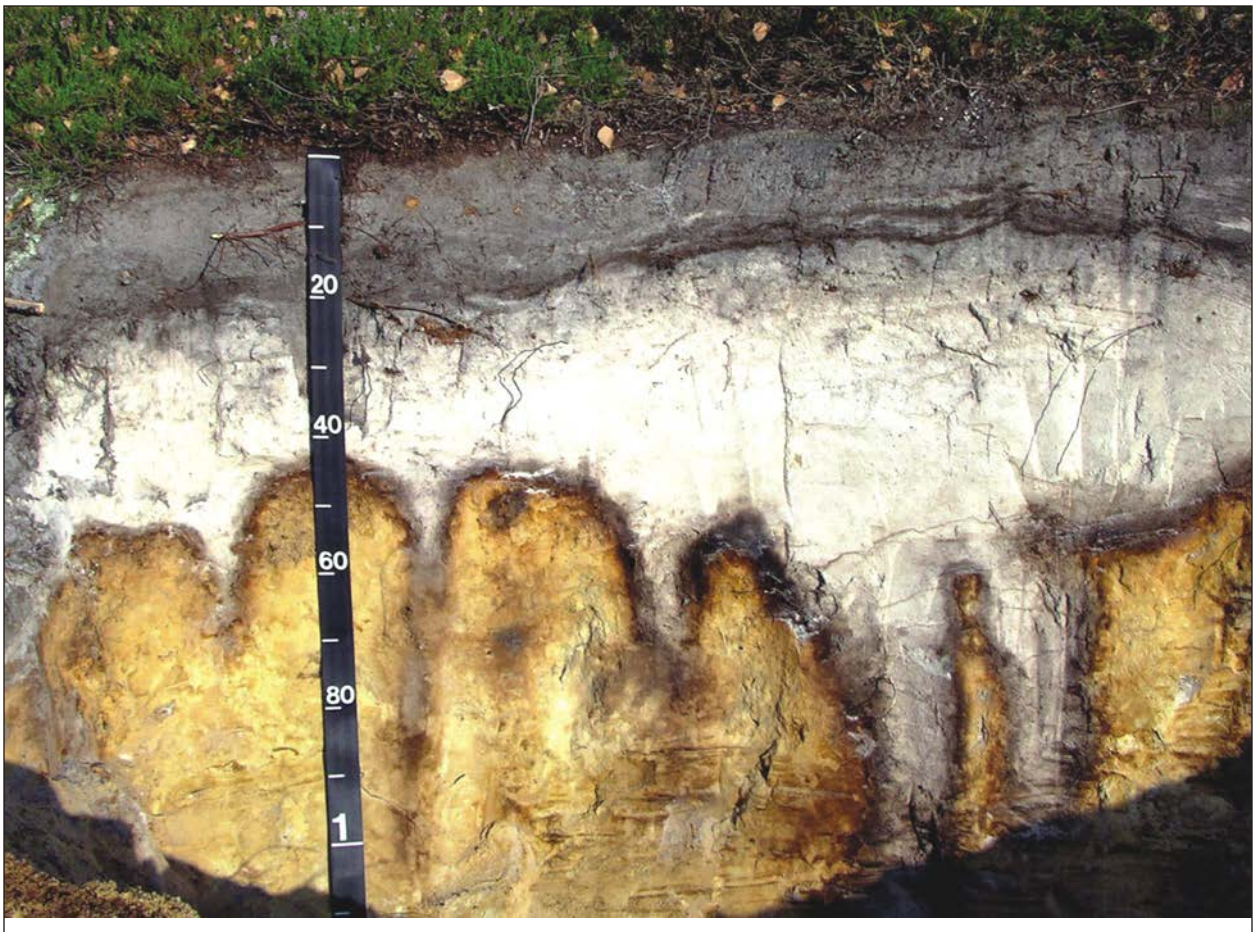

International Journal of Soil Science

ISSN 1816-4978

Academic Journals Inc.

www.academicjournals.com

OPEN ACCESS International Journal of Soil Science

ISSN 1816-4978
DOI: 10.3923/ijss.2017.39.42

Short Communication
Use of Fly-ash (Industrial Residue) for Improving Alkaline Soil Status

Ishwar Prakash Sharma and Anil Kumar Sharma

Department of Biological Sciences, College of Basic Sciences and Humanities, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

