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RESPONSE OF BRINJAL TO BIOZYME IN RELATION TO GROWTH, YIELD AND QUALITY

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ABSTRACT

A field research was carried out at New Alluvial Zone of West Bengal, for two consecutive years during autumn winter seasons of 2009-10 and 2010-11 to study the efficacy of some commercial formulations of biozyme on growth, yield, quality and economics of brinjal (Solanum melongena L). The experiment consisting of seven treatment combinations was laid out in simple randomised block design with three replications. Results showed that biozyme had positive effect on growth, yield and quality attributes of brinjal over control. Maximum yield (35.34 t.ha^{-1}) and quality (8.50 mg100g^{-1} ascorbic acid) was observed in the treatment of soil application of recommended dose of NPK (100:60:60 kg.ha^{-1}) + seedling treatment with biozyme seed plus (10ml L^{-1} water) + biozyme veg. granules as soil application (20kg ha^{-1}) + biozyme veg. liquid as foliar spraying (500ml ha^{-1}). Increased yield in this treatment was due to better growth and yield attributes i.e. maximum plant height (149.18 cm), higher number of branches (11.12), number of leaves per plants (148.75), number of fruits per plant (10.66), and weight of fruits (248.50g). Among different treatments, application of RD of NPK + biozyme seed plus (10ml L^{-1} water) + biozyme veg. granules + biozyme veg. liquid resulted in a higher net profit of (` 226034077 ha$^{-1}$) benefit cost ratio of 3.98. The lowest net profit (` 113756.77 ha^{-1}) and benefit: cost ratio (2.18) were recorded under control.Results suggested that the lesser pest damage of brinjal, was noted under different formulation of biozyme applied at different stages in combination with the RD of NPK.

Key words: Biozyme veg. liquid, biozyme seed plus, biozyme veg. granule, brinjal

INTRODUCTION

Brinjal (*Solanum melongena* Linn.) is popular vegetable and is native of India. It can be grown throughout the year in almost all the states of India except at higher altitudes. Brinjal fruit contains high amount of carbohydrates (6.4%), protein (1.3%), fat (0.3%), calcium (0.02%), phosphorus (0.02%), iron (0.0013%) and other mineral matters. The brinjal plant contains an alkaloid called "solanine" found in roots and leaves. Some medicinal use of eggplant tissues and extract include treatment of diabetes, asthama, cholera, bronchitis and diarrhoea, its fruit and leaves are reported to lower certain levels of blood cholesterol. Due to continuous hazardous effects of chemical fertilizer and pesticides on environment, a major interest is being shown the use of eco-friendly bio-products to regulating the plant growth and development (Tandona and Dubeyb, 2015). Biozyme is an organic storehouse of naturally occurring nutrients derived from Norwegian seaweed (*Ascophyllum nodosum*), known to be rich in cytokinins and auxin precursor, enzymes and hydrolyzed protein (Kumar *et al.,*, 2000). It can modify their physiological and morphological system at very lower concentration. It also helps in improving plants natural self defence system, which results in healthier crop with low pest pressure. Scientific studies in this field have been going on for close to 70 years but there are still unknowns and commercialization has been relatively minor (Tandona and Dubeyb, 2015). With these ideas in view, field experiments were planned to find out the effect of Biozyme on growth and yield attributes of brinjal.

MATERIALS AND METHODS

Field research was conducted at Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, for consecutive two years during autumn-winter seasons of 2009 and 2010. The research work consisted of seven different treatment combinations of different biozyme formulations along with recommended dose of fertilizer was laid out in simple randomised block design with four replication. Biozyme and fertilizers were applied according to the schedule of the experiment. The treatment details are as given below.

