato (var. *Akash Ganga*) at Research Farm, College of Agriculture, Golegaon, Vasantrao Naik Marathwada Agricultural University, Parbhani. The experiments were planned out in randomized block design with three replications. There were twelve treatments viz., T_1-RDF (100 % NPK through fertilization), T_2-Panchyagavya only, T_3 - Jeevamruth only, T_4- Beejamruth only, T_5- Panchyagavya + Beejamruth, T_6 - Beejamruth + Jeevamruth, T_7 -Panchyagavya + Jeevamruth, T_8-RDF + Beejamruth + Panchyagavya, T_9-RDF + Beejamruth + Jeevamruth, T_{10}-RDF + Beejamruth + Jeevamruth + Panchyagavya, T_{11} - Beejamruth + Jeevamruth + Panchyagavya, T_{12}- 100 % N through FYM. Soil is characterized by black colour dominated by montmorillonite clay with high coefficient of expansion and shrinkage leads to deep cracking. The soils are formed from basaltic material. The topography of experimental plot was fairly level. In each plot, 5 random plants were selected to be record biometric observations on yield attributes and yield. Five plants uprooted from the observation unit for recording the dry matter studies and after removing the roots, plant samples were kept in well labelled brown paper bag. First the samples were dried in shade and kept in oven at 65°C ± 2°C, and then the weight of dry matter was taken and expressed on per plant basis. Organic formulations (Panchyagavya, Beejamruth, and Jeevamruth) were applied @ 500 lit ha^{-1} at the time of transplanting and at 3 % spray at 15, 30, 45, 60, 75 and 90 DAT. The RDF was applied as per treatments. The number of fruits per plant were recorded at different growth stages and expressed as number of fruits per plant.

The three parcel dimensions are measured in centimetres (Length) x (Width) x (Height). Added the measurements of the two smallest dimensions together then take the longest dimension and add this to the package girth.

The sum of all pickings of tomato fruit was recorded from each plant and converted into hectare basis. The weight of dry matter accumulation in plant is an index of plant growth. The plant uprooted for dry matter study, excluding root system were air dried under sun for 8 days and subsequently dried in the thermostatic oven at 80°C till they were completely dried. The final constant dry weight was recorded as total dry matter accumulation per plant and per hectare was calculated. All the data were subjected to analysis of variance.

Results and Discussion

Number of fruit per plant

The data pertaining to number of fruits per plant as in influenced by different treatments during both the years of experimentation are presented in Table 1.The number of fruits per plant is important yield parameter, as it gives a rough estimate of probable yield. The number of fruits per plant varied in the range of 37.48 to 84.46 and 46.35 to 99.57 during 2017 and 2018. Significantly highest numbers of fruits per plant were recorded (84.46) and (99.57) during 2017 and 2018 in treatment RDF + Beejamruth + Jeevamruth + Panchyagavya (T_{10}). It was significantly superior over RDF (68.08 and 83.13) and rest of the treatments while lowest number of fruits per plant (37.48 and 46.35) were noticed in treatment only Beejamruth application (T_4). Results of pooled analysis of two years data revealed that the number of fruits per plant ranged from 41.92 to 92.01. The numbers of fruits per plant were recorded statistically highest in application of RDF + Beejamruth + Jeevamruth + Panchyagavya (T_{10}) superior over rest of the treatments. While, minimum number of fruits per plant were observed in application of Beejamurth only (T_4). As reported earlier, the increase in yield and yield attributes with the application of organic formulations along with RDF might be due to availability of sufficient amount of macro and micro nutrients and increased uptake of nutrients and effective utilization of nutrients for increased metabolism and synthesis of carbohydrates, greater vegetative growth and subsequent portioning and translocation from leaf (source) to the head (sink) and also release of energy rich compounds by the organic formulations which ultimately increased auxin activites, growth and activity of micro organisms which ultimately influenced the yield and yield attributes. Similar findings also reported by Ashraful Islam *et al.,* (2017), they reported that the inclusion of organics with chemical fertilizers significantly increased the number of fruits per plant in tomato.

