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SHORT COMMUNICATION

SOIL AMENDMENT USING OXYGENATED PEPTONE FOR QUANTITATIVE AND QUALITATIVE ENHANCEMENT IN THE YIELD OF ORIGANICALLY GROWN BRINJAL

NEELAM PATIL*[1], RUPALI CHITALE[1] AND K.N. DHUMAL[2]

[1]Post Graduate Research Centre in Botany, Tuljaram Chaturchand College, Baramati-413 102, Dist. Pune (M.S.)
[2]Department of Botany, Pune University, Pune-411 007 (M.S.)

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Brinjal (*Solanum melongena* L. cv. Ajay) seedlings were grown organically using pot culture. Soil was amended organically using oxygenated peptone (containing oxygen, peptone and silicate based inert filler compound) for soil conditioning. The effect of this treatment was studied on morphology of flowering and fruiting and on biochemical constituents, mineral contents and enzyme activity of fruit. The treatment resulted in quantitative increase in yield in terms of early flowering, increased fruit set, better fruit size and doubled yield. It also exhibited qualitative enhancement in the nutritious status with higher level of fiber content, soluble proteins, total carbohydrates and vitamin C. The analysis of minerals in fruit showed increase in total nitrogen, total potash, calcium, magnesium, copper, iron and manganese and decrease in total phosphorus, sodium and zinc. The enzyme activity of catalase, peroxidase and polyphenol oxidase was improved. Better shelf life, superior taste and better shining of fruit increased its marketability. So it is concluded that soil amendment with oxygenated peptone is an eco – friendly, easy technique, useful for enhancing quantity and quality of yield in organically grown brinjal.

Key words: **Brinjal, organic farming, oxygenated peptone, soil amendment, yield.**

The concept of food quality has changed dramatically in recent years. It refers not only to the final product but also to the way in which it is produced, processed and transported. Organically grown food is nutritious, tastier and leads to better health. Consumers are ready to pay 1.5 to 5 times more price to natural food products (green food) as compared to chemical food. Many countries all over the world produce organic food using 26.5 million ha. area in 2004. Commercial organic farming in India is still in nascent stage producing only 14000 tones of organic food in 2002. Total land under organic management has been showing an increasing trend rising from 1700 ha in 2001 to 76326 ha in 2004. The productivity of agricultural crops in organic farming in India is low and continued research and development efforts are required to improve productivity (Hazra 2003).

In sustainable agriculture, the theme is, "Feed the soil and not the crop." If the soil health is taken care of, it will ultimately lead to crop health and human health. This can be achieved by soil aeration. Soil oxygen is the fundamental requirement for the growth and productivity of a plant. Oxygen constitutes about 44% of dry matter of plant material (Sharma 2006). During night time, as respiratory rate is higher, more oxygen is needed, but stomata are closed. So plants have the only option to absorb oxygen from soil (Patil *et al.* 2006). So oxygen

*Corresponding author, E-mail: neelampatil_123@yahoo.co.in

rich soil is essential for proper plant growth. Unfortunately soil oxygen is the most neglected factor in plant growth due to lack of suitable technique to improve soil oxygen status. Oxygenated peptone, an organic soil aerator releases oxygen slowly and steadily for 40 – 50 days when injected in the soil at the depth of 10 cm and watered. In the light of this situation, the present investigation was undertaken with a view to amend the soil organically, using oxygenated peptone and study its quantitative and qualitative effect on organically grown brinjal, a solanaceous fruit vegetable grown all over the world, round the year. Besides, brinjal is a rich source of carbohydrates, proteins, ash, fibers and vitamin C (Singh *et al.* 2001).

The experiments were conducted in Post Graduate Research Centre, Department of Botany, Tuljaram Chaturchand College, Baramati (M.S.) India in pot culture. The earthen pots (40 x 40 cm) were filled with soil and vermicompost (10:1 kg / pot). Oxygenated peptone (containing 100 mg / g of oxygen, 650 mg / g of peptone and 250 mg / g silicate based inert filler compound) was injected to the soil (@ 2 g / pot at the depth of 10 cm, buried and watered. Seedlings (21 DAS) of brinjal (*Solanum melongena* L. cv. Ajay) were grown in these pots. Non – treated plants (control) were kept without oxygenated peptone. All plants were grown organically. Morphological parameters were analyzed 60 DAS using routine laboratory methods

Total solids, total soluble solids, ash, total acids, moisture and fiber content were analyzed by the methods described by Saini *et al.* (2006). Soluble proteins were analyzed by the method of Lowry *et al.* (1951) while total carbohydrates and ascorbic acid were analyzed by the methods described by Sadasivam and Manickam (2005). The activity of enzymes catalase, peroxidase and polyphenol oxidase were determined 60 DAS as per methods given by Sadasivam and Manickam (2005). Minerals were analyzed 60 DAS using Atomic Absorption Spectrophotometer (PERKIN ELMER – 3030). All sets were replicated five times and statistical analysis of data was carried out using ANOVA and comparisons of means were performed by the LSD test at $p < 0.05$.

