DOI: 10.15740/HAS/AU/15.4/374-381
Agriculture Update
Volume **15** | Issue 4 | Novermber, 2020 | 374-381
Visit us : *www.researchjournal.co.in*
ISSN-0973-1520

RESEARCH ARTICLE :

Standardization of organic protocols for growth and seed yield of multiplier onion (*Allium cepa* var. *aggregatum*) cv. Co (On 5)

K. Sundharaiya, S. Nagarai and G. Sathish

ARTICLE CHRONICLE :
Received :
10.07.2020;
Revised:
03.10.2020;
Accepted :
22.10.2020

KEY WORDS:
Multiplier onion, *Allium cepa* var.*aggregatum*, Organic manure, Bio stimulant

SUMMARY : Afield experiment on Effect of organic manures and biostimulants on growth and seed yield of multiplier onion (*Allium cepa* var. *aggregatum*) cv. Co (On 5) was conducted at Agricultural Research Station, Vaigaidam. The experiment was laid out in a Factorial Randomized Block Design with two factors *viz.,* organic manures and biostimulants which includes M_{1-} Control, M_2- FYM (12.5 t ha^{-1}), M_3- *Neem* cake (2 t ha^{-1}) and M_4- Vermicompost (2 t ha^{-1}) and S_1- Control (water spray), S_{2-} Humic acid (0.2 %), S_{3-} *Panchagavya* (2%), S_{4-} Vermiwash (2%) and S_{5-} Seaweed extract (2%). Totally twenty treatments and were replicated thrice. The results revealed that soil application of FYM @ 12.5 t ha^{-1} recorded higher plant growth bulb yield and seed yield when compared to other organic manures of the present study. Similarly among the bio stimulants 2 per cent seaweed extract spray recorded higher plant growth, bulb yield and seed yield when compared to other bio stimulants of the present study. Interaction effect also showed that soil application of FYM @ 12.5 t ha^{-1} and foliar application of seaweed extract excelled and recoded the maximum plant growth, bulb yield and seed yield in multiplier onion.

How to cite this article : Sundharaiya, K., Nagarai, S. and Sathish, G. (2020). Standardization of organic protocols for growth and seed yield of multiplier onion (*Allium cepa* var. *aggregatum*) cv. Co (On 5). *Agric. Update*, **15**(4): 374-381; **DOI : 10.15740/HAS/AU/15.4/374-381.**

Author for correspondence :
G. Sathish
Regional Research Station (T.N.A.U.), Vridhachalam, Cuddalore (T.N.) India
Email: gskspice@gmail.com

See end of the article for authors' affiliations

BACKGROUND AND OBJECTIVES

Onion a biennial herb belonging to the family Alliaceae. Multiplier onion (*Allium cepa* var. *aggregatum*) is commercially grown in large scale in Tamil Nadu as short duration annual crop for its bulb. Multiplier onion is commercially propagated through seed bulbs. A quantity of 1 – 1.2 tonnes of seed bulbs are required to plant one hectare of land. This increases the cost of cultivation high and storage of bulb is also a major problem. Tamil Nadu Agricultural University, Coimbatore has developed a seed producing multiplier onion variety Co (on 5). However, research studies on seed production technology in seed producing multiplier onion are very scanty. In any commercial crop production liberal application of chemical fertilizer is very essential to get higher yield (Stewart *et al*., 2005). But indiscriminate use of chemical fertilizers results health hazardous to human being as well as environment (Neem

et al., 2006). Use of organic manures in commercial crop production is one of the best alternate methods and awareness on organic produce is being increased. There are evidences that organic manure found increases the nutrient status of a soil which leads to increase in onion yield (Akoun, 2004) . At this junction standardization of organic protocols for crop production is important particularly in crop like onion. With this view the present investigation was carried out to find out the suitable organic inputs for growth and seed yield of multiplier onion.

RESOURCES AND METHODS

A field experiment on effect of organic manures and biostimulants on growth and seed yield of multiplier onion (*Allium cepa* var. *aggregatum*) cv. Co (On 5) was conducted at Agricultural Research Station, Vaigaidam, Tamil Nadu Agricultural University during 2010-2012. The experiment was laid out in a Factorial Randomized Block Design with two facor *viz.,*

Factor I-Organic manures including :

M_1- Control,
M_2- FYM (12.5 t ha^{-1}),
M_3- *Neem* cake (2 t ha^{-1}) and
M_4- Vermicompost (2 t ha^{-1})

Factor II-Biostimulants comprising :

S_1- Control (water spray),
S_2- Humic acid (0.2 %),
S_3- Panchagavya (2%),
S_4- Vermiwash (2%) and
S_5- Seaweed extract (2%).