Fruit yield per plant

The data pertaining to fruit yield per plant as in influenced by different treatments during both the years of experimentation are presented in Table 2. Fruit yield per plant was found significantly highest (18.00, 23.14 and 20.57 kg plant^{-1}) in treatment RDF + Beejamruth + Jeevamruth + Panchyagavya (T_{10}) followed by 17.77, 16.96 and 17.37 kg plant^{-1} having RDF + Beejamruth + Panchyagavya T_8 whereas, it showed lowest value 4.00, and 7.20 kg plant^{-1} in treatment with only Beejamruth (T_4) application during both the years of experimentation as well as in pooled analysis. Our results are in agreement with the findings of Gore and Shreenivasa (2011), they reported that fruit yield per plant was highest in treatment receiving RDF + Beejamruth + Jeevamruth + Panchyagavya followed by RDF + Beejamruth + Panchyagavya over RDF and alone application of liquid organic manures.

Fruit diameter

The data on fruit diameter as influenced by organic formulations and inorganic fertilization are presented in Table 3. Fruit diameter of tomato was increased significantly due to combination of organic formulations with RDF over RDF and alone application of organic formulations. Significantly maximum diameter of fruit of tomato 6.15 and 6.20 cm was recorded in RDF + Beejamruth + Jeevamruth + Pachyagavya (T_{10}) treatments while minimum fruit diameter of tomato 4.41 and 4.76 cm was recorded in treatment Beejamruth only (T_4) treatment during both the year of experimentation. Further pooled mean of two years data indicated that, fruit diameter of tomato was significantly more in

T_{10} (6.18 cm) followed by T_8 (6.15 cm) and less was in T_4 (4.58 cm) treatments. Arumugam and Anburani (2008) reported that the combined application of FYM + Vermicompost + foliar spray of Panchyagavya resulted in improving fruit diameter in tomato plant followed by the application of pressmud + vermicompost + foliar spray of Panchyagavya.

Fruit yield per hectare

The data on fruit yield of tomato (q ha^{-1}) as influenced by different treatments are tabulated in Table 4. There was significant increase in the fruit yield of tomato due to application of organic formulations along with recommended dose of fertilizer as compared to application of RDF or organic formulation only. Fruit yield increases from 222.88 to 348.21, 246.64 to 371.47 and 234.76 to 359.84 q ha^{-1} during 2017, 2018 and in pooled mean. Significantly highest fruit yield of tomato was obtained 348.21, 317.47 and 359.84 q ha^{-1} with treatment RDF + Beejamruth + Jeevamruth + Panchagavya (T_{10}) followed by 302.16, 329.96 and 316.06 q ha^{-1} in treatment RDF + Beejamruth + Panchagavya (T_8) and lowest was found in 222.88, 246.64 and 234.76 q ha^{-1} treatment receiving application of Beejamruth only (T_4) during 2017, 2018 and pooled mean, respectively. The fruit yield per hectare in the treatment of T_1 (RDF only) was found to be significantly highest among all the individual application of organic formulations. Among organic formulations, the application of alone was found to be significantly superior over Beejamruth or Jeevamruth with respect to fruit yield during both the years of study and pooled analysis.

The magnitude of increase in tomato fruit yield under RDF + Beejamruth + Jeevamruth + Panchagavya being about 19.57, 19.22 and 19.39 per cent over only RDF in both the years and pooled analysis, respectively. The application of RDF + Beejamruth + Jeevamruth + Panchyagavya recorded significantly higher yield as compared to Beejamruth + Jeevamruth + Panchyagavya due to adequate supply of required nutrients through chemical fertilizers and also overall improvement in soil physico-chemical and biological properties due to combined application of organic formulations. This is in confirmly with the findings of Sreenivasa *et al.,* (2010) who reported that number of fruits and fruit yield of chilli were significantly higher in treatments receiving RDF + Beejamruth + Jeevamruth + Panchagavya. The better nutrient availability and nutrient uptake increased the growth and yield of crop. Kondapanaidu (2008) reported that the treatment (50 % RDF + 50 % N through FYM + biofertilizer + Panchyagavya) recorded significantly higher dry chilli yield. The applications of Panchagavya alone had better effect as compared to Beejamruth and Jeevamruth which could be attributed to higher amount of nutrients, microbial activity and plant growth promoters present in it. According to Birendra and Christopher (2007), foliar spray of Panchyagavya @ 3 % resulted in a significant increase in the yield attributes. Kalarani (1991) reported that the action of the growth regulators in the plant system stimulated the necessary growth and development in plants and better yield. (Mamaril and Lopez, 1997) conclude that Panchyagavya includes coconut water, which contains kinetin which increases the biomass and yield. These results are in compliance with the findings of Gore and Sreenivasa (2011), Yadav *et al.,* (2017), Patel *et al.,* (2013) and Patil and Udmale (2016).