The soil application of oxygenated peptone on brinjal showed a decrease in number of days required for flower initiation (18.7%) and also days required to 50% flowering (22.2%) (Table 1). The other parameters exhibited increase in terms of number of flowers per plant (68.1%), length of flowering period (9.52%), length of fruiting period (10.7%), flower to fruit ratio (1.76%) and number of fruits per plant (65%). The fruit characters of treated plants, viz. length, diameter and weight of fruit showed increase by 58.7%, 54.3% and 174.8% respectively. The number of seeds increased by

Table 1. Effect of soil application of oxygenated peptone on flowering and fruiting in brinjal (*Solanum melongena* L. cv. Ajay).

Parameter	Untreated	Treated	Increase (%)
Days required for flower initiation	80	65	-18.7
Days required to 50% flowering	110	90	-22.2
Number of flowers / plant	11.3 ± 1.0	19.0 ± 1.2	68.1
Length of flowering period	126	138	9.52
Length of fruiting period	112	124	10.7
Flower to fruit ratio	1.13	1.15	1.76
Number of fruits / plant	10.0 ± 1.0	16.5 ± 0.5	65
Length of fruit (cm)	6.3 ± 0.1	10.0 ± 0.5	58.7
Diameter of fruit (cm)	12.7 ± 0.2	19.6 ± 0.2	54.3
Weight of fruit (g)	47.3 ± 0.4	130.0 ± 1.5	174.8
Number of seeds / fruit	750.0 ± 1.0	1050.0 ± 1.2	40
Weight of 100 seeds (g)	15.4 ± 0.8	38.2 ± 1.0	83.1
Total wt. of seeds per fruit to fruit wt. ratio	0.32	0.29	-30
Yield / plant (kg)	2.4 ± 1.0	5.0 ± 1.5	108.3
Shelf life (days)	05	08	60
Shining	+	++	

Data are mean values (n=5) followed by ± standard deviation. '*', '**' and 'ns' represent significance at $p < 0.05$, $p < 0.01$ and non-significance, respectively.

40.0% while weight of 100 seeds increased by 83.1%. At the same time, the ratio of total weight of seeds per fruit to fruit weight exhibited 30% decrease. There was 108.3% increase in yield per plant, 60% increase in shelf life and better fruit skin shining. The analysis of biochemical constituents of fruit in untreated and treated brinjal plants showed increase in total solids (14.2%), total soluble solids (43.0%) and ash (8.3%), and decrease in total acids (38.6%) and moisture (21.4%) (Table 2).

Table 2. Effect of soil application of oxygenated peptone on biochemical constituents and enzyme activity in fruits of brinjal (*Solanum melongena* L. cv. Ajay).

Parameter	Untreated	Treated	Increase (%)
Total solids (gm)	7.35 ± 0.1	8.40 ± 0.1	14.2
Total soluble solids (%)	0.65 ± 1.0	0.78 ± 1.0	43
Ash (gm)	0.12 ± 0.1	0.13 ± 0.1	8.3
Total acids (%)	6.1 ± 0.1	4.4 ± 0.1	-38.6
Moisture (%)	35.7 ± 2.0	29.4 ± 2.0	-21.4
Fiber content (%)	4.0 ± 0.1	7.5 ± 0.1	87.5
Soluble proteins (mg /g fw)	5.2 ± 0.1	9.2 ± 0.1	76.9
Total carbohydrates (mg /g fw)	3.6 ± 0.1	6.2 ± 0.1	72.2
Ascorbic acid (mg / 100 g fw)	85.0 ± 2.0	110.0 ± 2.0	29.4
Catalase (µmol H_2O_2/ min / mg protein)	0.16 ± 0.01	0.24 ± 0.05	37.4
Peroxidase (µmol guiaiacol / min / mg protein)	0.24 ± 0.02	0.40 ± 0.01	66.6
Polophenol oxidase (units / mg protein)	0.12 ± 0.1	0.16 ± 0.1	33.3

Data are mean values (n=5) followed by ± standard deviation. '*', '**' and 'ns' represent significance at $p < 0.05$, $p < 0.01$ and non-significance, respectively.

The fiber content was increased by 87.5%, soluble proteins by 76.9%, total carbohydrates by 72.2% and ascorbic acid (vitamin C) by 29.4%. The mineral analysis of fruits of untreated and treated brinjal plants showed increase in total nitrogen (28.5%), total potash (3.33%), calcium (66.6%), magnesium (0.6%), copper (496.2%), iron (19%) and manganese (30.7%) and decrease in total phosphorus (12.5%), sodium (87.8%) and zinc (34.4%) (Table 3).

