Environment and Ecology 40 (4) : 2081—2085, October—December 2022
ISSN 0970-0420

Effect of Organic Manures on Growth and Physiology of Aggregatum Onion (*Allium cepa* L. var. aggregatum)

Bijjula Sruthi, Somasundaram E., Murali Arthanari P., Shoba Thingalmaniyan K.

Received 29 May 2022, Accepted 9 July 2022, Published on 19 October 2022

ABSTARCT

A field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore during 2018-2019 to study the effect of organic manures on growth and physiology of aggregatum onion. Randomized Complete Block Design was used with twelve treatments and three replication. Organic manures used in the experiment includes FYM, Vermicompost and *Ganajeevamrutham* applied as basal application where as liquid manures such as *Panchagavya*, humic acid and *jeevamrutham* sprayed on 30, 45 and 60 DAS. The results had shown that the application of FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS recorded highest plant height, leaf length, number of leaves, root length, root volume and dry matter followed by RDF+TNAU pulse wonder @ 1% FS. Maximum leaf area index, crop growth rate and relative growth rate were recorded with the application of FYM @ 25 t ha^{-1} + Panchagavya @ 3% FS which was comparable with RDF+TNAU pulse wonder @ 1% FS. Lower growth attributes and physiological parameters were observed in absolute control.

Keywords Onion, Organic, *Panchagavya*, FYM , TNAU pulse wonder.

INTRODUCTION

Among the vegetable crops onion is the second most important crop also known as aggregatum onion or multiplier onion (*Allium cepa* L. var. aggregatum). It is cultivated both as vegetable and also as a spice crop. Aggregatum onion belongs to the family Alliaceace. It is mainly consumed due to its flavor and pungency. Sulfhur compounds present in onion are responsible for its pungency. Onion plays a major role in human diet, as it is anti-inflammatory, anti-cholesterol and anti- cancer properties. It is used for making pickles, soups and flakes. Fresh leaves of onion are used in salads.

Compared to the all the management practices, nutrient management plays a key role in onion as entire bulb production in onion varies with the application of nutrients and its application form. Due to increased impact of fertilizers on the environment,

Bijjula Sruthi*
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore 641003, Tamil Nadu, India

Somasundaram E.
Professor, Department of Sustainable, Organic Agriculture, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Murali Arthanari P.
Associate Professor and Principal Investigator, AICRIP Weed Management, Department of Agronomy, TNAU, Coimbatore, Tamil Nadu, India

Shoba Thingalmaniyan K.
Assistant Professor, Department of Horticulture, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Email: bangaram723@gmail.com
*Corresponding author

organic manures came into the role for sustaining the agriculture. Application of organic manures such as FYM, vermicompost, poultry manure, *panchagavya,* plant not only gains the major nutrients such as nitrogen, phosphorus and potassium but also supplied with micronutrients present in organic manures. Organic manures are the residue free manures also produce the quality produce with minimum cost of cultivation. Taking the sustainable production into consideration, this experiment was conducted to study the effect of different of organic manures on growth and physiology of aggregatum onion.

MATERIALS AND METHODS

Field experiment was carried out at Tamil nadu Agricultural University during 2018-2019 to study the effect of different organic manures on growth and physiology of aggregatum onion. Experiment design was Randomized Block Design with twelve treatments and replicated thrice using the onion CO (On 5) local variety of duration 75-90 days. FYM, vermicompost and *Ganajeevamruth* were applied as basal before last ploughing. Liquid manures like *Panchagavya*, humic acid and *jeevamruth* were sprayed on 30, 45 and 60 DAS. Treatment details are as follows T_1 - Application of *Ganajeevamruth* @ 200 kg ha^{-1} + *Jeevamruth* spray @ 200 l/ha, T_2 - Application of FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS on 30, 45 and 60 DAS, T_3- Application of FYM @ 12.5 t ha^{-1} + *Panchagavya* @ 3% FS on 30, 45 and 60 DAS, T_4 - Application of FYM @ 12.5 t ha^{-1} + Banana pseudostem sap @ 2% FS on 30, 45 and 60 DAS, T_5 - Application of Vermicompost @ 5 t ha^{-1} + *Panchagavya* @ 3% FS on 30, 45 and 60 DAS, T_6 - Application of Vermicompost @ 5 t ha^{-1} + Banana pseudostem sap @ 2% FS on 30, 45 and 60 DAS, T_7 - Application of *Ganajeevamruth* @ 200 kg ha^{-1} + *Panchagavya* @ 3% FS on 30, 45 and 60 DAS, T_8 - Application of *Ganajeevamruth* @ 200 kg ha^{-1} + Banana pseudostem sap @ 2% FS on 30, 45 and 60 DAS, T_9 - Application of Humic acid @ 25 kg ha^{-1} + *Panchagavya* @ 3% FS on 30, 45 and 60 DAS, T_{10} - Application of Humic acid @ 25 kg ha^{-1} + Banana pseudo-stem sap @ 2% FS on 30, 45 and 60 DAS, T_{11} - Recommended dose of NPK fertilizers + TNAU pulse wonder @ 2kg $acre^{-1}$ as 1% FS and T_{12} - Absolute control (No fertilizers/ No manures).

