

Effects of Organic and Chemical Fertilizers on Growth and Yield of Onion (*Allium cepa* L)

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Abstract— The field trials were carried out to study the effects of organic and chemical fertilizers on growth and yield characteristics of onion (*Allium Cepa* L) at outdoor nursery of Solapur University, in agricultural farm in the district of Solapur, Maharashtra State, India. Plot size 2m x 1m (2m²) were prepared for conducting field experiment. The experiment was arranged in Randomized Block Design (RBD) method with five treatments and three replications. The treatment details consist of vermicompost (T₁) at rate 0.5 kg/plot (@ 0.25 kg/sq. m), NADEP compost (T₂) at rate 1.25kg/plot (@ 0.625 kg/sq. m), pit compost (T₃) at rate 1.25kg/plot (@ 0.625 kg/sq. m), recommended dose of chemical fertilizers 100:50:50 kg ha⁻¹ (T₄) and Control T₅. The outcomes of field study showed that the highest length of leaves (cm/plant), single bulb weight (gm/plant), bulb yield (Kg/plot) were maximum with application of recommended dose of chemical fertilizer as compared to other fertilizer treatments. The application of vermicompost also gave the maximum plant biomass per plant of onion.

Keyword—Field, growth, organic fertilizer, Onion, straight chemical fertilizer, yield.

I. INTRODUCTION

Onion (*Allium cepa*) is a common seasonal crop (kharif and rabi) especially is used for food and medicinal purposes. Improper management of solid waste generates environmental problems. Composting of organic solid waste is best method to manage solid waste of different organic type of waste. Vermicompost, pit compost, NADEP compost these are such common methods of composting. Application of organic fertilizers provide nutrients to agricultural crop. It sustain fertility and moisture of soil. Use of organic manures with the inorganic fertilizer is the best method toward increase the production of crop system in field.

The importance of macro nutrients such as nitrogen, phosphorous, potassium, sulphur, zinc, and boron used for the growth and yield of various crops [1]. Onion crop shows progressive response with the use of organic and inorganic fertilizers. The practice of organic manures in agricultural field is the alternate source of the nitrogen

would give better result in its growth stages and yield [2]. Alam et al. (2007) studied the effect of vermicompost and NPKS fertilizers with their applications on growth and yield of red amaranth. They put forward that vermicompost along with 50% NPKS is more favourable for the production of red amaranth and also for the conservation of soil environment [3]. Manivannan et al., (2009) stated that the increased growth and yield of the beans, *Phaseolus vulgaris* can result due to the application of vermicompost which indirectly influences the physical conditions of the soil and also supports for better aeration to the plant roots, absorption of water, induction of N, P and K exchange there by resulting in improved growth of the plants [4]. Banjare et al (2015) conducted a field experiment on Onion at Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh and testified that application of 100 % recommended doses of fertilizers (RDF) can maximum bulb yield in Onion. The mixture of two nutrient sources helped to increase growth parameters and yield contributing characters resulting in good bulb yield in Onion. [5]. Related results were also found by Sankar et al (2005) in onion crop [6]. Sadaria et al (1997) reported that the yield of Onion was found highest using 100 kg nitrogen/ha [7]. Organic manures have helpful effect on root growth by improving the root rhizosphere conditions such as structure, humidity and also plant growth is encouraged by increasing the population of microorganisms in environment [8]. The objective of this research work is to study effects of organic and chemical fertilizers treatment on growth and yield of Onion.

II. MATERIALS AND METHODS

The field experiment was laid out in Randomized Block Design (RBD) with five treatments and three replications. The plot size was 2m x 1m. All together 15 plots of 2m² each were prepared for the experiment. Total 500 seeds of onion were cultivated per plot. Treatments selected for study were vermicompost (T₁), NADEP compost (T₂), pit compost (T₃), chemical fertilizers was applied in the proportion 100:50:50 Kg of NPK/ha according to recommended dose of fertilizers as T₄ and control (T₅). The process of composting was followed by as described

by Chavan et al., (2015) [9]. Vermicompost was used at rate 0.5 kg/plot (@ 0.25 kg/sq. m). A common dose of NADEP and pit compost were used at same rate @ 1.25 kg/plot (@ 0.625 kg/sq. m) as per usual practice of farmers. Straight chemical fertilizers (Urea-43.4gm + Single super phosphate-62.5gm + Murate of potash-16.6gm) combinantly used in Treatment T_4 having plot size 2m x 1m. The experimental view is presented in photo plate 1 and 2.

