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NOTE

Effect of Fly Ash Addition on Linoleic Acid Content of Seeds of *H. annuus*

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Nutritional value of seeds of *H. annuus* (sunflower) depends on contents of PUFA and amino acids.. PUFA content of seed is affected by soil pH nutrient availability. It was found to increase on fly ash addition as the latter has good nutrient content and high pH.

Key Words: Linoleic acid, *H. annuus*, Fly ash, Essential fatty acids.

Recent studies in nutrition have put into focus the vital role played by essential fatty acids (EFAs) such as *cis*-linoleic acid and α-linolic acid which should be essentially supplied in the diet. Linoleic acid and α-linoleic acid have little or no biological activity of their own but the two fatty acids undergo some biochemical changes to produce derivatives such as GLA, DGLA and eicosapentanoic acid which then play a major role in the control of diseases and regulation of metabolism. EFAs are essential for the normal growth and development of fetus. It is well documented that complications associated with hypertension and diabetes mellitus can be prevented or reduced by EFA supplementation. Deficiency of EFAs leads to a series of abnormalities including hair-fall and eruption of eczema-like skin lesions, the failure of wounds to heal, liver disorders etc. Current studies on these and other derived acids show that they play a very critical role in the body such as inhibiting the growth of malignant cells without interfering with normal cells[1]. Oil of *H. annuus* is gaining attraction as an edible oil due to its good EFA contents. It is also a rich source of phosphorus-containing proteins and vitamins[2]. But the plant is very much pH sensitive. It cannot grow on acidic soil. Its oleic to linoleic acid ratio is also affected by climatic conditions, plant location and genetics[3]. As its crop is very exhaustive in nature, the factor which affects nutrient availability to the plant may be unfavourable to its growth, *viz.*, acidic pH. In acid soil, nutrient availability reduces as at low pH, nutrients convert into their non-available and non-absorbable forms[4]. Linoleic acid content of seeds is also affected by nutrient content[5].

The area of Chhattisgarh (M.P.), India is a potential site for thermal power plants. The waste from thermal power plants, *i.e.*, fly ash, is basic in nature and has good

mineral content; therefore its addition to soil is advantageous in two ways: (1) it increases pH of soil and converts the nutrients to their available form; (2) supplies nutrient to soil. So it may be beneficial for the cultivation of *H. annuus.* In the present study we have observed the effect of fly ash on EFA contents of seeds.

Seeds of *H. annuus* [source: IGKVV, Raipur (modern variety)] were sown in different soil : fly ash combinations. Soil : fly ash mixture was analyzed for different physical contents, *viz.*, pH, electrical conductivity and nutrient content[6]. After growth the seeds were subjected to soxhlation. Oil obtained from different treated seeds was analyzed for physical parameters, *viz.*, specific gravity, sap. value, iodine value, etc. as per IP. Fatty acids were qualitatively estimated by TLC[7]. Oil was then processed for the isolation of the oil mixture unsaturated fatty acid and later was quantitatively estimated by GLC[8].

Soil and mixture analyses reveal that the pH, EC, nutrient availability increased on increasing fly ash content of the mixture. On perusal of result of oil analysis, it was observed that the iodine value of the oil significantly increases with increased fly ash addition. TLC result of fatty acid mixture produced four spots with different R_f values which were similar to R_f of palmitic, stearic, oleic and linoleic acid. GLC curves study indicates a 52.25% ($P < 0.5$) increase in linoleic acid over control.

TABLE-1
IODINE VALUE AND LINOLEIC ACID CONTENT OF DIFFERENT SEEDS OF *H. ANNUUS*

S. No.	Composition of soil mix	Symbol	pH	Iodine value	Linoleic acid (%)
1.	Control	A	6.22	124†	13.11*
2.	Soil + NPK	B	6.31	123†	14.56* (11.60)
3.	Soil + NPK + 10% fly ash	C	6.43	126*	—
4.	Soil + NPK + 20% fly ash	D	6.48	127*	16.21* (23.64)
5.	Soil + NPK + 30% fly ash	E	6.87	133†	19.96* (52.25)
6.	Soil + NPK + 40% fly ash	F	6.83	130*	15.30* (16.70)
7.	Soil + NPK + 50% fly ash	G	7.23	129*	15.04* (14.72)

* $P < 0.05$; † $P < 0.01$
Values in parentheses show the per cent change in linoleic acid content of seed over control.

Results obtained show a positive response of *H. annuus* to fly ash amelioration. Fly ash addition actually increases the pH of the soil that means reduces H^+ toxicity and root tip deterioration. Such conditions are responsible for maximum absorption/availability of nutrient to plant and effect of nutrient on oil content

and concentration of palmitic, stearic, oleic and linoleic acids was already reported by Bozburt and Karacal[5]. With increased fly ash doses, nitrogen availibility also increases which in turn has its direct effect on oleic to linoleic ratio. The ratio decreases with increased nitrogen fertilization[6]. Soil : fly ash ratio (70 : 30) has been found to be the best combination for optimum growth and good oil quality of *H. Annuus*.

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