AU Agriculture Update
Volume 12 | TECHSEAR-8 | 2017 | 2239-2245
Visit us : www.researchjournal.co.in

RESEARCH ARTICLE :

Effect of organic manures and biostimulants on growth and seed yield of multiplier onion (*Allium cepa* var. *aggregatum*) cv. Co (On 5)

■ K. SUNDHARAIYA, P.R. RENGANAYAKI, K. SUJATHA AND G. SATHISH

ARTICLE CHRONICLE :
Received :
20.07.2017;
Accepted :
16.08.2017

SUMMARY : Onion is one of the important bulbous vegetable crop occupies prime position in every kitchen. Onion is being used as salad as well as cooked vegetable. Since onion is used as fresh vegetable as salad and in ayurvedic system of medicine the residual effect due to chemical fertilizer is highly harmful to human being. Hence, development of organic cultivation practices is essential. The present 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 carried out to find out suitable organic inputs for higher yield. The The experiment was laid out in a Factorial Randomized Block Design with two factor *viz.*,factor I-Organic manures including M_1- Control, M_2- FYM (12.5 tha^{-1}), M_3- Neem cake (2 tha^{-1}) and M_4- Vermicompost (2 tha^{-1}) and 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. The results showed that organic manures and bio stimulants had significant influence on all the growth characters *viz.*, plant height, leaf length, leaf breadth and number of leaves, yield traits *viz.*, bulb length, bulb girth, number of bulblets and bulb weight, bulb yield per plot and bulb yield per hectare and seed yield traits *viz.*, number of umbels per hill, seed yield per plot and seed yield per hectare. Soil application of FYM @ 12.5 tha^{-1} and foliar application of seaweed extract @ 2 per cent significantly increased plant height, leaf length, leaf breadth and number of leaves, bulb length, bulb girth, number of bulblets and bulb weight, bulb yield per plot, bulb yield per hectare, number of umbels per hill, seed yield per plot and seed yield per hectare.

KEY WORDS :
Multiplier onion, Organic manures, Bio stimulants, Growth, Bulb yield, Seed yield

How to cite this article : Sundharaiya, K., Renganayaki, P.R., Sujatha, K. and Sathish, G. (2017). Effect of organic manures and biostimulants on growth and seed yield of multiplier onion (*Allium cepa* var. *aggregatum*) cv. Co (On 5). *Agric. Update,* **12** (TECHSEAR-8) : 2239-2245.

Author for correspondence :
K. SUNDHARAIYA
Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA
See end of the article for authors' affiliations

BACKGROUND AND OBJECTIVES

Onion a biennial herb belonging to the family Alliacea. 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) which sets seeds freely in the tropical plains. 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. But indiscriminate use of chemical fertilizers results health hazardous to human being as well as environment. Use of organic manures in commercial crop production is one of the best alternate methods and awareness on organic produce is being increased. Improvements of environmental conditions as well as public health are also important reasons for advocating increased use of organic materials (Seifritz, 1982). Maintenance of soil fertility is essential for optimum and sustained production. Inorganic fertilizers can be used to replenish soil nutrients and increase crop yields, but are too costly for the peasant farmers. The use of mineral fertilizers has been associated with increased soil acidity, nutrient imbalance and soil degradation (Kang and Juo, 1980). This has necessitated research on the use of organic manures. The use of organic materials has been proposed as one of the main pillars of sustainable agriculture as they provide large amounts of macro and micro nutrients for crop growth and eco-friendly besides being renewable alternatives to mineral fertilizers. Farmyard manure has been used as a soil conditioner since ancient times and its benefit have not been fully harnessed due to large quantities required in order to satisfy the nutritional needs of crops (Makinde *et al*., 2007). The need for renewable forms of energy and reduced cost of fertilizing crops, have revived the use of organic manures worldwide (Ayoola and Adeniran, 2006). Improvement in environmental conditions and public health are important reasons for advocating increased use of organic materials (Ojeniyi, 2000; Maritus and Vleic, 2001).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 factor *viz.*

