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Research Article

Influence of Industrial Solid Waste Compost on Growth and Yield of Groundnut Crop

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ABSTRACT

One of the important environmental problems faced at national and global level is the management of industrial wastes. The eco friendly disposal of industrial wastes is a great task for the industries. Utilization of solid waste in more beneficial way has gained importance as it contains essential nutrients such as nitrogen, phosphorous and potassium besides the micronutrients. Field experiment with groundnut as test crop was conducted in Randomized Block Design (RBD) with five treatments comprising the various doses of composted industry solid waste along with different levels of inorganic fertilizers. The treatments were fixed on the basis of nitrogen content of compost and nitrogen requirement of groundnut crop. Recommended dose of N, P and K supplied through 100 per cent inorganic fertilizers was included as a control to compare the effectiveness of industry solid waste compost. The significant increase in the kernel yield and dry matter production were recorded in the treatment with 863 kg ha^{-1} of compost and the increase were to the tune of 30 and 25 per cent, respectively over the control. Further, the analyses of kernel quality parameters revealed that this treatment significantly improved the protein and oil content (28.3 and 49.1 per cent, respectively). It is concluded from the field experiments that the solid wastes of industries can be suitably to produce value added manure which can be effectively recycled in agriculture.

Keywords: *Industry solid waste compost, Recycle*

INTRODUCTION

Reduce, recycle and reuse are the primary environmental amelioration options for solid waste management. Composting is one of the best methods to convert solid wastes to a useful and value added product. Composting is a microbiological, non polluting and safe method for disposal and recycling of organic waste (Kumaresan et al., 2003) and it is a dynamic process with a succession of mixed microbial population (Shindia, 1995).

The use of pesticide and mineral fertilizers does not necessarily lead to better farming than the use of natural and organic methods in agriculture.

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There is a need to encourage more productive, environment friendly farming practices. The uses of compost have been time-tested production inputs for improving the fertility and productivity of soil because composts are excellent source of humus and plant nutrients (Biswas et al., 1977; Hesse & Mishra, 1982). India produces about 7.942 million tonnes of organic wastes annually which could be utilized for the recovery of fertilizer, fodder, fuel and food (Bhattacharya & Chakraborty, 2005). A future goal mooted for a sustainable society is to ensure the effective utilization of waste materials in an eco friendly manner.

Today, groundnut has a share of approximately 25 per cent in the total Indian oilseed production. In India, it is grown over an area of 6.9 million hectare with total production of 5.3 metric tonnes. It grows in every type of soil, but the best crop is harvested from fertile loamy soils. It is highly rich in vitamin A and B. Besides having the highest protein contents among oil seeds, it also contains carbohydrates, calcium, iron, phosphorous, crude fibre, niacin and ascorbic acid (Farhad et al., 2011). With the above background, the present investigation was undertaken to study the possibilities of utilizing industry solid waste compost through soil application, which could offer the double benefits of safe disposal of the waste and its effective recycling of nutrients for crop production.

MATERIALS AND METHODS

Field experiments to assess the effect of composted industry solid waste on groundnut

Field experiment was conducted with groundnut var. VRI 6 (*Arachis hypogaea*) as test crop at Cuddalore district, Tamil Nadu to assess the effect of different doses of Industrial solid waste compost on soil and crop. The treatments were allocated to each plot by following random principle. Representative soil samples at 0-15 cm depth were collected and analyzed. Since, nitrogen is considered to be the most important nutrient for improving the productivity of the crop, treatments were fixed based on the nitrogen requirement of the ground nut crop.

Treatments:

- T_1- Control (17:34:54 kg NPK ha^{-1})
- *T_2-25% N through compost +75% N through inorganic fertilizers
- *T_3-50% N through compost +50% N through inorganic fertilizers
- *T_4-75% N through compost +25% N through inorganic fertilizers
- *T_5- 100% N through compost

*Remaining P & K were supplied through inorganic fertilizer

Growth attributes of groundnut

Biometric observations were taken on 30, 60, 90 and 120 days after sowing by randomly selecting plants in the net plot area of individual treatments. The growth attributes like plant height and numbers of leaves per plant were recorded as per the standard procedures and the mean values obtained were expressed as per the SI system of units.

Yield attributes of groundnut

The total number of matured pods per plant was counted from randomly selected plants in the net plot area of individual treatment at harvest. Pod weight and kernel weight were recorded from randomly selected one hundreds pods of five batches in each plot and the mean values obtained were expressed as per the SI unit system.

Yield of groundnut

The pods and haulm from the net plot were harvested and sun dried and their mean yield were expressed in kg ha^{-1} for individual treatment.

Dry matter production (DMP)

Five plants at random were cut close to the ground level for the estimation of DMP. Samples were sun dried for three days followed by oven drying at 70^0 C till the constant weight obtained. The dry weight of the plant samples were recorded and expressed in kg ha^{-1}.

RESULT AND DISCUSSION

Growth attributes of groundnut

Application of composted industry solid waste increased the growth attributes of groundnut

viz., plant height and numbers of branches per plant were very well brought out when compared to the control.