Abstract

Background and Objective: Fly-ash, an industrial residue from thermal power plants has been problematic solid waste whose utilization is necessary for nutrient recycling and on the other hand alkali soil is an another problem for agriculture. The objective of study was to overcome alkalinity of soil by using fly-ash by which both above mentioned problems might be resolve. **Methodology:** Experiment was conducted under control conditions with tomato plants by using different concentrations of fly-ash, total six treatments with four replicates for each were taken and statistically one-way ANOVA was used and data were presented in mean values±SE with significant differences at $p<0.05$. **Results:** In this study, all growth parameters of tomato plants have been significantly increased at $p<0.05$ with increasing fly-ash concentration into alkali soil whereas in alkali soil without fly-ash condition the plants could not survive. **Conclusion:** As increasing growth in aspect to increasing fly-ash concentrations it might be concluded that, such industrial waste can be utilized and recycled for improving wastelands to enhancing soil potential and reduce environmental pollution.

Key words: Fly-ash, wasteland, environmental pollution, toxic metal, recycle

Received: September 23, 2016 Accepted: November 16, 2016 Published: December 15, 2016

Citation: Ishwar Prakash Sharma and Anil Kumar Sharma, 2017. Use of fly-ash (industrial residue) for improving alkaline soil status. Int. J. Soil Sci., 12: 39-42.

Corresponding Author: Ishwar Prakash Sharma, Department of Biological Sciences, College of Basic Sciences and Humanities, G. B. Pant University of Agriculture and Technology, Pantnagar, 263 145 U.S. Nagar, Uttarakhand, India Tel: +91 7579095587

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Fly-ash formed as a result of coal combustion in thermal power station, these plants generate solid wastes. Recently fly-ash disposal into environment is one of the major concerns throughout the world. Chemically 90-99% fly-ash is made up of Si, Al, Fe, Ca, Mg, Na and Ti, K with Si and Al[1-4]. It also contains trace amounts of toxic metals such as U, Th, Cr, Pb, Hg, Cd etc. which performed negatively to the life[5]. Perhaps its utilization is necessary for environmental concern. Previously study confirmed the fly-ash application to influenced soil properties[6]. Mostly clay soils with a high pH>8.5 and poor soil structure and low filtration capacity is represented by alkaline soil. Research on this soil mainly occurred in Central Europe and North India, where alkaline soils occur frequently. It is difficult to use in agricultural production. Alkalinity is associated with the presence of sodium carbonates (Na_2CO_3) in the soil, either as a result of natural mineralization of the soil particles or brought in by irrigation and/or floodwater. The alkalinity of soil might be reduced by the help of fly-ash which is totally waste and harmful for environmental sustain ability. Due to this the environment can be protected by recycling of such industrial waste and on the other hand the alkali soil which is mostly wasteland can also be improves. Previously some authors utilize fly-ash for improving agricultural yields[7-9]. On this basis the current experiment was focused on the utilization of such industrial influent to improve soil property and productivity.

MATERIALS AND METHODS

Present study was carried at GB Plant University of Agriculture and Technology, Pantnagar during the month of September-October, 2013. Tomato var., PT-3 was used as testing biological material and to starting experiments, its nursery was prepared in tray, after four leaf stage plants were uprooted and transplanted in ½ kg pots having different concentration of alkali soil and fly-ash. Physical properties (pH and EC) of soil and fly-ash mixture were taken before transplanting. The experimental design and mixture properties are given in Table 1. One month after transplanting growth parameters was recorded. Whole experiment conducted in glasshouse conditions at an ambient temperature of 23-28°C, photoperiod of 16/8 h day/night cycle and relative humidity of 60% with six treatments having four replicates each.

Statistical analysis: Statistically data were presented in mean values±SE using Completely Randomized Design (CRD). Plant growth parameters were subjected to one factorial analysis of variance (ANOVA) using STPR-3 Statistical Software. The differences between the means were compared using least significant differences at $p<0.05$[10].