Totally 20 treatments were replicated in thrice. Nursery was raised with seeds of multiplier onion variety Co (On 5), obtained from Horticultural College and Research Institute, Periyakulam. Main field was ploughed three times to get fine tilth. Ridges and furrows were made at a distance of 30 cm. The main field was divided in to 60 plots with a plot size of 4m x 3m. About 40 days old healthy seedlings were transplanted on both the side of the ridges at a spacing of 10 cm. Life irrigation was given on 3rd of transplanting. Organic manures were applied basally in the main field as per the technical programme before planting and the main field was irrigated copiously. Biostimulants were applied through leaves as foliar application at fortnight intervals as per the technical programme. Irrigation, weeding and other horticultural operations were done at regular intervals. The nutrient content of organic manures tried *viz.*, FYM, *Neem* cake and vermicompost were 0.4, 0.3 and 0.3 and 1.5, 0.2 and 0.3 and 0.5, 0.25 and 0.5, respectively. Biometrical observations *viz.,* plant height (cm), number of leaves, leaf length (cm), leaf breadth (cm), bulb length (cm), bulb girth (cm), number of bulblets per hill, individual bulb weight (g), bulb yield per plot (kg), bulb yield per hectare (t), number of umbels per hill, seed yield per plot (kg) and seed yield per hectare (kg) were recorded from each treatment and the mean data were subjected to statistical analysis as per the procedure suggested by Panse and Sukhatme (1978).

OBSERVATIONS AND ANALYSIS

Results of growth characters are presented in the Table 1. The result revealed that organic manures had significant influence on all the growth characters *viz*., plant height, leaf length, leaf breadth, number of leaves and neck thickness. Among the different types of organic manures used soli application of farm yard manure @ 12.5 t ha^{-1} (M_2) recorded significantly higher pant height (32.91 cm), leaf length (28.55 cm), leaf breadth (0.88 cm), number of leaves (27.81) and neck thickness (2.30 cm). It was followed by the treatment M_4 (vermicompost @ 2 t ha^{-1}) which recorded 30.95 cm plant height, 27.15 cm leaf length, 0.78 cm leaf breadth, 25.97 number of leaves, and 2.23 cm neck thickness. Lower values of plant height (28.53 cm), leaf length (24.46 cm), leaf breadth (0.68 cm), number of leaves (21.75) and (2.11 cm) were recorded by control (M_1). This might be due to the favourable conditions created in the soil due to the application of organic manures and the resultant increased nutrient uptake. This results are corroborated with the findings of Amanullah *et al*. (2006) and Anburani and Manivannan (2002) in brinjal, Premsekar and Rajashree (2009) in okra and Dileep (2005) in chilli. Soil application of vermicompost increased the growth parameters might be due slow release of nutrients for absorption with additional nutrients like gibberellins, cytokinin and auxins, as reported by Lalitha *et al.* (2000) in okra. Foliar application of biostimulants also showed significant influence on all the growth characters of the present study. Among the biostimulants, seaweed extract @ 2 per cent (S_5) recorded higher plant height (32.63 cm), leaf length (27.68 cm), leaf breadth (0.82 cm), number

of leaves (27.43) and neck thickness (3.26 cm). It was closely followed by foliar application of vermiwash @ 2 per cent (S_4- 31.64 cm plant height, 27.21 cm leaf length, 0.78 cm leaf breadth, 25.02 number of leaves and 3.21 cm neck thickness). Whereas lower plant height (29.34 cm), leaf length (25.61 cm), leaf breadth (0.73 cm), number of leaves (22.68 cm) and neck thickness (2.91 cm) values were recorded by control (S_1). Seaweed

Table 1: Effect of organic manures and biostimulants on vegetative characters of multiplier onion var. Co (On 5)

