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RESPONSE OF AGGREGATUM ONION (*ALLIUM CEPA* L. VAR. *AGGREGATUM* DON.) TO ORGANIC INPUTS, BIO FERTILIZERS AND BIOSTIMULANTS

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Abstract

A field experiment was conducted at Venanallur of Ariyalur District, Tamilnadu during the year 2018. The experiment was laid out in a Factorial Randomized Block Design which included 20 treatments each of which was replicated thrice. Among the basal application treatments, FYM @ 25 t ha^{-1} + Poultry manure @ 3 t ha^{-1} + Biofertilizer (*Azotobacter* @ 2 kg ha^{-1} + VAM)-B_3 significantly improved the yield attributing traits *viz.,* number of bulbs per plant, bulb length and diameter, individual bulb weight and bulb yield per plant. Next best values were obtained with Sheep manure, Vermicompost and Neem cake in order. Among the different biostimulants, foliar application of Panchagavya @ 2% (F_2) sprayed twice registered significantly higher values for all the traits. Interaction effect showed that combination of FYM @ 25 t ha^{-1} + Poultry manure @ 3 t ha^{-1} + Biofertilizer (*Azotobacter* @ 2 kg + VAM) + Panchagavya @ 2 % (B_3F_2) recorded the highest values for yield (26.22 t ha^{-1}).

Key words: Aggregatum onion, Bio fertilizers, Panchagavya, Poultry manure, Sheep manure.

Introduction

Aggregatum onion (*Allium cepa* L. var. *aggregatum* Don.) is one of the most important commercial vegetable crops cultivated extensively in India and it belongs to family Amaryllidaceae. The total area under aggregatum onion is on an increase in India. In Tamil Nadu it is cultivated in 4.0 lakh hectares with a production of 47.27 lakh tonnes (Anon, 2014). The major share is from Dindigul, Perambalur, Ariyalur and Trichy Districts. The total area and production of onion in Ariyalur District is 107 ha and 910 t, respectively (Anon, 2015).

Aggregatum onion is a unique vegetable that is used throughout the year in the form of salad or for cooking with other vegetables. As found in large onion, bulbs of this crop are also rich in carbohydrates, protein and minerals like phosphorus and calcium. It also contains Vitamin 'C'. It possess anti-microbial properties. Several antioxidant compounds, mainly polyphenols such as flavonoids and sulphur-containing compounds have also been identified in this crop.

In modern agriculture, fertilizers constitute major portion of cost of production of onion. In recent years, it has been realized that judicious application of organic nutrients can help in obtaining stable yield. It has been established that organic materials such as poultry manure, green manure and farmyard manure can substitute inorganic fertilizers to maintain productivity and environmental quality (Choudhary *et al.,* 2002). Bio-fertilizers and biostimulants are known supplement and promote the available nutrients for crop growth. So the present study was designed to investigate the effect of organic nutrient management on yield of aggregatum onion.

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Materials and Methods

A field experiment framed to study the effect of organic nutrient management on yield of aggregatum onion was conducted in a farmer's field at Venanallur located in Ariyalur District during the year 2018. Except FYM, no other inorganic materials were incorporated in the identified field from 2012. The site is located at 10º.53' -11º.26' North latitude; 78.56'-79º.31' East longitude. The area usually receives annual rainfall of 440.4 mm, average maximum temperature of 34ºC, average minimum

Table 1: Effect of organic manures, bio fertilizers and bio stimulants on yield characteristics of aggregatum onion.