RESULTS

Pictorially, results have been indicated in Fig. 1 represents much better results. Experimental results showed that the

Table 1: Treatments along with composition and physical properties

Treatments	Alkali soil (%)	Fly ash (%)	pH	EC (μS m^{-1})
T1	100	0	10.16	586
T2	90	10	9.68	467
T3	80	20	9.60	413
T4	70	30	9.45	397
T5	60	40	9.40	311
T6	50	50	9.01	295

EC: Electrical conductivity

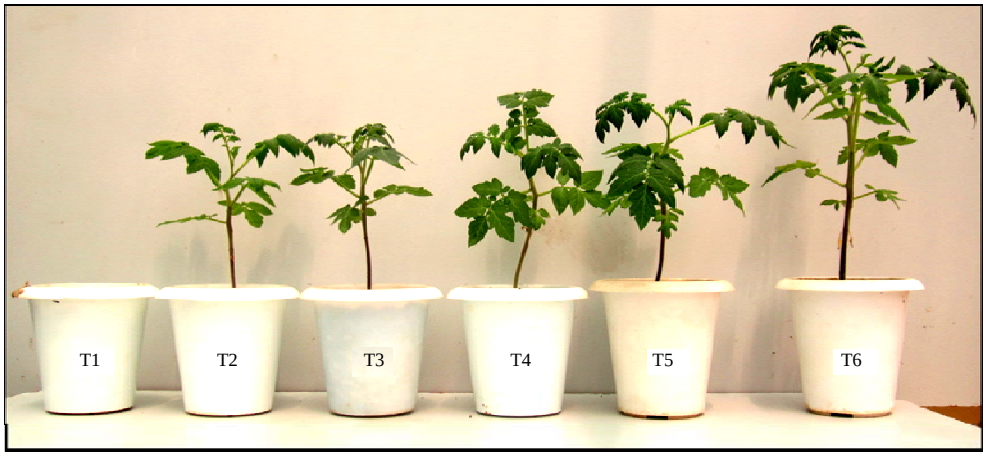

Fig. 1: Effect of different concentrations of fly ash on tomato plants growth

Table 2: Effect of fly ash on plant growth parameters along with alkali soil

	Length (cm)		Fresh weight (g)		Dry weight (g)	
Treatments	Shoot	Root	Shoot	Root	Shoot	Root
T1	00.00±0.00	00.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.000±0.00
T2	20.53±0.22	19.30±0.21	3.63±0.24	0.34±0.02	0.41±0.03	0.058±0.01
T3	21.13±0.18	19.23±0.18	3.61±0.10	0.36±0.02	0.43±0.01	0.067±0.00
T4	22.77±0.20	20.67±0.94	4.26±0.05	0.39±0.02	0.45±0.01	0.077±0.00
T5	23.77±0.26	22.53±0.15	4.70±0.53	0.52±0.04	0.50±0.03	0.079±0.00
T6	28.23±0.18	26.07±0.63	6.71±0.40	0.78±0.02	0.67±0.07	0.116±0.01

All parameters based on four replicates (n = 4). Statistically data were presented in mean values±SE with significant differences at $p<0.05$

treatments significantly increased ($p<0.05$) growth parameters. In T1, which having 100% alkali soil, plants were not survived whereas in other treatments plants grew and survived easily. The T6 having maximum (50%) fly-ash concentrations were observed much better than lower concentrations. In T6, maximum 28 and 26 cm length were recorded in shoot and root respectably, similarly biomass was highly improved, in shoots (6.71 and 0.67 g) and roots (0.78 and 0.116 g) fresh and dry weight were recorded respectively (Table 2).

DISCUSSION

The rate of plant growth higher in increasing fly-ash concentrations and alkalinity was reduced which might be responsible for better plants growth. Similar results were observed in the previous study where fly-ash was used along with dung and urine to the alkaline soil[11]. They suppose, fly-ash contributes to adding some elements which are useful for plant growth. Fly-ash applications on sandy soil reported previously which permanently alter soil texture, increase porosity and improve water holding capacity[12,13]. Previously fly-ash application in Korean paddy soil has been done which was better for rice productivity[14]. Similar observations were recorded in turnip[6], methi[15], chick pea, golden gram, black gram, radish, tomato, brinjal, bottle gourd and sponge gourd[16]. These results showed alkaline soil become more fertile after using fly-ash. In many studies, effect of fly-ash has been evaluated for long term consequences of on soil environment and crop productivity[17,18]. Adding of up to 40% fly-ash in the sandy loam soil modified the soil environment including moisture retention, pH, EC and organic carbon[17].

CONCLUSION

Nutshell, fly-ash could be used in soil amendment to improve soil texture and fertility, especially the alkaline soil which is usually waste land. This study indicated the potential use of industrial waste which can be utilized and recycled when used in wasteland for increasing soil fertility and on the other hand environment can be protected by reducing pollution which created by such solid waste.

