International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(4): 1614-1617

Received: 27-05-2018
Accepted: 28-06-2018

SB Dugmod
PG Student, Department of Horticulture, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, India

AM Bhosale
Assistant Professor, Department of Horticulture, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, India

SJ Syed
PhD Scholar, Department of Horticulture, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, India

Correspondence
SB Dugmod
PG Student, Department of Horticulture, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani, Maharashtra, India

Effect of bio enzymes on growth parameters of cabbage (*Brassica oleracea* var. Capitata L.)" var. golden acre

SB Dugmod, AM Bhosale and SJ Syed

Abstract
The experimentation was conducted during 2007-2008, on the experimental field of Horticulture Research Scheme (Vegetable), V. N. M. K. V, Parbhani, The experiment was laid out in randomized block design with ten treatments and three replications, the experiment was conducted on Cabbage crop, Golden acre cultivar. The result revealed that, the control treatment (water spray) against all other treatments not performs well in increasing growth quality of cabbage var. golden acre. Among the various concentrations of bio enzymes sprayed at different intervals and recorded observations at regular intervals of 15, 30, 45, and 60 days after transplanting. The treatment T6 (Synzyme 3ml. /l) spray of bio enzyme performed well in overall characters of growth parameters over other treatments.

Keywords: Golden acre, bio enzymes, Synzyme, cabbage, RBD

Introduction
Vegetables are high yielding and provide nutritional security, employment, cash, and more foreign exchange. India is the second largest producer (next to china) of vegetable in year 2002-2003 area 5.9 million hectares and production 84.8 million tonnes, in year 2003-04 area 6.7 million hectares and production 101.4 million tons in 2004-05 area 7.1 million hectares and production 108.2 million tones and in year 2005-06 7.2 million hectares area and production 113.5 million tones. During the year 2006-07 vegetables has 108.00 million tonnes production (Anonymous 2008) [2]. Per capita consumption has also increased from 95 g to 175 g per day as against 280g, recommended dietary requirement per day.

In Maharashtra area under vegetable 4.05 lakh hectares with production of 47.69 lakh tone with productivity of 11.8 tone /hectares (Anonymous 2007) [1] With improved varieties and hybrids, improved production technologies, better infrastructure, ensured genuine seed production, supply policy and participation of all entrepreneurs, India is poised achieve a revolution in vegetable production to fulfil the largest of 220 million tonnes by7 the end of 2020 AD (Som Dutt, 2001) [6].

Among different vegetables cabbage (*Brassica oleracea var.* Capitata) is one of the most important winter vegetable among the Cole crops which belongs to the genus Brassica of the family, Cruciferae, Cabbage is essentiality a cold weathers hardy crop and thrives best in cool and moist climate. Cabbage having cross pollination system.

The group Cole crops is said to be derived from the wild cabbage Cole warts Coastal region of England, Southern and Western Europe are native place. Cabbage was introduced in our country much earlier than cauliflower. Though exact date of introduction is not available but it was reported to be grown during Mughal period. It appears to have been introduced by Portuguese through the crop became popular during British rule.

This was originated from Cyprus and the first crop of cabbage was introduced in India in 6th century A.D and India occupies third position in cabbage production of world. In India area 3.34 lakh hectares with annual production of 53.92 lakh tones and productivity of 23.1 t/ha.

Area under cabbage in Maharashtra for the year 2004 is estimated around 13.125 (thousand hectare) with production of 328.13 (thousand tonnes) with productivity of 25 tons /hectare (Anonymous 2007) [1] Cabbage is the fifth most important vegetable crop of the country primarily grown in winter season. In India among vegetable cabbage having an area of 0.28 million hectares with production of 4.80 million tons during the year 2002-03.

Cabbage grown for its thickened main bud called head. It contains adequate quantity of vitamins like A, B, C and minerals like phosphorus potassium calcium sodium iron It is used as salad boiled vegetables cooked in curried, pickles as well as dehydrated vegetables.

During the last two or three decades there is rapid increase in the population which increased the heavy demand for vegetable production, Efforts have been made to increase the vegetable production by developing large number of high yielding quality and disease resistant varieties and hybrids and production and protection technologies. However there is need to achieve over target to meet the requirements of 1 billion population reached by 2000 A.D. All these are tried and there appears to be limit in application of these technologies for increasing yield. Moreover excessive use of fertilizers reduces quality of crop and now a day people are demanding fruit and vegetables. Without the use of pesticides or in other words vegetables produced with use of organic manures and biopesticides.

