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ORIGINAL RESEARCH

Commercialization of fish processing wastes on various ways

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ABSTRACT
This study was carried with the objective to study and compare the quality characteristics of the biofertilizer made from the fish processing waste. Comparison of the microbial load of the soil alone, after the treatment of chemicals, organic fertilizer and biofertilizer made from the fish processing waste. Parameters like physical characteristics, nutrient composition, sensory qualities of few vegetables were studied. Biofertilizer grown vegetables got higher values for colour, pod length, pod weight and taste.

KEY WORDS: *Biofertilizer, fish processing waste, vegetables*

INTRODUCTION

Fish processing wastes generates considerable quantity of waste in the form of edible and non-edible byproducts. The major non edible byproducts arising out of fish processing waste include viscera, skin scales, bones and bone frames. Majority of the fish processing waste is unorganized hence facing disposal problems. These wastes are an important source of proteins and lipids and efforts are being made to recover these biomolecules. Of these bimolecules lipids, fish oils, squalene, vitamins, cholesterol carotenoids, protein hydrolysates peptides, amino acids, collagen, gelatin, enzymes can be recovered. The recovery of these components with potential biological activities and functionalities provides a means for value addition to the fish processing waste. There are so many applications with the fish processing wastes such as the biofertilizer, biopesticide, nutritional supplements for the animal feed, isolated enzymes are used for dehairing, deskinning, soap manufacturing, bioremediation, metal leaching, food preservation. In this paper we focus on the application of fish processing wastes as biofertilizer .

Mostly all farmers are now gradually shifting back to organic farming in India, as extensive dependence on chemical farming has led to the depletion in soil fertility. In this context Tanusree (2011) opines that, organic farming is more economical to the farmer than chemical farming as it saves the cost of external inputs and utilizes the inputs present in the farm itself. Plant growth regulators are the organic chemical compounds which modify or regulate physiological process in an appreciable measure in plants when used in small concentrations. They are readily absorbed and move rapidly through tissues when applied to different parts of the plant. Either to, plant growth regulators have gained wide acceptance in many flower crops for optimizing the yield of plants by modifying growth, development and stress behavior. Hence, strategies such as application of organic manures along with foliar application of bioregulators are

essential to regulate the crop growth continuously. Consumers interest in healthy and safe food and in environmental concerns has been increasing recently. The definition of quality product has been changing and in addition to the nutritional and health characteristic of food products, environmental protection has been emphasized, giving to the product itself a new attribution of a so called "environmental quality" (Cornevale) 2000.

Composting is an environmentally sound and agronomically advantageous way to utilize organic wastes for soil organic amendment at an acceptable operational cost. It involves complete or partial degradation of a variety of chemical compounds by a consortium of microorganisms. Biofertilizers were found to have positive contribution to soil fertility resulting in an increase in crop yield without causing any type of environmental wastes or soil hazards(Chatterjee and Bandyopadhyay, 2014).Significant improvement in growth and yield and quality of vegetables with different biofertilizer applications have been reported on various crop (Bhagavantagoudra and Rokhade, 2002). The degradation of major constituents like cellulose, hemicelluloses, lignin, starch and different protein compounds present in waste is carried out by specific enzymes. Therefore, the qualification of enzyme activity during composting can reflect the dynamics of composting process in terms of decomposition of organic matter and nitrogen transformation. It may also be helpful in providing information about the maturity of the composted product.

Against this background, this study was to evaluate the effect of fish processing waste on the growth and yield production of different plants since the fish wastes contain nutrients and all the essential cofactors for the growth of plants and comparing with the chemical fertilizer and organic fertilizer.

RESULTS AND DISCUSSION

Morphological and biochemical characteristics of all the isolates were done in identifying bacterial and fungal isolates as shown in Table 1. All the organisms were present on the soil, in which biofertilizer made out of fish processing waste applied. Essential organisms are missing on the soil where chemical fertilizer is used.

Brinjal growth characters

Height of the plant

Effects of treatments on height of the plant at different stages of brinjal growth on 180th day are furnished in Table 2.Significant difference in plant height was observed throughout the plant growing stages with difference in organic manure application. Plants that recorded in treatment with the biofertilizer with the fish processing waste resulted in maximum height at all growth stages. Influence of treatments on the length of the plants, had significant influence on the yield of the brinjal over other treatments.

