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RESEARCH ARTICLE

Effect of flyash and sewage sludge on growth and yield of raddish (*Raphanus sativus*)

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ABSTRACT : Protection of Environment is the most vital issue today explosive population growth, rapid growth in science and technology, massive industrialization, use of various chemicals in agriculture of most important. The current agricultural priorities are to sustain and maintain fertility levels of soil without damaging the natural ecosystem. Various alternatives, including no-tillage management systems and organic by products application, such as sewage sludge, compost, crop residues, etc. to soil is a current environmental and agricultural practice for maintaining soil organic matter, induce degraded soils and supplying plants nutrients. The present study comprise of 30 plots experiment which was laid out at the Nursery of Environment Science, Sam Higginbottom Institute of Agriculture and Technology Sciences (Deemed to be- University) Allahabad during *Rabi* season 2013-2014. During the sampling events the top two inches of surface soil was removed along with all types of plant growth. Surface samples were gathered at depths ranging from 0 - 15 cm. In order to preserve the soil moisture level, the plastic bags were sealed immediately after sampling. These soils are put in experimental field. In view of the given results the following conclusion were drawn that the treatment T_3 (10 ton/ hec^{-1} flyash + 5 ton/ hec^{-1}sewage sludge) may be conceded as in all of plant parameter plant height (cm), number of leaves per plant in (30 and 60 days) and maximum plant root length, maximum fresh weight, maximum dry weight and maximum total yield. An impatient alternation open field modal maximum net return.

Key Words :
Flyash, *Raphanus sativus*, Swedge sludge, Cursory glance

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Protection of Environment is the most vital issue today explosive population growth, rapid growth in science and technology, massive industrialization, use of various chemicals in agriculture of most important. The human activities are the factors threatening the very quality of life (Sharma and Ramamurthy, 2000). The tremendous progress in every sphere of science and technology has led ultimately to environment impact resulting in extreme unhygienic conditions modifying our living environment. Environmental disturbances in the ecosystem against the backdrop of rapid population growth uncontrolled urbanization of un regulated industrialization are mainly reflected by changes in the chemical element concentration Pattern. Environment degradation by trace element accumulation in eco-friendly systems caused by over exploitation of resource materials and human impose interactions are the few unending problems encountered which threatened the very basic economy of nation and individuals by affecting both the progress of the nation as well as the health of the human beings.

The major environment problem of crop out from the waste disposal either in the form of pollutants or water pollutants having high concentration of toxic metals (Werff and Pett, 1971). Such contamination of soil, air and water with increase industrialization is a threat to the continuous existent of complex spices of plants and animals of the ecosystem and may ultimately become greatest hazard to human population. Recent studies have shown that toxic metals cause long term health problems even in areas without industrial activities or other obvious exposure sources. Low-dose health effect are known for some metals, but little is known about the impact of mixtures of toxic elements in food and drinking water, the main sources of toxic and essential metals and other trace element.

The current agricultural priorities are to sustain and maintain fertility levels of soil without damaging the natural ecosystem. Various alternatives, including no-tillage management systems and organic by-products application, such as sewage sludge, compost, crop residues, etc. to soil is a current environmental and agricultural practice for maintaining soil organic matter, induce degraded soils and supplying plants nutrients. This is one of the bigger problems when we utilize sewage sludge. Due to its high organic matter content, sewage sludge can improve physical, chemical, and biological properties of soil. The effects of sewage sludge on soil quality are twofold. On the one hand, sludge applications to soil increases the content of organic matter and plant nutrients, but on the other hand, sewage sludge coming from urban and industrial areas can be contaminated with appreciable amounts of toxic metals (Cu, Zn, Ni, Cd, Cr, Pb, Hg). Those metals are accumulated in soil, from where they can be absorbed by the plants and so those toxic metals arrive in to the human body through the foods. It is very important to know where the limit for fertilization whit sewage sludge.

The use of flyash (FA) in agriculture has been based on its neutralizing potential and supply of essential elements such as Ca, B, S, and Mo (Martens, 1971 and Page *et al.*, 1979). However, the use of flyash as an agricultural amendment can be enhanced by blending it with potentially acid-forming organic by-products such as sewage sludge. The latter contains significant amounts of N and P (Adriano *et al*., 1980).Consequently, flyash may serve as a composting ingredient, along with sewage sludge. Its basic property should permit the neutralization of the acidic sewage sludge, thereby minimizing the bioavailability of heavy metals and the attendant injury to plants. We hypothesized that combined use of flyash and sewage sludge for land application could prove a beneficial means of their disposal. Because of the contrasting chemical properties and nutrient contents of flyash and sewage sludge, land application of both products as mixture can improve soil quality and crop production. This could help to alleviate waste disposal and management problems associated with land application of sewage sludge or flyash.

