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Opinion

Antioxidant Activity in Plants Grown in Fly Ash Amended Soil

Praveen Dahiya*

Amity Institute of Biotechnology, Amity University Uttar Pradesh, Sector-125, Noida, 201303, Uttar Pradesh

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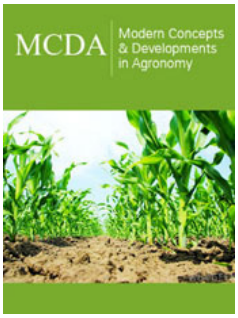

***Corresponding author:** Praveen Dahiya, Associate Professor, Amity Institute of Biotechnology, Amity University Uttar Pradesh, Noida, India

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Opinion

During past years, meager information is obtained regarding the plant's reaction with respect to heavy metal stress induced when the plant is cultivated on various treatment of fly ash in soil. Fly ash is an inorganic solid waste which contain several macronutrients, micronutrients, heavy metals like As, Cr, Cd, Cu, Pb, Ni, Zn etc. which shows harmful effect on the environment, soil, and ultimately human health. Throughout the world, fly ash is produced in huge amounts, and now-a-days it is utilized as soil ameliorants in agriculture, as a building material, in road construction, and in manufacturing of cement. As per reports from various researchers, fly ash amended to soil may improve the physico-chemical properties of soil and which h will ultimately improves the plant growth and yield [1,2]. The heavy metal concentration level in different treatments of fly ash and soil may stimulate or inhibit the plant antioxidant enzyme activity. Several studies are available on fly ash utilization as a soil amendment resulting in enhanced yield and biomass of plant, but fewer reports are available on plant antioxidant potential and oxidative stress when cultivated on different dosage of fly ash.

Metal(loid)s from fly ash will enter the plant through its roots and results in the generation of reactive oxygen species (ROS) in plants. In plants, the ROS species produced includes O^{2-}, OH^{-}, O^{-} that leads to decrease in overall biomass production [3]. Imbalance in production and elimination of ROS results in oxidative stress in plants which ultimately leads to protein, DNA and carbohydrate damage, lipid peroxidation etc. [4]. To overcome the stress due to heavy metals, plants utilize various defense mechanisms. Primarily, root thickness and formation of trichomes serves as a morphological barrier which avoids entry of heavy metals into plant tissues. If heavy metals overcome this barrier, then activation of cellular defense mechanism of plant will take place which can nullify the harmful metal impact. It includes the production of flavonoids, phenolics, heat shock proteins, phytochelatins, hormones, organic acids etc. However, to deal with free radicals generated, antioxidant defense mechanism of plant that includes enzymatic (catalase, superoxide dismutase, ascorbate peroxidase, and glutathione peroxidase) and non-enzymatic antioxidants (ascorbate, vitamins, carotenoids, proline, alkaloids etc.) gets activated.

Various researchers observed the impact of heavy metal stress on the antioxidant potential of diverse plants. Metals such as Cu, Cd, Cr, Fe and Zn in *Cicer arietinum* showed enhanced level of catalase and peroxidase enzymes which was reported to be maximum in roots in comparison to the shoots and leaves of Chickpea [5]. Similarly, enhanced antioxidant enzyme activity (superoxide dismutase, catalase, and glutathione) due to increased level of soil Cr was observed in *Helianthus annus* and *Solanum nigrum.* Metals such as Cu, Cd, Pb and Zn were reported to enhance the superoxide dismutase and catalase activity in the

roots of *Pisum sativum.* The increase in phenolic compounds in all treatment studied was reported due to metal Cd stress in plant *Erica andevalensis* [6]. Similarly, ethanolic leaf extracts prepared from *Calendula officinalis* grown at different treatments of fly ash added to soil showed maximum content of phenolic and flavonoid obtained at 60% fly ash treatment when compared to other treatments [7]. The above results showed positive correlation in between total phenolics and flavonoids contents with metal(loid)s like As, Co, Fe, Mn, and Zn in leaves of *Calendula officinalis*.

References

1. Gangolff WJ, Ghodrati M, Sims JT, Vasilas BL (2010) Impact of fly ash amendments and incorporation method of hydraulic properties of sandy soil. Water, Air, Soil Pollution 119(1-4): 231-245.
2. Karthik S, Kumar AE, Gowtham P, Elango G, Gokul D, et al. (2014) Soil stabilization by using fly ash. IOSR- J Mech Civ Eng 10(6): 20-26.
3. Gill SS, Tuteja N (2010) Reactive oxygen species and antioxidant machinery in abiotic stress tolerance in crop plants. Plant Physiol Biochem 48(12): 909-930.
4. Farmer EE, Mueller MJ (2013) ROS-mediated lipid peroxidation and RES-activated signaling. Annu Rev Plant Biol 64: 429-450.
5. Pandey VC, Singh JS, Kumar Tiwari DD (2010) Accumulation of heavy metals by Chickpea grown in fly ash treated soil: effect on antioxidants. CLEAN Soil Air Water 38(12): 1116-1123.
6. Belen Marquez Garcıa M, Fernandez Recamales A, Cordoba F (2012) Effects of cadmium on phenolic composition and antioxidant activities of *Erica andevalensis*. J Bot 2012: 1-6.
7. Varshney A, Mohan S, Dahiya P (2021) Assessment of leaf morphological characteristics, phenolics content and metal(loid)s concentrations in *Calendula officinalis* L. grown on fly ash amended soil. Industrial Crops and Products 174: 114233.