Plant growth regulators play an important role in modifying various parameters in horticultural crops. Recently bio enzymes are extensively which are the products containing enzymes Auxins and hydrolysed proteins.

In recent years bioenzyme a commercial product obtained from *Asephyllum modosum*, a seaweed algae known to rich in cytokinin and auxin precursors. Wide range of trace elements (B, Mo, Fe, Zn, Cu, Mn and Cl). Enzymes and hydrolysed proteins foliar spray of bio enzymes at 1 to 4 ml/lit. of water have enhanced vegetative growth and fruits per plant with good quality. Thus Bio enzymes is a new tool to increase yield of vegetables (More, 2000) [3].

There are different bio enzymes reported to promote the vegetative growth of plant and affect the quality of produce in different crops. Maxitalol and vipul increased growth flowering and yield of okra (Pandita *et al*. 1991) [4]. In this context use of bio enzymes, which does not have any residual effect appears to be most important new tool in increasing the yield of vegetables (Rana and Vasishtha, 1985: More 2000) [5, 3].

Materials and Method

The experiment was laid out in Randomized Block Design with ten treatments and three replication at Horticulture Research Scheme (Vegetables), Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during 2007-2008, treatment details given in Table no. 1.

Table 1: Treatment details.

S. No.	Treatment No.	Treatments
1	T_1	1ml/lit Biozyme.
2	T_2	2ml/lit Biozyme.
3	T_3	3ml/lit Biozyme.
4	T_4	1ml/lit Synzyme
5	T_5	2ml/lit Synzyme
6	T_6	3ml/lit Synzyme
7	T_7	1ml/lit Zymegold
8	T_8	2ml/lit Zymegold
9	T_9	3ml/lit Zymegold
10	T_{10}	Water sprays (control)

Results and discussion

The present experiment entitled "Effect of bio enzymes on growth, yield and quality of cabbage (*Brassica oleracea* var. Capitata L.)" data obtained in the present investigation in respect of number of leaves, plant spread, stem diameter, height of plant, days required for head initiation and maturity, head diameter, stem diameter, were studied. An obtained data in present investigation were analysed statistically and results of each character are presented in this chapter under suitable heads with proper interpretation.

1. Number of leaves per plant

Number of leaves per plant was recorded at 15, 30, 45 and 60 DAT and data in presented in table 2.

Table 2: Effect of bio enzymes on mean number of leaves per plant

T. no	Treatments	Days after transplanting			
		15	30	45	60
T_1	1ml/lit Biozyme.	8.33	13.60	17.60	19.07
T_2	2ml/lit Biozyme.	7.87	13.80	17.53	18.67
T_3	3ml/lit Biozyme.	7.93	16.20	20.13	21.07
T_4	1ml/lit Synzyme	8.13	14.13	18.20	20.27
T_5	2ml/lit Synzyme	7.80	14.87	18.73	19.27
T_6	3ml/lit Synzyme	8.20	18.13	22.07	22.60
T_7	1ml/lit Zymegold	7.80	13.33	18.07	19.53
T_8	2ml/lit Zymegold	7.73	14.93	18.87	19.40
T_9	3ml/lit Zymegold	8.27	16.07	20.67	21.53
T_{10}	Water sprays (control)	7.73	12.27	16.13	17.20
	S.E.+	0.17	0.26	0.33	0.47
	CD at 5%	NS	0.77	0.99	1.41

The observations recorded at 15 DAT showed that all the treatments were non-significant. At 30 DAT highest numbers of leaves per plant were observed in treatments Synzyme 3 ml/lit (T_6) it was significant over all the treatments. Whereas, the minimum number of leaves observed in the control (T_{10}). At 45 DAT highest number of leaves per plant were observed in treatment (T_6) (Synzyme 3ml/lit) which is significantly superior over the rest of treatments. While the lowest number of leaves was observed in control (T_{10}). In case of 60 DAT, treatment Synzyme 3ml/lit. (T_6) recorded the highest number of leaves per plant which is at par with the treatments (T_9) zymegold 3ml/lit and significantly showed the lowest number of leaves in the control (T_{10}).

2. Plant height (cm)

The height of plant were recorded at 15, 30, 45 and 60 DAT and data is presented in table 3.