Flyash has been reported to be a repository of nutrients which helps in reclamation of alkaline and saline soils and also improves soil properties for plant growth (Kesh *et al.*, 2003). Flyash application can alter the water holding capacity (Pathan *et al.*, 2003) and available water content of soils (Adriano and Weber, 2001). Presence of organic matter in soil has an additive effect as it reduces the concentration of toxic metals through sorption, lowers the C/N ratio and provides organic compounds, which promote microbial proliferation and diversity (Wong and Wong, 1986). Increased microbial activity was reported for ash amended soils containing sewage sludge (Pichtel, 1990). Flyash-sludge mixtures containing 10 per cent ash had positive effect on soil micro-organisms in terms of enzyme activity, N and P cycling and reducing the availability of heavy metals. Microbial biomass is commonly used to characterize the microbiological status of soil and to study the effect of soil management practices. Soil microbial biomass is a sound indicator of soil health since it regulates nutrient cycling and acts as a highly labile source of plant available nutrients (Jenkinson and Ladd, 1981).

EXPERIMENTAL METHODOLOGY

The present study comprise of a plot experiment which was laid out at the Nursery of Environment Science, Sam Higginbottom Institute of Agriculture and Technology Sciences (Deemed to be- University). Allahabad during *Rabi* season 2013-2014.The detail of the experiment site, experiment details, plan of lay-out, details of treatment, chemical analysis, planting material, measurement of plants, laboratory studies and statistical analysis.

30 plots for these experiment and soil sampling. Soil

samples were taken from the field of forest nursery. During the sampling events the top two inches of surface soil was removed along with all types of plant growth. Surface samples were gathered at depths ranging from 0 - 15 cm. Equipment used for collecting the samples where cleaned. For each sample a Separated, and contain in plastic bags. In order to preserve the soil moisture level, the plastic bags were sealed immediately after sampling. These soils are put in experimental field.

Table A : Pre-analyses of soil, flyash and sewage sludge

Parameter	Value		
	Soil	Sewage sludge	Flyash
pH (1:2) w/v	7.51	7.60	7.85
EC (1:2) (dsm^{-1})	0.08	1.00	0.42
Organic carbon (%)	2.84	1.81	0.68
Available nitrogen (kg ha^{-1})	115.18	465.25	0.07
Available phosphorus (kg ha^{-1})	11.31	10.28	0.28
Available potassium (kg ha^{-1})	24	18.8 5	1.85

Table B : Details of treatment combination

Treatments	Description
T_1	0 ton/ ha Flyash + 0 ton/ ha sewage sludge + (RDF)
T_2	5 ton/ ha Flyash + 5 ton/ ha sewage sludge + (RDF)
T_3	10 ton/ ha Flyash + 5 ton/ ha sewage sludge + (RDF)
T_4	15 ton/ ha Flyash + 5 ton/ ha sewage sludge + (RDF)
T_5	5 ton/ ha Flyash + 10 ton/ ha sewage sludge + (RDF)
T_6	10 ton/ ha Flyash +10 ton/ ha sewage sludge + (RDF)
T_7	15 ton/ ha Flyash + 10 ton/ ha sewage sludge + (RDF)
T_8	5 ton/ ha Flyash + 15 ton/ ha sewage sludge + (RDF)
T_9	10 ton/ ha Flyash + 15 ton/ ha sewage sludge + (RDF)
T_{10}	15 ton/ ha Flyash + 15 ton/ ha sewage sludge + (RDF)

EXPERIMENTAL FINDINGS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Plant height :

The plant height at 60 days T_3 (23.86) was observed with the application (10 ton/ hec^{-1} flyash + 5 ton/hec^{-1} sewage sludge). After 60 days after sowing whereas minimum plant height was T_0 (17.94) with the application (0 ton/ hec^{-1} flyash + 0 ton/ hec^{-1}sewage sludge) as shown in Fig.1.