Number of leaves of the brinjal plant at the flowering stage

The effect of treatments on number of leaves at the flowering stages on 210th day presented in the Table 3.Biofertilizers made from the fish processing waste are significantly influenced the number of leaves of plants. At the time of transplantation the number of leaves in all the treatments was almost same. At the flowering stage of the plants the maximum number of leaves of the brinjal plant as followed by treatment of the biofertilizer from the fish processing waste was shown on the table 3. Lowest numbers of leaves number were shown in the control. Between controls significant difference were noted at all stages.

Number of branches on the brinjal plant

Compared to controls number of branches were higher in treatment with biofertilizer from the fish processing waste followed by treatment with the organic fertilizer. Numbers of branches at the time of harvest were depicted in Table 4.

Total number of fruits

Total number of fruits in each treatment was shown in Table 5.Total number of fruits in each treatment were counted and recorded. Compared to other treatments, treatment with the biofertilizer from the processing waste showed significantly higher number of fruits. Arunkumar, 2000 published a similar work stating that organic fertilizers have more yield and cause no harm to the soil.

Total protein content of brinjal

Biofertilizer showed higher total protein value 6.16 mg/l followed by the treatment with the organic fertilizer from the market showed 5.9 mg/l. Control treatments received lower proteins content compared to others. Total protein content of brinjal on different treatment was depicted in Table 6.

The quality evaluation of cowpea cultivated using chemical fertilizer available in the market, organic fertilizer available in the market and cowpea cultivated with the biofertilizer from fish processing waste was conducted with respect to

Table 1: Distribution of microorganisms on 21st day after the treatments of various chemicals on the soil

Microorganisms	Chemical fertilizer from the market	Organic fertilizer from the market	Biofertilizer Produced from fish processing waste	Control - Soil without any fertilizer
Staphylococcus sps	+	+	+	+
Bacillus Sps	-	+	+	+
Pseudomonas Sps	+	+	+	-
Clostridium Sps	+	+	+	+
Seretia Sps	-	-	+	-
Acetobacter Sps	+	+	+	-
Acinetobacter Sps	+	+	+	+
Aspergillus sps	-	+	+	+
Fusarium sps	+	-	+	-
Rhizopus sps	+	+	+	+
Candida sps	-	+	+	+
Saccharomyces sps	+	-	+	-
Pichia sps	-	+	+	+

Table 2: Heights of the brinjal plant at the flowering stage (180th day)

Treatment	Replications				
	R1	R2	R3	Total	Mean
Control	64	59	57	180	60
Organic fertilizer from the market	89	70	76	235	78.3
Chemical fertilizers	84.6	96.8	94.5	275	91.9
Biofertilizer from fish processing waste	102	108	111	321	107

Table 3: Number of leaves of the brinjal plant at the flowering stage

Treatment	Replication				
	R1	R2	R3	Total	Mean
Control	**8**	**7**	**8**	**23**	**7.6**
Chemical fertilizer	10	11	10	31	10.3
Organic fertilizer	10	12	12	34	11.3
Biofertilizer from fish processing waste	21	17	14	**52**	17.3

Table 4: Number of branches of the brinjal tree at the time of harvest

Treatment	Replications				
	R1	R2	R3	Total	Mean
Control	2	2	2	6	2
Chemical fertilizer	3	4	3	10	3.3
Organic fertilizer	3	4	4	11	3.6
Organic fertilizer from fish processing waste	5	4	6	15	5

Table 5: Total number of brinjals per plant

Treatment	Replications				
	R1	R2	R3	Total	Mean
Control	21	22	19	62	20.6
Chemical fertilizer	32	31	31	94	31.3
Organic fertilizer	49	38	42	129	43
Biofertilizer from fish processing wate	44	53	54	151	50.3

Table 6: Protein content of the brinjal

Treatment	Replications				
	R1	R2	R3	Total	Mean
Control	4.24	4.01	4.11	12.36	4.12
Chemical fertilizer	5.49	5.26	5.21	15.96	5.32
Organic fertilizer	5.89	5.75	5.81	17.45	5.81
Organic fertilizer from fish processing waste	6.18	5.99	6.32	18.49	6.16

physical characteristics, sensory qualities, shelf life, nutrient composition, anti-nutrient profile and pesticide residue.