Treatments	No. of bulb / plant	Buld length (cm)	Buld diameter (cm)	Individual bulb weight (g)	Buld yield/ plant (g)	Buld yield/ hectare (t ha^{-1})
B_1	5.31	3.72	5.17	5.05	25.16	16.17
B_2	6.24	4.28	5.81	5.70	28.22	18.93
B_3	7.20	4.87	6.47	6.53	31.96	21.69
B_4	4.47	3.36	4.55	4.44	20.21	13.21
B_5	1.92	1.52	2.48	2.36	9.32	5.24
S.Ed	0.05	0.05	0.05	0.06	0.56	-
CD	0.10	0.11	0.10	0.12	1.13	-
Factor II – Biostimulants (F)						
F_1	5.24	3.65	5.06	5.03	23.87	15.73
F_2	6.08	4.22	5.70	5.72	27.37	18.38
F_3	5.68	3.94	5.37	5.35	25.61	17.02
F_4	3.11	2.38	3.44	3.15	15.05	9.07
S.Ed	0.04	0.04	0.04	0.05	0.50	-
CD	0.09	0.09	0.09	0.10	1.01	-
Interaction between – B × F						
B_1F_1	5.55	3.86	5.39	5.48	25.55	16.90
B_1F_2	6.38	4.41	5.99	5.95	29.04	19.68
B_1F_3	5.96	4.08	5.66	5.55	27.30	18.30
B_1F_4	3.36	2.54	3.64	3.22	18.74	9.81
B_2F_1	6.60	4.42	6.12	6.03	30.16	20.12
B_2F_2	7.53	5.08	6.75	6.84	33.66	22.92
B_2F_3	7.07	4.75	6.41	6.45	31.93	21.52
B_2F_4	3.77	2.86	3.97	3.50	17.15	11.18
B_3F_1	7.75	5.09	6.86	6.92	34.51	23.50
B_3F_2	8.66	5.80	7.52	7.77	38.15	26.22
B_3F_3	8.20	5.42	7.19	7.36	36.27	24.87
B_3F_4	4.19	3.19	4.30	4.09	18.91	12.18
B_4F_1	4.60	3.52	4.63	4.52	20.68	13.67
B_4F_2	5.30	3.86	5.29	5.36	24.13	15.96
B_4F_3	5.03	3.85	4.96	4.94	22.40	14.73
B_4F_4	2.94	2.21	3.31	2.97	13.65	8.51
B_5F_1	1.71	1.39	2.32	2.24	8.44	4.46
B_5F_2	2.54	1.93	2.98	2.72	11.90	7.12
B_5F_3	2.13	1.62	2.65	2.48	10.17	5.71
B_5F_4	1.28	1.13	1.99	2.00	6.78	3.69
S.Ed	0.10	0.10	0.10	0.12	1.12	-
CD	0.21	0.22	0.21	0.24	2.27	-

temperature of 21ºC and 46% Relative humidity. Texture of soil is clayey loam having 7.5 pH and 0.15 µmho/cm EC. Seed bulbs of local type were used for cultivation.

The experiment was laid out in a Factorial Randomized Block Design. Factor 1 was five levels of organic manures including basal application of Vermicompost -12 t ha^{-1} (B_1), Sheep manure-15 t ha^{-1} (B_2), Poultry manure -3 t ha^{-1} (B_3), Neem cake - 3.5 t ha^{-1} (B_4) along with biofertilizers (*Azotobacter* @ 2 kg ha^{-1} + VAM) and Control - FYM alone (B_5). Factor II was four levels of biostimulants comprising sea weed extract @ 2 % (F_1), Panchagavya @ 2 % (F_2), Vermiwash @ 2% (F_3) and Control (F_4 –without spray). All 20 treatments were replicated thrice.

The organic manures- Vermicompost, Poultry manure, Sheep manure and Neem cake were applied in quantities calculated on 'N' equivalent basis, to supply 30 Kg N/ha. Biofertilizer, *Azotobacter* @ 2 kg ha^{-1} and carrier material with VAM species *Glomus mosseae* @ 15 kg ha^{-1} were basally applied in B_1, B_2, B_3 and B_4 treatments. Main field was ploughed three times to get fine tilth. Ridges and furrows were prepared at a distance of 20 cm. The main field was divided in to 60 plots; each measuring 4m × 3m. Bulbs were planted along both the sides of the ridges at a spacing of 10 cm. Organic manures were incorporated during last ploughing. Before planting, biofertilizers like *Azotobacter* @ 2 kg ha^{-1} and VA mycorrhiza inoculum were incorporated at the time of planting. Panchakavya, Sea weed extract and Vermiwash, all prepared as 2% solution was sprayed twice on 45th and 60th days after transplanting in respective treatments. Twenty randomly selected plants in individual plot were tagged for recording observations and were statistically analysed (Panse and Sukhatme, 1978).

