Novel Approach for Production of Biofertilizer by Utilizing Fish Waste

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ABSTRACT

This is the first effort where the biological waste material successfully utilized for synthesis of liquid biofertilizer. The result of experiment demonstrates the primary data. The effectiveness of liquid biofertilizer evaluate by measuring vegetative growth (length of root and shoot, Weight) of *Cicer arientinum.* This biofertilizer has unique combination of Phosphate Solubilizing Bacteria (PSB) and *Trichoderma sp.* Along with humic acid containing nutritious fermented liquid. The result of experiment revealed that the plant samples treated with biofertilizer had promising physical characteristics and this can be best substitute for chemical biofertilizer.

KEYWORDS: Fish waste, Biofertilizer, Vegetative growth, Solid-State Fermentation

INTRODUCTION

India is an agrarian country and its economy is based on agriculture (Godfray et al., 2010). Increasing rate of population requires a sufficient food supply. During green revolution the extra crop production was increased by applying synthetic products. However, a deleterious impact of these products on the environment was reported by earlier researchers (Shah and Seth, 2012). Therefore, organic agro based products are used for production and protection of crop (Ngampimol and Kunathigan, 2008). Biofertilizer contains the living organisms and synthesized by means of natural resources which revealed promising results through upgrading the natural soil ecosystem (Adnezhad et al., 2016).

Hence, in the present investigation waste material of fishes was utilized for the production of microorganism based biofertilizer.

METHODOLOGY

Preparation of Liquid Biofertilizer

Step I - Fermentation

Fish waste and jaggery mixed (7:3) and keep it for Solid State Fermentation for 20 days

Step II - Liquid Separation

Fermented material was filtered by fabricated filter and this filtered liquid was used as supplement for II batch (Fermented liquid & Fish waste (5:5) for 10 days).

Step III - Preparation of humic based PSB solution

Incubated PSB solution was prepared with adding 100 gm. humic acid. This humic based PSB culture media mixed with filtered liquid.

Efficiency check by conducting experiments

Experimental Site and Material

Design with 3 treatments and 3 replications conducted in pots with the mouth diameter of 7 cm and height of 9 cm

in the laboratory. The maximum temperature was 26˚C.

The experiment was conducted in the laboratory with the above conditions, the effects of soil, vermicompost & cow manure on the Chickpea (*Cicer arientinum*). It is annual dicotyledon, legume of the family Fabaceae. It grows in cool season. The soil used in potting media was collected from the field. The soil was black cotton.

Experimental Design

In the current experiment, total 27 pots were used for 3 treatments (9 pots for each treatment). For the control set 1-3 pots were filled with 100% soil (T1), 4-6 with 5% compost & 95% soil (T2), 7-9 with 5% vermicompost & 95% soil (T3) treated with 15 ml water as a control.

In the second set, 10-12 pots were filled with 100% soil (T4), 13-15 with 5% compost & 95% soil (T5), 15-18 with 5% vermicompost & 95% soil (T6) treated with 10 ml water along with 5 ml biofertilizer.

For the third set, 19-21 pots were filled with 100% soil (T7), 21-24 with 5% compost & 95% soil (T8), 24-27 with 5% vermicompost & 95% soil (T9) seeds treated with biofertilizer for half hour & contains 10 ml water along with 5 ml biofertilizer [5].

