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Effect of organic, inorganic and biofertilizer on growth and yield of onion (*Allium cepa* L.) cv. GJRO-11

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Abstract

Present investigation was conducted the year 2018-19 in *Rabi* season at Horticultural Research Farm, College of Horticulture, AAU, Anand, Gujarat with ten treatments in a simple RBD with three replications. The soil application of 50% RDF (50: 37.5: 37.5 NPK kg/ha) + 25% N from vermicompost + 5 ml Bio-NPK consortium was most effective treatment and which was recorded significantly maximum on growth and yield parameters *viz.*, plant height (70.11 and 86.70 cm at 45 and 90 DAT respectively), minimum bolting per cent (4.38), average bulb weight (129.30 g), bulb volume (136.70 cc), neck thickness (1.11 cm), bulb yield (24.18 kg/plot and 497.60 q/ha), maximum A and B grade bulb yield (395.98 q/ha and 91.50 q/ha, respectively) and TSS (13.47 °Brix). While number of leaves per plant was non-significant.

Keywords: Onion, organic, inorganic, biofertilizer, growth and yield

Introduction

Onion (*Allium cepa* L.) is one of the most important vegetable bulbous crops grown in India from ancient time. Onion is the “Queen of the kitchen”. The edible portion is a modified stem which is known as ‘bulb’ and develops underground. Onion is preferred mainly because of its green leaves, immature and mature bulbs are either eaten raw or cooked as vegetables. It is popular as salad crop and mature onion bulbs are widely used as a cooked vegetable in soups, stews and casseroles in addition to a flavoring agent in many additional dishes. It is one of the few versatile vegetable crops that can be kept for a fairly long period and can safely withstand the hazards of rough handling including long distance transportation.

In world, India ranks 2nd in area and production of onion. India is prominent in the production and export of onion in the world. Onion is being grown in area of 1285000 ha with total bulb production of 23262000 MT (Anon., 2018) [2]. In Gujarat, onion occupied an area of about (54488 ha) with total bulb production of 1416602 MT (Anon., 2018) [2]. The major onion growing districts are Bhavnagar, Rajkot, Amreli, Junagadh, Jamnagar, Porbandar, Kutch, Mehsana, Surat and Anand. Bhavnagar is a leading district for onion cultivation of 32,000 ha area and 870400 MT production. (Anon., 2018) [3].

As regard with the productivity the combined application of organic manures and inorganic fertilizers to increase yield but has paramount importance in ameliorating the yield. Use of inorganic fertilizers now a day is costly affair and increases cost of cultivation. Secondly the sole application of inorganic fertilizers deteriorates soil fertility level day by day, which affect the production, economics of production and human health, while organic manure and bio-fertilizers are cheap, easily available and eco-friendly, giving quality produce, improving keeping quality, T.S.S. and pungency. It improves the physiochemical properties like soil structure, infiltration rate, porosity, water holding capacity, bulk density, etc. and also very useful for the sustainable crop production as well as soil fertility and productivity.

Material and methods

A field experiment entitled “Effect of organic, inorganic and biofertilizer on growth and yield of onion (*Allium cepa* L.) cv. GJRO-11” was laid out during the year of 2018-19 at Horticultural Research Farm, College of Horticulture and Laboratory work was carried out in the Department of Horticulture as well as Department of Microbiology, B. A. College of Agriculture, Anand Agricultural University, Anand.

