International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 13-06-2021, Accepted: 30-06-2021, Published: 13-07-2021
Volume 6, Issue 4, 2021, Page No. 204-206

Effect of fly ash extract on early growth of wheat

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Abstract
The huge amount of fly ash, produced in the process of electricity generation through coal based thermal power stations is a matter of great environmental concern. Proper handling of such large amount of fly ash is really needed. As we know that fly ash is a coal residue, which is entirely organic in composition. It has various micro and macro nutrients. The present study was conducted in the laboratory of Agra College to find out the effect of fly ash on the early growth of wheat. Aqueous extract of fly ash was prepared and used on two different wheat varieties (HD-2967 and PBW-343) in different concentrations (0%, 25%, 50%, 75% and 100%) and positive responses related to different early growth parameters were recorded. The aqueous extract of fly ash with increasing concentration (0% - 50%) stimulated the seed germination as compared to control. Maximum stimulation was recorded at 25% in HD-2967 cultivar while at 50% in PBW-343 cultivar. Further increase in concentration significantly inhibits the early growth**.**

Keywords: coal, residue, fly ash, germination, nutrients, growth

Introduction
Burning of coal in thermal power plant produces different residues which are collectively called coal combustion residues (CCRs). Among these residues fly ash is produced in large amount. Coal is the only natural resource available in abundance in India so it is used widely as a thermal energy source and also as fuel for thermal power plants producing electricity (Vasistha, 2014) [13]. According to Kumar and Jha, 2014 [5] thermal power plants in India consume more than 430 million tonnes of coal and produces fly ash around 145.42 million tonnes of fly ash. India depends mostly (55.60%) on coal based thermal power plants which annually generates 235 million tonnes fly ash and is projected to exceed up to 1000 million tonnes by the year 2031-32 (Kumar and Jha, 2014) [5]. Management of this huge amount of fly ash is really a great environmental and economic concern all over the world. Because such a large amount of fly ash is generated each year, a great deal of research needs to be conducted to determine the feasibility of its utilization in agriculture (Raj and Mohan, 2014) [9]. According to Sharma *et al*, 2016 [12] fly ash is rich in different trace elements like As, B, Ca, Mo, S, Se, Sr etc. Productivity of soil increases on the addition of significant amount of fly ash due to the presence of different micro and macronutrients. Aggarwal *et al*, 2009 [1] concluded that application of fly ash modify the physical and chemical properties of soil along with the growth and yield of wheat. Fly ash also contains heavy metals in its composition so it can be used in agriculture as a source of fertilizer for soil which can increase the plant growth performance (Raj and Mohan, 2016) [10]. The use of fly ash reduced the growth of several soil borne pathogenic microbes whereas the population of *Rhizobium* sp. were increased under the soil amended with fly ash (Chandrakar *et al*, 2015) [4].

Material and Methods
For the present study fly ash was collected in sufficient quantity from National Capital Thermal Power Station, Dadri (U.P.). For laboratory experiments, different concentrations (0%, 25%, 50%, 75% and 100%) of fly ash extract were prepared and then their effect was studied on seed germination and seedling growth of HD-2967 and PBW-343 cultivars of wheat.

Preparation of Fly Ash Extract
To prepare fly ash extract 100 gm of fly ash was soaked in 500 ml of distilled water (1:5 W/V) on dry weight basis for 24 hours at room temperature. The contents were shaken thoroughly at regular intervals. The extract was filtered first through three layers of muslin cloth and then through two layers of whatmann No. 1 filter paper. Thus a clear solution of fly ash was obtained. This filtrate was treated as 100 % concentration. It was then diluted further with distilled water to prepare 75%, 50% and 25 % concentrations of fly ash extract.

Methodology of Bioassay
The seeds of the test cultivars were disinfected with 0.1 % $HgCl_2$ solution for 1 minute and then washed 5-6 times with distilled water to remove all traces of $HgCl_2$ and then seeds were dried with filter paper. Sterilized petriplates (6 cm dia.) were lined with two filter papers at the bottom. 20 seeds of each test cultivars were kept equidistant on the top of the filter paper in separate petriplates. In each petriplate, the filter paper was wetted with 3 ml extract and control distilled water was used. The filter papers were kept moist by adding 2 ml extract/distilled water in each petriplate on 2^{nd}, 4^{th}, 6^{th}, 8^{th} and 10^{th} day of sowing. The petriplates were kept in BOD incubator at 20 ± 2^0C. Each treatment was replicated thrice. The germination was recorded at 2^{nd}, 4^{th}, 6^{th} and 8^{th} day and seedling growth (root and shoot length and dry matter accumulation) on 10^{th} day after sowing (DAS). For determining seedling growth, 10 randomly selected seedlings from each petriplate were taken and their mean values were used for statistical analysis. After measuring root and shoot length, the seedlings were dried in

an oven at 70^0C till the weight become constant for determining dry weight accumulation. Then they were weighed on digital balance.

Result and Discussion

In the present study, the effect of 0%, 25%, 50%, 75% and 100 % concentrations of fly ash extract was investigated on the seed germination and seedling growth of both wheat cultivars HD-2967 and PBW-343 under laboratory conditions.