Number of leaves :

Results shows the maximum number of leaves per

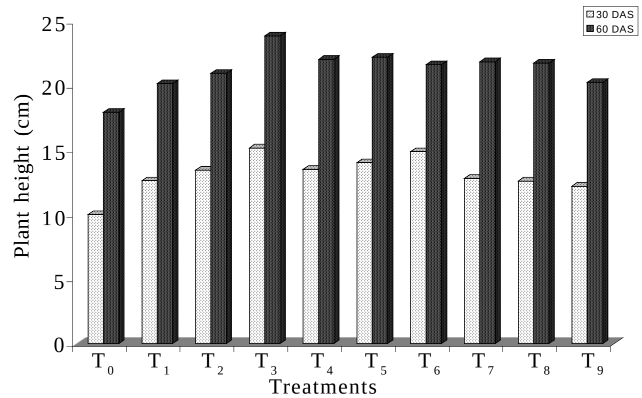

Fig. 1 : Effect of sewage sludge and flyash on plant height (cm) of radish (*Raphanus sativus*)

plant at 60 days T_3 (21.87) was observed with the application (10 ton/ hec^{-1} flyash + 5 ton/ hec^{-1}sewage sludge). After 60 days after sowing whereas minimum number of leaves per plant was T_0 (16.86) with the application (0 ton/ hec^{-1} flyash + 0 ton/ hec^{-1}sewage sludge). Similar finding had also reported by **(**Parvaze Ahmad *et al.*, 2007) as shown in Fig. 2.

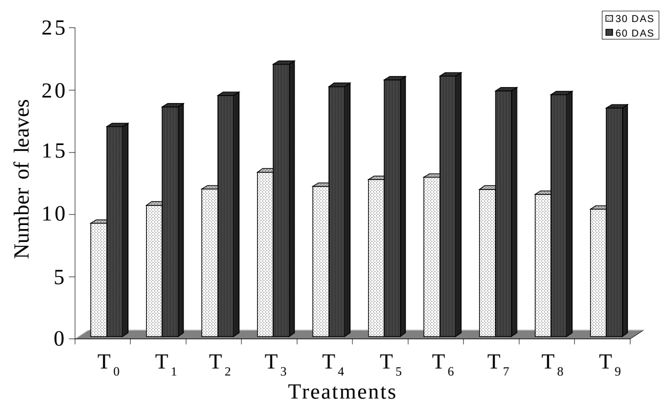

Fig. 2 : Effect of sewage sludge and flyash on number of leaves of radish (*Raphanus sativus*)

Root length (cm) :

A cursory glance maximum plant root length (cm) at T_3 (23.44) was observed with the application (10 ton/ hec^{-1} flyash + 5 ton/ hec^{-1}sewage sludge). After, sowing whereas minimum plant root length (cm) was T_0 (17.79) with the application (0 ton/ hec^{-1} flyash + 0 ton/ hec^{-1} sewage sludge). Similar findings was also reported by (Siddharth *et al.*, 2011) as shown in Fig. 3.

Fresh weight :

Data appended maximum fresh weight (g) at T_3

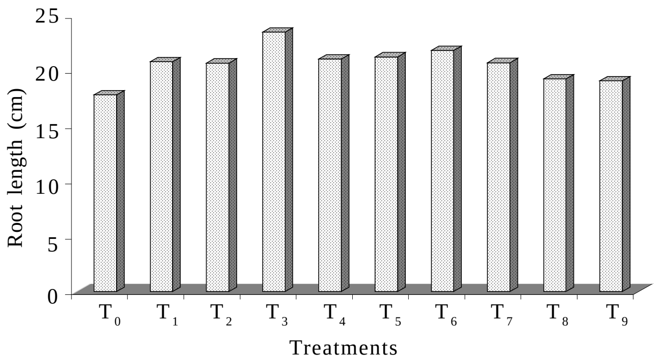

Fig. 3 : Effect of sewage sludge and flyash on root length (cm) of radish (*Raphanus sativus*)

(142.33) was observed with the application (10 ton/ hec^{-1} flyash + 5 ton/ hec^{-1}sewage sludge). After sowing whereas minimum fresh weight (g) was T_0 (88.66) with the application (0 ton/ hec^{-1} flyash + 0 ton/ hec^{-1}sewage sludge). Weight Similar finding had also reported by (Renoux *et al.*, 2001) as shown in Fig. 4.