Ridges and furrows were formed at a spacing of 45cm and bulbs were planted on both sides of ridges with a spacing of 10cm.Net size of the plot taken in the study is 3.7x4m. Observation for growth attributes such as plant height (cm), leaf length (cm), number of leaves, root length (cm), root volume (cc) and dry matter production were taken at 30, 45, 60 and harvest stages. Physiological parameters like leaf area index (LAI), crop growth rate (CGR) and relative growth rate (RGR) were calculated at 30, 45 and 60 and harvest. Formulas for LAI, CGR and RGR were mentioned below.

Leaf area index

Leaf area index was calibratedstage wise by Lx B x K method as formulated by Palaniswamy and Gomez (1974).

$$LAI = \frac{L \times B \times K \times \text{Number of leaves}}{S}$$

Where, L = Length of the leaf (cm), B = Maximum width of the leaf (cm)
K = Constant factor (0.62), S = Spacing (cm^2).

Crop growth rate (g/m^2/day)

Crop growth rate was calculated at 3 stages viz., stage I (30-45 DAS), stage II (45-60DAS), stage III (60 harvest) by using formula proposed by Watson (1958) and the mean was expressed in g/m^2/day.

$$CGR = \frac{W_2 - W_1}{(t_2 - t_1)}$$

Where,
W_1 and W_2 - plant dry weight in grams at time t_1 and t_2, respectively, P - Plant spacing in m^2.

Relative growth rate (g/g/day)

It is an indicator of productivity of plant. It is the rate of increment in the dry mass per unit plant mass and is expressed as g/g/day (Williams 1946).

$$RGR = \frac{\text{Log e } W_2 - \text{Log e } W_1}{t_2 - t_1}$$

Where, W_1 - Whole plant dry weight at t_1:W_2- Whole plant dry weight at t_2 and t_1 and t_2 - Time interval in days.

RESULTS AND DISCUSSION

Among all the treatments application of FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS recorded greater plant height on 30, 45, 60 and harvest stages (29.5, 39.4, 45.6 and 40.7 cm, respectively), which was comparable with RDF + TNAU pulse wonder @ 1% FS (27.9, 37.2, 43.1 and 38.5 cm on 30, 45, 60 and harvest stages, respectively). Whereas, lowest plant height was recorded with absolute control (Table 1). Due to drying of leaf tips plant height has shown increased trend upto 60 DAS and significantly decreased at harvest stage. Magnesium present in FYM might had helped in increase in chlorophyll, eventually had resulted higher photosynthesis rate and increases in plant height. Similar results were reported by Sundharaiya *et al*. (2016).

Higher leaf length was found at 30, 45, 60 and harvest (25.5, 35.5, 36.4 and 34.7 cm, respectively) with the application of FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS, which was statistically on par with RDF + TNAU pulse wonder @ 1% FS (24.1, 35.0, 34.7 and 33.1 cm on 30, 45, 60 and harvest stages, respectively) and humic acid @ 25 kg ha^{-1}+ banana pseudostem sap @ 2% FS (22.9, 33.3, 34.1 and 32.5 cm on 30, 45, 60 and harvest stages, respectively). Similarly maximum number of leaves were observed in treatment FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS (21.0, 31.0, 36.5 and 32.2, respectively) whereas minimum number of leaves were observed with the absolute control (Table 1). On decomposition of FYM releases nutrients in the form of ammonia which increases the protein synthesis by increasing the amino acid production in which nitrogen is the main constituent. Protien synthesis increase the leaf area simultaneously leaf length and leaf production were increased. Padmapriya (2004) has found the similar results.