Table 3: Effect of bio enzymes on height of plant

T. No.	Treatments	Days after transplanting			
		15	30	45	60
T_1	1ml/lit. Biozyme	11.89	16.67	22.06	29.67
T_2	2ml/lit. Biozyme	12.23	17.50	23.55	30.47
T_3	3ml/lit. Biozyme	12.26	18.39	25.83	34.31
T_4	1ml/lit. Synzyme	12.45	17.81	24.70	30.21
T_5	2ml/lit. Synzyme	12.13	18.16	24.89	31.56
T_6	3ml/lit. Synzyme	12.65	20.50	27.30	36.25
T_7	1ml/lit Zymegold	12.81	17.83	22.99	31.34
T_8	2ml/lit Zymegold	12.63	18.11	24.51	32.41
T_9	3ml/lit Zymegold	12.61	19.33	26.27	35.06
T_{10}	Water spray (control)	11.65	13.17	20.34	23.55
	S.E. _+	0.25	0.92	1.17	1.51
	CD at 5%	NS	2.75	3.50	4.50

The observation recorded at 15 DAT showed that all treatments were non-significant. At 30 DAT, treatment Synzyme 3 ml /lit. showed the maximum plant height (20.50cm) which is statistically at par with the rest of the treatment significantly less height (13.17cm) was recorded in control (T_{10}) i.e. 13.17 cm.

The data in respect of height of plant at 45 DAT the treatment (T_6) Synzyme 3ml/lit showed the maximum height (27.30) which is statistically at par the treatment T_3, T_4, T_8 and T_9. The treatment T_2, T_5, T_7 produced more height which is statistically at par with each other. Significantly less height (20.34 cm) was recorded in control (T_{10}).

At 60 DAT the highest plant height (36.25cm) was recorded in Synzyme 3ml/lit (T_6) treatment which is statistically at par with treatment T_3, T_8, and T_9. The next better treatments were T_2, T_4, T_5 and T_7 which were similar to each other and superior over control. The treatment T_{10} (control) produced less plant height (23.55cm).

3. Plant spread(cm)

Spread of plant was recorded at 15, 30, 45 and 60 days after transplanting and data is represented in Table 4. At 15 days all the treatments were non-significant. At 30 DAT highest spread of plant was recorded in T_6 Synzyme 3ml/lit (50.13cm) which were statically at par with all the other treatments except T_1 and T_{10} (control). The minimum spread of plant observed in T_{10} control (36.20cm) at 30 DAT. At 45 DAT maximum spread of plant were observed in T_6 Synzyme 3ml/lit (54.07cm) followed by T_9 (53cm) treatment T6 were statistically found at par with T_9.

Table 4: Effect of bio enzymes on plant spread

S. no.	Treatments	Days after transplanting			
		15	**30**	**45**	**60**
T_1	1ml/lit Biozyme.	14.91	44.60	50.10	57.77
T_2	2ml/lit Biozyme	17.39	47.70	51.03	57.57
T_3	3ml/lit Biozyme	18.23	47.23	51.73	59.93
T_4	1ml/lit Synzyme	17.77	46.99	51.17	57.23
T_5	2ml/lit Synzyme	17.70	47.90	51.07	56.60
T_6	3ml/lit Synzyme	19.00	50.13	54.07	62.67
T_7	1ml/lit Zymegold	17.51	47.50	51.37	55.47
T_8	2ml/lit Zymegold	16.97	47.88	51.23	55.63
T_9	3ml/lit Zymegold	18.67	49.53	53.00	61.33
T_{10}	Water sprays (control)	13.97	36.20	38.50	45.00
	S.E+	1.08	1.20	0.40	2.08
	CD at 5%	NS	3.57	1.20	6.18

Treatment T_3 (51.73cm) were found statistically at par with T_2, T_3, T_4, T_5, T_7, T_8 except T_1 (50.10cm). The minimum spread of plant at 60 DAT was recorded in T10 control (38.50cm). At 60 DAT maximum spread of plant recorded by T_6 (62.27cm) which was statistically at par with all other treatments except T_7 (55.47).

4. Days required for head initiation

Significant differences in respect of days required for head initiation were observed in different levels of Biozyme spray can be seen from days after transplanting in Table 5.

The treatments Synzyme 3 ml/lit (T_6) recorded earlier head initiation (36.67 days) as compared to all other treatments under study. The next best treatments for producing early head initiation were T_9 (37.67 days) which were statistically at par with T_3 and T_5 with each other.

Table 5: Effect of bio enzymes mean number of days required for head initiation.