Sr.No.	Treatments	Plant height (cm)	Leaf length (cm)	Leaf breadth (cm)	No. of leaves	Neck thickness (cm)
Organic manures (M)						
1.	M_1	28.53	24.46	0.68	21.75	2.11
2.	M_2	32.91	28.55	0.88	27.81	2.30
3.	M_3	30.80	26.31	0.76	24.40	2.16
4.	M_4	30.95	27.15	0.78	25.97	2.23
	S.E.±	0.596	0.743	0.031	0.552	0.073
	C.D.(P=0.05)	1.197	1.505	0.063	1.118	0.147
Biostimulants (S)						
1.	S_1	29.34	25.61	0.73	22.68	2.91
2.	S_2	29.97	26.14	0.76	25.30	3.01
3.	S_3	30.41	26.46	0.76	24.50	3.03
4.	S_4	31.64	27.21	0.78	25.02	3.21
5.	S_5	32.63	27.68	0.82	27.43	3.26
	S.E.±	0.667	NS	0.034	0.617	0.081
	C.D.(P=0.05)	1.347		0.070	1.250	0.165
Organic manures X Biostimulants (M x S)						
1.	M_1S_1	26.10	23.00	0.63	19.30	2.73
2.	M_1S_2	29.67	24.40	0.67	21.73	2.80
3.	M_1S_3	28.70	24.70	0.63	21.93	3.00
4.	M_1S_4	28.40	24.90	0.70	22.90	2.93
5.	M_1S_5	29.80	25.30	0.77	22.90	3.13
6.	M_2S_1	29.77	25.37	0.87	23.30	3.30
7.	M_2S_2	30.60	27.30	0.87	26.03	2.90
8.	M_2S_3	32.70	28.10	0.87	28.33	3.13
9.	M_2S_4	33.70	30.10	0.87	29.37	3.60
10.	M_2S_5	37.80	31.90	0.90	31.80	3.67
11.	M_3S_1	30.63	28.37	0.67	23.77	3.10
12.	M_3S_2	27.80	27.77	0.70	26.67	3.20
13.	M_3S_3	32.57	24.47	0.80	25.37	3.20
14.	M_3S_4	32.60	26.17	0.87	25.23	3.10
15.	M_3S_5	31.13	27.67	0.83	28.53	3.00
16.	M_4S_1	30.87	25.70	0.73	24.33	2.90
17.	M_4S_2	28.70	24.30	0.80	23.77	2.97
18.	M_4S_3	31.80	26.57	0.73	21.33	3.13
19.	M_4S_4	30.03	27.33	0.70	25.90	2.70
20.	M_4S_5	32.60	28.97	0.87	27.17	3.30
	S.E.±	1.316	1.663	NS	1.235	0.163
	C.D.(P=0.05)	2.763	3.367		2.501	0.330

NS= Non-significant

products contain growth regulators (auxins, cytokinine and gibberellins), amino acids and mineral nutrients, that accordingly positively affect plant growth as reported by Berlyn and Russo, (1990). Foliar application of Seaweed extract increased the response of different growth parameters in Watermelon (Abdel-Mawgoud *et al.,* 2010). Similarly, Shehata *et al.* (2011) on Celeriac plants, Fawzy *et al.* (2012) on Chinese garlic plants and Hernández *et al.* (2013) on tomato also found that foliar spraying of seaweed extract increased the values of vegetative growth.

Interaction effect also had significant influence on all the growth characters. The highest plant height (37.80 cm), leaf length (31.90 cm), leaf breadth (0.90 cm), number of leaves (31.80) and neck thickness (3.67 cm) were recorded by M_2S_5 (farm yard manure @ 12.5 t ha^{-1}+seaweed extract @ 2%). This increased plant growth characters might be due to the better availability of nutrients from organic and foliar sources of nutrients and effective conversion of nutrients from organics such as Fe, Mg and Zn available at the site of photosynthesis. Corroborative results are also meade by Yadav *et al.* (2017) in chick pea and Kamal and Ghanem, (2012) in snap bean. Positive effect of foliar application of seaweed extract on different growth parameters were also reported by Abdel-Mawgoud *et al.* (2010) in Watermelon. Similarly, Shehata *et al.* (2011) on Celeriac plants, Fawzy *et al.* (2012) on Chinese garlic plants and Hernández *et al.* (2013) on tomato were also found that foliar spraying of seaweed extract increased the values of vegetative growth. It was followed by M_2S_4 (farm yard manure @ 12.5 t ha^{-1} + vermiwash @ 2 %) which recorded 33.70 cm plant height, 30.10 cm leaf length, 0.87 cm leaf breadth, 29.37 number of leaves and 3.60 cm neck thickness. Whereas the lowest plant height (26.10 cm), leaf length (23.00 cm), leaf breadth (0.63 cm), number of leaves (19.30 cm) and neck thickness (2.73 cm) were recorded by M_1S_1.