Factor I-Organic manures including

M_1- Control (No fertilizers applied),

M_2- FYM (12.5 tha^{-1}),

M_3- Neem cake (2 tha^{-1}) and

M_4- Vermicompost (2 tha^{-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 three times through leaves as foliar application at fortnight intervals starting from 45 DAP *viz*., 45 DAP, 60 DAP and 75 DAP 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) were at the time harvest and 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 1and 2. The result revealed that organic manures had significant influence on all the growth characters *viz*., plant height, leaf length, leaf breadth and number of leaves. Among the different organic manures used soil application of FYM @ 12.5 tha^{-1} excelled than other organic manures of the present study. Increased growth characters due to application of FYM might be due to the presence of micronutrients particularly magnesium an essential mineral for photosynthesis might have increased the photosynthetic rate resulted in increased growth. These results are in agreement with the findings of Nehra *et al*. (2001) and Sanwal *et al*. (2007). Regarding plant height it was observed that significantly higher plant of 27.81 cm was observed with soil application of FYM @ 12.5 tha^{-1} (M_2). This was 127.86 per cent increase over the control (M_1) value of 21.75 cm. Soil application of vermicompost @ 2 tha^{-1} (M_4) adjusted as next best treatment with a value of 25.97 cm. Significantly higher leaf length of 25.14 cm was recorded by soil application of FYM @ 12.5 tha^{-1} (M_2). This was 128.27 per cent increase over the control (M_1 – 19.81 cm). It was closely followed by soil application of vermicompost @ 2 tha^{-1} (M_4) which recorded a leaf length of 24.86 cm. From the result it was also observed that the treatment M_2 and M_4 were on par with each other. The other growth character *viz*., leaf breadth and number of leaves also showed a similar trend. Regarding leaf breadth soil application of FYM @ 12.5 tha^{-1} (M_2 – 0.65 cm) recorded 120.37 per cent increased leaf breadth than control (M_1-0.54 cm) and 115.88 per cent increased leaf number over control (27.45). This might be due to the favourable conditions created by soil application of organic manures and increased nutrient uptake. These results are agreed with Subbiah *et al*. (1985) in brinjal, in brinjal, Dileep (2005) in chilli and Premsekar and Rajashree (2009) in okra.

Foliar application of biostimulants also showed significant influence on all the growth characters. Among the biostimulants, seaweed extract @ 2 per cent (S_5) recorded higher plant height of 27.43 cm. This was 120.94 per cent increase over the control (S_1-22.68 cm). Data pertaining to leaf length showed that foliar application of seaweed extract @ 2 per cent (S_5) recorded higher leaf

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

	Plant height (cm)				Mean	Leaf length (cm)				Mean
	M_1	M_2	M_3	M_4		M_1	M_2	M_3	M_4	
S_1	19.30	23.30	24.33	23.77	22.68	18.30	21.80	23.20	25.27	22.14
S_2	21.73	28.53	23.77	27.17	25.30	19.10	25.33	22.17	23.37	22.49
S_3	21.93	29.37	21.33	25.37	24.50	20.20	26.00	19.67	24.33	22.55
S_4	22.90	26.03	25.90	25.23	25.02	20.93	25.50	22.47	24.47	23.34
S_5	22.90	31.80	26.67	28.33	27.43	20.53	28.43	24.70	26.90	25.14
Mean	21.75	27.81	24.40	25.97		19.81	25.41	22.44	24.86	
	M	S	MXS			M	S	MXS		
S.E. ±	0.552	0.617	1.235			0.846	0.946	1.892		
C.D. (P=0.05)	1.118	1.250	2.501			1.713	1.915	3.831		