Dry matter yield of tomato

Dry matter yield of tomato was increased during both the years of experiments with the application of organic formulations along with recommended dose of fertilizers and data is

tabulated in Table 5. Dry matter yield of tomato varied in the range of 12.55 to 22.27, 15.62 to 26.10 and 14.09 to 24.19 q ha^{-1}) during both the years and pooled mean at harvest, respectively. The treatment T_{10} was found to have significantly highest dry matter yield (22.27, 26.10 and 24.19 q ha^{-1}) with RDF + Beejamruth + Jeevamruth + Panchyagavya and lowest (12.55, 15.62 and 14.09 q ha^{-1}) was recorded with only Beejamruth application during both the years and pooled data. The magnitude of increase in dry matter yield of tomato under RDF + Beejamruth + Jeevamruth + Panchyagavya being about 37.98, 36.64 and 37.28 per cent over only RDF in both the years and pooled analysis, respectively. The dry matter production and its accumulation in different parts of the plant are the manifestation of the magnitude and persistence of photosynthetic capacity of the plant and its translocation to different parts. In the present study, the dry matter production was significantly higher with the application of RDF + Beejamruth + Jeevamruth + Panchyagavya at both the stages of crop growth. The organic formulation provides nutrients and plant growth promoting substances but they may not be sufficient to show the early growth and development of the crop. So fertilizer application @ RDF might have provided the required NPK for plant growth at early stages. Kondapanaidu (2008) reported the total dry matter production was observed in the treatment given 50 % RDF + 50 % N through FYM + biofertilizers. The application of RDF had better effect on the dry matter production as compared to individual treatments of organic formulations. The application of RDF + Beejamruth + Jeevamruth + Panchyagavya might have resulted in the better availability of nutrients throughout the crop growth. This is mediated through biological processes as noticed by higher microbial activity, soil enzymatic activity and plant growth promoter present in it. These results are in conformity with the findings of Gore and Sreenivasa (2011), Sahay *et al.,* (2016), Yadav *et al.,* (2017) and Patil and Udmale (2016).

Quality parameters of tomato

Ascorbic acid content

The ascorbic acid content in tomato fruit was estimated and data obtained is presented in Table 6. The results revealed that, ascorbic acid content was significantly influenced by organic formulations and fertilizers. Highest ascorbic acid content was noticed 54.82, 57.01 and 55.92 mg 100 gm^{-1} in treatment RDF + Beejamruth + Jeevamruth + Panchyagavya (T_{10}) over rest of the treatments during both the years and pooled means, respectively. Whereas, lowest ascorbic acid content was noted 37.56, 38.83 and 38.20 mg 100 gm^{-1} in treatment only Beejamruth (T_4), during both the years of experimentation and pooled analysis, respectively. During 2017, 2018 and pooled analysis, treatment T_{10} was at par with treatment T_8 and T_9 in respect of ascorbic acid content in tomato fruits. Among the individual treatments, the application of Panchyagavya was better with respect to ascorbic acid content as compared to Beejamruth or Jeevamruth. Panchyagavya is a blend of five products obtained from cow viz., dung, urine, milk, curd, ghee. When these ingredients were mixed and used, it showed positive influence on living organisms. Cow milk enhanced the fruit taste (Shenoy *et al.,* 2000). The application of Jeevamruth and Beejamruth proved to be the efficiency of crops and nutritional quality of fruits and vegetables (Natarajan, 2002). Illupeju *et al.,* (2015) reported significant increase in ascorbic acid content in fruits of tomato by application of Tithonia compost along with 75 % RDF over RDF or control. Similar findings were also reported by Hisham Aziz Amran (2014).

