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Effects of Flyash and Plant Hormones Treated Soil on the Increased Protein and Amino Acid Contents in the Seeds of Ground Nut (*Arachis hypogaea*)

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Soils of newly formed Chhattisgarh state are acidic (red, yellow) and soil acidity is responsible for Al^{3+} ion toxicity which leads to reduced micro organism activity, as well as Mo and Zn deficiency. In plants indole acetic acid and giberellic acid were used as growth hormones. Plant growth parameters were compared for plain and flyash and hormone treated soil.

Key Words: Flyash, *Arachis hypogaea*, Giberellic acid, Protein hydrolyzate, Indole acetic acid.

INTRODUCTION

Ground nut is an important oil seed crop of India. It covers an area of 7.4 million hectares with a production of 8.4 million tonnes. The yield and poor, quality of seed kernels are the major problems in ground nut production. Ground nut seeds contain about 50% edible oil and 50 % of high quality of proteins[1]. Indiscriminate use of NPK fertilizers removes trace elements fastly from the soils[2]. Flyash has following properties. (i) It is basic in nature to ameliorate soil acidity, (ii) It is a reserve source of trace elements to replenish its deficiency in the soil and (iii) Its physico-chemical properties, texture helps to mix homogeneously with soils[3].

Biotechnologically, the present work on ground nut is unique in one aspect of its nutrition. The seeds develop *via* nutrients it gathers directly from the soil rather than those transported from roots to shoots and back to the seeds[4]. Aluminum ion toxicity is perhaps the most important cause of reduced plant growth. Flyash is basic in nature and a good source of NPK alongwith Cu, Zn, Mn, Mo and Fe. In the present work, soil of Arpa irrigation project area has been used for amelioration of soil acidity.

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EXPERIMENTAL

Flyash from NTPC Korba district of Chhattisgarh state is used to ameliorate the acidic, soil of Arpa irrigation project area. Soil, flyash and their various combinatioins were analyzed for their physico-chemical properties. Soil and flyash were mixed in different proportions and homogenized by grinding and seiving. Samples of different combinations were analyzed by the methods suggested by Hesse[5].

About 4 kg sample of each combination were taken in pots. The details of each combination have been shown in the Table-1. The properties of flyash are summarized in Table-2.

TABLE-1
SOIL AND FLYASH COMBINATIONS

S. No.	Details of combinations	Symbols
1.	Plain soil	A
2.	90 % w/w soil + 10 % w/w flyash + NPK (400 : 600 : 100)	B
3.	80 % w/w soil + 20 % w/w flyash + NPK (400 : 600 : 100)	C
4.	70 % w/w soil + 30 % w/w flyash + NPK (400 : 600 : 100) + indole acetic acid + giberellic acid (0.001 M each) sprayed periodically.	D

TABLE-2
PROPERTIES OF FLYASH

Properties of flyash		Properties of flyash	
pH	8.795	Fe_2O_3 (%)	7
Electrical conductivity (m mhos/cm)	0.172	P_2O_5 (%)	0.20
SiO_2 (%)	62	SO_3 (%)	0.25
Al_2O_3 (%)	18	CaO (%)	1.62

The physico-chemical properties of different combinations are shown in the Table-3.

TABLE-3
PHYSICO-CHEMICAL PROPERTIES OF DIFFERENT COMBINATIONS

Symbol	pH	Electrical conductivity (m mhos/cm)	Oxides and N conc. (%)					Trace elements conc. (ppm)			
			SiO_2	Al_2O_3	P_2O_5	CaO	N	Mn	Fe	Zn	Mo
A	6.25	0.082	77.00	15.00	0.15	1.19	0.006	47	40	54	3.5
B	6.40	0.085	77.50	15.50	0.18	1.49	0.008	48	42	60	3.9
C	6.52	0.090	77.55	16.00	0.20	1.50	0.006	50	42	55	4.5
D	6.88	0.120	78.00	17.00	0.22	1.60	0.005	52	45	60	4.6

Preparation of protein hydrolyzate

Oil was first removed from seeds of ground nut (*A. hypogaea* L.) using soxhlet extractor, using normal hexane as solvent. Proteins were isolated by repeated exhaustive extraction of defatted, decarbohydrated seeds, with cold, alkaline 10 % brine solution. The proteins were precipitated from the filtrate by addition of 10 % CH_3COOH and heating the solution at 80ºC for 2 h.

Isolated protein (0.5 g) was refluxed with a mixture of 100 mL 6 N HCl and 90 % HCOOH for 10 h. Excess of acid was removed by evaporation. Volume was reduced to 5 mL and then further diluted with 25 mL of distilled water and filtered. Filtrate was vacuum dried and stored in a brown bottle under nitrogen atmosphere and sent for HPLC analysis[6]. Plant growth parameters have been displayed in Table-4.

TABLE-4
PLANT GROWTH PARAMETERS OF GROUND NUT (*A. hypogaea* L.)

Symbol	Root length (cm)	Shoot length (cm)	Leaf area (cm^2)	Total chlorophyll content (mg/g)	Yield per plant (g)	Protein concentrate (%)
A	12	55	2090	1.70	15	55
B	14	60	2950	1.80	16	60
C	15	65	3550	1.90	17	65
D	17	70	4500	2.50	19	70

HPLC studies of seeds of ground nut (*A. hypogaea* L.) from the plain soil (A) and harmone treated soil (D) show the presence of phenyl alanine, methionine, threonine, leucine and valine. This has been further confirmed by the molecular interactions of L-amino acids and iodine in 50 % aqueous ethanol solvent system as shown in the Table-5.

TABLE-5
ELECTRONIC ABSORPTION SPECTRA OF L-AMINO ACIDS-IODINE SYSTEM IN 50 % AQUEOUS ETHANOL SOLUTION

S. N.	System of L-amino acid and iodine in 50 % aqueous ethanol solution	λ_{max} (absorbance)
1.	Leucine	212 (0.6302), 297 (0.3590), 359 (0.3689)
2.	Phenyl alanine	212 (0.4558), 294 (0.2340), 352 (0.2352)
3.	Valine	212 (0.5870), 290 (0.1800), 358 (0.120)
4.	Threonine	212.4 (1.095), 291 (0.3400), 358 (0.190)
5.	Methionine	215 (0.345), 287 (0.360)

RESULTS AND DISCUSSION

The ground nut is unique in one aspect of nutrition. The seed develops *via* nutrients it gathers directly from the soil rather than those transported from roots to shoots then to seeds. Acidic soil requires liming for better crop yield and better seed kernel developments. In the case (D) the maximum yield is due to better calcium absorption by the pod[7]. Phosphorus may be the most deficient element on a global scale[8]. Molybdenum deficiency is more common in acid soils while molybdenum is required to increase nitrogen, methionine and other amino acids contents. It is essential for nodule formation[9]. Zinc deficiency occurs in acidic soil[10].

Application of plant hormones indole acetic acid and giberellic acid are important to induce enzyme activities. Cell elongation, accompanied by increased DNA synthesis is due to GA application[11]. Protein synthesis requires auxin induced cell enlargement[12].

Conclusively in the present work, the use of flyash has ameliorated soil acidity and help in availability of trace elements to the crop which has resulted increased plant growth parameters, protein and essential amino acid contents.

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