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

	Leaf breadth (cm)				Mean	Number of leaves				Mean
	M_1	M_2	M_3	M_4		M_1	M_2	M_3	M_4	
S_1	0.50	0.53	0.53	0.60	0.54	26.00	25.93	29.80	28.80	27.63
S_2	0.53	0.63	0.57	0.60	0.58	27.00	29.90	26.77	29.90	28.39
S_3	0.53	0.67	0.63	0.67	0.63	30.00	33.00	25.97	31.67	30.16
S_4	0.57	0.63	0.60	0.60	0.60	30.00	33.30	26.97	27.93	29.55
S_5	0.57	0.80	0.59	0.70	0.65	31.00	36.93	27.77	29.93	31.41
Mean	0.54	0.65	0.61	0.63		28.80	31.81	27.45	29.65	
	M	S	MXS			M	S	MXS		
S.E. ±	0.017	0.019	0.038			0.707	0.791	1.581		
C.D. (P=0.05)	0.035	0.039	0.078			1.431	1.601	3.201		

length value of 25.14 cm. this was 113.55 per cent over control (S_1-22.14 cm). Similarly for other traits *viz.*, leaf breadth and number of leaves foliar application of seaweed extract @ 2 per cent (S_5) recorded 120.37 per cent and 113.68 per cent increase over control (Table 1). The increased growth attributes due to foliar application of seaweed extract might be due to increased root proliferation and establishment; thereby plants are able to uptake the nutrients even from the distance and deep place thus, increased nutrient uptake might have resulted in increased growth attributes. Crouch *et al.* (1990) reported that seaweed extracts improve nutrient uptake by roots, resulting in root systems with improved water and nutrient efficiency thereby causing enhanced general plant growth and vigour. Similar reports also made by Singh and Chandel (2005) in wheat and Sylvia *et al.* (2005) in okra.

Interaction effect of organic manures and biostimulant also showed significant influence on all the growth characters. Soil application of FYM in combination with fortnight foliar application of seaweed extract @ 2% produced very good plants with higher growth characters. The maximum plant height of 31.80 cm was recorded by the treatment M_2S_5 which was 164.77 per cent increase over control (19.30 cm). Similarly the same treatment M_2S_5 registered the maximum leaf length (28.43 cm), leaf breadth (0.80 cm) and number of leaves (36.93). Whereas the minimum values for leaf length (18.50 cm), leaf breadth (0.50 cm) and number of leaves (26.00) were recorded by M_1S_1. The stimulating effect of seaweed extract on growth characters might be attributed to its essential action on enhancing cell division because it contains higher amounts of nutrients *viz.*, (N,P,K,Mg,Ca,S,Cu,Fe,Mn,B and Mo), natural hormons like cytokinins, IAA and GA3, amino acids, vitamins and antioxidants (James,1994 and Soliman *et al.*, 2000) and these components play an important roles in improving cell division and the biosynthesis of organic foods. These results are in agreement with results of El-Sawy, (2005) and Oraby, (2013).

Soil application of organic manures had significant influenced the yield traits *viz.*, bulb length, bulb girth, number of bulblets and bulb weight, yield per plot and yield per hectare (Table 3, 4 and 5). From the result it was observed that significantly higher bulb length (6.34

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

	Bulb length (cm)				Mean	Bulb girth (cm)				Mean
	M_1	M_2	M_3	M_4		M_1	M_2	M_3	M_4	
S_1	3.67	5.87	5.00	5.87	5.10	5.50	6.67	6.57	7.10	6.46
S_2	4.40	6.40	5.73	6.23	5.69	5.60	9.30	7.80	7.77	7.62
S_3	4.47	6.63	6.13	6.53	5.94	5.70	8.80	7.97	8.17	7.66
S_4	4.37	5.87	5.67	6.03	5.48	5.90	8.27	7.76	7.90	7.46
S_5	4.87	6.93	5.53	6.60	5.98	6.43	8.73	7.47	8.90	7.88
Mean	4.35	6.34	5.61	6.25		5.83	8.35	7.51	7.96	
	M	S	MXS			M	S	MXS		
S.E. ±	0.252	0.282	NS			0.270	0.302	NS		
C.D. (P=0.05)	0.510	0.571				0.546	0.611			