Table.1 Effect of organic formulations and inorganic fertilizations on number of fruits per plant of tomato

Treatment	Number of fruits		
	2017	2018	Pooled
T_1: RDF (100% NPK through fertilizer)	68.08	83.13	75.61
T_2: Panchyagavya only	49.19	55.41	52.30
T_3: Jeevamruth only	40.80	49.41	45.11
T_4: Beejamruth only	37.48	46.35	41.92
T_5: Panchyagavya + Beejamruth	42.65	61.37	52.01
T_6: Beejamruth + Jeevamruth	48.15	64.00	56.07
T_7: Panchyagavya + Jeevamruth	52.85	70.81	61.83
T_8: RDF + Beejamruth + Panchyagavya	73.14	88.49	80.82
T_9: RDF + Beejamruth + Jeevamruth	70.83	86.00	78.42
T_{10}: RDF + Beejamruth + Jeevamruth + Panchyagavya	84.46	99.57	92.01
T_{11}: Beejamruth + Jeevamruth + Panchyagavya	67.42	81.19	74.31
T_{12}: 100% N through FYM	60.17	74.70	67.44
SEm ±	3.21	1.79	1.84
CD at 5 %	9.41	5.26	5.24
Grand mean	57.94	71.70	64.82

Table.2 Effect of organic formulations and inorganic fertilizations on yield per plant of tomato

Treatment	Yield (kg plant^{-1})		
	2017	2018	Pooled
T_1: RDF (100% NPK through fertilizer)	9.84	12.62	11.23
T_2: Panchyagavya only	5.13	7.72	6.43
T_3: Jeevamruth only	4.57	7.33	5.95
T_4: Beejamruth only	4.00	7.20	5.60
T_5: Panchyagavya + Beejamruth	7.20	10.12	8.66
T_6: Beejamruth + Jeevamruth	6.03	9.11	7.57
T_7: Panchyagavya + Jeevamruth	13.07	10.60	11.84
T_8: RDF + Beejamruth + Panchyagavya	17.77	16.96	17.37
T_9: RDF + Beejamruth + Jeevamruth	14.85	17.77	16.31
T_{10}: RDF + Beejamruth + Jeevamruth + Panchyagavya	18.00	23.14	20.57
T_{11}: Beejamruth + Jeevamruth+ Panchyagavya	9.10	12.11	10.61
T_{12}: 100% N through FYM	8.60	11.85	10.23
SEm ±	0.43	0.64	1.01
CD at 5 %	1.27	1.88	3.13
Grand mean	9.85	12.21	11.03

Table.3 Effect of organic formulations and inorganic fertilizations on fruit diameter of tomato

Treatment	Fruit diameter (cm)		
	2017	2018	Pooled
T_1: RDF (100% NPK through fertilizer)	6.06	6.10	6.08
T_2: Panchyagavya only	4.45	4.90	4.68
T_3: Jeevamruth only	4.41	4.84	4.63
T_4: Beejamruth only	4.41	4.76	4.58
T_5: Panchyagavya + Beejamruth	4.70	5.49	5.09
T_6: Beejamruth + Jeevamruth	4.49	5.22	4.86
T_7: Panchyagavya + Jeevamruth	4.90	5.84	5.37
T_8: RDF + Beejamruth + Panchyagavya	6.13	6.17	6.15
T_9: RDF + Beejamruth + Jeevamruth	6.09	6.13	6.11
T_{10}: RDF +Beejamruth + Jeevamruth + Panchyagavya	6.15	6.20	6.18
T_{11}: Beejamruth + Jeevamruth + Panchyagavya	5.37	5.85	5.61
T_{12}: 100% N through FYM	5.70	5.90	5.80
SEm ±	0.19	0.17	0.12
CD at 5 %	0.54	0.49	0.35
Grand mean	5.24	5.62	5.43

Table.4 Effect of organic formulations and inorganic fertilizations on yield per hectare of tomato