Results pertaining to bulb yield traits are presented in the Table 2. The results showed that soil application of organic manures had significant influence on bulb length, bulb girth, number of bulblets, individual bulb weight, yield per plot and yield per hectare. Among the different organic manures used soil application of FYM @ 12.5 t ha^{-1} registered higher bulb length (6.25 cm), bulb girth (8.35 cm), number of bulblets (4.76), individual bulb weight (4.80 g), yield per plot (18.43 kg) and yield per hectare (15.35 t). This might be due to soil application of FYM found increases the nutrient status of a soil which leads to increase in onion yield as reported by Akoun (2004). There are evidences of increase in bulb weight, bulb diameter and bulb yield when FYM is applied to the crop (Yohannes *et al.,* 2013; Soni *et al.,* 2016 and Tsegaye *et al.,* 2016). It was followed by soil application of vermicompost @ 2 t ha^{-1} (bulb length (6.03 cm), bulb girth (7.84 cm), number of bulblets (4.21), individual bulb weight (4.57 g), yield per plot (17.55 kg) and yield per hectare (14.56 t). Cook *et al.* (1980) observed that the yields of spinach and onion in response to vermicompost was highly significant which may be due to increased availability of more exchangeable nutrients in the soil by the application of vermicompost (whereas the lower bulb length (4.35 cm), bulb girth (5.83 cm), number of bulblets (3.46), individual bulb weight (3.66 g), yield per plot (13.83 kg) and yield per hectare (11.55 t) were registered by M_1 (Control).

Similarly, foliar application of biostimulants had significant influence on all the yield attributing traits. Foliar application seaweed extract @ 2 per cent significantly increased the bulb length (5.98 cm), bulb girth (7.88 cm), number of bulblets (4.72), individual bulb weight (4.61 g), yield per plot (17.75 kg) and yield per hectare (14.64 t). These findings are in line with the findings of Prasad *et al.* (2017) and Yokoya *et al.* (2010). It was followed by foliar application of vermiwash @ 2 per cent (bulb length-5.94 cm, bulb girth-7.66 cm, number of bulblets-4.49, individual bulb weight-4.58g, yield per plot-17.34 kg and yield per hectare-14.36 t). Patil *et al.* (2012) reported that vermiwash which contains microbial count and plant growth promoting substances (PGPR) thus, stimulates growth and yield of crops. Whereas lower bulb length (5.10 cm), bulb girth (6.46 cm), number of bulblets (3.25), individual bulb weight (4.10 g), yield per plot (15.41 kg) and yield per hectare (12.90 t).

Results of interaction effect showed that soil application of FYM @ 12.5 t ha^{-1} and foliar application of seaweed extract registered the highest values for bulb length (6.93 cm), bulb girth (9.30 cm), number of bulblets (5.30), individual bulb weight (4.97 g), yield per plot (19.47 kg) and yield per hectare (16.17 t) and it was closely followed by application of FYM @ 12.5 t ha^{-1} and foliar application of vermiwash @ 2 per cent (bulb length (6.63 cm), bulb girth (8.90 cm), number of bulblets (5.20), individual bulb weight (4.90 g), yield per plot (19.03 kg) and yield per hectare (15.83 t). Studies showed that the combination of different sources of organics given better

results and higher productivity than their individual application (Shete *et al.,* 2010; Ghanshyam *et al.,* 2010; Meena and Ram, 2013; Sohu *et al.,* 2015 and Kiran *et al.,* 2016). Whereas, the lowest bulb length (3.67 cm), bulb girth (5.50 cm), number of bulblets (3.07), individual bulb weight (3.50 g), yield per plot (13.23 kg) and yield

Table 2: Effect of organic manures and biostimulants on bulb yield characters of multiplier onion var. Co (On 5)