NS=Non-significant

Table 4 : Effect of organic manures and biostimulants on bulb yield characters of multiplier onion var. Co(On 5)

	No. of bulblets				Mean	Bulb weight (g)				Mean
	M_1	M_2	M_3	M_4		M_1	M_2	M_3	M_4	
S_1	3.10	3.30	3.30	3.30	3.25	3.50	4.73	4.07	4.10	4.10
S_2	3.07	5.20	4.27	3.40	3.99	3.53	4.67	4.50	4.27	4.24
S_3	3.47	5.00	4.20	4.47	4.28	3.70	4.90	4.70	4.77	4.52
S_4	3.63	5.10	4.63	4.60	4.49	3.67	4.63	4.63	4.63	4.38
S_5	4.03	5.20	4.33	5.30	4.72	3.90	4.97	4.77	4.87	4.63
Mean	3.46	4.76	4.15	4.21		3.66	4.80	4.53	4.53	
	M	S	MXS			M	S	MXS		
S.E. ±	0.094	0.105	0.210			0.114	0.128	NS		
C.D. (P=0.05)	0.190	0.213	0.426			0.232	0.259			

NS=Non-significant

cm), bulb girth (8.35 cm), number of bulblets (4.76), bulb weight (4.80 g), yield per plot (18.43 kg) and yield per hectare (15.35 t) were recorded by the treatment M_2 (farm yard manure @ 12.5 t ha-1) which was 145.75, 143.22, 137.57, 131.15, 133.26 and 132.90 higher than the treatment control (M_1- 4.35 cm bulb length, 5.83 cm bulb girth, 3.46 number of bulblets, 3.66 g bulb weight, 13.83 kg yield per plot and 11.55 ton. yield per hectare). The treatment M_4 (vermicompost @ 2 tha-1) adjusted as next best treatment (bulb length (6.25 cm), bulb girth (7.96 cm), number of bulblets (4.21), bulb weight (4.53 g), bulb yield per plot (17.55 kg) and bulb yield per hectare (14.78 t). Soil application of FYM improves soil health and releases macro and micro nutrients and it maintain soil fertility and water holding capacity might have been the reason for increased yield traits in onion (Sandeep Kumar *et al*. 2016).

Foliar application of bio stimulant showed significant influence on bulb length, bulb girth, number of bulblets, bulb weight, bulb yield per plot and bulb yield per hectare. Foliar application of seaweed extract @ 2 per cent (S_5) recorded significantly higher bulb length (5.98 cm), bulb girth (7.88 cm), number of bulblets (4.72), bulb weight (4.63 g), bulb yield per plot (17.75 kg) and bulb yield per hectare (14.64 t). Whereas lower values for bulb length (5.10 cm), bulb girth (6.46 cm), number of bulblets (3.25), bulb weight (4.10 g), bulb yield per plot (15.41 kg) and bulb yield per hectare (12.90 t) were recorded by the treatment S_1(Control). The results revealed that the treatment S_5 registered 117.25, 121.98, 145.23, 112.93, 115.18 and 113.49 per cent increased bulb length, bulb girth, number of bulblets, bulb weight, yield per plot and yield per hectare over the control treatment. Yield increases in seaweed treated plants are thought to be associated with the hormonal substances present in the extracts especially cytokinins.(Dogra and Mandradia, 2012). In addition to growth hormones, the increase in yield characters could be due to the fact that seaweed extracts contain macro, micronutrients and organic matters like, amino acids that improve vegetative growth and yield (Abd El-Migeed *et al*., 2004; Abd El-Moniem and Abd-Allah 2008).