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Notation	Treatments	Time of application
	No fertilizer + No biozyme (Control)	
T_1	Biozyme seed plus (10ml.l^{-1} water)	Seedling treatment
	Biozyme vegetable granules (20 kg.ha^{-1})	Land preparation
T_2	Biozyme veg liquid (500 ml.ha^{-1})	Vegetative stage Flowering stage Fruit set stage
T_3	Recommended dose of fertilizer (RDF) (100:60:60::N:P:K kg.ha^{-1})	1/3 N + full dose of P and K as Basal 1/3 N top dressed at 21 DAT 1/3 N top dressed at 45 DAT
	T_3 + biozyme seed Plus (10 ml.l^{-1} water)	Seedling treatment
	Biozyme vegetable granules (20 kg.ha^{-1})	Land preparation
T_4	Biozyme veg liquid (500 ml.ha^{-1})	Vegetative stage Flowering stage Fruit set stage
	T_3 + biozyme seed plus (10 ml.l^{-1} water)	Seedling treatment
T_5	Biozyme vegetable granules (20 kg.ha^{-1})	Land preparation Vegetative stage
	T_3 + biozyme seed plus (10 ml.l^{-1} water)	Seedling treatment
T_6	Biozyme veg liquid (500 ml.ha^{-1})	Vegetative stage Flowering stage Fruit set stage
T_7	T_3 + biozyme seed plus (10 ml.l^{-1} water)	Seedling treatment

The uniform and healthy five weeks old seedlings were transplanted in experimental plot (size-3.0 m × 3.0 m) at 75cm × 100cm spacing. Randomly five plants from each plot were selected for recording growth. Ten fruits from selected plants were taken for taking observations regarding yield and yield attributing characters. Ascorbic acid content in brinjal fruits was estimated using 2, 6-Dichlorophenol indophenol titration method (Sadasivam and Manikam, 1992). Statistical analysis was done using standard procedure given by Panse and Sukhatme (1978). The economic analysis of brinjal cultivation was calculated taking into consideration the cost of cultivation and net return.

RESULTS AND DISCUSSION

Pooled data (Table 1) revealed that biozyme showed beneficial effect on growth, yield and quality of brinjal during both the years of study. Soil application of RDF + seedling treatment with biozyme seed plus + biozyme vegetable granules (soil application) + biozyme veg. liquid (as foliar spray) recorded maximum plant height (149.18 cm), number of leaves per plant (148.75) and number of branches per plant (11.12) followed by treatment T_7 (RDF + seedling treatment with biozyme seed plus) and treatment T_6 (RDF + seedling treatment with biozyme seed plus + biozyme veg. liquid) (Table 1). The minimum values for these attributes were recorded in treatment T_1 (control). The present findings are in line of work reported by Manna *et al.,* (2012) who reported that vegetative growth parameters of chilli show positive response with application of biozyme. Similarly Gore *et al.,* (2007) and Reeta *et al.,* (2010) reported beneficial effect of bio-enzyme and seaweed liquid fertilizer on chilli and tomato, respectively. The better results of biozyme regarding vegetative growth might be due to its growth stimulant nature (consisting cytokinin and auxin precursors), which increase the cell division, cell enlargement with better utilization of chemical fertilizers resulting in to rapid vegetative growth (Manna *et al.,* 2012).

Table 1: Effect of biozyme on growth, yield and quality parameters of brinjal (Pooled data of two years)

Treatments	Plant height (cm)	Branches/ plant	eaves/ Plant	Weight of fruit (g)	Fruit /plant	Diameter of fruit (cm)	Total yield (t ha^{-1})	Dry matter (%)	Ascorbic acid (mg 100 g^{-1})
T_1	137.31	9.25	128.62	201.06	7.72	8.55	20.72	13.98 (21.97)	5.16
T_2	141.57	10.37	129.75	220.39	8.16	8.79	23.99	14.12 (22.06)	5.93
T_3	140.93	10.50	138.25	222.59	9.89	8.87	29.37	14.54 (22.38)	6.08
T_4	149.18	11.12	148.75	248.50	10.66	9.75	35.34	15.10 (22.87)	8.50
T_5	139.81	10.31	133.75	221.90	9.22	8.67	27.30	14.88 (22.71)	7.08
T_6	143.25	11.06	138.00	243.29	10.31	9.10	33.45	15.02 (22.79)	7.60
T_7	146.43	10.43	138.25	223.63	7.97	8.46	23.79	14.67 (22.54)	7.03
SEm (±)	2.39	0.204	6.91	9.86	0.323	0.161	1.67	0.26	0.57
CD at 5%	7.10	0.607	NS	NS	0.96	0.479	4.98	0.77	1.70