Treatment	Yield (q ha^{-1})		
	2017	2018	Pooled
T_1: RDF (100% NPK through fertilizer)	291.22	311.58	301.40
T_2: Panchyagavya only	255.66	271.15	263.40
T_3: Jeevamruth only	241.26	263.62	252.44
T_4: Beejamruth only	222.88	246.64	234.76
T_5: Panchyagavya + Beejamruth	267.89	289.01	278.45
T_6: Beejamruth + Jeevamruth	263.47	281.48	272.47
T_7: Panchyagavya + Jeevamruth	270.91	293.38	282.15
T_8: RDF + Beejamruth + Panchyagavya	302.16	329.96	316.06
T_9: RDF + Beejamruth + Jeevamruth	297.18	326.66	311.92
T_{10}: RDF + Beejamruth + Jeevamruth + Panchyagavya	348.21	371.47	359.84
T_{11}: Beejamruth + Jeevamruth + Panchyagavya	271.19	294.92	283.05
T_{12}: 100% N through FYM	268.83	299.27	282.55
SE m±	6.60	7.40	4.96
CD at 5 %	19.35	21.71	14.14
Grand mean	275.07	298.27	286.67

Table.5 Effect of organic formulations and inorganic fertilizations on dry matter yield per hectare of tomato

Treatment	Dry matter (q ha^{-1})					
	2017-18		2018-19		Pooled	
	Flowering	Harvesting	Flowering	Harvesting	Flowering	Harvesting
T_1: RDF (100% NPK through fertilizer)	8.03	16.14	10.63	19.10	9.33	17.62
T_2: Panchyagavya only	6.65	13.60	8.76	16.60	7.71	15.10
T_3: Jeevamruth only	5.80	13.21	7.58	16.00	6.69	14.61
T_4: Beejamruth only	5.01	12.55	7.20	15.62	6.11	14.09
T_5: Panchyagavya + Beejamruth	7.84	15.63	9.59	18.60	8.72	17.12
T_6: Beejamruth + Jeevamruth	7.09	14.84	7.92	17.10	7.51	15.97
T_7: Panchyagavya + Jeevamruth	7.13	15.36	8.15	18.20	7.64	16.78
T_8: RDF + Beejamruth + Panchyagavya	14.59	20.70	14.95	23.00	14.77	21.85
T_9: RDF + Beejamruth + Jeevamruth	12.66	19.62	12.55	21.20	12.61	20.41
T_{10}: RDF + Beejamruth + Jeevamruth + Panchyagavya	17.43	22.27	17.68	26.10	17.55	24.19
T_{11}: Beejamruth + Jeevamruth + Panchyagavya	7.49	15.29	8.66	18.20	8.07	16.75
T_{12}: 100% N through FYM	7.98	15.62	8.52	18.60	8.25	17.11
SEm ±	0.37	0.51	0.41	0.86	0.43	0.50
CD at 5 %	1.08	1.51	1.19	2.52	1.35	1.43
Grand mean	8.98	16.24	10.18	19.03	9.58	17.63

Table.6 Effect of organic formulations and inorganic fertilizations on ascorbic acid content in tomato fruit

Treatment	Ascorbic acid (mg 100 gm^{-1})		
	2017	2018	Pooled
T_1: RDF (100% NPK through fertilizer)	49.43	51.06	50.25
T_2: Panchyagavya only	42.64	43.70	43.17
T_3: Jeevamruth only	38.86	40.70	39.78
T_4: Beejamruth only	37.56	38.83	38.20
T_5: Panchyagavya + Beejamruth	45.18	46.88	46.03
T_6: Beejamruth + Jeevamruth	39.95	41.45	40.70
T_7: Panchyagavya + Jeevamruth	41.83	43.44	42.64
T_8: RDF + Beejamruth + Panchyagavya	53.09	56.17	54.63
T_9: RDF + Beejamruth + Jeevamruth	50.63	52.31	51.47
T_{10}: RDF + Beejamruth + Jeevamruth + Panchyagavya	54.82	57.01	55.92
T_{11}: Beejamruth + Jeevamruth + Panchyagavya	48.93	49.54	49.24
T_{12}: 100% N through FYM	46.96	48.24	47.60
SEm ±	2.01	1.36	1.21
CD at 5 %	5.89	4.00	3.46
Grand mean	45.82	47.45	46.63

Table.7 Effect of organic formulations and inorganic fertilizations on TSS content in tomato fruit.