Application of FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS had resulted in highest root length at 30, 45, 60 and harvest (9.1, 11.2, 16.6 and 22.4 cm, respectively) which was comparable with RDF + TNAU pulse wonder @ 1% FS (8.8, 10.9, 15.7 and 21.2 cm on 30, 45, 60 and harvest stages, respectively). Absolute control has recorded the lowest root length. Similar trend follows in root volume also, application of FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS had resulted in highest root volume at 30, 45, 60 and harvest (9.1, 11.2, 16.6 and 22.4 cc, respectively) (Table 2). Lowest was recorded in control. Phosphorus present in FYM and also application of FYM to the soil improved the soil properties and it helps in better root proliferation, where as in control no nutrients were available in soil. Similar results were reported by Bua *et al*. (2017).

Table 1. Effect of organic manures on plant height, leaf length and number of leaves of aggregatum onion.

	Plant height				Leaf length				Number of leaves			
	30	45	60	Harvest	30	45	60	Harvest	30	45	60	Harvest
T_1	22.4	29.9	34.6	30.9	19.4	29.4	30.4	29.0	2.2	3.9	5.1	7.2
T_2	29.5	39.4	45.6	40.7	25.5	35.5	36.4	34.7	4.1	5.8	7.0	9.1
T_3	18.6	24.8	28.7	25.6	16.1	25.2	25.9	24.7	1.3	2.7	3.9	6.0
T_4	19.0	25.3	29.3	26.2	16.4	25.6	26.2	25.0	1.5	2.8	4.0	6.1
T_5	20.7	27.6	32.0	28.5	17.9	27.8	28.5	27.2	1.8	3.5	4.7	6.8
T_6	20.3	27.0	31.4	28.0	17.6	27.3	28.0	26.7	1.6	3.2	4.4	6.5
T_7	22.9	30.5	35.4	31.6	19.8	29.7	30.4	29.0	2.3	4.0	5.2	7.3
T_8	25.6	34.2	39.5	35.3	22.1	32.9	32.5	31.0	2.9	4.6	5.8	7.9
T_9	24.1	32.1	37.2	33.2	20.8	31.3	32.0	30.5	2.4	4.1	5.3	7.4
T_{10}	26.5	35.4	40.9	36.5	22.9	33.3	34.1	32.5	3.2	4.9	6.1	8.2
T_{11}	27.9	37.2	43.1	38.5	24.1	35.0	34.7	33.1	3.9	5.6	6.6	8.9
T_{12}	17.0	22.7	26.3	23.4	14.7	24.1	24.8	24.0	1.1	2.3	3.5	5.6
SEd	1.19	1.71	1.89	1.84	0.97	1.69	1.51	1.47	0.12	0.20	0.25	0.36
CD (P=0.05)	2.47	3.55	3.91	3.81	2.00	3.52	3.14	3.05	0.26	0.42	0.52	0.75

Table 2. Effect of organic manures on root length, root volume and dry matter production of aggregatum onion.

	Root length (cm)				Root volume (cc)				DMP (kg ha^{-1})			
	30	45	60	Harvest	30	45	60	Harvest	30	45	60	Harvest
T_1	2.2	3.9	5.1	7.2	10.4	20.7	34.1	51.9	471.4	1302.7	2421.4	3391.1
T_2	4.1	5.8	7.0	9.1	12.9	25.6	42.2	64.3	600.0	1658.0	3000.0	4275.0
T_3	1.3	2.7	3.9	6.0	7.7	15.3	25.2	38.4	394.3	1089.5	2074.3	2860.7
T_4	1.5	2.8	4.0	6.1	8.6	17.0	28.0	42.7	402.9	1113.2	2112.9	2919.6
T_5	1.8	3.5	4.7	6.8	9.5	18.9	31.2	47.6	445.7	1231.7	2305.7	3214.3
T_6	1.6	3.2	4.4	6.5	9.2	18.3	30.1	45.9	428.6	1184.3	2228.6	3096.4
T_7	2.3	4.0	5.2	7.3	10.7	21.2	35.0	53.3	480.0	1326.4	2460.0	3450.0
T_8	2.9	4.6	5.8	7.9	11.3	22.4	36.9	56.2	522.0	1442.5	2649.0	3738.8
T_9	2.4	4.1	5.3	7.4	10.7	21.3	35.0	53.4	488.6	1350.1	2498.6	3508.9
T_{10}	3.2	4.9	6.1	8.2	11.8	23.5	38.7	59.0	539.1	1489.8	2726.1	3856.6
T_{11}	3.9	5.6	6.6	8.9	12.2	24.3	40.0	60.9	582.9	1610.6	2922.9	4157.1
T_{12}	1.1	2.3	3.5	5.6	7.3	14.5	23.9	36.5	368.6	1018.5	1958.6	2683.9
SEd	0.12	0.20	0.25	0.36	0.5	1.0	1.88	2.60	22.4	71.3	89.1	173.9
CD (P=0.05)	0.26	0.42	0.52	0.75	1.05	2.11	3.90	5.39	46.5	147.8	184.8	360.7