Physical and Sensory characteristics of cowpea

Consumer choice is definitely affected by physical appearance of vegetables. Hence, a comparative analysis of physical appearance of vegetables from each treatment was done. The characteristics determined for cowpea were color, pod length, seeds per pod, pod weight and tenderness. Cowpea of all the 3 treatments showed significant difference in all the sensory characteristics like appearance, colour, flavour and taste. In the case of appearance, highest value was observed in organic cowpea cultivated using biofertilizer, but in the rest of the sensory attributes like colour, flavour, texture and taste, highest values were obtained for organically cultivated cowpea using biofertilizer. *Smith et al.,* (2002) after reviewing several studies reported

that organic vegetables are claimed to be better tasting and fresher. There have been many comparative studies of organoleptic quality of organic and conventional fruits and vegetables.

The results consistently showed enhanced organoleptic quality in organic produce. Table 7 represents the physical characteristics of cowpea cultivated under different farming practices. This table shows that organic cowpea cultivated using biofertilizer got higher values for colour, pod length, pod weight and tenderness. Bajpai, 2013 had published a similar kind of work.

Yield characters o tomato plant

In the current investigation biofertilizer from fish processing waste recorded maximum number of fruits per plant, fruit weight per plant followed by number of seedlings per plant. The increased seed yield was obtained in biofertilizers application could be attributed to the growth hormones like AA and cytokinin produced by Azospirillum which stimulated root morphology. This in return, would have improved assimilation of nutrients and thus seed yield. Increase in seed yield and its components may be attributed due to increase in seed weight per fruit as a result of improvement in seed number due to adequate plant nutrition. On the other hand, organic fertilizer and chemical fertilizer recorded lower yield and yield attributing characters as compare to other treatments. This might due to low nutrient supply than that was needed by crop through treatment results were also reported by Suthar*et al*. (2005) in brinjal, Thamizh and Nanjan (1998) in potato, Kropisz (1992) andRiazuddin (1995) in tomato.

Seedling characters

The data revealed that the biofertilizers effected seedling parameters of tomato as shown in (Table 11). Biofertilizer showed maximum 1000 seed weight (2.52unit ?? gm), germination (81.33%), shoot length (5.75cm), root length (5.78 cm) and seedling dry weight (18.80mg). Increased in seedling parameters is due to increase in availability of essential nutrients like N and P available in the presence of biofertilizers. Minimum values due to lack of availability of sufficient nutrients similar findings were reported in Shashidhara (2000).

Table 7: Physical characteristics of cowpea plants treated with various fertilizers.

Treatments	Colour (ranked mean)	Pod length (cm)	Seeds per pod (no)	Pod weight	Tenderness (ranked mean)
Chemical	6.70	44.34	18	12.20	8.20
Biofertilizer	9.20	44.68	18	12.30	8.8
Organic	8.1	44.3	18	11.52	7.0
Mean	8.0	44.44	18	12.0	8.0
F value	0.89	0.11		1.10	0.45

Table 8. Sensory qualities of cowpea plants treated with various fertilizers

Attributes	Scores of different treatments			
	Biofertilizer	Chemical	Organic	X^2
Appearance	16.85	9.0	20.65	10.15
Colour	23.90	14.30	8.30	17.70
Flavour	22.30	13.05	11.15	10.34
Texture	17.75	16.40	15.35	2.60
Taste	21.50	15.0	10.0	10.11

Table 9: Different parameters of cowpea plants on the treatment of various fertilizers

Treatment	Plant Height(cm)		Plant weight(g)		Fruit yield (ton/ha)		Fruit length(cm)		Fruit diameter(cm)	
Control	40.33	39	180	179	17.87	14.74	7.53	7.8	6.07	6.2
Chemical	43.33	44	251.33	250.67	18.47	19.58	8.33	8.6	6.47	6.67
Organic	52.32	50.27	373	367.97	39.37	36.68	9.83	10.03	7.63	7.67
Biofertilizer	64.5	62	407.67	405a	49.17	44.16	10.03	10.13	7.81	7.90

Table 10: Comparison of various fertilizers on yield of Tomato

Treatment Code	Number of fruits per plant	Fruit weight kg/plant	Number of seeds per fruit
Chemical	17.53	0.78	66.53
Organic	19.26	0.86	70.20
Bioertilizer	21.60	0.97	71.26
SE.d	0.34	0.02	0.39
CD	0.72	0.04	0.83

