Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(3): 1768-1770
Received: 18-03-2019
Accepted: 22-04-2019

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Influence of organic manures on yield, quality and economics of aggregatum onion (*Allium cepa*. L. var. *aggregatum*)

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Abstract
Field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore during 2018-19 to evaluate the influence of organic manures on yield, quality and economics of aggregatum onion. The experiment was laid out in a randomized block design with twelve treatments which was replicated thrice Treatments included organic, inorganic and control treatment. FYM, Vermicompost, *Ganajeevamruth*, humic acid are applied as basal and *Panchagavya*, banana pseudostem sap, *Jeevamruth* are applied as foliar spray on 30 DAS, 45 DAS and 60 DAS. Yield parameters such as bulb number per clump, bulb weight per clump, bulb yield, quality parameters such as total soluble solids (TSS), ascorbic acid were recorded. Economic parameters such as net return, gross return and B:C ratio were calculated. Application of FYM @ 25t ha^{-1} along with *Panchagavya* @ 3% significantly recorded maximum number of bulbs per clump (5.73), bulb weight per clump (70g), bulb yield (15.9 t ha^{-1}),TSS (22.5^0B) and ascorbic acid (18.1mg/100g) followed by recommended dose of NPK along with TNAU pulse wonder @ 2kg $acre^{-1}$. Application of Humic acid @ 25kg ha^{-1} along with banana pseudostem sap @ 2% recorded maximum gross return, net return and B:C ratio followed by recommended dose of NPK (60:60:30) with TNAU pulse wonder @ 2kg $acre^{-1}$.

Keywords: Onion, Organic, Quality, Economics, *Jeevamrutha*

Introduction
Aggregatum onion (*Allium cepa* L. var. aggregatum) is also known as small onion or multiplier onion is the second most important vegetable crop, cultivated after tomato. It is a biennial herb belongs to the family Alliaceae. Onion is not only used as vegetable, but also used as spice in culinary preparations. So, it is called as "Queen of kitchen". Small onion is largely cultivated in Tamil Nadu especially in Erode, Coimbatore, Dindigul and Theni districts. India is the second most largest producer of onion in world next to china. Onion was mainly propagated through bulb. Multiplier onion variety Co (on 5) was developed at TNAU is a free flowering and seed setting type variety.

Being a short duration variety, onion requires high amount nutrients for its growth and development. A crop of 35t ha^{-1} removes approximately 120kg of N, 50 kg of P_2O_5 and 160kg of k_2O (Tandon,1987) [1]. Onion productivity in India is very low compared to world's average productivity. Due to imbalanced use of chemical fertilizers, productivity of onion is reducing day by day. Better alternative to the use of chemical fertilizers is organic manures. Organic farming is a holistic approach which mainly uses the waste from farm and improves soil fertility and productivity in a sustainable way. Besides this organic products are gaining more importance in national and international level market. Driving force for the premium price of organic products in market is due to the consumer preference. Organic manures not only increase the productivity but also improves the quality of the produce and reduces cost of cultivation. Research studies on Organic farming in aggregatum onion are sparse. Keeping this in view, present research was conducted to standardize the organic package of practices.

Materials and Methods
Field experiment was conducted at TNAU, Coimbatore during 2018 - 19 to evaluate the influence of organic manures on yield, quality and economics of aggregatum onion. The experiment was laid out in randomized block design with 12 treatments and were replicated thrice. Treatment details are as follows: T_1: Organic farmers practice (*Gana Jeevamruth* @ 200 kg ha^{-1} + *Jeevamruth* spray @ 200 l ha^{-1}, T_2: FYM @ 25 t ha^{-1} + *Panchagavya* @ 3% FS on 30, 45 & 60 DAS, T_3: FYM @12.5 t ha^{-1} + *Panchagavya* @ 3% FS on 30, 45 & 60 DAS, T_4: FYM @12.5 t ha^{-1} + Banana pseudostem sap @ 2% FS on 30, 45 &60 DAS, T_5: Vermicompost @ 5t ha^{-1}+ *Panchagavya* @ 3% FS on 30, 45 & 60 DAS, T_6: Vermicompost