The data presented in the table. 1 depicted that plant height and number of branches per plant was influenced by the application of industry solid waste compost at various stages. The highest plant height and number of branches per plant at 90 DAS were 43.8 cm and 6.5 recorded in the treatment that received industry solid waste compost @ 863 kg ha^{-1}. Control recorded the lowest plant height (27.8 cm) and number of branches per plant (4.60).

The application of composted industry solid waste @ 863 kg ha^{-1} that satisfied 100 per cent nitrogen requirement of plant recorded the highest plant height and number of branches per plant to the tune of 30.5 cm and 5.92 respectively as compared to the control and other levels of compost. The growth and yield of groundnut improved significantly with the use of organic supplements (Dosani et al., 1999). Similar results also reported by Gedam et al. (2008) in groundnut crop. The improvement in plant height and number of leaves resulted in higher total dry matter production. Our results are in accordance with Chattopadhayaay (2002) who reported that crop nitrogen requirement was fully met both at early and later stages of crop growth.

Table 1: Effect of industry solid waste compost on growth attributes of groundnut

Treatment / stages	Plant height (cm)				No. of branches plant			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
T_1	7.9	18	27.8	**17.9**	2.45	4.25	4.60	**3.65**
T_2	10.5	19.6	30.3	**20.1**	3.75	4.75	5.00	**4.50**
T_3	11.2	21.4	33.9	**22.2**	4.50	5.50	5.75	**5.25**
T_4	12.8	25.6	38.4	**25.6**	4.00	5.80	6.25	**5.50**
T_5	15.5	32.3	43.8	**30.5**	5.25	6.00	6.50	**5.92**
Mean	**11.6**	**23.4**	**34.8**	**23.3**	**3.99**	**5.30**	**5.50**	**4.96**
	SEd		**CD (0.05)**		**SEd**		**CD (0.05)**	
T	2.150		5.062		0.134		0.270	
S	1.942		3.921		0.109		0.221	
TxS	4.344		8.768		0.269		0.541	

T_1- 100% RDF (17:34:54 kg of NPK ha^{-1}); T_2-25% N through COMPOST (216 kg ha^{-1}) +75% N through inorganic fertilizers; T_3-50% N through compost (432 kg ha^{-1}) +50% N through inorganic fertilizers; T_4-75% N through compost (635 kg ha^{-1}) +25% N through inorganic fertilizers; T_5- 100% N through compost (863 kg ha^{-1})

S_1 : 30 DAS, S_2: 60 DAS, S_3: 90 DAS,

Yield and yield attributes of groundnut crop

The results on the yield attributes influenced by industry solid waste compost like pod yield, kernel yield, haulm yield and dry matter production (DMP) are presented in Table 2. Among the treatments, the maximum pod yield (1969 kg ha^{-1}), kernel yield (1492 kg ha^{-1}), haulm yield (4208 kg ha^{-1}) and dry matter production (6177 kg ha^{-1}) were recorded in the treatment that received industry solid waste compost @ 863 kg ha^{-1}. The minimum pod yield (1440 kg ha^{-1}), kernel yield (1044 kg ha^{-1}), haulm yield (3197 kg ha^{-1}) and dry matter production (4637 kg ha^{-1}) were recorded in control, which was significantly less when compared to all other treatments.

The highest dried kernel yield of 1492 kg ha^{-1} and dry matter production of 6177 kg ha^{-1} were recorded in groundnut that received application of composted industry solid waste @ 863 kg ha^{-1}. This might be due to the application of organics was attributed to the supply of essential nutrients by continuous mineralization of organic manures, enhanced

inherent nutrient supplying capacity of the soil and its favourable effect on the soil physical and biological properties. Similar finding was supported by Hati et al. (2001).

Likewise, Kannan et al. (2006) also emphasized that the application of 100 per cent N through different organic sources significantly influenced the tomato growth and yield comparable with that of 100 per cent RDN through urea. These observations are in agreement with earlier findings that, application of organic manures increased the yield parameters to 21% in number of pods, 10.5% in shelling percentage and 37% in hundred kernel weights in groundnut (Balakrishnan et al., 2009).

Table 2: Effect of industry solid waste compost on yield and yield attributes of groundnut

Treatments	Pod yield (kg ha^{-1})	Kernel yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	DMP (kg ha^{-1})
T_1	1440	1044	3197	4637
T_2	1538	1098	3502	5040
T_3	1613	1128	3730	5343
T_4	1756	1252	3968	5724
T_5	1969	1492	4208	6177
Mean	**1663**	**1203**	**3721**	**5384**
SEd	30.2	21.1	41.1	95.5
CD (0.05)	64.5	44.9	88.3	203

T_1- 100% RDF (17:34:54 kg of NPK ha^{-1}): T_2-25% N through compost (216 kg ha^{-1}) +75% N through inorganic fertilizers; T_3-50% N through compost (432 kg ha^{-1}) +50% N through inorganic fertilizers; T_4-75% N through compost (635 kg ha^{-1}) +25% N through inorganic fertilizers T_5- 100% N through compost (863 kg ha^{-1})

CONCLUSION

Over all, the nutrients present in the composted industry solid waste played a significant role in increasing the growth parameters and yield attributes of groundnut. Therefore, the present investigation confirmed that application of composted industry solid waste would offer double benefits of safe disposal of the industry waste and its effective recycling of major plant nutrients for improving the crop yield and quality.

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