Sr.No.	Treatments	Bulb length (cm)	Bulb girth (cm)	No. of bulblets	Individual bulb weight (g)	Yield per plot (kg)	Yield per ha. (t)
Organic manures (M)							
1.	M_1	4.35	5.83	3.46	3.66	13.83	11.55
2.	M_2	6.25	8.35	4.76	4.80	18.43	15.35
3.	M_3	5.93	7.64	4.15	4.52	17.33	14.42
4.	M_4	6.03	7.84	4.21	4.57	17.55	14.56
	S.E.±	0.252	0.270	0.094	0.114	0.375	0.301
	C.D. (P=0.05)	0.510	0.546	0.190	0.232	0.760	0.611
Biostimulants (S)							
1.	S_1	5.10	6.46	3.25	4.10	15.41	12.90
2.	S_2	5.48	7.46	3.99	4.24	16.62	13.77
3.	S_3	5.69	7.62	4.28	4.38	16.81	14.23
4.	S_4	5.94	7.66	4.49	4.58	17.34	14.36
5.	S_5	5.98	7.88	4.72	4.61	17.75	14.64
	S.E.±	0.282	0.302	0.105	0.128	0.419	0.337
	C.D. (P=0.05)	0.571	0.611	0.213	0.259	0.849	0.683
Organic manures X Biostimulants (M x S)							
1.	M_1S_1	3.67	5.50	3.07	3.50	13.23	11.00
2.	M_1S_2	4.40	5.60	3.10	3.53	13.40	11.20
3.	M_1S_3	4.47	5.70	3.47	3.70	13.77	11.57
4.	M_1S_4	4.37	5.90	3.63	3.67	14.17	11.80
5.	M_1S_5	4.87	6.43	4.03	3.90	14.60	12.17
6.	M_2S_1	5.87	6.67	3.30	4.73	17.27	14.40
7.	M_2S_2	6.23	8.73	5.00	4.67	18.60	15.50
8.	M_2S_3	6.60	8.80	5.20	4.90	18.60	15.50
9.	M_2S_4	6.63	8.90	5.20	4.90	19.03	15.83
10.	M_2S_5	6.93	9.30	5.30	4.97	19.47	16.17
11.	M_3S_1	5.00	6.57	3.30	4.07	16.10	13.40
12.	M_3S_2	5.53	7.80	3.40	4.50	17.43	14.50
13.	M_3S_3	6.13	7.47	4.47	4.77	18.20	15.20
14.	M_3S_4	5.67	7.76	4.60	4.63	17.67	14.97
15.	M_3S_5	6.03	8.27	4.33	4.63	17.80	14.83
16.	M_4S_1	5.87	7.10	3.30	4.10	15.03	12.80
17.	M_4S_2	5.73	7.77	4.27	4.27	17.03	13.67
18.	M_4S_3	6.53	7.97	4.20	4.77	18.33	14.83
19.	M_4S_4	5.87	7.90	4.63	4.60	17.60	14.73
20.	M_4S_5	6.40	8.17	5.10	4.87	18.37	15.30
	S.E.±	NS	NS	0.210	NS	NS	NS
	C.D. (P=0.05)			0.426			

NS= Non-significant

per hectare (11.00 t).

Results of seed yield traits were presented the Table 3. From the results it was observed that organic manures and bio stimulants had significant influence on number of umbels per hill, seed yield per plot and seed yield per hectare. Soil application of FYM @ 12.5 t ha^{-1} (M_2) recorded higher number of umbels per hill (4.51), seed yield per plot (0.65 kg) and seed yield per hectare (241.42

Table 3 : Effect of organic manures and biostimulants on seed yield characters of multiplier onion var. Co (On 5)