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There were ten treatments *i.e.* T₁ -100 % RDF (control), T₂ - 75 % RDF + 25 % N from FYM, T₃ - 75 % RDF + 25 % N from vermicompost, T₄ - 75 % RDF + 25 % N from castor cake, T₅ - 50 % RDF + 50% N from FYM, T₆ - 50 % RDF + 50% N from vermicompost, T₇ - 50 % RDF + 50% N from castor cake, T₈ - 50 % RDF + 25 % N from FYM + 5 ml Bio-NPK Consortium, T₉ - 50 % RDF + 25 % N from vermicompost + 5 ml Bio-NPK Consortium and T₁₀ - 50 % RDF + 25 % N from castorcake + 5 ml Bio-NPK Consortium in a Randomized block design with three replication with plot size of 3 x 2 m. The soil of the experimental field was light alluvial having sandy loam texture with the soil pH of 7.5, 0.25 % organic carbon 220.25 kg/ha available nitrogen determined by alkaline potassium permanganate method, 28.22 kg/ha available phosphorus estimated with Olson's extraction method, 258.32 kg/ha available potassium determined with Flame photometer and microbial count of soil at initial and after harvest the crop was counted by colony forming unit machine. Onion seeds were sown on 11th October, 2018. About six weeks old seedlings was transplanted on 4th December, 2018 at row to row distance of 15 cm and plant to plant distance of 10 cm. Common dose of FYM 20 t/ha applied one month before the transplanting. The organic manures (Farm yard manure, Vermicompost, and Castor cake) were applied at the time of field preparation and half of the nitrogen (N) and full dose of phosphorus (P) and potassium (K) were applied before transplanting and remaining nitrogen (N) were applied one month after transplanting. Observations were recorded for different traits. The recommended dose of fertilizer was done as NPK @100:75:75 kg/ha and Bio-fertilizers applied as a root dipping treatment (3-5 ml/l water for 10-15 minutes). Plant height was measuring by measuring scale. Bulb diameter and neck thickness measuring by Vernier Calipers. Bulb weight measure by weighing balance. TSS determined by digital refractro meter. For observation of plant five-five plants per plot was selected at random for the purpose in each

observation at different stages of plant growth as mentioned earlier and after that the average value was calculated. Recording growth parameter like plant height (cm), number of leaves, bolting percent and yield parameter like average bulb weight (g), bulb volume (cc), neck thickness (cm), bulb yield (kg/plot and q/ha), grading of bulb (A grade > 65 g, B grade 45-65 g, C grade < 45 g) and TSS (°Brix). The bulbs were harvested on 30th March, 2019 when 70% tops started falling over. The tops were removed two days after field curing leaving 2.5 cm top with the bulb. The data were analyzed statistically as per standard procedure.

Result and discussion

Growth parameters

Growth of onion crop was evaluated in terms of plant height, number of leaves and bolting percent. The result of the effect of various combination of organic, inorganic and biofertilizer found that the maximum plant height (70.11 and 86.70 cm at 45 and 90 DAT respectively) and minimum bolting per cent (4.38). While number of leaves per plant at 45 and 90 DAT was non-significant in treatment T₉ (50% RDF + 25% N from VC + 5 ml Bio-NPK Consortium) which was at par with T₁₀ (50% RDF + 25% N from CC + 5 ml Bio-NPK Consortium), T₈ (50% RDF + 25% N from FYM + 5 ml Bio-NPK Consortium) and T₆ (50% RDF + 50% N from VC) and minimum in T₂ (75% RDF + 25% N from FYM). Higher plant height, number of leaves and minimum bolting percent due to application of biofertilizer improve nitrogen status of soil because it is free nitrogen fixer, thereby increase the nitrogen level and ultimately increase plant growth and development and also vermicompost along with NPK which increase physical and biological condition of soil which helps to increase plant growth parameter and suppress bolting percent. Similar result finding were also reported by Jayathilake *et al.* (2003), Jayathilake *et al.* (2006), Chuda *et al.* (2009), Maneesh kumar (2015), Jat *et al.* (2018) Singh and Singh (2018) ^[11, 10, 4, 13, 8, 22] in onion.

Table 1: Effect of organic, inorganic and biofertilizers on growth parameters of onion cv. GJRO-11

Treatment No.	Plant height (cm)		No. of leaves/plant		Bolting (%)
	45 DAT	90 DAT	45 DAT	90 DAT	
T ₁	61.75	77.57	7.73	10.40	5.29
T ₂	54.21	71.19	7.27	9.53	5.48
T ₃	56.71	75.67	7.53	10.13	5.33
T ₄	55.47	74.77	7.40	10.07	5.46
T ₅	57.07	75.93	7.63	10.20	6.20
T ₆	67.67	83.53	8.00	10.73	4.77
T ₇	62.19	77.70	7.93	10.47	5.09
T ₈	68.03	84.57	8.07	10.90	4.53
T ₉	70.11	86.70	8.13	11.07	4.38
T ₁₀	68.57	85.73	8.07	11.00	4.38
S.Em. ±	2.54	3.38	0.28	0.32	0.15
C. D. at 5%	7.56	10.05	NS	NS	0.44
C.V. %	7.09	7.38	6.29	5.23	5.08