Table 3. Effect of soil application of oxygenated peptone on mineral contents in fruit of brinjal (*Solanum melongena* L. cv. Ajay).

Parameter	Untreated	Treated	Increase (%)
Total nitrogen (%)	0.70	0.90	28.5
Total potash (%)	1.500	1.550	3.33
Calcium (%)	0.003	0.005	66.6
Magnesium (%)	0.151	0.152	0.6
Copper (ppm)	27	161	496.2
Iron (%)	21	25	19
Manganese (ppm)	13	17	30.7
Total phosphorus (%)	0.152	0.133	-12.5
Sodium (%)	0.033	0.004	-87.8
Zinc (ppm)	29	19	-34.4

Oxygenated peptone is used for both soil aeration and soil conditioning and it can be used safely in organic farming as it fulfils the conditions of organic farming (Patil *et al.* 2006). It increases soil oxygen level and soil porosity making the soil micro–climate inducive for the growth of both plant and aerobic non–pathogenic soil microbes. It discourages the growth of anaerobic pathogens and reduces the toxicity of reduced metal ions in the soil by oxidizing them. In addition, it avoids soil reduction which is very significant because soil reduction adversely affects growth and biomass accumulation in plants (Pezeshki and De Laune 2002). Peptone is the food for microbes. The presence of oxygen and peptone in rhizosphere attracts the aerobic microbes from different soil pockets and their population increases in rhizosphere area to carry out various processes as per needs of the plant. So genetic potential of the plant is better exploited which results in better growth and yield of plant. Indeed, healthy soil and healthy crop is an essential factor for higher yield with better quality. Morra *et al*. (2003) reported that soil amendment using organic compounds leads to better yield than using mineral treatment in vegetable crops including brinjal. This is supported by Lathiff and Maraikar (2003) in brinjal.

The present investigation denotes that decrease in number of days to 50% flowering and increase in fruit number lead to better yield. This is in line with the observations made by Illangakoon *et al*. (2004), who evaluated six cultivers of brinjal to determine the relationship of physico – agronomic and chemical characteristics with yield. They found that days to 50% flowering and fruit number were correlated with yield and can be used as indicators to predict the yield. Soil amendment with oxygenated peptone is found to increase flowering, fruit set and yield per plant. The same effect is obtained by spraying the leaves of brinjal plants with GA (El-Zawily *et al.* 1985, Sorte *et al.* 2001, Khedr *et al*. 2004). The seed characters obtained under experimental condition are remarkable as they show increase in weight of 100 seeds which denotes healthy condition and better germination capacity. The ratio of total weight of seeds per fruit to fruit weight exhibited decrease, which is the indication of more fleshy fruits with less seeds, a commercially desirable character. The increase in total solids, total soluble solids and ash along with decrease in total acids and moisture show that the fruits were tasty and fleshy and not pulpy. The increase in protein, ascorbic acid and shelf life was also observed. Singh *et al.* (2001) and Singh (2004) also reported higher protein and vitamin C content alongwith better shelf life in brinjal using biofertilizers and organic manure.

The mineral analysis exhibited increase in total nitrogen, total potash, calcium, magnesium and iron which is significant from human nutrition point of view. The five times increase in copper content is significant as copper is known to kill pathogenic microbes. The activity of catalase and peroxidase showed higher level as compared to that of polyphenol oxidase. Aluko and Ogbadu (1986) stated that high activity of catalase and peroxidase with low activity of polyphenol oxidase is the best situation for storage and resistance to injury and diseases in brinjal. The increase in the shelf life of brinjal fruits in the present investigation seems to be the effect of higher activity of catalase and peroxidase concomitant with lower activity of polyphenol oxidase.

Soil treatment with oxygenated peptone improved yield, storage life and shining of fruit skin. This is significant achievement from economical and commercial point of view as it increases marketability of brinjal fruits. This is concomitant with the observations of Prasanna and Rajan (2001) who reported that the number of marketable fruits was more with organic fertilizers and less with inorganic fertilizers in brinjal. The present investigation could bring about 108.3% increase in yield with better marketable fruits using very simple, easy, less costly, rapid, eco–friendly and user friendly technique. It is interesting to know here that Acciarri *et al.* (2002) experimented with brinjal to get genetically modified parthenocarpic fruits with 33% increase in yield and marketable seedless fruits. In the present investigation, though complete seedless-ness is lacking, the seed number per fruit is decreased. The fruits are more fleshy, more tasty and less pulpy, a desirable character. The overall picture showed that soil amendment using oxygenated peptone is an easy, eco-friendly technique for quantitative and qualitative enhancement in the yield of orginically grown brinjal as it leads to higher yield with better nutitional quality and better marketability.

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