Sr.No.	Treatments	Number of umbels per hill	Seed yield per plot (kg)	Seed yield per hectare (kg)
Organic manures (M)				
1.	M_1	3.45	0.47	161.03
2.	M_2	4.51	0.65	241.42
3.	M_3	4.15	0.57	191.47
4.	M_4	4.16	0.57	195.49
	S.E.±	0.323	0.014	15.07
	C.D. (P=0.05)	0.655	0.029	30.52
Biostimulants (S)				
1.	S_1	3.60	0.43	149.14
2.	S_2	3.77	0.53	185.18
3.	S_3	3.88	0.60	200.14
4.	S_4	4.29	0.61	210.75
5.	S_5	4.68	0.67	241.35
	S.E.±	0.361	0.016	16.85
	C.D. (P=0.05)	0.732	0.032	34.12
Organic manures X Biostimulants (M x S)				
1.	M_1S_1	3.00	0.40	139.00
2.	M_1S_2	3.03	0.40	143.67
3.	M_1S_3	3.50	0.50	166.53
4.	M_1S_4	3.73	0.50	171.27
5.	M_1S_5	3.97	0.57	184.70
6.	M_2S_1	3.97	0.43	152.47
7.	M_2S_2	3.63	0.67	240.67
8.	M_2S_3	4.93	0.70	246.67
9.	M_2S_4	5.13	0.73	246.67
10.	M_2S_5	5.27	0.73	335.97
11.	M_3S_1	3.60	0.43	152.67
12.	M_3S_2	4.43	0.43	157.37
13.	M_3S_3	3.80	0.63	208.33
14.	M_3S_4	4.37	0.63	212.43
15.	M_3S_5	4.27	0.60	199.00
16.	M_4S_1	3.83	0.47	152.43
17.	M_4S_2	3.80	0.60	199.00
18.	M_4S_3	3.93	0.60	194.37
19.	M_4S_4	4.07	0.60	212.63
20.	M_4S_5	4.60	0.70	231.33
	S.E.±	NS	0.032	NS
	C.D. (P=0.05)		0.065	

NS=Non-significant

kg). It was followed by soil application of vermicompost @ 2 t ha^{-1} number of umbels per hill (4.16), seed yield per plot (0.57 kg) and seed yield per hectare (195.49 kg). this might be due to higher growth and bulb yield obtained by soil application of organic manures like FYM and vermicompost (Abdissa *et al.,* 2011 and Nimje and Seth, 1987). Meanwhile control (M_1) recorded lower values for number of umbels per hill (3.45), seed yield per plot (0.47 kg) and seed yield per hectare (161.03 kg). Similarly, foliar application of biostimulants also had significant influence on number of umbels, seed yield per plot and seed yield per hectare. Among the bio stimulant seaweed extract @ 2 per cent (S_5) recorded higher number of umbels per hill (4.68), seed yield per plot (0.67 kg) and seed yield per hectare (335.97 kg) when compared to other treatments. It was followed by vermiwash @ 2 per cent (S_4) which registered 4.29 numbers of umbel, 0.61 kg of seed yield per plot and 210.75 kg seed yield per hectare. Lower values for number of umbels per hill (3.69), seed yield per plot (0.43 kg) and seed yield per hectare (149.14 kg) were recorded by control (S_1).

From the results of interaction effect it was observed that the maximum number of umbels per hill (5.27), seed yield per plot (0.73 kg) and seed yield per hectare (375.99 kg) were recorded by the treatment M_2S_5 (FYM @ 12.5 t ha^{-1} + seaweed extract @ 2 %). It was followed by M_2S_4 (FYM @ 12.5 t ha^{-1} + vermiwash@ 2%), which recorded 5.13 numbers of umbel per hill, 0.73 kg seed yield per plot and 246.67 kg seed yield per hectare. Whereas the minimum values for number of umbels per hill (3.00), seed yield per plot (0.40 kg) and seed yield per hectare (139.00 kg). Soil application of organics like FYM and vermicompost improve the soil physical, chemical and biological properties (Prasad *et al.,* 2017) along with conserving the moisture holding capacity of soil which resulted in enhanced bulb and seed yield obtained in the present study. The combined use of organic manures, liquid organic manures and their combinations is important to maintain and sustain higher level of soil fertility and nutrient availability to crop. The results showed that amongst organics FYM @ 12.5 tha^{-1} and vermicompost 2 t ha^{-1} will be optimum to harvest higher bulb and seed yield in onion. Similar results were also reported by Nekar *et al.* (2009) and found that foliar application of liquid organic manures on growth and productivity of groundnut. The reason for increased bulb weight, bulb yield and seed yield might be due to solubilisation effect of plant nutrients by the addition of FYM and vermicompost resulted in increased uptake of NPK (Somasundaram *et al.*, 1998). Vermicompost are rich in microbial population and diversity particularly fungi, bacteria and actinomycetes (Edwards, 1998), which consistently promote biological activities. This helps the plant to germinate, flower and yield better than other fertilizers (Atiyeh *et al*., 2000).