Yield parameters

The result of the effect of various combination of organic, inorganic and biofertilizer found that the maximum average bulb weight (129.30 g), bulb volume (136.70 cc), neck thickness (1.11 cm), pollar diameter (5.56 cm), equatorial diameter (6.91 cm), bulb yield (24.18 kg/plot and 497.60 q/ha), maximum A and B grade bulb yield (395.98 q/ha and 91.50 q/ha, respectively) and TSS (13.47 °Brix) in treatment T₉ (50% RDF + 25% N from VC + 5 ml Bio-NPK Consortium) which was at par with T₁₀ (50% RDF + 25% N

from CC + 5 ml Bio-NPK Consortium), T₈ (50% RDF + 25% N from FYM + 5 ml Bio-NPK Consortium) and T₆ (50% RDF + 50% N from VC) and minimum in T₂ (75% RDF + 25% N from FYM). Because of application of biofertilizer improve nitrogen status of soil and also it is free nitrogen fixer, thereby increase the nitrogen level, major nutrient availability is supplied by inorganic fertilizer will be utilized quickly and other essential secondary nutrient slowly released by organic substance and also vermicompost increase physical and biological condition of soil which helps to increase vegetative

growth of plant & due to high rate of photosynthesis, chlorophyll synthesis & translocation of more photosynthates to the storage organ resulting good bulb yield. Similar result finding were also reported by Krishnamurthy (2005), Mahanthes *et al.* (2005) and Chuda *et al.* (2009), Kumar *et al.* (2011), Mandal *et al.* (2013), Brinjh *et al.* (2014), Singh *et al.* (2015), Rabari *et al.* (2016) [12, 15, 4, 14, 16, 21, 19] in onion.

Conclusion

On the basis of the present investigation study, it could be concluded that treatment T₉ -50% RDF (50: 37.5: 37.5 NPK kg/ha) + 25% N from vermicompost + 5 ml Bio-NPK

consortium was found superior in respect to growth parameter and yield of onion cv. GJRO-11 under Middle Gujarat condition.

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Table 2: Effect of organic, inorganic and Bio fertilizers on yield parameters and yield of onion cv. GJRO-11

Treatment No.	Average bulb weight (g)	Bulb volume (cc)	Neck thickness (cm)	Bulb diameter (cm)		Bulb yield		Grading of bulbs			TSS (°Brix)
				Pollar diameter	Equatorial diameter	Kg/plot	q/ha	A grade	B grade	C grade	
T ₁	116.60	120.17	0.84	5.16	6.22	19.39	398.97	327.37	46.84	24.69	12.48
T ₂	105.07	107.07	0.69	4.58	5.83	16.30	335.39	270.03	28.81	36.69	11.71
T ₃	111.13	117.53	0.81	5.01	6.08	18.06	371.60	298.77	41.02	31.96	12.47
T ₄	110.80	116.67	0.84	4.87	5.98	17.07	351.17	287.79	29.42	34.02	12.28
T ₅	113.33	119.23	0.84	5.10	6.16	18.52	381.00	307.89	44.92	28.33	12.51
T ₆	123.64	128.40	0.96	5.36	6.44	21.84	449.31	353.37	83.88	12.21	13.15
T ₇	117.93	123.07	0.86	5.21	6.30	20.42	420.10	342.11	61.80	16.19	12.96
T ₈	123.73	128.87	0.97	5.44	6.49	22.60	465.02	369.00	84.43	11.66	13.18
T ₉	134.30	136.70	1.11	5.56	6.91	24.18	497.60	395.98	91.50	10.01	13.48
T ₁₀	126.13	131.80	1.07	5.48	6.73	23.01	473.39	371.67	90.88	10.77	13.37
S.Em. ±	4.86	2.90	0.05	0.11	0.16	0.95	19.60	14.56	3.05	1.05	0.33
C. D. at 5%	14.45	8.61	0.16	0.34	0.47	2.83	58.23	43.26	9.06	3.13	0.98
C.V. %	7.12	4.08	10.40	3.82	4.31	8.19	8.19	7.59	8.75	8.43	4.47

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