Treatment	TSS (^{0}B)		
	2017	2018	Pooled
T_1: RDF (100% NPK through fertilizer)	5.47	6.10	5.79
T_2: Panchagavya only	5.13	4.90	5.02
T_3: Jeevamruth only	4.90	4.84	4.87
T_4: Beejamruth only	4.80	4.76	4.78
T_5: Panchagavya + Beejamruth	5.30	5.49	5.39
T_6: Beejamruth + Jeevamruth	5.28	5.22	5.25
T_7: Panchagavya + Jeevamruth	4.62	5.84	5.23
T_8: RDF + Beejamruth + Panchagavya	5.59	6.17	5.88
T_9: RDF + Beejamruth + Jeevamruth	5.39	6.13	5.76
T_{10}: RDF + Beejamruth + Jeevamruth + Panchagavya	5.64	6.20	5.92
T_{11}: Beejamruth + Jeevamruth + Panchagavya	5.49	5.85	5.67
T_{12}:100% N through FYM	5.00	5.90	5.45
SEm ±	0.12	0.17	0.22
CD at 5 %	0.36	0.49	0.70
Grand mean	5.22	5.62	5.42

Table.8 Effect of organic formulations and inorganic fertilizations on reducing sugar content in tomato fruit

Treatment	Reducing sugar (%)		
	2017	2018	Pooled
T_1: RDF (100% NPK through fertilizer)	3.40	3.30	3.35
T_2: Panchagavya only	2.75	2.65	2.70
T_3: Jeevamruth only	2.70	2.60	2.65
T_4: Beejamruth only	2.60	2.49	2.55
T_5: Panchagavya + Beejamruth	2.90	3.10	3.00
T_6: Beejamruth + Jeevamruth	2.80	2.90	2.85
T_7: Panchagavya + Jeevamruth	3.00	3.23	3.12
T_8: RDF + Beejamruth + Panchagavya	3.70	3.90	3.80
T_9: RDF + Beejamruth + Jeevamruth	3.60	3.87	3.73
T_{10}: RDF + Beejamruth + Jeevamruth + Panchagavya	3.90	4.10	4.00
T_{11}: Beejamruth + Jeevamruth + Panchagavya	3.10	3.30	3.20
T_{12}: 100% N through FYM	3.53	3.00	3.27
SEm ±	0.09	0.07	0.12
CD at 5 %	0.26	0.20	0.36
Grand mean	3.17	3.20	3.18

Table.9 Effect of organic formulations and inorganic fertilizations on non reducing sugar content in tomato fruit

Treatment	Non reducing sugar (%)		
	2017	2018	Pooled
T_1: RDF (100% NPK through fertilizer)	13.37	13.47	13.42
T_2: Panchagavya only	11.80	12.10	11.95
T_3: Jeevamruth only	11.60	11.80	11.70
T_4: Beejamruth only	11.30	11.50	11.40
T_5: Panchagavya + Beejamruth	12.30	12.60	12.45
T_6: Beejamruth + Jeevamruth	12.00	12.30	12.15
T_7: Panchagavya + Jeevamruth	12.50	12.70	12.60
T_8: RDF + Beejamruth + Panchagavya	13.40	13.80	13.60
T_9: RDF + Beejamruth + Jeevamruth	13.30	13.60	13.45
T_{10}: RDF + Beejamruth + Jeevamruth + Panchagavya	13.60	13.11	13.36
T_{11}: Beejamruth + Jeevamruth+ Panchagavya	12.70	12.10	12.40
T_{12}: 100% N through FYM	13.00	13.13	13.07
SEm ±	0.30	0.31	0.22
CD at 5 %	0.89	0.92	0.62
Grand mean	12.57	12.68	12.63

Table.10 Effect of organic formulations and inorganic fertilizations on total sugar content in tomato fruit

