Physico-Chemical Properties of Soyawaste and its Effects on the Growth and Yield of Chilli Plants (Capsicum Annum)

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Abstract:

The physico-chemical characterizations of soyawaste (Waste from soyabean oil industry), three different soils and irrigation water were studied. The growth of chilli plants was studied in 0%, 2%, 5%, 10%, 15%, 20% etcsoyawaste- soil blends. Growth of plants was monitored regularly after every month up to three months from the date of sowing for control as well as for blended soils in rainy season (June-sept.) of the year 2010. The overall plant growth and maximum number of fruits were found at 10% soil-soyawaste blending for all the three soils S_1, S_2 and S_3. Thus, the present study shows the possibility of use of industrial wastes like soyawaste by proper blending with soil for better plant growth and yield.

Keywords: Blended soil; Soyawaste; Plant growth; Chilli; Waste Characterization.

Introduction:-

In India during 2000 the green revolution has brought a phenomenal rise in fertilizer consumption from 0.75 million tons to 18 million tons[1]. Yet the nutrient supply is the major constraint in the development of Indian agriculture and the cost of organic fertilizers is also increasing due to the excess mining of the nutrients as well. In the present day, there is a limited availability of organic manure in agriculture due to population explosion, intensive agriculture, reduction in livestock population, etc. Therefore, the judicious application of nutrients is essential to keep the soil fertile and to make the agriculture sustainable. In developing countries like India, the disposal of domestic and industrial waste is becoming a problem of great concern, which may cause land, water and air pollution. Soil contamination by industrial effluents has affected both soil health and crop productivity.

Many untreated and contaminated sewage and effluents may have high concentration of several heavy metals such as Cd, Ni, Pb and Cr which causes[2,3] the decrease in cell activities of living cells, inhibition of growth and various deficiency/ diseases in plants and it has been found[4] that continuous disposal of industrial effluents on agricultural soils has resulted in soil sickness[5] and thereby reduces the crop yield. However, these effluent are purposely used[6] for irrigation due to scarcity of water especially for vegetable and fruits. The nutritional status is a major determinant of the productivity of a soil. Many waste materials containing essential plant nutrients are available in huge quantities which when applied at appropriate rates can enhance the nutrient status as well as other soil properties.

An attempt has been made to understand the effect of Soyawaste blended soil on the overall growth of the chilli plants.

EXPERIMENTAL

The effluent from soyabean oil factory (Soyawaste) was obtained from the Rasoya Proteins Private Limited, At. Wani, Dist. Yavatmal (Maharashtra). The soyawaste samples were collected in clean and dry polyethylene bottles of 1 liter capacity without leaving any air gap and closed tightly. These bottles were first cleaned with chromic acid then by distilled water and lastly were rinsed by respective soyawaste samples 3 -4 times before filling. The samples were immediately transported to the laboratory for analysis and stored in a cool place away from light[7,8]. Seeds of chilli (of make Jwala) were collected from the market. Three different soil samples were taken at 25cm depth from the surface and sampling was carried out by quartering method. These soils were air dried and powdered. These soils were blended with soyawaste in % by weight as 0%, 2%, 5%, 10%, 15%, 20% etc. and were kept in cleaned polythene bags. Two seeds of chilli were sown in each bag.

The physico-chemical characteristics of three soils were analyzed by standard methods[9,10]. The physical and chemical properties of soyawaste and irrigation water were analysed by following the Standared[11] procedure. All chemicals used were of AR/GR grade.

All the chilli plants were watered equally with same period and with the same irrigation water. The height, number of leaves, number of flowers and the number of fruits were recorded on each plant after every month from the date of sowing up to the three months (July-September 2010).

Result and Discussion:

Table 1 shows the results of physico-chemical parameters of soya waste and water. The physico-chemical characteristics of the soils S_1, S_2 and S_3 are shown in Table 2. Observations of growth of chilli plants with respect to plant height, number of leaves, flowers and fruits for three soils were recorded.