The treatment details were given bellow

Botanical name: *Allium Cepa L*

Variety: local

Experiment: Field

Design: Randomized block design

Plot size: 2m x 1m (2m²).

Replications: Three

Number of seeds sown per plot: 500

Treatment details and recommended dose fertilizers:

T_1 - Vermicompost prepared from agricultural solid waste @ 2500 kg/h [10]

T_2 - NADEP compost prepared from agricultural solid waste @ 6.25 t/ha [11]

T_3 - Pit compost prepared from municipal solid waste @ 6.25 t/ha [11]

T_4 - Chemical fertilizer- 100:50:50 - N: P₂O₅: K₂O Kg/ha [12]

T_5 - Control

Quantity of fertilizers used in plots having size 2m X 1m(2m²).

T_1 - @ 0.5 kg/plot (@ 0.25 kg/sq. m)

T_2 - @ 1.25 kg/plot (@ 0.625 kg/sq. m)

T_3 - @ 1.25 kg/plot (@ 0.625 kg/sq. m)

T_4 - According to Recommended Dose of Fertilizer (Urea-43.4gm+single super phosphate-62.5gm+murate of potash-16.6gm)

T_5 - Soil without fertilizers

III. RESULT AND DISCUSSION

Results achieved in present investigation are described below. All the all values of nutrients found after their analysis in laboratory by known standard methods for prepared organic fertilizers and experimental soil are noted in table 1.

Table 1. Soil and organic fertilizers characteristics.

Parameters	Soil	T_1	T_2	T_3
pH	08.10	8.06	7.65	7.15
Moisture (%)	8.08	30.20	18.34	05.35
Org. matter (%)	1.00	16.42	11.75	11.30
N (%)	0.34	1.01	0.92	0.77
P (%)	0.25	1.50	1.06	0.17
K (%)	0.15	1.05	1.91	0.88

T_1 indicates vermicompost, T_2 indicates NADEP compost and T_3 indicates Pit compost.

The growth characters of Onion were observed after 30th, 60th and 90th day from the date of planting. At time of final harvest 50 plants were selected randomly from the plot and morphological data such as leaves length (cm/plant), no. of leaves/plant, weight of single bulb (gm/plant), fresh weight/plant (gm/plant), yield/plot (Kg/plot) were recorded after 90th day.

Table.2: Effects of organic and chemical fertilizer on growth and yield of Onion.

Treatment	Leaves length (cm/plant)			Number of leaves/plant	Weight of single bulb (gm/plant)	Fresh weight/plant (gm/plant)	Yield/plot (Kg/plot)
	After 30 th day	After 60 th day	After 90 th day				
T_1	11.48 (±1.09)	33.27 (±3.83)	41.46 (±2.41)	7.87 (±1.36)	17.01 (±4.68)	30.00 (±4.41)	8.280
T_2	11.72 (±1.55)	36.04 (±5.20)	37.27 (±4.98)	8.66 (±0.81)	14.31 (±2.11)	24.71 (±3.82)	6.930
T_3	11.56 (±1.44)	29.58 (±5.18)	35.67 (±7.58)	6.85 (±1.24)	11.89 (±1.07)	19.85 (±3.39)	5.300
T_4	10.6 (±2.58)	34.31 (±7.04)	43.42 (±3.84)	8.12 (±1.05)	17.70 (±5.07)	28.12 (±10.64)	9.105
T_5	10.68 (±1.38)	33.67 (±9.67)	34.38 (±6.54)	7.87 (±1.83)	13.71 (±2.14)	23.75 (±5.35)	6.660

T_1 indicates vermicompost, T_2 indicates NADEP compost, T_3 indicates pit compost, T_4 indicates chemical fertilizers and T_5 indicates control.

Leaves length (cm/plant):

Average leaves length (cm/plant) in the treatments T_1 , T_2 , T_3 , T_4 and T_5 were found to be 11.48cm, 11.72cm, 11.56cm, 10.6cm and 10.68cm respectively after 30th day (fig. 1). The maximum leaves length (11.72cm/plant)

were recorded by the treatment of T_2 at rate 1.25 kg/plot (@ 0.625 kg/sq. m) while it is minimum (11.56cm/plant) in T_3 and lower in treatment T_4 after 30th day.