Table 11: Effect of various fertilizers on seedling characters of Tomato

Treatment Code	1000 seed weight (g)	Germination (%)	Shoot length (cm)	Root length (cm)	Dry weight of seedling (mg)
Chemical	2.18	78.33	5.36	4.40	17.05
Organic	2.42	80.00	6.71	5.78	18.80
Biofertilizer	2.52	81.33	7.26	6.33	20.25
SE.d	0.018	0.28	0.11	0.11	0.19
CD	0.053	0.86	0.35	0.33	0.57

CONCLUSION

Modern agriculture is based on the use of various organic manures which are eco-friendly and low in cost. Biofertilizers are very popular among the farmers to produce quality product. These are eco-friendly and the cheapest sources of nutrients. Due to abundant additions of chemical fertilizers, decline in yield under continuous cropping system is very common. The effective utilization bioertilizer from the fish processing waste would not only provide economic benefits to the farmers but also improve and maintain soil fertility and sustainability in natural eco-system. From the present study, we can understand that the biofertilizer from the fish processing waste, is an eco-friendly, low in cost, and gives high yield.

MATERIALS AND METHODS

Microbiological examination of soil

Soil samples were collected in triplicates using sterilized polythene bags and stored at ambient temperature. Serial dilutions of soil samples were prepared, from each dilution 0.1 ml of sample was inoculated in to appropriate media for the isolation of microorganisms. Sabarouds dextrose agar supplemented with 0.01% Streptomycin sulphate were used for isolation and enumeration of fungi. Mac Conkey agar and Nutrient agar was used for isolation of bacteria and Nutrient agar was used for total viable count of bacteria.

Brinjal plant

Brinjal or egg plant (*Solanummelongena* L) is an important solanaceous vegetable crop grown in India and throughout the world. It has been one of the vegetables in our diet since ancient times. Brinjal is a warm season fruit vegetable susceptible to frost. It is highly productive and rated as poor man vegetable. It has much potential raw material in pickle making, dehydration industries (Singh *et al* 2000). Besides its use as fresh vegetable, it is known to have some medicinal properties in curing diabetic patients.

1 Height of the brinjal plant

Heights of the plants were examined at the time of transplantation and different intervals.

2 Number of branches per brinjal plant

The total numbers of branches in each treatment were counted at the maximum growth stage and then the average was taken.

3 Number of leaves per brinjal plant

Number of leaves of each treatment was counted at different intervals and the mean number of leaves per plant was worked out.

4. Yield per plant

Weight of fruits per plant was recorded in after each harvest and the average was calculated to get the fruit yield per plant.

5. Estimation of total protein content of the brinjal

Lowry's method developed by Lowry *et al* (1951) was adopted for the estimation of protein.

Cowpea plant

Cowpea is a crop that occupies a prime position in Kerala, because, it is an important source of protein and hence its yield and quality are important. It is cultivated for its long green pod- as a vegetable, seed

as pulses and foliage-as a vegetable and fodder.Limited studies have systematically compared the quality of organically and conventionally produced vegetables in this state. Hence, a study was taken up to compare the quality of the above said vegetable cultivated organically, as well as conventionally.

6. Colour– Colour of cowpea was compared amongst the 3 treatments by direct observation and rated on a hedonic scale.

7. Pod length – Length of the pod was measured and expressed in centimeters. The average values of 5 pods were noted.

8. Seeds per pod – Five pods taken separately and the number of seeds in each pod were counted and the average was worked out.

9. Pod weight – Ten pods were taken after the second day harvest, weighed and expressed in grams and the average was worked out.

10. Tenderness – Tenderness of the pods were determined by direct observation and rated on a score card.

11. Sensory quality – Sensory quality consists of judging the quality of food using our sense organs viz, eyes, nose, mouth and skin. The sensory qualities were assessed using a score card method proposed by Swaminathan (1995). The following major quality attributes were included in the score. Appearance, Colour, Flavour, Texture, Taste were assessed on a 5 point rating scale ranging from 1 to 5. The evaluation was done by a semi trained panel of 10 members.

Tomato

Tomato (*Lycopersiconesculentum* Mill.) belongs to family solanaceae. It is self-pollinated crop and Peru-equator is the centre of origin. Tomato is one of the popular vegetables of great commercial value and is used in various forms. It contains higher quantity of total sugar (2.5-4.5%), starch (0.6-1.2%) and minerals like potassium, calcium, sodium, magnesium, phosphorus, boron, manganese, zinc, copper, iron, etc. Apart from this it also contains organic acids such as citric, malic and acetic acid which are known as health acids in fresh tomato.