Figures within parentheses indicate angular transformation data of fruit setting percentage

Biozyme proved to be significantly beneficial for number of fruits/plants and diameter of fruits but the effect of biozyme on average fruit weight (Table 1) was non-significant. However, higher number of fruits per plants, diameter of fruit and average fruit weights (7.97, 8.46cm, 223.63g, respectively) were observed in the treatment T_4 (plants received RDF along with biozyme seed plus + biozyme veg. granules + biozyme veg. liquid). The present results corroborate with the findings of Eris *et al.,,* (1995) who observed that fruit diameter significantly increased with the increase seaweed extract treatment in pepper. Similarly, Manna *et al.,* (2012) and Ofosu-Anim *et al.,* (2007) observed that application of Biozyme as foliar fertilizer increase mean number of fruits per plant, fruit weight, fruit diameter of chilli and tomato, respectively. Biozyme also showed the marked impact on the fruit yield of brinjal. Highest fruit yield of 35.34 $t.ha^{-1}$was recorded with T_4 which was statistically superior to other treatments. The yield was meagre of 20.72 t ha^{-1} only in control (T_1). The results are in consonance with the findings of Manna *et al.,* (2012), Gore *et al.,* (2007) and Kumar *et al.,* (2000) who reported that application of biozyme significantly increase the yield of chilli and bell pepper, respectively. Significant increase in yield over control might be due direct or indirect effects of different growth and yield attributing characters, viz, branches per plant, flowers per plans, fruit length, fruit setting percentage and fruits per plant and also fruit weight. Thus, it is amply clear that the biozyme which consisted of precursors of auxin, enzyme, protein and micronutrients were responsible for improved vegetative growth and yield of crop.

Table 2: Effects of various treatments on the economics of brinjal cultivation

Treatment combination	Yield (tha^{-1})	Total cost of cultivation	Gross income	Net profit	Benefit cost ratio
T_1	20.72	52048	165804.8	113756.77	2.18
T_2	23.99	54545	191985.3	137440.26	2.51
T_3	29.37	54206	234962.7	180756.70	3.33
T_4	35.34	56703	282737.8	226034.77	3.98
T_5	27.30	56138	218456.8	162318.83	2.89
T_6	33.45	55903	267620.4	211717.37	3.78
T_7	23.79	54538	190339.3	135801.29	2.49

The production of dry matter percentage in brinjal was significantly affected by the different treatments. The maximum dry matter percentage (15.10%) was recorded in treatment T4 followed by T6 (15.02 %). Whereas, T1 (13.98 %) showed minimum percentage of dry matter. Biozyme components such as macro and micronutrients, amino acids, vitamins, cytokinins, auxins and abscisic acid, promote cellular metabolism of treated plants, leading to enhanced growth and yields in terms of dry matter and start accumulation (Crouch *et al.,,*1992). Biozyme enzyme-hydrolysed proteins improve uptake of complex molecules and previously unavailable nutrients and water from soil by plants to be used in enhanced dry matter

content biosynthesis and accumulation (Karanja *et al.,* 2013). Adeline and Anburani (2006) supported the present findings. Ascorbic acid content was found to be highest under the treatment T_4 (8.50mg.100g^{-1}) followed by the T_6 (7.60mg.100g^{-1}), and the minimum ascorbic acid content was noticed with T_1 (5.16mg.100g^{-1}). Result may be due to the role of biozyme, increasing beneficial microorganisms which convert the organic form of nutrient to mineral form that leads to increase the availability and uptake and accordingly enhance the chemical properties like ascorbic acid content of fruits. The present result are in conformity with the findings of Manna *et al.,* (2012) who reported that application of biozyme significantly increase ascorbic acid content in green chilli fruits. Similarly, Reeta *et al.,* (2010) also observed significant increase in ascorbic acid content in tomato due to application of seaweed liquid fertilizers.