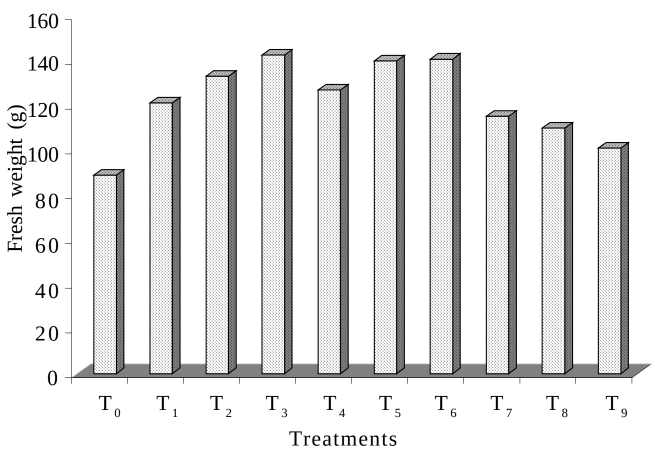

Fig. 4 : Effect of sewage sludge and flyash on fresh weight (g) of radish (*Raphanus sativus*)

Dry weight (g) of radish :

Perusal of the data maximum dry weight (g) at T_3 (54.00) was observed with the application (10 ton/ hec^{-1} flyash + 5 ton/ hec^{-1}sewage sludge).After sowing whereas minimum dry weight (g) was T_0 (10.24) with the application (0 ton/ hec^{-1} flyash + 0 ton/ hec^{-1}sewage sludge). Similar finding had also reported by (Jacobson and Gustafsson, 2001) as shown in Fig. 5.

Yield in (q/ha) of radish :

A cursory glance maximum total yield (q/ha^{-1}) at T_3 (260) was observed with the application (10 ton/hec^{-1}

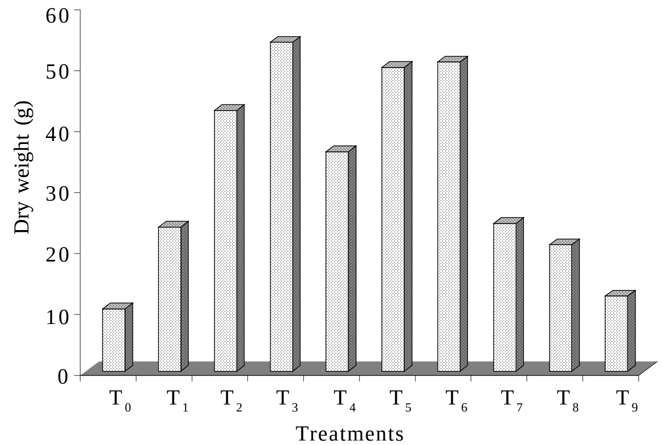

Fig. 5 : Effect of sewage sludge and flyash on dry weight (g) of radish (*Raphanus sativus*)

flyash + 5 ton/ hec^{-1}sewage sludge). After sowing whereas minimumtotal yield (q/ ha^{-1}) was T_0 (150) with the application (0 ton/ hec^{-1} flyash + 0 ton/ hec^{-1}sewage sludge). Similar finding had also reported by (Simon Qviberg, 2011) as shown in Fig. 6.

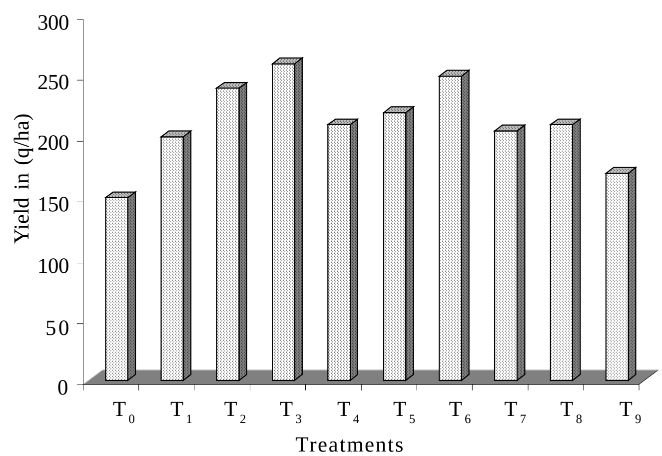

Fig. 6 : Effect of sewage sludge and flyash on yield in (q/ha) of radish (*Raphanus sativus*)

Conclusion :

In view of the given results the following conclusion were drawn that the treatment T_3(10 ton/ hec^{-1} flyash + 5 ton/ hec^{-1}sewage sludge) may be conceded as in all of plant parameter plant height(cm), number of leaves per plant in (30 and 60 days) and maximum plant root length, maximum fresh weight, maximum dry weight and maximum total yield. An impatient alternation open field modal maximum net return.

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