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

	Bulb Yield per plot (kg)				Mean	Bulb Yield per hectare (t)				Mean
	M_1	M_2	M_3	M_4		M_1	M_2	M_3	M_4	
S_1	13.23	17.27	15.03	16.10	15.41	11.00	14.40	12.80	13.40	12.90
S_2	13.40	18.60	17.03	17.43	16.62	11.20	15.50	13.67	14.50	13.77
S_3	13.77	19.03	18.37	18.20	17.34	11.57	15.83	14.83	15.20	14.36
S_4	14.17	17.80	17.60	17.67	16.81	11.80	14.83	14.97	15.30	14.23
S_5	14.60	19.47	18.60	18.33	17.75	12.17	16.17	14.73	15.50	14.64
Mean	13.83	18.43	17.33	17.55		11.55	15.35	14.20	14.78	
	M	S	MXS			M	S	MXS		
S.E. ±	0.375	0.419	NS			0.301	0.337	NS		
C.D. (P=0.05)	0.760	0.849				0.611	0.683			

NS=Non-significant

Table 6 : Effect of organic manures and biostimulants on seed yield characters of multiplier onion var. Co(On 5)

	Number of umbels per hill				Mean	Seed Yield per plot (kg)				Mean	Seed yield per hectare (kg)				Mean
	M_1	M_2	M_3	M_4		M_1	M_2	M_3	M_4		M_1	M_2	M_3	M_4	
S_1	3.00	3.97	3.60	3.83	3.60	0.40	0.43	0.43	0.47	0.43	139.00	152.47	152.67	152.43	149.14
S_2	3.03	3.63	3.80	4.60	3.77	0.40	0.70	0.43	0.60	0.53	143.67	240.67	157.37	199.00	185.18
S_3	3.50	4.93	3.80	3.93	4.29	0.50	0.70	0.60	0.63	0.61	166.53	246.67	194.37	208.33	210.75
S_4	3.73	4.27	4.43	4.07	3.88	0.50	0.67	0.60	0.63	0.60	171.27	231.33	212.43	212.63	200.14
S_5	3.97	5.27	4.37	5.13	4.68	0.57	0.73	0.60	0.73	0.67	184.70	335.97	199.00	246.67	241.35
Mean	3.45	4.51	4.00	4.31		0.47	0.65	0.53	0.61		161.03	241.42	183.17	203.81	
	M	S	MXS			M	S	MXS			M	S	MXS		
S.E. ±	0.323	0.361	NS			0.014	0.016	0.032			15.07	16.85	NS		
C.D. (P=0.05)	0.655	0.732				0.029	0.032	0.065			30.52	34.12			

NS=Non-significant

Interaction effect of organic manures and biostimulant showed non significant effect on all the yield traits except number of bulblets. However, higher bulb length (6.93 cm), bulb girth (8.73 cm), number of bulblets (5.20), bulb weight (4.97 g), bulb yield per plot (19.47 kg) and bulb yield per hectare (16.17 t) were recorded by M_2S_5 and it was followed by M_2S_3 (bulb length (6.63 cm), bulb girth (8.80 cm), number of bulblets (5.00) bulb weight (4.90 g), bulb yield per plot (19.03 kg) and bulb yield per hectare (15.83 t). The increased yield observed by the soil application of organic manures and foliar application of bio stimulant might be due to increased plant height, leaf length, leaf breadth and number of leaves. Nutrients contained in organic manures are released more slowly and are stored for a longer time in the soil, thereby ensuring a long residual effect (Sharma and Mitra, 1991) thus, supporting better root development, leading to higher crop yields (Abou El-Magd, 2005).