Average leaves length (cm/plant) in the treatments T_1 , T_2 , T_3 , T_4 and T_5 were found to be 33.27cm, 36.04cm,

29.58cm, 34.31cm and 33.67cm respectively after 60th day (fig. 1). After 60th day, length of leaves increased with application of NADEPcompost (T₂) at rate 1.25 kg/plot (@ 0.625 kg/sq. m) as compared to remaining fertilizer treatments and control.

After 90th day, Average leaves length (cm/plant) in the treatments T₁, T₂, T₃, T₄ and T₅ were found to be 41.46cm, 37.27cm, 35.67cm, 43.42cm and 34.38cm respectively (fig. 1). The highest leaves length (43.42cm/plant) were recorded from chemical treatment T₄ followed by vermicompost treatment T₁ (41.46cm/plant) and it was minimum (37.27cm/plant) in treatments T₂ (37.27cm/plant). Lowest leaves length (34.38cm/plant) was found in control treatment (T₅).

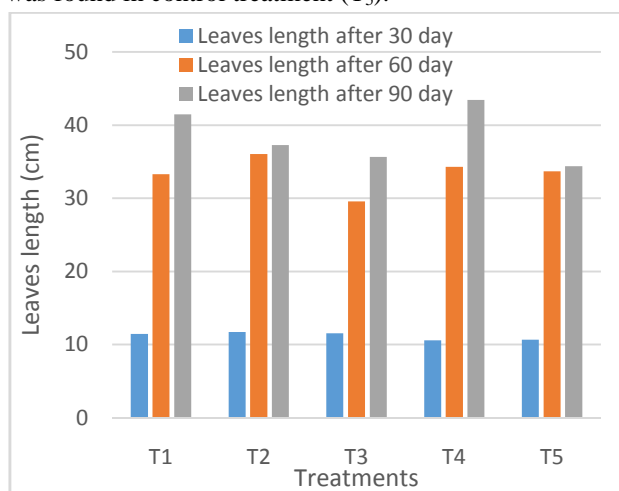


Fig.1: Effects of fertilizer treatments on leaves length of Onion crop.

Number of leaves/plant: After 90th day, average number of leaves in the treatments T₁, T₂, T₃, T₄ and T₅ were found to be 7.87 (1.36), 8.66 (0.81), 6.85 (1.24), 8.12 (1.05) and 7.87 (1.83) respectively (fig. 2). After 90th day, application of NADEP compost (T₂) at rate 1.25 kg/plot (@ 0.625 kg/sq. m) recorded higher number of leaves (8.66). The minimum number of leaves (6.85) was observed with chemical fertilizer treatment (T₄) and lower (6.85) in pit compost treatment (T₃).

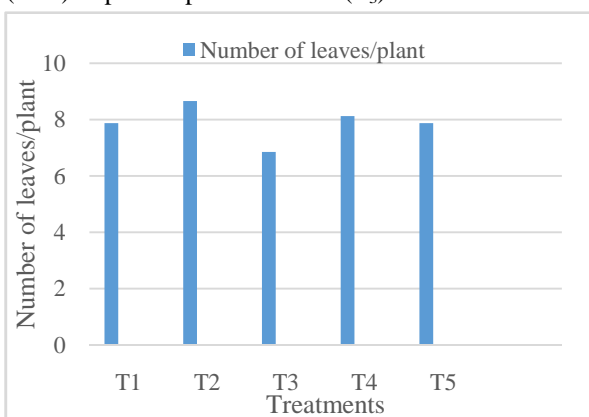


Fig.2: Effects of fertilizer treatments on number of leaves of Onion crop.

Weight of single bulb (gm/plant): After 90th day, weight of single bulb (gm/plant) in the treatments T₁, T₂, T₃, T₄ and T₅ were found to be 17.01gm (±4.68), 14.31gm (±2.11), 11.89gm (±1.07), 17.70gm (±5.07) and 13.71gm (±2.14) respectively (fig. 3). Recommended dose chemical fertilizers treatment (T₄) resulted in maximum weight of single bulb (17.70gm/plant) which was closely related to vermicompost treatments (T₁) at rate 0.5 kg/plot (@ 0.25 kg/sq. m). The lowest weight of single bulb (11.79gm/plant) was observed by using pit compost treatment (T₃) at rate 1.25 kg/plot (@ 0.625 kg/sq. m).