SIGNIFICANCE STATEMENTS

This study discovers that the industrial waste can be utilized for enhancing wasteland fertility and reduce environmental pollution by recycling nutrients. So that the study will help the researcher to uncover the critical areas of improving alkaline soil by using fly-ash that many researchers were not able to explore. Thus a new theory on Alkali soil improvement may be arrived at wasteland areas where no or negligible productivity takes place due to alkalinity in the soil.

ACKNOWLEDGMENTS

Authors are greatly thankful to Rhizosphere Biology Lab, Department of Biological Sciences, College of Basic Sciences and Humanities, Pantnagar for providing facilities and encouraging the research study.

REFERENCES

1. Basu, M., M. Pande, P.B.S. Bhadoria and S.C. Mahapatra, 2009. Potential fly-ash utilization in agriculture: A global review. Prog. Natural Sci., 19: 1173-1186.
2. Kishor, P., A.K. Ghosh and D. Kumar, 2010. Use of flyash in agriculture: A way to improve soil fertility and its productivity. Asian J. Agric. Res., 4: 1-14.
3. Vassilev, S.V. and C.G. Vassileva, 2007. A new approach for the classification of coal fly ashes based on their origin, composition, properties and behaviour. Fuel, 86: 1490-1512.
4. Dzantor, E.K., E. Adeleke, V. Kankarla, O. Ogunmayowa and D. Hui, 2015. Using coal fly ash in agriculture: Combination of fly ash and poultry litter as soil amendments for bioenergy feedstock production. Coal Combust. Gasificat. Prod., 7: 33-39.
5. Dhadse, S., P. Kumari and L.J. Bhagia, 2008. Fly ash characterization, utilization and Government initiatives in India: A review. J. Sci. Ind. Res., 67: 11-18.

6. Inam, A., 2007. Use of flyash in turnip (*Brassica rapa* L.) cultivation. Pollut. Res., 26: 39-42.
7. Arivazhagan, K.,M. Ravichandran, S.K. Dube, V.K. Mathur and R.K. Khandakar *et al*., 2011. Effect of coal fly ash on agricultural crops: Showcase project on use of fly ash in agriculture in and around thermal power station areas of national thermal power corporation Ltd., India. Proceedings of the World of Coal Ash Conference, May 9-12, 2011, Denver, USA.
8. Patra, K.C., T.R. Rautray and P. Nayak, 2012. Analysis of grains grown on fly ash treated soils. Applied Radiat. Isotopes, 70: 1797-1802.
9. Manoharan, V., I.A.M. Yunusa, P. Loganathan, R. Lawrie and C.G. Skilbeck *et al*., 2010. Assessments of Class F fly ashes for amelioration of soil acidity and their influence on growth and uptake of Mo and Se by canola. Fuel, 89: 3498-3504.
10. Casella, G., 2008. Statistical Design. Springer, New York, Pages: 307.
11. Kumbhar, P.P., Y.M. Patil, C.D. Chavan and M.V. Kulkarni, 2002. Recycling of after-extraction-residues and flyash through composting for amelioration of alkaline soil. J. Sci. Ind. Res., 61: 286-288.
12. Page, A.L., A.A. Elseewi and I.R. Straughan, 1979. Physical and chemical properties of fly ash from coal-fired power plants with reference to environmental impacts. Residue Rev., 71: 83-120.
13. Khan, M.R. and M.W. Khan, 1996. The effect of fly ash on plant growth and yield of tomato. Environ. Pollut., 92: 105-111.
14. Lee, H., H.S. Ha, C.H. Lee, Y.B. Lee and P.J. Kim, 2006. Fly ash effect on improving soil properties and rice productivity in Korean paddy soils. Bioresour. Technol., 97: 1490-1497.
15. Inam, A., 2007. Response of methi to nitrogen and flyash supplemented as a source of nutrients. Pollut. Res., 26: 43-47.
16. Singh, S., D.P. Gond, A. Pal, B.K. Tewary and A. Sinha, 2011. Performance of several crops grown in fly ash amended soil. Proceedings of the World of Coal Ash Conferences, May 9-12, 2011, Denver, Colorado.
17. Garg, R.N., N. Kalra, R.C. Harit and S.K. Sharma, 2003. Flyash incorporation effect on soil environment of texturally variant soils. Asia Pac. J. Environ. Dev., 10: 59-63.
18. Sharma, S.K. and N. Kalra, 2006. Effect of flyash incorporation on soil properties and productivity of crops: A review. J. Sci. Ind. Res., 65: 383-390.