@ 5t ha^{-1} +Banana pseudostem sap @ 2% FS on 30, 45 & 60 DAS, T_7: *GanaJeevamruth* @ 200 kg ha^{-1} + *Panchagavya* @ 3% FS on 30, 45 & 60 DAS, T_8: *Gana Jeevamruth* @ 200 kg ha^{-1} +Banana pseudostem sap @ 2% FS on 30, 45 & 60 DAS, T_9: Humic acid @25 kg ha^{-1} + *Panchagavya* @ 3% FS on 30, 45 & 60 DAS, T_{10}: Humic acid @ 25 kg ha^{-1} + Banana pseudo-stem sap @ 2% FS on 30, 45 & 60 DAS, T_{11}: Recommended dose of NPK fertilizers + TNAU pulse wonder @ 2kg acre^{-1} as 1% FS, T_{12}: Absolute control.

FYM, vermicompost, *Ganajeevamruth* and humic acid were applied as basal whereas *Panchagavya*, banana pseudostem sap and *Jeevamruth* are applied as foliar spray on 30 DAS, 45 DAS and 60 DAS. Field was ploughed two times with rotavator to get fine tilth. Ridges and furrows were made at a distance of 45cm using bullock. Plots were with a net size of 3.7 x 4m. Organic manures were applied basally before planting and field was irrigated. Variety used in this experiment was local CO (On 5) of duration 75-90 days which was grown only in Coimbatore. Bulbs were treated with liquid *Pseudomonas* and shade dried for 20min.Field was irrigated and bulbs were planted on both sides of ridges with 10cm spacing between the bulbs. Life irrigation was given on 3rd day after planting. Organic liquid manures were applied as foliar spray at 15 days intervals as per the treatments. Irrigation was given based on the moisture content in the soil. Weeding and earthing up were done at regular intervals. Observations were recorded from randomly selected 5 plants of each plot and mean data were analysed statistically on yield parameters bulb number per clump, bulb weight per clump bulb yield (t ha^{-1}), quality parameters like total soluble solids, ascorbic acid (A.O.A.C. 1975) [2] and economic parameters such as net return, gross return and B:C ratio.

Results and discussion

Application of organic manures significantly increased the number of bulbs per clump. Maximum number of bulbs per clump was recorded in FYM @ 25t ha^{-1} + foliar spray of *Panchagavya* @ 3% (5.73) followed by recommended dose of NPK fertilizers + TNAU pulse wonder @ 2kg acre^{-1} (5.2). Organic manures improved the soil condition and leads to the better growth and yield. Similar results were reported by Sundharaiya *et al*. (2016) [3].

Significantly higher bulb weight per clump was recorded in FYM @ 25t ha^{-1} + foliar spray of *Panchagavya* @ 3% (70g) followed by recommended dose of NPK fertilizers + TNAU pulse wonder @ 2kg acre^{-1} (65g) where as minimum bulb weight was recorded in control (46.4g). Increased application of organic manures increases onion bulb size. Application of higher amount of FYM makes unavailable sources of nutrients into available form and increased the nutrient uptake by plant which leads to increase in crop growth and yield. Similar result was also reported by Sundharaiya *et al*. (2016).

Maximum bulb yield was recorded with the application of FYM @ 25t ha^{-1} + foliar spray of *Panchagavya* @ 3% (15.6t ha^{-1}) followed by recommended dose of NPK fertilizers + TNAU pulse wonder @ 2kg acre^{-1} (15.4t ha^{-1}) which was on par with humic acid @ 25 kg ha^{-1} + foliar spray of Banana pseudo-stem sap @ 2% whereas Lowest yield was recorded in control (15.2t ha^{-1}). Increase in bulb weight resulted in increase in the yield. Increase in the yield might be due to the presence of micronutrients such as Fe and Zn in *Panchagavya* balances the nutrition in the crop and also smaller amounts of IAA and GA are present in the *Panchagavya* which enhances the growth regulators and increases the yield. Similar results also reported by Somasundaram *et al.* (2003) [4].