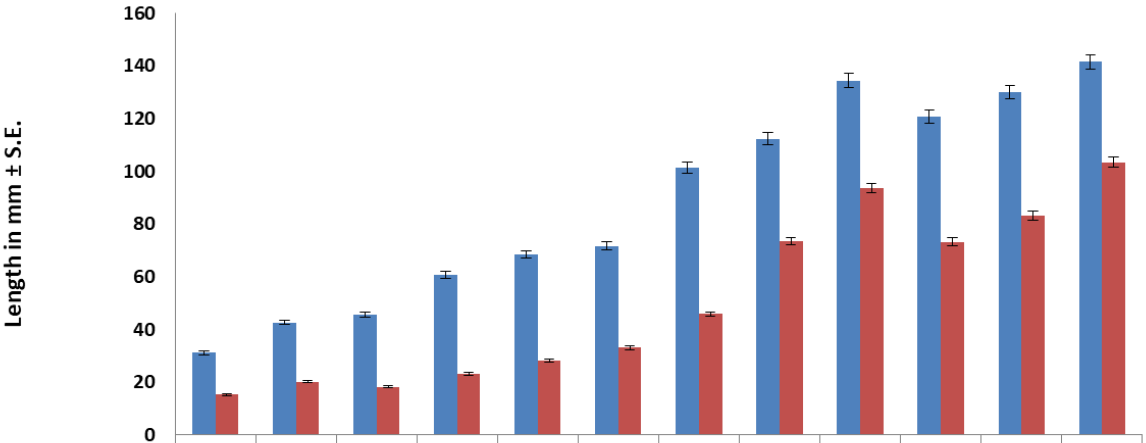
RESULT AND DISCUSSION

The biofertilizer was applied as supplement for the chickpea plant (Cicer arientinum) in order to determine the effectiveness of the biofertilizer.

The prepared biofertilizer shows acidic (5) pH value. The viability test shows good count of Phosphate Solubilizing Bacteria (PSB) and bio fungicide (*Trichoderma sp.*) after addition of Humic acid.

The comparative length of root and shoot of soil samples (control, treated soil & treated seeds) showing the consistently increasing values that shows the positive effectiveness of biofertilizer.

Graph 1. Comparative length of root and shoot in control

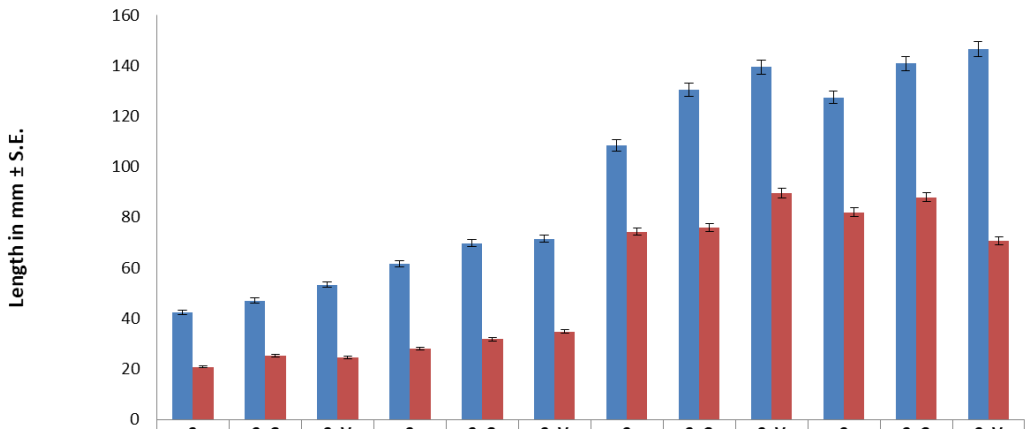


	S	S+C	S+V	S	S+C	S+V	S	S+C	S+V	S	S+C	S+V
	4 Day			5 Day			6 Day			7 Day		
Length of Root	31.0875	42.5675	45.705	60.655	68.3825	71.655	101.3475	112.3225	134.255	120.6675	130.0025	141.385
Length of Shoot	15.29	20.05	18.2275	23.0575	28.2825	33.0525	45.8025	73.4875	93.5825	73.2125	83.0325	103.4125

The comparative length of root and shoot of soil with compost samples (control, treated soil & treated seeds) showing the consistently increasing values

than control that shows the positive effectiveness of biofertilizer.