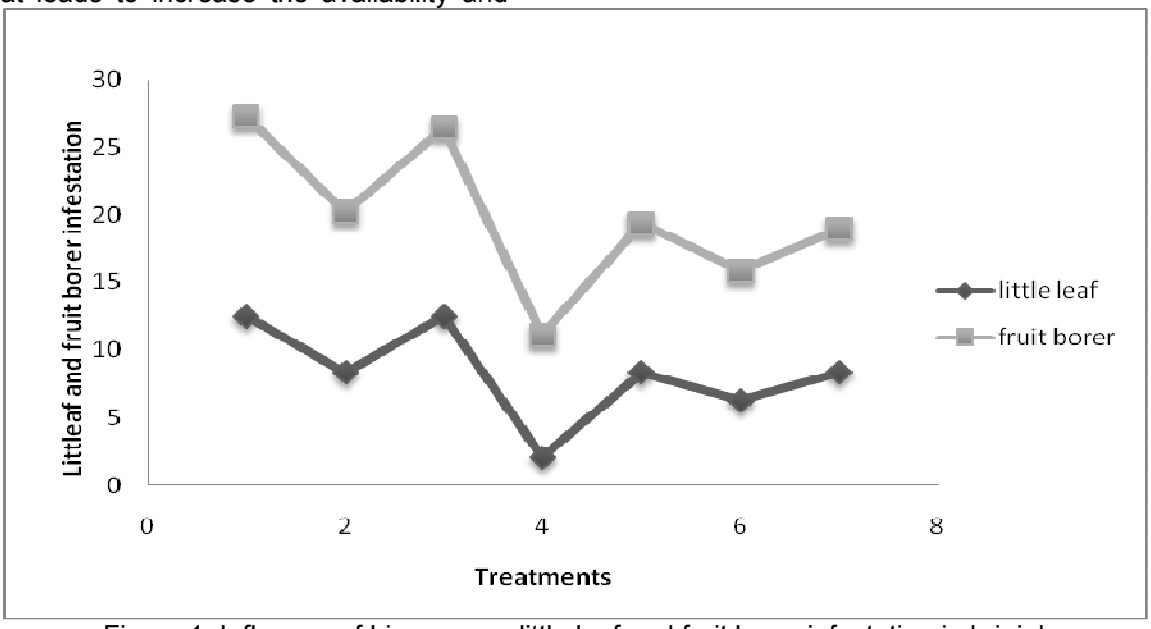

Figure 1: Influence of biozyme on little leaf and fruit borer infestation in brinjal

Application of biozyme had positive effect on pest management. The results (Fig.1) revealed that minimum pest infestation (fruit borer and little leaf) occur in treatment T_4 and maximum in T_1 (Control). Biozyme, primary and secondary nutrients (Mg, Fe, B, Mn, Zn, Cu, and Mo) provide nourishment required for healthy plant development. These nutrients are naturally chelated and readily assimilated by plants to improve cell division and enlargement, chlorophyll content and plant natural self - defence against pest pressure (Karanja *et al.,* 2013).

The highest gross returns (` 282737.80 ha$^{-1}$), net profit (` 226034.77 ha^{-1}) and benefit cost ratio (3.98) were obtained from the soil application of RDF + seedling treatment with biozyme seed plus + biozyme vegetable granules (soil application) + biozyme veg. liquid (as foliar spray) as compared to rest of the treatments. Lowest values of these economic parameters were obtained from T_1 (control). The higher gross return and net return is obviously due to the higher fruit yield under T_4 treatment. Highest benefit: cost ratio was obtain by the application of RDF + seedling treatment with biozyme seed plus + biozyme vegetable granules (soil application) + biozyme veg. liquid (as foliar spray) than control where only recommended dose of NPK was used.Similar results of higher benefit cost ratio by application of different formulation of biozyme has also been reported by Manna *et al.,* (2012).

It may be concluded from the results that for better growth, yield and lesser pest damage of brinjal crop may be obtained with different formulation of biozyme applied at different stages in combination with the recommended dose of fertilizer under the plains of West Bengal with the special reference of New Alluvial Zone.

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