TSS is the measure of total sugars present in the bulb. Significantly higher TSS was recorded in FYM @ 25t ha^{-1} + foliar spray of *Panchagavya* @ 3% (22.5^{o}B) followed by NPK fertilizers + TNAU pulse wonder @ 2kg acre^{-1} (20^{o}B) and lower TSS was recorded in control(13^{o}B) than rest of the treatments. Application of high amount of FYM supplied nutrients to the plant and enhanced the metabolic activity for synthesis of higher amounts of acids which might have increased the TSS. Similar findings were reported by Sachin and Bhalerao, (2018) [5].

Application of FYM@ 25t ha^{-1} + foliar spray of *Panchagavya* @ 3% led to maximum increase in ascorbic acid content in onion bulb (18.1 mg/100g) and was statistically on par with recommended dose of NPK fertilizers + TNAU pulse wonder @ 2kg acre^{-1} (17.9mg/100g), humic acid @ 25 kg ha^{-1} + foliar spray of Banana pseudo-stem sap @ 2% (17mg/100g), *GanaJeevamruth* @ 200 kg ha^{-1} + Banana pseudostem sap @ 2% (16.5mg/100g) and humic acid @25 kg /ha + *Panchagavya* @ 3% (16.1mg/100g). Minimum ascorbic content was recorded in control (11.8mg/100g). Increased metabolic activity with the application of FYM resulted in increase in ascorbic acid content in bulb. Talwar Dilpreet *et al*. (2016) [6].

Humic acid @ 25 kg /ha and foliar spray of Banana pseudostem sap @ 2% recorded higher net return (Rs.) and benefit cost ratio (3.12) followed by recommended dose of NPK fertilizers + TNAU pulse wonder @ 2 kg acre^{-1} (Table 2). Lower net return (Rs. 64093) and benefit cost ratio (1.92) was recorded in control. This might be due to the low cost of humic acid, banana pseudostem sap and its usage. Similar results were reported by Geries (2013) [7]

Table 1: Effect of Organic manures on Yield, yield attributes Quality parameters of Aggregatum Onion

Treatment details	Bulb number per clump	Bulb weight per plant(g)	Bulb yield (t ha^{-1})	TSS %	Ascorbic acid (mg/100g)
T_1 - Organic farmers practice (Gana*Jeevamruth* @ 200 kg/ha + *Jeevamruth* spray @ 200 l/ha	4.30	55.0	13.2	16	15.1
T_2 - FYM @ 25 t ha^{-1} + *Panchagavya*@ 3% FS on 30, 45 & 60 DAS	5.73	70.0	15.9	22.5	18.1
T_3- FYM @12.5 t ha^{-1} + *Panchagavya*@ 3% FS on 30, 45 & 60 DAS	3.98	53.0	12.0	16	12.1
T_4- FYM @12.5 t ha^{-1} + Banana pseudostem sap @ 2% FS on 30, 45 &60 DAS	3.74	53.6	11.5	15.5	12.0
T_5 - Vermicompost @ 5t ha^{-1}+ *Panchagavya*@ 3% FS on 30, 45 &60 DAS	4.25	54.6	12.9	16.5	12.9
T_6 - Vermicompost @ 5t ha^{-1} +Banana pseudostem sap @ 2% FS on 30, 45&60 DAS	4.10	54.0	12.5	17	12.5
T_7 - Gana*Jeevamruth* @200 kg /ha + *Panchagavya* @ 3% FS on 30, 45 & 60 DAS	4.6	56.0	13.3	17.5	15.5
T_8 - Gana*Jeevamruth* @200 kg /ha +Banana pseudostem sap @ 2% FS on 30, 45 & 60 DAS	4.87	60.0	14.2	17.5	16.5
T_9 - Humic acid @25 kg /ha + *Panchagavya* @ 3%FS on 30, 45 & 60 DAS	4.73	59.6	13.6	16	16.1
T_{10}- Humic acid @ 25 kg /ha + Banana pseudo-stem sap @ 2% FS on 30, 45 &60 DAS	4.93	62.9	15.1	18	17.0
T_{11}- Recommended dose of NPK fertilizers + TNAU pulse wonder @ 2kg /acre as 1% FS	5.20	65.0	15.2	20	17.9
T_{12} -Absolute control (No fertilizers/ No manures)	3.60	46.4	8.90	13	11.8
SE.d	0.15	1.94	0.68	0.57	0.51
CD(0.05)	0.32	4.04	1.41	1.19	1.06