Both the wheat cultivars responded positively to fly ash aqueous extract and showed more or less similar response. The lower concentrations of fly ash extract (25 % and 50 %) were stimulatory for seed germination and seedling growth (Table-1). In both the cultivars of wheat, germination percentage and seedling growth were maximum in 25% and 50% extract concentration. Maximum seed germination was recorded for HD-2967 at 25 % extract concentration whereas it was recorded maximum for PBW-373 at 50 % extract concentration (Table-1). At higher concentrations of the extract (75 % and 100 %) effects were inhibitory. The maximum reduction was observed in 100 % extract concentration for both the cultivars. The growth of root and shoot also recorded a significant decrease with the increase of the extract concentration beyond 50%. In their research Pani *et al*, (2015) [8] reported a clear optimal response for most of the growth parameters at 25% FAA in sunflower cultivars. They also found same response for different rice cultivars. Different researchers concluded that fly ash can be used potentially in agriculture. In their study they found that application of fly ash increased the crop yield of wheat, alfalfa, barley, bermuda grass and mung (Basu *et al*, 2009) [3]. It was found that root length, shoot length, fresh weight and dry weight of root and shoot increased progressively up to the fruiting stage which is a common phenomenon among various cereals and pulses (Ahmad, 2017) [2]. Robab *et al*, 2010 [11] reported after performing their experimental research on *Solanum nigrum* L. that amendment of soil with fly ash up to 30% level was beneficial for growth and biomass.

However some studies reported the risk of heavy metals associated with use of fly ash in agriculture but fly ash composting appears viable mostly at low incorporation rates (Mupambwa *et al*, 2014) [6] and the potential contamination risk of HMs contained in new fly ash-based soil conditioner to the soil is negligible and can be ignored (Ou *et al*, 2020). Present study suggests the suitability of lower fly ash extract concentrations for germination and early growth of wheat cultivars. Stimulation of early growth of wheat by fly ash extracts clearly points towards its utilization in agriculture for soil amendments. However, the bioaccumulation of toxic heavy metals and their critical levels for human health in plant parts and soil should be investigated on long term basis.

Table 1: Effect of fly ash extract on germination and early growth of HD- 2967 and PBW - 343 cultivars of Wheat

Characters / FA extract Conc. (%)	Germination (%)	Root Length (cm)	Shoot Length (cm)	Dry Weight of root (mg)	Dry Weight of shoot (mg)	Dry Weight of residual seed (mg)
HD-2967						
0%	91.00	8.70	8.45	5.54	9.47	41.35
25%	98.16	9.91	10.44	6.10	11.13	44.41
50%	96.86	9.10	9.90	7.40	13.42	51.35
75%	86.70	8.56	8.26	5.74	8.35	40.37
100%	82.53	6.92	7.64	4.11	6.62	38.00
CD at 5%	0.84	0.60	0.64	0.51	0.47	0.72
PBW-343						
0%	90.50	8.66	8.61	5.24	8.48	42.74
25%	93.50	9.19	9.53	7.39	12.40	50.40
50%	97.50	10.15	10.49	6.40	11.21	49.56
75%	85.00	8.25	8.23	4.35	8.28	42.11
100%	81.50	6.30	6.53	3.91	7.14	37.74
CD at 5 %	0.64	0.57	0.52	0.63	0.20	1.50

References

1. Aggarwal S, Singh GR, Yadav BR. Utilization of fly ash for crop production: Effect on the growth of wheat and sorghum crops and soil properties. Journal of Agricultural Physics,2009:9:20-23.
2. Ahmad I. Utilization of thermal plant wastewater and coal fly ash to improve growth and yield of chickpea. International Journal of Applied Environmental Sciences,2017:12(1):155-178.
3. Basu M, Pande M, Bhadoria PBS, Mahapatra SC. Potential fly ash utilization in agriculture: A Global Review, Elsevier,2009:19:1173-1186.
4. Chandrakar T, Jena D, Das AK, Jena SN, Panda N, Monica M. Soil microbial activity as influenced by application of fly ash and soil amendments to maize crop in acidic alfisols. International Research Journal of Agricultural Science and Soil Science,2015:5(4):120-128.
5. Kumar V, Jha GK. Use of fly ash in agriculture: Indian Scenario, WACAU, International Workshop on Agricultural Coal Ash Uses, May, Israel. 2014, 27-29.
6. Mupambwa HA. Fly ash composting to improve fertiliser value - A review. South African journal of science,2014:111:1-5.
7. Yanjun O, Shuhua M, Xiao Z, Xiaohui W, Jianping S, Yi Z. The effect of a fly ash based soil conditioner on corn and wheat yield and risk analysis of heavy metal contamination. Sustainability,2020:12:7281.
8. Pani NK, Samal P, Das R, Sahoo S. Effect of fly ash on growth and yield of sunflower. International Journal of Agronomy and Agriculture Research,2015:7(2):64-74.
9. Raj S, Mohan S. Approach for improved plant growth using fly ash amended soil. International Journal of Emerging Technology and Advanced Engineering,2014:4(6):709-715.

10. Raj S, Mohan S. Effect of low concentration of fly ash on the plant growth performance: A review. Special Issue on International Journal of Recent Advances In Engineering And Technology,2016:4:(1):91-95.
11. Robab MI, Hisamuddin, Azam T. Impact of fly ash on vegetative growth and photosynthetic pigment concentrations of *Solanum nigrum* L. Nanobiotechnica Universal,2010:1(2):95-178.
12. Sharma S, Kumar V, Yadav KK, Gupta N, Vishwakarma SK. Effect of fly ash deposition on biochemical parameters of different crop plants around Parichha Thermal Power Plant, Jhansi, India. International Journal of Current Microbiology And Applied Sciences,2016:5(8):873-877.
13. Vasistha V. Effect of pollutants produced by thermal power plant on environment: A review. International Journal of Mechanical Engineering and Robotics Research,2014:3(2):202-207.