From the data obtained, it was observed that, in rainy season, the plant height (13.0 inch), number of leaves (66), flowering (18), number of fruits (14) and dry weight (7.3 g) in S_1 were recorded maximum at 10% blending concentration. In case of S_2 also,the highest values of plant height (17 inch), number of leaves (80), flowering (38), number of fruits (20) and dry weight (8.6 g) were found at 10% concentration. Similarly, in S_3 the optimum values of growth parameters were reported at 10% blending concentration as plant height (15.5 inch), number of leaves (88), flowering (32), number of fruits (21) and dry weight (11.1 g). The fairly good results for S_3 may be attributed to the better % of organic C, P and Fe in S_3. However, higher or lower concentrations of the effluent than these in respective soils decreased the growth parameters of chilli plant. These findings are in accordance with the observations recorded by Somashekaret al[12] in jowar, bajra and rice.

Figure shows the number of fruits of chilli plants in different soils with various blending during Sepember'2010. Therefore, this investigation showed that, at 10% blending concentration for all the three soils S_1, S_2 and S_3, there was a

promotional influence on the plant growth which might be due to the optimum level plant nutrients in the effluent at these concentrations; soyawaste effluent being rich source of sodium (0.98 me/l), potassium (0.52 me/l), TDS (1825 ppm) and sulphates (3.32 me/l) and other plant nutrients, the use of soyawaste at these concentration resulted in reduced toxicity and better utilization of plant nutrients like Na, Cl, N, P and K. Similar results were obtained[13], in rice crop wherein they noticed that at 5% effluent concentration, the overall growth was better than in control whereas at higher concentration the growth was retarded.

From the commercial view point overall maximum number of fruits was found in rainy season at 10% blending. This indicates that, the ingredients present in the blends of soyawaste and soil at particular concentration are supportive to the growth of plant.

Shrivastava et al,[14] studied the effect of effluent of paper mill industries on seed germination and early growth performance of Reddish and Onion. He found that germination and early growth were decreased by Chloro-Alkali paper effluent. Islam et al[15], studied the impact of effluents on plant growth and soil properties and observed that the contaminated soil exerted significant negative effect on the growth, yield and nutrition of rice and grass plant grown in it and the reduction were more pronounced in rice. These negative effects may be ascribed to the excessive concentration of effluents.

Table.1-Physico-chemical characteristics of Soyawaste and water

Srno.	Parameters	Soyawaste	Water
1	TDS (ppm)	1825	906
2	pH	7.45	7.44
3	E.C. (mS/cm)	1.355	3.18
4	Calcium (me/L)	4.4	4.9
5	Magnesium (me/L)	2.4	2.4
6	Sodium (me/L)	0.98	0.78
7	Potassium (me/L)	0.52	0.41
8	Bicarbonates (me/L)	2.0	2.3
9	Chlorides (me/L)	1.9	2.3
10	Sulphates (me/L)	3.32	1.52

Table.2-Physico-chemical analysis of three different soils

Sr. No.	Parameters	S_1	S_2	S_3
1	Bulk density (g/cc)	1.49	1.61	1.78
2	W.H.C. (%)	75.83	75.83	58.42
3	pH	7.63	7.70	7.65
4	Conductivity (mS/cm)	0.51	0.53	0.50
5	Available P (kg/ha)	16	18	20
6	Available K (kg/ha)	552	625	298
7	Na (%)	0.52	1.78	0.63
8	Organic C (%)	0.39	0.34	0.49
9	Ca (%)	36.0	27.0	29.2
10	Mg (%)	3.7	9.2	3.7
11.	Porosity (%)	60.05	54.52	35.63
12.	Moisture (%)	8.99	7.16	10.02
13.	Zn (ppm)	0.25	0.48	0.47
14.	Cu (ppm)	1.16	2.84	1.41
15.	Fe (ppm)	0.29	0.56	0.64
16.	Mn (ppm)	2.04	5.21	1.62