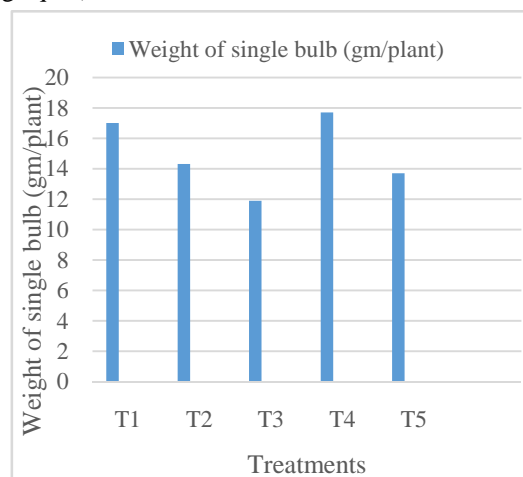


Fig.3: Effects of fertilizer treatments on weight of single bulb of Onion crop.

Fresh weight/plant (gm/plant): After 90th day, fresh weight per plant (gm/plant) in the treatments T₁, T₂, T₃, T₄ and T₅ were found to be 30.00gm (±4.41), 24.71gm (±3.82), 19.85gm (±3.39), 28.12gm (±10.64) and 23.75gm (±5.35) respectively (fig. 4). The highest fresh weight/plant (30.00gm/plant) was obtained from the vermicompost treatment T₁. The lowest Fresh weight/plant (19.85gm/plant) was obtained from the treatment T₃.

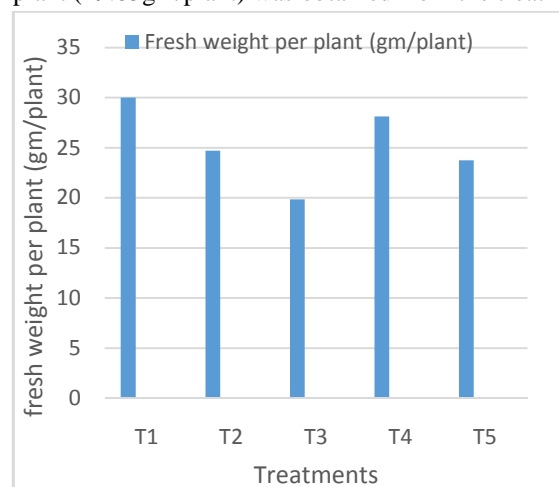


Fig.4: Effects of fertilizer treatments on fresh weight per plant of Onion crop.

Yield/plot (Kg/plot): After 90th day, the bulb yield (Kg/plot) of Onion crop in the treatments T₁, T₂, T₃, T₄

and T₅ were found to be 8.280Kg/plot, 6.930Kg/plot, 5.300Kg/plot, 9.105 and 6.660Kg/plot respectively(fig. 5).

The results in Table 2 showed that the maximum bulb yield of onion(9.105Kg/plot) was found with utilization of chemical fertilizer treatment (T₄) then followed byvermicomposttreatment (T₁),the minimum yield (5.300Kg/plot) was recorded in pit compost treatment (T₃). Bulb yield was recorded from the T₂ (6.930Kg/plot) and T₅(9.105Kg/plot) treatment which was close to each other and lowest bulb yield was (5.300Kg/plot) from T₃ treatment.

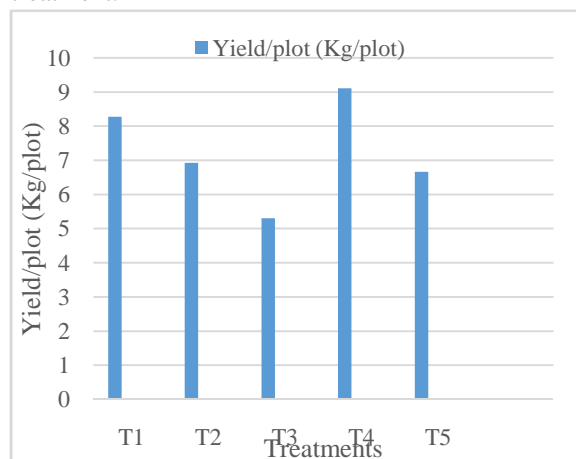


Fig.5: Effects of fertilizer treatments on bulb yield of Onion crop.



Photo plate 1. Experimental view of onion crop on field



Photo plate 2. Experimental view of onion crop on field

IV. CONCLUSION

The production of bulb yield of Onion was maximum with application of recommended dose of chemical fertilizer (T₄) and was followed by vermicompost treatment (T₁), while it was minimum in NADEP compost treatment (T₂) and lower in pit compost treatment (T₃) than control.

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