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### Economics, fertility status and microbial count on soil of onion (*Allium cepa* L.) cv. GJRO-11 as influenced by organic, inorganic and biofertilizer

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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 % N from FYM was significantly maximum availability of N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O and Organic carbon (369, 44.67, 331 kg/ha and 0.39 %, respectively) and application of 50 % RDF + 25 % N through FYM + 5 ml Bio-NPK consortium recorded maximum *Azotobacter*, *Azopirillum*, PSB, KMB and Total count of bacteria. Among the different treatments; T<sub>9</sub>-50% RDF (50: 37.5: 37.5 NPK kg/ha) + 25% N from vermicompost + 5 ml Bio-NPK consortium registered the highest net realization 306569.38/ha with BCR value of 3.35 as compared to rest of the treatments.

**Keywords:** Onion, organic, inorganic, bio fertilizer, economics, fertility status

**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 2<sup>nd</sup> 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) <sup>[1-2]</sup>. In Gujarat, onion occupied an area of about (54488 ha) with total bulb production of 1416602 MT (Anon., 2018) <sup>[1-2]</sup>. 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) <sup>[1-2]</sup>.

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. 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. Organic manures acts as a buffering agents and supplies food for beneficial living organisms. Organic manures helps to control the plant parasitic nematodes and fungi up to some extent by altering the balance of micro-organisms and increase organic carbon in the soil. In recent years, biofertilizer NPK consortium are gaining much popularity. Bio-NPK consortium contain five strains of agriculturally beneficial microorganism (two Nitrogen fixer, two Phosphate solubilizer and one potash mobilizer) is the one time solution for all the macronutrient (N, P, and K) requirement of crop. Use of Bio-NPK consortium @ 3-5 ml for root dipping treatment can save up to 25% N, P, K chemical fertilizer with increase in growth and yield with reduction of soil, water and air pollution.

## 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 Agriculture University, Anand. There were ten treatments *i.e.* T<sub>1</sub> -100 % RDF (control), T<sub>2</sub> - 75 % RDF + 25 % N from FYM, T<sub>3</sub>- 75 % RDF + 25 % N from vermicompost, T<sub>4</sub>- 75 % RDF + 25 % N from castor cake, T<sub>5</sub>- 50 % RDF + 50% N from FYM, T<sub>6</sub>- 50 % RDF + 50% N from vermicompost, T<sub>7</sub>- 50 % RDF + 50% N from castor cake, T<sub>8</sub>- 50 % RDF + 25 % N from FYM + 5 ml Bio-NPK Consortium, T<sub>9</sub>- 50 % RDF + 25 % N from vermicompost + 5 ml Bio-NPK Consortium and T<sub>10</sub> - 50 % RDF + 25 % N from castor cake + 5 ml Bio-NPK Consortium in a Randomized block design with three replication with plot size of 3x 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 11<sup>th</sup> October, 2018. About six weeks old seedlings was transplanted on 4<sup>th</sup> 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). The bulbs were harvested on 30<sup>th</sup> 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. The economic study of the crop was done by computing the cost of cultivation and net profit in rupees per hectare on the basis of prevailing rate of inputs and outputs obtained from the local market. Nutrient status and microbial of soil at initial and after harvest the crop is determined by different method of estimation.

## Result and Discussion

### Economics

The result of the effect of various combination of organic, inorganic and biofertilizer found that the highest net realization 306569.38 /ha with BCR value of 3.35 in treatment T<sub>9</sub> (50% RDF + 25% N from VC + 5 ml Bio-NPK Consortium) as compared to rest of the treatments and minimum in T<sub>2</sub> (75% RDF + 25% N from FYM). Similar result finding were also reported by Dilpreet *et al.* (2017) in onion.

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

Treatment No.	Yield (kg/ha)	Gross realization ( /ha)	Total cost of production ( /ha)	Net realization ( /ha)	BCR
T <sub>1</sub>	39897	319176	87893.13	231282.87	2.63
T <sub>2</sub>	33539	268312	91561.68	176750.32	1.93
T <sub>3</sub>	37160	297280	92949.18	204330.82	2.20
T <sub>4</sub>	35117	280936	92255.43	188680.57	2.05
T <sub>5</sub>	38100	304800	95229.12	209570.88	2.20
T <sub>6</sub>	44931	359448	98004.12	261443.88	2.67
T <sub>7</sub>	42010	336080	96616.62	239463.38	2.48
T <sub>8</sub>	46502	372016	90123.12	281892.88	3.13
T <sub>9</sub>	49760	398080	91510.62	306569.38	3.35
T <sub>10</sub>	47339	378712	90816.87	287895.13	3.17

### Nutrient status of soil

The result of the effect of various combination of organic, inorganic and biofertilizer found that the soil application of 50 % RDF + 50 % N from FYM was significantly maximum availability of N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O and Organic carbon (369, 44.67, 331 kg/ha and 0.39 %, respectively). While in organic carbon and available phosphorus in T<sub>6</sub> (50% RDF + 50% N from VC) and T<sub>7</sub> (50% RDF + 50% N from CC) at par with T<sub>5</sub> (50% RDF + 50% N from FYM) and available nitrogen and potash

in T<sub>6</sub> (50% RDF + 50% N from VC), T<sub>7</sub> (50% RDF + 50% N from CC), T<sub>8</sub> (50% RDF + 25% N from FYM + 5 ml Bio-NPK Consortium) and T<sub>10</sub> (50% RDF + 25% N from CC + 5 ml Bio-NPK Consortium) at par with T<sub>5</sub> and minimum in T<sub>1</sub> (control). Similar result finding were also reported by Jayathilake *et al.* (2006) [4], Singh and Pandey (2006) [8], Sharma *et al.* (2009) [7], Nainwal *et al.* (2015), Thangasamy and Lawande (2015) [15] and Shinha *et al.* (2017) in onion.