Tr. no	Treatments	Days required for head initiation
T_1	1ml/lit. Biozyme.	40.00
T_2	2ml/lit. Biozyme.	39.00
T_3	3ml/lit. Biozyme.	38.00
T_4	1ml/lit. Synzyme.	39.33
T_5	2ml/lit. Synzyme	38.33
T_6	3ml/lit. Synzyme	36.67
T_7	1ml/lit Zymegold.	39.67
T_8	2ml/lit Zymegold.	40.67
T_9	3ml/lit Zymegold.	37.67
T_{10}	Water sprays (control).	43.33
	S.E.+	0.44
	CD at 5%	1.31

The treatments T_1, T_2, T_4, T_7 and T_8 were found statistically at par with each other. Significantly maximum number of days for head initiation (43.33) was recorded in the treatment control (T_{10}).

5. Days required for head maturity

The observations presented in table 6, in respect of days required for head maturity indicated significant different at different levels of bio enzymes spray. The treatments Synzyme 3ml/lit (T_6) recorded the earliness in head maturity (64.33 days 0 which is statistically at par with treatment T_1, T_2, T_3, T_4, T_7 and T_8. The treatments T_5 and T_9 were significantly at par with each other.

Table 6: Effect of bio enzymes on mean number of days required for head maturity.

T. No	Treatments	Days required for head maturity.
T_1	1ml/lit Biozyme.	70.67
T_2	2ml/lit Biozyme.	67.00
T_3	3ml/lit Biozyme.	66.00
T_4	1ml/lit Synzyme	67.00
T_5	2ml/lit Synzyme	65.00
T_6	3ml/lit Synzyme	64.33
T_7	1ml/lit Zymegold	67.67
T_8	2ml/lit Zymegold	68.33
T_9	3ml/lit Zymegold	65.33
T_{10}	Water spray (control)	74.33
	S.E.+	0.53
	CD at 5 %	1.60

Significantly more number of days required for head maturity (74.33) was recorded in treatment (T_{10}) control among all the treatments.

6. Head diameter (cm)

The diameter of head was significantly influenced due to the different bio enzymes treatments presented in table 7. The maximum diameter of head obtained in T_6 (14.93cm) followed by T_3 (14.69cm) and T_9 (14.62cm) the treatment T_5 (14.10 cm) statistically at par with all of the treatments (T_1, T_2, T_4, T_7, T_8). The minimum head diameter was observed in the treatment T_{10} (12.50).

Table 7: Effect of bio enzymes on mean head diameter (cm).

T. no	Treatments	Head diameter(cm)
T_1	1ml/lit Biozyme.	13.30
T_2	2ml/lit Biozyme.	13.40
T_3	3ml/lit Biozyme.	14.69
T_4	1ml/lit Synzyme	13.34
T_5	2ml/lit zymegold	14.10
T_6	3ml/lit zymegold	14.93
T_7	1ml/lit zymegold	13.35
T_8	2ml/lit zymegold	13.42
T_9	3ml/lit zymegold	14.62
T_{10}	Water sprays(control)	12.50
	S.E.+	0.23
	CD at 5%	0.69

7. Stem diameter

Data presented in table 8, revealed significant differences in increasing stem diameter at harvest due to different bio enzymes.

Maximum stem diameter were observed in T_6 Synzyme 3ml/lit. (8.87cm) which were statistically at par over all rest of treatments. Treatments T_9 (7.70) found statistically at par over T_2, T_3, and T_5. The minimum stem diameter was found in T_{10} control (6.25cm).

Table 8: Effect of bio enzymes on mean stem diameter (cm).

T. no	Treatments	Stem diameter(cm)
T_1	1ml/lit Biozyme.	6.65
T_2	2ml/lit Biozyme.	7.21
T_3	3ml/lit Biozyme.	7.59
T_4	1ml/lit Synzyme	7.01
T_5	2ml/lit zymegold	7.29
T_6	3ml/lit zymegold	8.87
T_7	1ml/lit zymegold	6.78
T_8	2ml/lit zymegold	7.12
T_9	3ml/lit zymegold	7.70
T_{10}	Water sprays(control)	6.25
	S.E.+	0.18
	CD at 5%	0.54

4. References

1. Anonymous. 2007. www.heritibizyindia.org.
2. Anonymous. 2008. www.agri.mah.nic.in.
3. More SP. Effect of aminocel and bio enzymes on vegetative growth and seed production of okra M. Sc. (Agri.) Thesis, M.A.U., Parbhani, 2000.
4. Pandita ML, Sharma NK, Arora SK. Effect of mixtalol and vipul on growth, flowering and yield of okra. Veg. Sci. 1991; 18(1):32-40.
5. Rana BS, Vasishtha. Effect of various chemicals on growth yield characteristics of radish. Haryana J Hort. Sci. 1985; 14:97-101.
6. Som Dutt. Horticulture an emerging industry in India. Employment news, New Delhi. 2001; 19-25:1.