The experiment was laid out as split plot design with three replications, was randomized in main plots three types of manures such as chemical, organic and biofertilizer. The seedlings were raised in a seedbed of 1m wide and convenient length. DAP (18%N, 46%P_2O_5) at recommended rate was uniformly applied to the seed bed and lightly mixed with the soil using a rake; seeds were sown in furrows 30cm apart and thinly covered with top soil. The seedlings were ready for transplanting 42 days after sowing i.e. when they were 8-10cm in height. All three manures were applied to the marked plots two weeks before transplanting of the seedlings by evenly spreading them within the appropriate experimental plots and incorporated to a depth of 15cm. During transplanting DAP and the particular fertilizer in the respective field was applied.Five plants were randomly tagged in each treatment as per replication and data was recorded according to growth, yield and seedling characteristics attributes *viz.* plant height (cm), number of leaves per plant at 30, 60 and 90 days after transplanting, days to 50% flowering, number of fruits per plant, fruit Weight per plant (kg), number of seeds per fruit, seed yield per plant (gm), seed yield per plot (gm), seed yield per hectare (kg), 1000 seed weight (g), germination %, shoot length (cm), root length (cm), seedling dry weight (mg) .

REFERENCES

Njoroge, W.J. and Manu, C. (1999). Organic Farming. A Textbook for Post-Secondary Education. Kenya Institute of Organic Farming. Nairobi, Kenya.

Walker, D.J., R. Clemente and M.P. Bernal, (2004). Chemosphere, 57: 215–224

Clemente, R. and M.P. Bernal, (2006). Chemosphere, 64: 1264–1273.

Agbede, T.M., S.O. Ojeniyi and A.J. Adeyemo,(2008). American-Eurasian J. Sustainable Agric., 2: 72–77.

Muhammad, D. and R.A. Khattak, (2009). Soil Environ., 28: 145–155

Singh, A.K., Amgain, L.P. and Sharma, S.K. (2000). Root characteristics, soil physical properties and yield of rice (*Oryza sativa*) as influenced by integrated nutrient management in rice-wheat (*Triticumaestivum*) system. Indian J. Agron. 45:217-222

Cornevale E (2000) Attualicriteri per la valutazionedellaqualitanutrizionaledeglialimenti. In Attilconferenzanazionealesulleducazionealimentare, Rome 2000

Lowry, O.H., Rosebrongh, N.J., Parr, A.L. and R.J. Randall (1951). J. Biolchem.. 193-265

Arunkumar.(2000). Organic nutrition in amaranthus (Amaranthus tricolor L.). M.Sc. (Ag.) thesis, Kerala Agricultural University, Trissur, p.108.

Bajpai PPD .(2013). Sensory evaluation of vegetables grown under organic and inorganic condition, 6 (2) :203-205.

Bhagavantagoudra,KH, Rokhade, A.K. (2002). Economics of *Azospirillum* inoculation to cabbage. Karnataka Journal of Agricultural Sciences, 15(2): 314-415.

Chatterjee R and Bandyopadhyay S. (2014). Studies on Effect of Organic, Inorganic and Biofertilizers on Plant Nutrient Status and Availability of Major Nutrients in Tomato.International Journal of Bio-resource and Stress Management, 5(1): 093-097.

Shashidhara GB, (2000).Integrated nutrient management for chilli (Capsicum annuum L.) in Alfisops of Northern Transition Zone of Karnataka. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka, India,.

Suthar MR, Singh GP, Rana MK, Makhan-Lal, (2005)Growth and fruit yield of brinjal {Solatiummelongena L.) as influenced by planting dates and fertility levels. Crop Research. Hissar,; 30(1):77-79.

Thamizh VR.and Nanjan K(1998). Biofertilizer for potato in the Nigeria. South Indian Horticultre.; 46(3, 4):21, 1-2 13.

Kropisz A, (1992). Influence of fertilization with compost on yield of vegetables and their content of mineral elements. Annals of Warsaw Agricultural University,; 16:9-13.

Riazuddin AS(1993). Influence of composted coconut coirdust (Coir pith) on soil physical (Lycopersiconesculentum Mill.). South Indian Horticulture,; 45(5):264-269.