Graph 2. Comparative length of root and shoot treated with biofertilizer

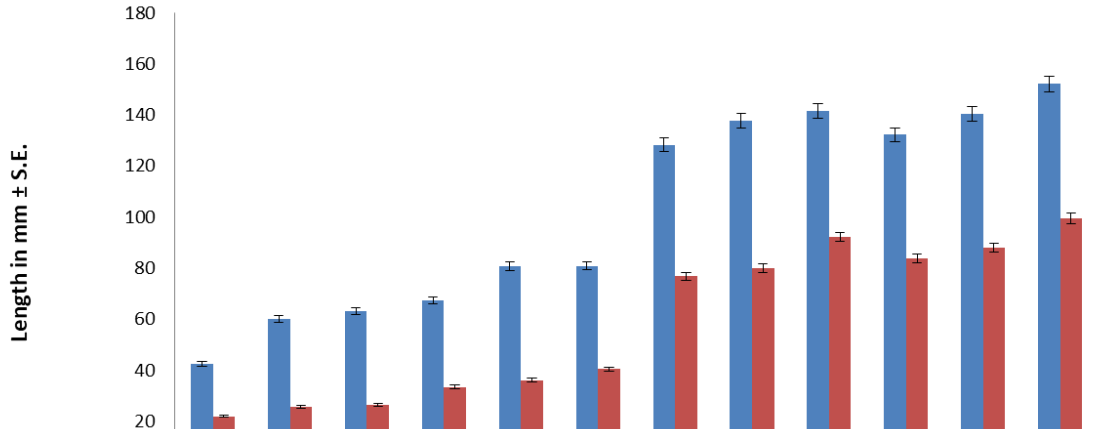


	S	S+C	S+V	S	S+C	S+V	S	S+C	S+V	S	S+C	S+V
	4 Day			5 Day			6 Day			7 Day		
Length of Root	42.385	47.06	53.3075	61.6825	69.66	71.5175	108.355	130.28	139.4075	127.435	140.87	146.4875
Length of Shoot	20.815	25.295	24.5125	27.975	31.685	34.7025	74.2875	75.9325	89.5625	82.0025	87.835	70.6725

The comparative length of root and shoot of soil with vermicompost samples (control, treated soil & treated seeds) showing the consistently increasing values than control that shows the positive effectiveness of biofertilizer.

In the all pots of soil and vermicompost samples with treated seeds shows the highest growth than control and treated set.

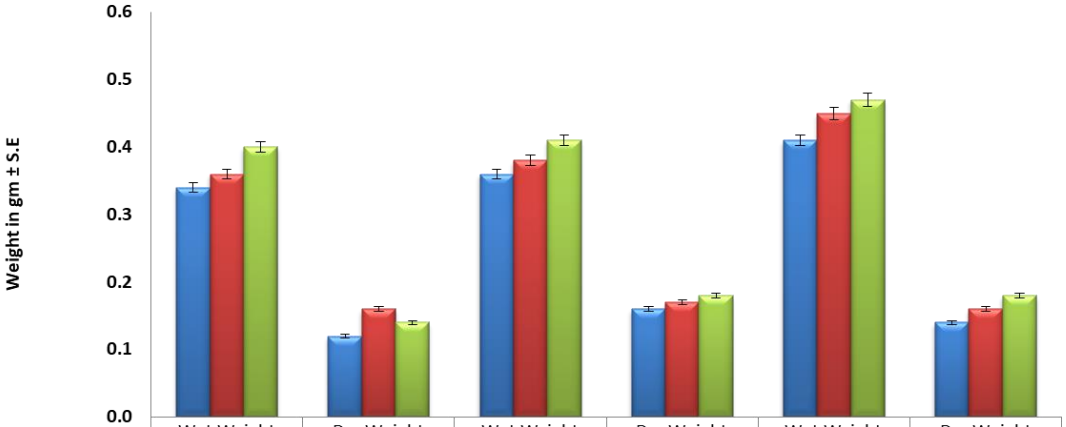
Graph 3. Comparative length of root and shoot treated seeds with biofertilizer



	S	S+C	S+V	S	S+C	S+V	S	S+C	S+V	S	S+C	S+V
	4 Day			5 Day			6 Day			7 Day		
Length of Root	42.445	60.045	63.215	67.19	80.705	80.845	128.315	137.665	141.625	132.375	140.505	152.155
Length of Shoot	21.9375	25.66	26.375	33.4775	36.0475	40.445	76.725	79.915	92.195	83.7375	88.0375	99.495

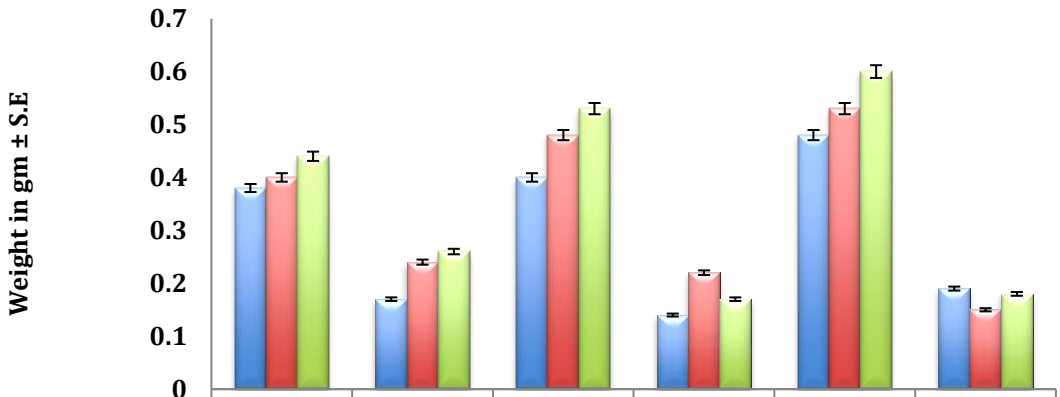
All plant samples were analysed for weight (wet weight & dry weight) of 7 days. Increased values of dry weight reveal the effectiveness of biofertilizer. In all samples the highest value of dry weight recorded for treated seeds with soil and vermicompost (4 days 0.18< 7 days 0.29).