Similarly organic manures and biostimulant had significant influence on number of umbels per hill, seed yield per plot and seed yield per hectare. Among the different organic manures used, higher number of umbels per hill (4.51), seed yield per plot (0.65 kg) and seed yield per hectare (241.42 kg) were registered by soil application of FYM @ 12.5 tha^{-1} (M_2). It was followed by soil application of vermicompost @ 2 tha^{-1} (M_4) Table 6. However, the lowest number of umbels per hill (3.45), seed yield per plot (0.47 kg) and seed yield per hectare (161.03 kg). Among the different types of biostimulants, foliar application of seaweed extract @ 2 per cent (S_5) recorded significantly higher number of umbels per hill (4.68), seed yield per plot (0.67 kg) and seed yield per hectare (241.35 kg). It was followed by foliar application of panchagavya @ 2 per cent (S_3). Whereas the lowest number of umbels per hill (3.60), seed yield per plot (0.43 kg) and seed yield per hectare (149.14 kg) were recorded by control (S_1). However, the interaction effect showed non significant influence on seed yield traits except seed yield per plot. The highest number of umbels per hill (5.27), seed yield per plot (0.73 kg) and seed yield per hectare (335.97 kg) was recorded by M_2S_5 (FYM @ 12.5 t ha^{-1} + seaweed extract @ 2 percent). It was followed by M_2S_3 (4.93 number of umbels per hill, 0.70 kg seed yield per plot and 246.67 kg seed yield per hectare). Whereas the lowest number of umbels per hill (3.00), seed yield per plot (0.40 kg) and seed yield per hectare (139.00 kg) were recorded by control (M_1S_1). The beneficial effect of seaweed extract on seed yield could be due to the stimulatory influence of seaweed extract on triggering profuse flowering and fruit set. These results are in accordance with the findings of Arthur *et al*. (2003). Positive effect of farm yard manure and seaweed extract on flowering might be attributed to their essential role in balancing the ratio between carbohydrates and nitrogen in favour of flowering. The increased seed yield due to FYM and seaweed extract might have due to the beneficial effect of FYM and seaweed extract on growth and bulb traits owing to the availability of macro and micro nutrients and growth hormones. Corroborative results are also made by Neumann and Zur-Nieden**, (**2001**).**

From the results it was inferred that soil application of FYM @ 12.5 tha-1 and foliar application of seaweed extract @ 2 per cent had beneficial effect on plant vigour, bulb yield traits and seed yield traits on multiplier onion cv. Co (On 5).

Authors' affiliations :

P.R. RENGANAYAKI, K. SUJATHA AND G. SATHISH, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA

REFERENCES

Abou El-Magd, M.M., Hoda, M.A. and Fawzy, Z.F. (2005). Relationships, growth, yield of broccoli with increasing N, P or K ratio in a mixture of NPK fertilizers. *Annals Agril. Sci.*, **43** (2): 791-805.

Abd El-Migeed, A.A., El-Sayed, A.B. and Hassan, H.S.A. (2004). Growth enhancement of olive transplants by broken cells of fresh green algae as soil application. *J. Agric. Res.*, **29**(3) : 723-737.

Abd El-Moniem, E.A. and Abd-Allah, A.S.E. (2008). Effect of green algae cells extract as foliar spray on vegetative growth, yield and berries quality of superior grapevines. *Am. Euras. J. Agric. and Environ. Sci.*, **4**(4) : 427-433.

Arthur, G.D., Stirk, W.A. and Staden, J. Van (2003). Effect of a seaweed concentrate on the growth and yield of three varieties of Capsicum annuum. *S. Afr. J. Bot.*, **69** : 207-211.

Ayoola, O.T. and Adeniran, O.N. (2006). Influence of poultry manure and NPK fertilizer on yield and yield components of crops under different cropping systems in South West Nigeria. *Afr. J. Biotechnol.*, **5** : 1336- 1392.

Crouch, I.J., Beckett, R.P. and Staden, J. Van (1990). Effect of seaweed concentrate on the growth and mineral nutrition of nutrient stressed lettuce. *J. Appl. Phycol.*, **2** : 269-272.

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, T.N. (INDIA).

Dogra, B.S. and Mandradia, Rakesh K. (2012). Effect of seaweed extract on growth and yield of onion. *Internat. J. Farm Sci.*, **2**(1) : 59-64.

El-Sawy, Y.A. (2005). Studies on the effect of some organic fertilizers,ammonium nitrate and the Biofertilizer (Algae extract) on growth and productivity of Williams banana (*Musa Cavendishii* L.). M.Sc.Thesis Faculty of Agric. Minia University, Egypt.