Treatment	Total sugar (%)		
	2017	2018	Pooled
T_1: RDF (100% NPK through fertilizer)	16.77	16.77	16.77
T_2: Panchyagavya only	14.55	14.75	14.65
T_3: Jeevamruth only	14.30	14.4	14.35
T_4: Beejamruth only	13.90	13.99	13.95
T_5: Panchyagavya + Beejamruth	15.20	15.7	15.45
T_6: Beejamruth + Jeevamruth	14.80	15.2	15.00
T_7: Panchyagavya + Jeevamruth	15.50	15.93	15.72
T_8: RDF + Beejamruth + Panchyagavya	17.10	17.21	17.36
T_9: RDF + Beejamruth + Jeevamruth	16.90	17.47	17.18
T_{10}: RDF + Beejamruth + Jeevamruth + Panchyagavya	17.50	17.70	17.40
T_{11}: Beejamruth + Jeevamruth + Panchyagavya	15.80	15.4	15.6
T_{12}: 100% N through FYM	16.53	16.13	16.34
SEm ±	0.37	16.77	0.27
CD at 5 %	1.09	1.18	0.78
Grand mean	15.74	15.88	15.81

Total soluble solid content

Total soluble solid content in fruits of tomato significantly affected due to application of organic formulations and inorganic fertilizers and data compiled in Table 7. Significantly greater values of total soluble solid in tomato fruit were noticed 5.64, 6.20 and 5.92 ^{0}B with treatment RDF + Beejamruth + Jeevamruth + Panchyagavya (T_{10}) during both the years and pooled means, respectively, followed by 5.59, 6.17 and 5.88 ^{0}B receiving in treatment RDF + Beejamruth + Panchagavya (T_8) and lower values of total soluble solid in tomato fruit were observed in treatment T_4 4.80, 4.76 and 4.78 ^{0}B receiving Beejamruth application only. Among the individual treatments, the application of Panchyagavya was better with respect to total soluble solid content as compared to Beejamruth or Jeevamruth. Experimental results are in accordance with the findings of Hisham Aziz Amran (2014) who reported that maximum TSS was recorded in organic treatment and minimum TSS was found in without organic treatment.

Reducing sugar content

The data pertaining to reducing sugar content in tomato fruits as influenced by organic formulations and RDF are narrated in Table 8. Reducing sugar content in fruit of tomato varied in the range of 2.60 to 3.90 %, 2.49 to 4.10 % and 2.55 to 4.00 %, respectively during 2017, 2018 and pooled analysis. There was increase in reducing sugar content in tomato fruit due to combined application of organic formulations and inorganic fertilizers. The highest reducing sugar content 3.90, 4.10 and 4.00 % during both the years of experimentation and pooled analysis, was obtained in treatment receiving RDF + Beejamruth + Jeevamruth + Panchyagavya (T_{10}). The lowest reducing sugar content was registered in treatment receiving Beejamruth only (T_4). Among the individual treatments, the application of was better with respect to reducing sugar content in tomato fruit as compared to Beejamruth or Jeevamruth.

Non reducing sugar content

The non reducing sugar content in fruit of tomato was significantly affected due to different organic formulations with RDF are presented in Table 9. The data revealed that non reducing sugar content was improved with combine application of RDF and organic formulations. Among different treatments, RDF + Beejamruth + Jeevamruth + Panchyagavya (13.60, 13.11 and 13.36 %) followed by treatment of RDF + Beejamruth + Panchyagavya (13.40, 13.80 and 13.60 %) increased the non reducing sugar in tomato fruits as compared to RDF and alone application of organic formulations during 2017, 2018 and pooled analysis, respectively. The lowest amount of non reducing sugar in tomato fruits was found in application of Beejamruth only T_4 treatment. Among the individual treatments, the application of Panchagavya was better with respect to non reducing sugar content in tomato fruit as respect to non reducing sugar content in tomato fruit as compared to Beejamruth or Jeevamruth.

Total sugar content

The total sugar content in different treatments ranged from 13.90 to17.50 %, 13.99 to 17.70 and 13.95 to 17.40 % during 2017, 2018 and pooled means, respectively. The highest total sugar content 17.50, 17.70 and 17.40 % were noted in the treatment receiving RDF + Beejamruth + Jeevamruth + Panchyagavya (T_{10}). Whereas lowest total sugar content 14.10, 13.79 and 13.95 % was noticed in treatment Beejamruth only (T_4). Among the individual treatments, the application of Panchyagavya was better with respect to total sugar content as compared to Beejamruth.

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