Graph 4. Comparative weight of seeds after 4 days



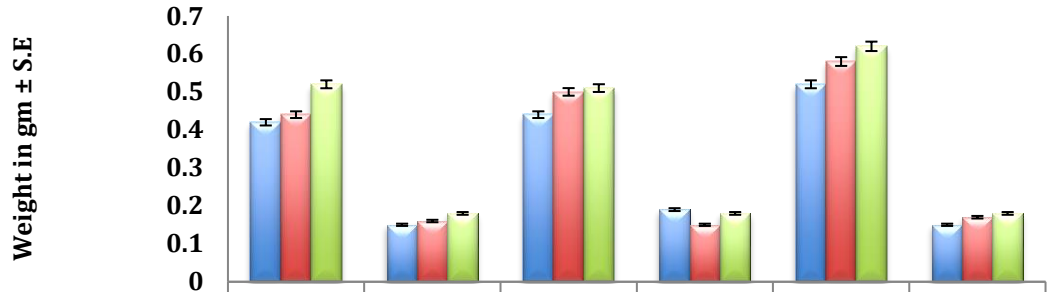
	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight
Control	0.34	0.12	0.36	0.16	0.41	0.14
Treated	0.36	0.16	0.38	0.17	0.45	0.16
Treated Seeds	0.4	0.14	0.41	0.18	0.47	0.18

Graph 5. Comparative weight of seeds after 5 days



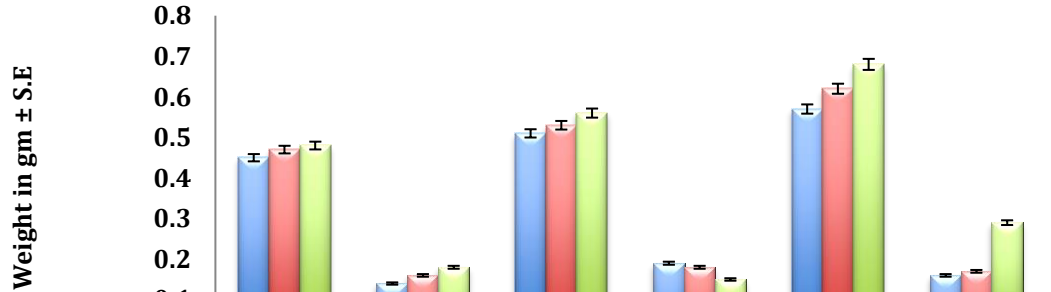
	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight
Control	0.38	0.17	0.4	0.14	0.48	0.19
Treated	0.4	0.24	0.48	0.22	0.53	0.15
Treated Seeds	0.44	0.26	0.53	0.17	0.6	0.18

Graph 6. Comparative weight of seeds after 6 days



	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight
Control	0.42	0.15	0.44	0.19	0.52	0.15
Treated	0.44	0.16	0.5	0.15	0.58	0.17
Treated Seeds	0.52	0.18	0.51	0.18	0.62	0.18

Graph 7. Comparative weight of seeds after 7 days



	Wet Weight	Dry Weight	Wet Weight	Dry Weight	Wet Weight	Dry Weight
Control	0.45	0.14	0.51	0.19	0.57	0.16
Treated	0.47	0.16	0.53	0.18	0.62	0.17
Treated Seeds	0.48	0.18	0.56	0.15	0.68	0.29

CONCLUSION

The present work provides the best substitute for the chemical fertilizer without harming the microbes by utilizing the fish waste material. Significant result of experiment reflects the efficiency of biofertilizer. Hence, this study has shown that fisheries waste can be suitable to be used to produce low cost liquid biofertilizer using SSF.

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