Dry weight of the plant per unit area and unit is expressed as dry matter production. Higher dry matter production was recorded in FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS (600, 1658, 3000 and 4275 kg ha^{-1}, respectively) followed by RDF + TNAU pulse wonder @ 1% FS (582.9, 1610.6, 2922.9 and 4157.1 kg ha^{-1} on 30, 45, 60 and harvest stages, respectively) lowest was observed in control (Table 2). Dry matter production is directly related to the photosynthesis rate.Organic manures improve soil structure and texture, so that more water and nutrients penetrates into the plant through roots and led to more accumulation of photosynthates. Results were in collobaration with Padmapriya (2004).

Physiological parameters such as LAI (0.38, 2.50, 3.72 and 2.80 on 30, 45, 60 and harvest stages, respectively) was recorded highest in FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS. Increased LAI is due to the increased leaf area as mentioned above. CGR (7.05, 8.90 and 8.49 g m^{-2} day^{-1} on 30, 45, 60 and harvest stages, respectively) and RGR were recorded highest in FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS,

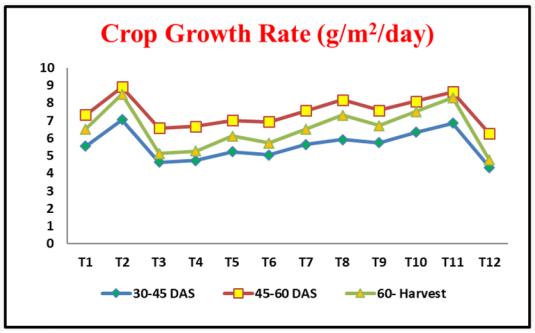

Fig. 2. Effect of organic manures on CGR of the plant.

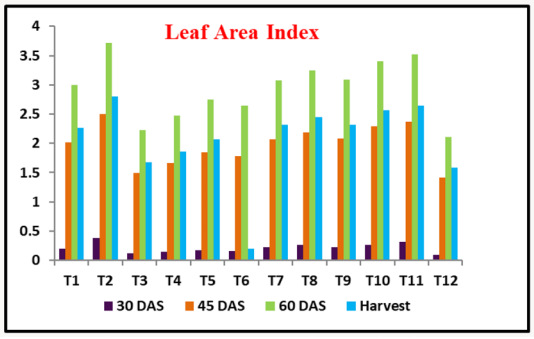

Fig. 1. Effect of organic manures on LAI of the plant.

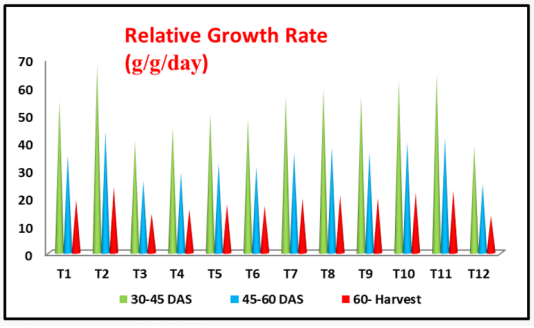

Fig. 3. Effect of organic manures on RGR of the plant.

which was comparable with TNAU pulse wonder @ 1% FS. Increased photosynthetic activity increased the RGR and CGR Figs. 1- 3.

CONCLUSION

It is concluded that application of FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS at 30, 45 and 60 increase the growth of onion due to slow release of nutrients by the organic manures.

REFERENCES

Bua B, Owiny R, Ocwa A (2017) Response of onion to different organic amendments in central Uganda. *J Agric Sci Technol* 7(2): 79-85.

Padmapriya S (2004) Studies on effect of shade, inorganic, organic and biofertilizers on growth, yield and quality of turmeric (*Curcuma longa* L.) genotype cl 147. PhD, Department of Spices and Plantation Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University.

Palaniswamy K, Gomez K (1974) Length-width method for estimating leaf area of rice. *Agron J* 66(3): 430-433.

Sundharaiya K, Sujatha K, Renganayaki PR, Sathish G (2016) Exploitation of organic inputs for growth and yield of multiplier onion (*Allium cepa* var aggregatum) var Co (On 5). *J Prog Agric* 7(2): 52-58.

Watson D (1958) The dependence of net assimilation rate on leaf-area index. *Ann Bot* 22(1): 37-54.

Williams RF (1946) The physiology of plant growth with special reference to the concept of net assimilation rate. *Ann Bot* 10(37): 41-72.