Results and Discussion

The data recorded on number of bulbs per plant, bulb length and diameter, individual bulb weight, bulb yield per plant and bulb yield per hectare as influenced by different organic manures, biostimulants and their interaction effects are presented in table 1. Among the different levels of Factor I, B_3 excelled other treatments by recording the highest values for all traits observed. The next best treatment was B_2. Foliar application of biostimulants (Factor 2) also had significant influence on

yield per plant. Panchagavya @ 2%, registered best results.

Combined application of organic manures and biostimulants also showed significant differences for yield parameters. Among the different combinations, the maximum values were recorded in B_3F_2 which received the application of FYM @ 25 t ha^{-1} + PM @ 3 t ha^{-1} + Biofertilizer (*Azotobacter* 2 kg ha^{-1} + VAM) + Panchagavya @ 2% foliar spray. This was followed by B_3F_3. Next better treatment was B_3F_1 which was on par with B_2F_2. The minimum was observed in control (B_5F_4).

In aggregatum onion, the formation of bulblets starts from 40 DAP and the bulblet number varies based on nature of ideotype as well as on the nutrient status of the land. From 60 DAP the bulking takes place which is also much influenced by the crop management practices mainly the available nutrient status. Application of poultry manure and bio-fertilizers improved the bulb dimension significantly. Decrease in bulk density and increase in porosity and water holding capacity of the soil due to organic manures might have contributed in keeping the land favourable for accumulation of photosynthates in underground organs, which ultimately would have resulted in increased bulb length and diameter. Further, there may be improved solubilisation of plant nutrients due to combined application of poultry manure and bio-fertilizers leading to increased uptake of NPK. Similar results have been reported by Verma and Pandey, (2016) in carrot.

Comparatively increased yield was also obtained due to application of Sheep manure. This may be attributed to the high amount of macro nutrients and other essential nutrients required for plant growth (Dekisissa *et al*., 2008). The use of such manure positively influences vegetative growth of plants due to better mineralization as stated by Elbehri *et al.,* (1993) in grain amaranth and by Ojeniyi and Sanni, (2000) in okra. Higher yield was also realised due to application of Vermicompost. This may be attributed to the high level of nutrients along with growth stimulating substances excreted by earthworms into their casts. The findings of Mohamed Rafi *et al*., (2002) revealed that application of FYM 12.5 t ha^{-1} + Vermicompost 2.5 t ha^{-1} + Panchagavya 3% foliar spray improved the yield of tomato.

Furthermore, Neem cake is rich in plant nutrients and in addition to that it contains alkaloids nimbin and nimbidin, which have nitrification inhibiting properties and release N slowly. Thus nutrient content in the neem cake, have resulted in producing better yield when compared to control. Further, bulking after 60 days would have been supported by continuous supply of nutrients by the way of sprays (biostimulants) that are linked to the increased bulb diameter as reported in large onion by Velu, (2002) and in shallot onion by Yoldas *et al.,* (2011). Such results of increased bulb weight, bulb yield per plant and bulb yield per hectare due to poultry manure application could be attributed to easy solubilisation effect of released plant nutrients leading to improved nutrient status and water holding capacity of the soil. VAM are wide spread group of soil fungi that enhance yield of crops (Thanuja, 2002). Nagaraju *et al.,* (2000) reported that, the bulb diameter of onion significantly increased with the application of VAM in combination with 50% SSP as compared to 100% SSP and no inoculation. Onion responds well to incorporation of *Azotobacter* application also and yield increase upto 20 percent has been reported earlier by Meshram and Shende, (1990). Present study revealed that foliar spray of Panchagavya @ 2% resulted in significant increase in yield attributes. This is in agreement with the finding of Rajesh and Kaliyamoorthy, (2013) in okra.

In this experiment yield increase in seaweed treated plants are thought to be associated with the hormonal substances present in the extracts especially cytsokinin. Similar findings were reported by Dogra and Mandradia, (2012) in onion plants. The study can be concluded stating that yield of this specific ecotype of aggregatum (*Allium cepa* L.var. aggregatum Don.) grown by farmers of Ariyalur District can be significantly improved by basal application of FYM @ 25 t ha^{-1} +Poultry manure @ 3 t ha^{-1} along with Biofertilizer (*Azotobacter* @ 2% + VAM) and Panchagavya @ 2% spray. Repeated usage of such inputs over a few years would establish the merits of using organic nutrients in terms of sustainability.

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