James, B. (1994). Chapters from life. *Ann. Rev. Physiol. Plant. Mol. Biolog.*, **4** : 1-23.

Kang, B.T. and Juo, A.S.R. (1980). Management of low-acidity soils in Tropical Africa for food crop production. In Terry, E.R. (ed). Tropical Root Crops: Research strategies for 1980s. Ottawa, Ontario, 1980. 5. Keerthi S., Rao A.U., Ramana AV, Ramesh.

Makinde, E.A., Agboola, A.A., Oluwatoyinbo, F.I. (2001). The effects of organic and inorganic fertilizers on the growth and yield of maize in a maize/melon intercrop. *Moor J. Agril. Res.*, **2**: 15-20.

Maritus, C.H.T. and Vleic, P.L.G. (2001). The management of organic matter in tropical soils. What are the priorities? *Nutrient cycling in Agroecosystems*, **61** : 1-6.

Nerhra, A.S., Hooda, I.S. and Singh, K.P. (2001). Effect of integrated nutrient management on growth and yield of wheat (*Triticum aestivum* L.). *Indian J. Agron.*, **45 :** 112-117.

Neumann, D. and Zur-Nieden, U. (2001). Silicon and heavy metal tolerance of higher plants. *Phytochemistry,* **56** : 685-692.

Ojeniyi, S.O. (2000). Effect of goat manure on soil nutrients and okra yield in a rain forest area of Nigeria. *Appl. Tropical Agric.*, **5** : 20-23.

Oraby, A.A.F. (2013). Partial replacement of inorganic nitrogen fertilizer by spraying some vitamins, yeast and seaweed extract in Ewaise mango orchard under Upper Egypt conditions. M.Sc. Thesis Faculty of Agriculture Minia University, Egypt.

Panse, V.G. and Sukhatame, P.V. (1978). *Statistical method for Agricultural workers*. I.C.A.R. New Delhi, India pp.145.

Premsekhar, M. and Rajashree, V. (2009). Influence of organic manures on growth and quality of okra. *American-Eurasian J. Sustainable Agric.*, **3**(1): 6-8.

Kumar, Sandeep, Meena, M.L., Lal, Deepa and Rai, Tribhuvan (2016). Effect of integrated nutrient management on growth and yield of onion (*Allium Cepa* L.). *Res. Environ. Life Sci.*, **9**(1) 56-58.

Sanwal, S.K., Lakshminarayana, K., Yadav, R.K., Rai, N., Yadav, D.S. and Mousmi, M. (2007). Effect of organic manures on soil fertility, growth, physiology, yield and quality of turmeric. *Indian J. Hort.*, **64**(4) : 444-449.

Sharma, A.R., Mittra, B.N. (1991). Effect of different rates of application of organic and nitrogen fertilizers in a rice-based cropping system. *J., Agril. Sci.*, **117** : 313-318.

Singh, P.K. and Chandel, A.S. (2005). Effect of biozyme on yield and quality of wheat (*Triticum aestivum*). *Indian J. Agron.*, **50**: 58-60.

Soliman, A.I.I., Hussein, M.H., Dessouki, S.A.S. and Torky, Y. (2000). Production of phytohormones by using some blue green algae used as soil inoculants for rice fields in Egypt. *J.Union Arab Biol., Cairo* (**88**): Physiology and Algae: 83-102.

Subbiah, BV., Sachdev, M.S., Arora, RP. and Sud, YK. 1985. Efficiency of fertilizer nitrogen use in multiple cropping system-studies with isotopic techniques. *Fertilizer New,* **30**: 45-48.

Sylvia, S., Baluiswami, M., Vijaya Partha Sarathy, M.D. and Krishnamurthy, V. (2005). Effect of liquid seaweed fertilizers extracted from Gracilaria edulis (Gmel.), Silva, Sargassum wightii Grevilla and Ulva lactuca Linn. On the growth and yield of Abelmoschus esculentus (L) Moench. *Indian Hydrobiology*. **7** Suool. 69-88.