Table 2: Effect of Organic manures on economics of aggregatum onion

Treatment details	Cost of cultivation (Rs ha^{-1})	Gross returns (Rs ha^{-1})	Net returns (Rs ha^{-1})	B:C ratio
T_1 - Organic farmers practice (Gana*Jeevamruth* @ 200 kg/ha + *Jeevamruth* spray @ 200 l/ha	90907	198000	107093	2.18
T_2 - FYM @ 25 t ha^{-1} + *Panchagavya*@ 3% FS on 30, 45 & 60 DAS	99407	238500	139093	2.40
T_3 - FYM @12.5 t ha^{-1} + *Panchagavya*@ 3% FS on 30, 45 & 60 DAS	83657	180900	97243	2.16
T_4 - FYM @12.5 t ha^{-1} + Banana pseudostem sap @ 2% FS on 30, 45 &60 DAS	79307	172560	93253	2.18
T_5 - Vermicompost @ 5t ha^{-1}+ *Panchagavya*@ 3% FS on 30, 45 &60 DAS	91907	193500	101593	2.11
T_6 - Vermicompost @ 5t ha^{-1} +Banana pseudostem sap @ 2% FS on 30, 45&60 DAS	90557	187500	96943	2.07
T_7 - Gana*Jeevamruth* @200 kg /ha + *Panchagavya* @ 3% FS on 30, 45 & 60 DAS	93907	200250	106343	2.13
T_8 - Gana*Jeevamruth* @200 kg /ha +Banana pseudostem sap @ 2% FS on 30, 45 & 60 DAS	89557	213000	123443	2.38
T_9 - Humic acid @25 kg /ha + *Panchagavya* @ 3%FS on 30, 45 & 60 DAS	77507	204000	126493	2.63
T_{10}- Humic acid @ 25 kg /ha + Banana pseudo-stem sap @ 2% FS on 30, 45 &60 DAS	71157	226500	155343	3.18
T_{11}- Recommended dose of NPK fertilizers + TNAU pulse wonder @ 2kg /acre as 1% FS	75041	228150	153109	3.04
T_{12} -Absolute control (No fertilizers/ No manures)	67407	133500	66093	1.98

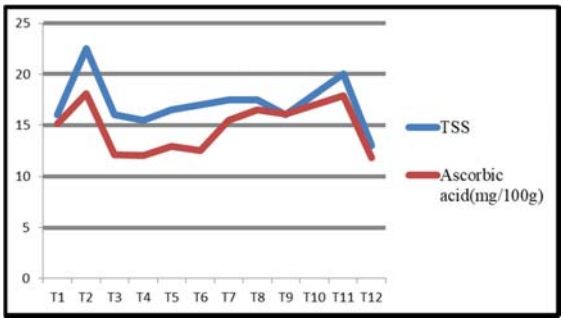

Fig 1: Effect of organic manures on quality parameters of aggregatum onion.

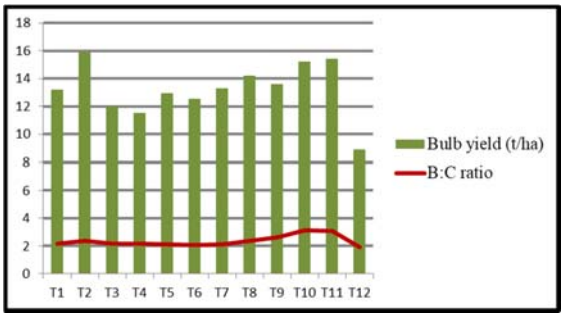

Fig 2: Effect of organic manures on bulb yield and economics of aggregatum onion

Conclusion

From the study, it is inferred that application of humic acid @ 25 kg ha^{-1} and foliar spray of banana pseudostem sap @ 2% on 30, 45 and 60 DAS was found to be the best in attaining higher yield, quality and net return of aggregatum onion in the western agro climatic zone of Tamil Nadu.

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