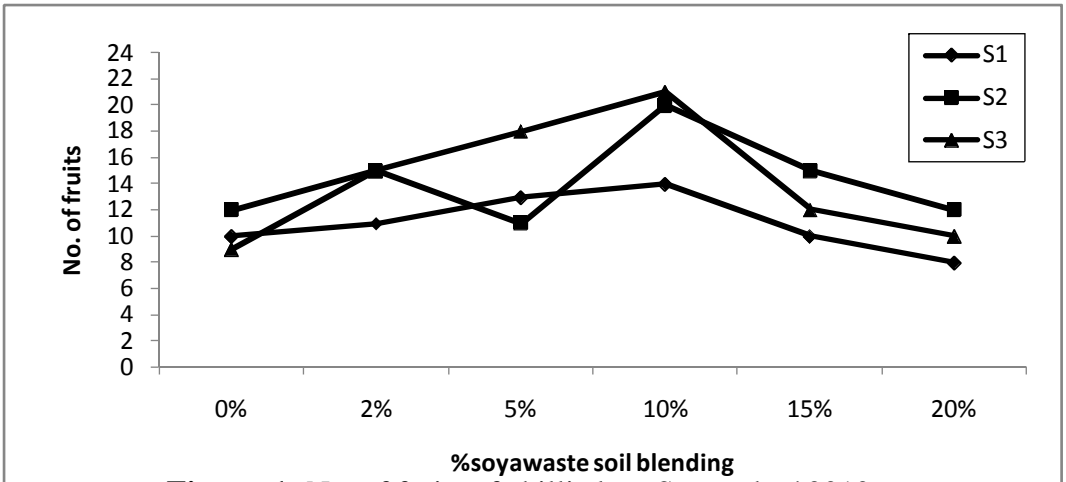

Figure. 1- No. of fruits of chilli plant-September' 2010

Conclusion:

Thus, 10% Soyawaste-soil blending concentration was found beneficial for the growth and yield of chilli plant. That means soyawaste acts as an excellent source of essential nutrients for appreciably improving the texture and fertility with significant increase in crop yield over the control at a particular blending concentration only and is supportive to plant growth. Hence, there is an opportunity with soyawaste to be used as an eco-friendly and non-conventional fertilizer at proper blending. However there is a need of detail and time series study to declare it is totally safe and eco-friendly to be used as fertilizer.

References:

1. **Manunatha N. (2008):** Effect of industrial effluents on seed quality attributes of cereal crops: A Thesis, university of agricultural sciences, Dharwad.

2. **Arora, B.R,;Azad, A.S.; Singh, B. andSekhon, G.S.(1985).** Pollution potential of municipal waste water of Ludhiana, Punjab.*Indian Journal of Ecology*,12: 1-7.

3. **Narwal, R.P.; Antil, R.S. and Gupta, A.P. (1992).**Soil pollution throughindustrial effluent and its management, *Journal of Soil Contamination,* 1: 265-272.

4. **Farooqi, Z.R, Iqbal, M.Z, M. Kabir and M. Shafiq, (2009):** Toxic effects ofLead and Cadmium on germination and seedling growth of Albezialebbeck (L.) Benth. Pak. J. Bot., 41; 27-33.

5. **Narwal, R.P.; Singh, M. and Gupta, A.P. (1988).**Effect of different sources of irrigation on the physico-chemical properties of soil.www.intechopen.com*Indian Journal of Environment, Agriculture and biotechnology*, 3: 27-34.

6.**Ghafoor A, Rauf A, Arif M. and Muzaffar W. (1994):** Chemical compositionof effluents from different industries of the Faisalabad City. Pak., J.Agri. Sci.,31:367-369.

7. **Manivasakam N., (2002):**Physicochemical Examination of Water, Sewage and Industrial Effluents. PragatiPrakashan 234.

8. **Greenberg A. E., Trusell R. R. and Clesceri L. S., (1989):**Standard methods for the examination of water and wastewater, 17th Ed. American Public Health Association (APHA).

9. **Jackson M. L., (1973):** Soil Chemical Analysis, Prentice Hall of India Pvt. Ltd, New Delhi.

10.**Black C. A. (ed). (1965):** Methods of Soil Analysis Part-1 and 2. American Society of Agronomy Publication, Madison, WI.

11. **APHA** (American Public Health Association) (2005):Standard methods for the Examination Of Water and Wastewater, Washington DC, Edn., 21.

12.**Somashekar R.K., Gowda M. T. G., Shettigar S. L. N. and Srinath K. P., (1984):** Effect of industrial effluents on crop plants, Indian J. Environ. Hlth., 26(2):136-146.

13. **Sahai, R., Jabeen S. and Saxena P.K. (1983):** Indian J. Eco., 10,7.

14. **Shrivastava S., Thakur U., Shrivastava L., (2011):** Behavioural responses of Tilapia mossambica to water polluted with fly ash from coal: A laboratory study, Int. J. Biology, Vol.3, No.1, 153-160.

15. **Islam M.O., Khan Md. H. R., Das A. K., .Akhtar M. S., Oki Y.and AdachiT., (2006):**Soil and Environ. 25(2): 113-118.