

IMPACT OF FLY ASH ON IRRIGATED VERTISOLS VIS-À-VIS ON BIOMASS YIELD AND CONTENT OF HEAVY METALS AND ACTIVITY OF RADIO NUCLIDES OF CROPS

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SUMMARY

Fly ash-treated soils have been analyzed for both trace elements and radionuclides to study the effect of application of fly ash to soils and uptake of elements by plant species. This paper describes the details on sampling and sample preparation and analytical techniques and the uptake of trace elements and radionuclides by sunflower-maize crops in sequence over a period of three years. The Results indicated the beneficial effect of fly ash / pond ash along with FYM in increasing the biomass yield of crops. There was no significance difference between fly ash / pond ash and have better residual effect on succeeding crops. The maximum biomass yield of sunflower 23.1 t/ha was recorded due to fly ash @ 40t/ha along with FYM @20 t/ha. And per cent increase over control was 36.7 whereas highest biomass yields of maize of 41.2 q/ha was recorded due to application of fly ash @ 40t/ha every year and percent increase over control was 61.6. The activity of radionuclides namely ^{226}Ra , ^{228}Ac and ^{40}K in fly ash was 101.5, 109.3 and 361.4 Bq/kg and the corresponding values in the pond ash were 98.0, 106.0 and 342.4 Bq/kg which was slightly lower as compared to fly ash. Even though application of fly ash / pond ash at different level has increased the activity of radionuclides in both the crops biomass, the activity of these natural radionuclides are comparable with those crops grown in normal soils.

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Many elements found in fly ash are essential to plants and animals, including some macroelements (K, P, Mg, Ca) and trace elements (Fe, Mn, Mo, Cu, Zn). Selenium is commonly found in coal ash and is essential to animals. However, the range between beneficiary and toxicity level is relatively narrow. Little information is available concerning the uptake and movement of potentially toxic elements from coal ash in the ecosystem. Plants grown in soils amended with fly ash from various sources are known to accumulate a number of elements, of which Pb, As, Se and Mo have been reported to reach levels potentially toxic to grazing animals in some areas (Kefer and Sajwan, 1993). A large fraction of coal extracted from the earth is burnt in thermal power stations (Johnes, 1988). In the combustion process, most of the mineral matter in the coal is fused into fly ash. The physico-chemical properties of soil and fly ash are similar in many respects. Therefore fly ash has a great potential for utilization in agriculture as a soil conditioner and as a provider of nutrients for plants. The radionuclides, which contribute most to environmental radiation are the members of the natural radioactive series and ^{40}K (UNSCEAR, 1988). Coal, like most of the material found in nature, contains trace quantities of the naturally occurring radionuclides arising from the uranium and

thorium series and also ^{40}K . The concentrations of these long-lived radionuclides are usually low in the coal, when it is burnt in power stations. The fly ash that is emitted through the stack gets enriched in some of the radionuclides.

The concentration of trace elements/radioactivity in fly ash is extremely variable and depends on the composition of the parent coal, conditions during coal combustion, efficiency of emission control devices, etc. The magnitude of absorption of radionuclides by plants grown on fly ash amended soils depends on the content of elements and radionuclides in fly ash, the rate of application, the soil type and its pH, the type of plant etc. (Furry *et al.*, 1976). The contents of heavy metals and naturally occurring gamma radionuclides in crops grown on fly ash-applied to irrigated vertisols have been analyzed to study the bulk application and long term effect on biomass yield, content of heavy elements and radionuclides in sunflower-maize cropping sequence. The present paper reports the results of such investigations.

MATERIALS AND METHODS

The vertisol represents the Raichur Series (Typic Haplusterts). Sunflower and maize were the test crops. The experiment was laid out in RBD with three replications. Fly ash/ pond ash from Raichur Thermal Power Station, Shaktinagar, Raichur were used as