From the results it was concluded that FYM @ 12.5 t ha^{-1} and vermicompost @ 2 t ha^{-1} would be sufficient to get higher growth, bulb and seed yield in onion under organic system of cultivation. Foliar application of seaweed extract @ 2 per cent and vermiwash @ 2 per cent also improves plant growth and bulb and seed yield in onion. From the results it was also concluded that combined application of organic manures and biostimulants had more beneficial effect than individual application.

Authors' affiliations :

K. Sundharaiya, Krishi Vigyan Kendra, Vridhachalam, Cuddalore (T.N.) India (Email : aiya_hort@rediffmail.com)

S. Nagarai, Tamil Nadu Agicultural University, Coimbatore (T.N.) India

REFERENCES

Abdel-Mawgoud, A. M. R., Tantawy, A. S., Magda, M., Hafez and Hoda, A. M. and Habib (2010). Seaweed extract improves growth, yield and quality of different watermelon hybrids. *Res. J. Agric. & Biological Sci.*, **6** (2): 161–186.

Abdissa, Y., Tekalign, T. and Pant, L.M. (2011). Growth, bulb yield and quality of onion (*Allium cepa* L.) as influenced by nitrogen and phosphorus fertilization on vertisol I. growth attributes, biomass production and bulb yield. *African J. Agric. Res.,* **6** (14) : 3252-3258.

Akoun, J. (2004). Effect of plant density and manure on the yield and yield components of the common onion (*Allium cepa* L.) var. nsukka red. *Nigerian J. Hort. Sci.,* **4** (9) : 43-48.

Amanullah, M. M., Somasundaram, E., Alagesan, A., Vaiyapuri, K., Pazhanivelan, S. and Sathyamoorthi, K. (2006). Evaluation of some tree species for leaf fodder in Tamil Nadu. *Res. J. Agric. Biol. Sci.,* **2** (6): 552-553.

Anburani, A. and Manivannan, K. (2002). Effect of integrated nutrient management on growth in brinjal (*Solanum melongenea* L.) cv. Annamalai. *South Indian Horticulture*., **50** (4-6): 377-386.

Atiyeh, R.M., Aran con, N., Edwards, C.A. and Metzgar (2000). Influence of earth worm processed pig manure on the growth

and yield of green house tomatoes. *Bioresource Technology*. **3**: 175-180.

Berlyn, G.P. and Russo, R.O. (1990). The use of organic biostimulants to promote root growth. *Below Gr.Ecol*.,**1**:12-13.

Cook, A.G., Critchley, B.R. and Critchley, U. (1980). Effects of cultivation and DDT on earthworm activity in a forest soil in the sub-humid tropics. *J. Appl. Ecol.,* **17:**21-29.

Dileep, S. N. (2005). Studies on effect of organic manures on the productivity and quality of chilli cv. K1. M.Sc. (Hort.) Thesis, Tamil Nadu Agricultural University Coimbatore (India).

Fawzy, Z.F., El-Shal, Z.S., Li Yunsheng, Ouyang Zhu and Omaima M. Sawan (2012). Response of garlic (*Allium sativum,* L.) plants to foliar spraying of some bio-stimulants under sandy soil condition. *J.Appl. Sci. Res.*, **8** (2) : 770-776.

Ghanshyam, Rakesh, K. and Jat, R.K. (2010). Productivity and soil fertility as effected by organic manures and inorganic fertilizers in greengram (*Vigna radiata*)–wheat (*Triticum aestivum*) system. *Indian J. Agron.,* **55** (1) : 16-21.

Hernández, R., Santacruz, M. H., F. M. and Ruiz-López, A. (2013). Effect of liquid seaweed extracts on growth of tomato seedlings (*Solanum lycopersicum* L.). Springer Science Business Media Dordrecht.

Kamal, A.M. and Ghanem, K.M. (2012). Impact of some bio-stimulants on organically cultivated snap bean plants. *Egyt. J. of Appl. Sci.,* **27**(2): 89-104.

Kiran, Satyanarayana, R. and Rameshkumar C. (2016). Effect of nutrient management practices through organics on growth, yield and economics of chickpea under rainfed condition. *Green Farming*, **7** : 880-883.