**Table 2:** Effect of organic, inorganic and biofertilizers on available nutrient status of the soil at initial and after harvest the crop

Treatment No.	Organic Carbon (%)	Available Nutrient status of the soil		
		Nitrogen (kg/ha)	Phosphorus (kg/ha)	Potash (kg/ha)
Initial	0.25	220.25	28.22	258.32
T <sub>1</sub>	0.25	254.33	33.00	266.00
T <sub>2</sub>	0.26	282.67	36.67	296.00
T <sub>3</sub>	0.29	260.00	34.33	280.33
T <sub>4</sub>	0.27	271.00	35.33	291.00
T <sub>5</sub>	0.39	369.00	44.67	331.00
T <sub>6</sub>	0.36	350.67	41.67	324.33

T <sub>7</sub>	0.36	357.33	42.33	326.67
T <sub>8</sub>	0.30	340.00	39.67	323.67
T <sub>9</sub>	0.34	293.00	37.33	302.67
T <sub>10</sub>	0.33	327.67	39.00	321.67
S.Em. ±	0.01	14.66	1.38	5.39
C. D. at 5%	0.03	43.55	4.11	16.01
C.V. %	6.26	8.17	6.25	3.05

### Microbial count of soil

The data presented in Table 3 revealed that among the different combination of treatments, T<sub>8</sub>(50 % RDF + 25 % N through FYM + 5 ml Bio-NPK consortium) recorded maximum Azotobacter, Azopirillum, PSB, KMB and Total count of bacteria. Whereas, the minimum Azotobacter, Azopirillum, PSB, KMB and Total count of bacteria in Control. FYM treatments improved the microbial count at

harvesting time as compared to other biofertilizer treatments. It might be due to slow releasing of nutrients from FYM. Farm yard manure is a carrier of organic carbon and organic dry matter. Due to this reason, organic carbon and microbial count improved in onion with the application of FYM alone or in combination with biofertilizers. Similar trends of results were reported Dilpreet *et al.* (2017).

**Table 3:** Effect of organic, inorganic and biofertilizers on microbial count of soil at initial and after harvest the crop

Treatment No.	Microbial count (cfu/g) of soil				
	Azotobacter	Azopirillum	PSB	KMB	Total count
Initial	2.4 x 10 <sup>3</sup>	2.1 x 10 <sup>3</sup>	1.9 x 10 <sup>3</sup>	2.9 x 10 <sup>3</sup>	4.0 x 10 <sup>7</sup>
T <sub>1</sub>	2.8 x 10 <sup>3</sup>	6.1 x 10 <sup>4</sup>	4.3 x 10 <sup>4</sup>	2.8 x 10 <sup>4</sup>	4.5 x 10 <sup>7</sup>
T <sub>2</sub>	4.8 x 10 <sup>4</sup>	3.5 x 10 <sup>4</sup>	2.4 x 10 <sup>5</sup>	3.9 x 10 <sup>5</sup>	5.6 x 10 <sup>8</sup>
T <sub>3</sub>	3.9 x 10 <sup>4</sup>	3.0 x 10 <sup>4</sup>	2.1 x 10 <sup>5</sup>	3.4 x 10 <sup>5</sup>	4.9 x 10 <sup>8</sup>
T <sub>4</sub>	3.1 x 10 <sup>4</sup>	2.5 x 10 <sup>4</sup>	1.8 x 10 <sup>5</sup>	2.9 x 10 <sup>5</sup>	4.1 x 10 <sup>8</sup>
T <sub>5</sub>	5.2 x 10 <sup>4</sup>	3.9 x 10 <sup>4</sup>	3.3 x 10 <sup>5</sup>	5.0 x 10 <sup>5</sup>	6.2 x 10 <sup>8</sup>
T <sub>6</sub>	4.4 x 10 <sup>4</sup>	3.2 x 10 <sup>4</sup>	2.7 x 10 <sup>5</sup>	4.5 x 10 <sup>5</sup>	5.7 x 10 <sup>8</sup>
T <sub>7</sub>	3.8 x 10 <sup>4</sup>	2.8 x 10 <sup>4</sup>	2.5 x 10 <sup>5</sup>	4.0 x 10 <sup>5</sup>	5.1 x 10 <sup>8</sup>
T <sub>8</sub>	7.1 x 10 <sup>5</sup>	6.1 x 10 <sup>5</sup>	4.7 x 10 <sup>5</sup>	6.2 x 10 <sup>5</sup>	7.3 x 10 <sup>9</sup>
T <sub>9</sub>	6.0 x 10 <sup>5</sup>	5.5 x 10 <sup>5</sup>	4.2 x 10 <sup>5</sup>	5.8 x 10 <sup>5</sup>	6.9 x 10 <sup>9</sup>
T <sub>10</sub>	4.1 x 10 <sup>5</sup>	4.4 x 10 <sup>5</sup>	3.5 x 10 <sup>5</sup>	5.1 x 10 <sup>5</sup>	6.3 x 10 <sup>9</sup>

### Conclusion

On the basis of the present investigation study, it could be concluded that treatment T<sub>9</sub>-50% RDF (50: 37.5: 37.5 NPK kg/ha) + 25% N from vermicompost + 5 ml Bio-NPK consortium was registered the highest net realization 306569.38/ha with BCR value of 3.35 as compared to rest of the treatments for onion cv. GJRO-11 under Middle Gujarat condition.

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