Lalitha, R., Fathima, K. and Ismail, S.A. (2000). Impact of biopesticides and microbial fertilizers on productivity and growth of *Abelmoschus esculentus. Vasundhara the Earth,* **1 &2** : 4-9.

Meena, B.S. and Ram, B. (2013). Effect of integrated nutrient management on productivity, soil fertility and economics of chickpea (*Cicer arietinum* Linn.) varieties in vertisols. *Annals of Agriculture Research*, **34**: 225-230.

Neem M., Iqbal, J. and Bakhsh, M.A.A. (2006). Comparative study of inorganic fertilizers and organic manures on yield and yield components of mungbean (*Vigna radiate* L.). *J. Agric. & Soc. Sci.,* **(2)** : 227- 229.

Nekar, N.M., Babalad, H.B, Bhat, S.N. and Sreenivasa, M.N. (2009). Response of groundnut (*Arachis hypogaea* L.) to foliar application of liquid organic manures. *J. Oilseeds Res.*, **26** (Sp.Issue) : 390-392.

Nimje, P.M. and Seth, J. (1987). Effect of phosphorus and farm yard manure on soybean and their residual effect on succeeding winter maize. *Indian J. Agric. Sci.,* **57** (6) : 404-409.

Panse, V.G. and Sukhatme, P.V. (1978). *Statistical method for agricultural workers*. Indian Council of Agricultural Research. New Delhi. pp. 108.

Prasad, H., Sajwan, P., Kumari, M. and Solanki, S.P.S. (2017). Effect of organic manures and biofertilizer on plant growth, yield and quality of horticultural. *Internat. J. Chem. Stud.,* **5**(1) : 217-221.

Premsekar, M. and Rajashree, V. (2009). Influence of bio-fertilizers on the growth characters, yield attributes, yield and quality of tomato. *American-Eurasian J. Sustain. Agric.,* **3**(1): 6-8.

Shehata, S.M., Heba, S., Abdel- Azem, A., Abou El-Yazied and El- Gizawy, A.M. (2011). Effect of foliar spraying with amino acids and seaweed extract on growth, chemical constitutes, yield and its quality of Celeriac plant. *European J. Scientif. Res.,* **58** (2) : 257-265.

Shete, P.G., Thanki, J.D., Adhav, S.L. and Kushare, Y.M. (2010). Response of *Rabi* geengram (*Vigna radiata* L.) to land configuration and inorganic fertilizer with and without FYM. *Crop Research*., **39**: 43-46.

Sohu, I., Gandahi, A.W., Bhutto, G.R., Sarki, M.S. and Gandahi, R. (2015). Growth and yield maximization of chickpea (*Cicer arietinum*) through integrated nutrient management applied to rice-chickpea cropping system. *Sarhad J. Agric.,***31**:131-138.

Soni, A.K., Dhaka, R.S. and Paliwal, R. (2016). Response of integrated nutrient management on the growth, yield and quality of *Kharif* onion (*Allium cepa* L.). *Asian J. Hort.* **2**(1): 199-201.

Stewart, M.W., Dibb, W.D., Johnston, E.A. and Smyth, J.T. (2005). The contribution of commercial fertilizer nutrients to food production. *Agron. J.,* **97**: 1-6.

Tsegaye, B., Bizuayehu, T. Woldemichael, A. and Mohammed, A. (2016). Yield and yield components of onion (*Allium cepa* L.) as affected by irrigation scheduling and nitrogen fertilization at hawassa area districts in southern ethiopia. *J. Medical & Biological Science Research.* **2** (2) : 15-20.

Yadav, Jitendra Kumar, Sharma, Mahendra, Yadav, R.N., Yadav, S.K. and Yadav, Saroj (2017). Effect of different concentrations of commercial seaweed liquid extract of *Ascophyllum nodosum* as a plant bio stimulant on growth, yield and biochemical constituents of onion (*Allium cepa* L.). *J. Pharmacognosy & Phytochemistry,* **6** (4) : 658-663.

Yohannes, K.W., Belew, D. and Debela, A. (2013). Effect of FYM and nitrogen fertilizer rates on growth, yield and yield components of Onion (*Allium cepa* L.) *J. Plant Sci.,* **12**(8): 228 - 234.