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Studies on the Effect of Flyash and Plant Growth Hormones on Chlorophyll-a,b and Total Chlorophyll Contents in Wheat, Bengal Gram and Sunflower Leaves

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In the present work, flyash and plant hormones have been used in the pot experiments in wheat, Bengal gram and sunflower plants to study their effects in chlorophyll contents.

Key Words: Flyash, Total Chlorophyll Contents, Wheat, Bengal gram, Sunflower leaves.

INTRODUCTION

Flyash is a good source of trace elements essential for chlorophyll formation[1]. Other methods were followed to increase chlorophyll contents[2, 3]. In one case phenol and proline contents in the leaf and stem of mung bean seedlings were affected[4]. The soil of the newly formed Chhattisgarh state has been found to be acidic and as a result it causes aluminium toxicity, reduced micro-organism activity, Mn and Fe toxicity, Ca, Mg, Mo, N, P and S deficiency. Collectively all these factors reduce the chlorophyll content of plants[5]. Previous workers have used liming to get rid of aluminium toxicity[6].

EXPERIMENTAL

Acidic soil of Bilaspur district and flyash from NTPC Korba were mixed homogeneously in different proportions and kept in 4 kg capacity pots. Details are given in Table-1. Physico-chemical properties of soil and flyash combinations were analyzed and described in Table-2. Laboratory methods were employed for physico-chemical analysis as reported method[7].

Determination of Chlorophyll-a,b and total chlorophyll[8]

Chlorophyll is extracted in 90% acetone at 663 and 645 nm in the spectrophotometer (Spectronics-20). Using the absorption coefficients, the amounts of chlorophyll-a,b and total chlorophyll were estimated in the leaves of *Triticum aestivum* (wheat), *Cicer arietinum* (Bengal gram) and *Helianthus annus* (sunflower).

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TABLE-1
SCHEME OF POT EXPERIMENTS

S.No.	Combinations	Symbol used
1.	Plain soil	A
2.	80% soil + 20% flyash + NPK (400 : 500 : 100 g)	B
3.	70% soil + 30% flyash + NPK (400 : 500 : 100 g)	C
4.	70% soil + 30% flyash + NPK (400 : 500 : 100 g) + indole acetic acid	D
5.	70% soil + 30% flyash + NPK (400 : 500 : 100 g) + gibberellic acid	E
6.	70% soil + 30% flyash + NPK (400 : 500 : 100 g) + indole acetic acid + gibberellic acid	F

TABLE-2
PHYSICO-CHEMICAL PROPERTIES OF SOIL AND FLYASH COMBINATIONS

S. No.	Symbol used	Electrical conductivity in millimhos/cm	pH	Compound concentration in %						Trace elements in ppm		
				SiO_2	Al_2O_3	P_2O_5	SO_3	CaO	N	Zn	Mo	B
1.	A	0.971	6.34	75	17	0.18	0.25	1.18	0.007	54	3.50	0.30
2.	B	0.990	6.40	78	16	0.20	0.30	1.24	0.008	55	4.00	0.32
3.	C	1.090	6.50	80	16	0.22	0.35	1.30	0.008	56	4.50	0.35
4.	D	1.250	6.90	82	15	0.30	0.40	1.40	1.000	58	5.00	0.40
5.	E	1.250	6.90	82	15	0.30	0.40	1.40	1.000	58	5.00	0.40
6.	F	1.250	6.90	82	15	0.30	0.40	1.40	1.000	58	5.00	0.40

Procedure: 1 g of well mixed representative sample of leaves were finely cut and ground with 20 mL of 80% acetone, centrifuged (5000 rpm for 5 min) and supernatant liquid transferred to a 100 mL volumetric flask. The procedure was repeated till residue was colourless. Volume was made up to 100 mL mark with 80% acetone in all the three cases individually.

Calculation: The amount of chlorophyll was calculated using the formula mentioned below:

(1) mg chlorophyll-a per g leaves $= 12.7(A_{663}) - 2.69(A_{615}) \times \frac{V}{1000 \times W}$

(2) mg chlorophyll-b per g leaves $= 22.9(A_{615}) - 4.68(A_{663}) \times \frac{V}{1000 \times W}$

(3) mg total chlorophyll per g leaves $= 20.2(A_{645}) - 8.02(A_{663}) \times \frac{V}{1000 \times W}$

where

A = absorbance at specific wavelengths,

V = final volume of chlorophyll extract in 80% acetone,

W = fresh weight of leaves extracted.

RESULTS AND DISCUSSION

In the present experiment, the effects of fly ash, indole acetic acid and gibberellic acid were observed in wheat, cicer and sunflower crops in the pot experiments to study chlorophyll contents (Table-3.).

TABLE-3
AMOUNT OF CHLOROPHYLL-A,B AND TOTAL CHLOROPHYLL IN THE LEAVES OF WHEAT, BENGAL GRAM AND SUNFLOWER PLANTS AFTER FLY ASH TREATMENT IN THE ACIDIC SOIL OF BILASPUR DISTRICT

S. No.	Symbol used	Amount of chlorophyll in mg/g leaves after 90 days								
		Wheat (*T. aestivum*) Chlorophyll			Bengal gram (*C. arietinum*) Chlorophyll			Sunflower (*H. annus*) Chlorophyll		
		a	b	Total	a	b	Total	a	b	Total
1.	A	4.2460	5.227	9.473*	3.1030	5.648	8.750*	3.524	5.809	8.750‡
2.	B	4.6835	5.909	12.682†	3.0220	6.335	9.357*	4.419	6.918	11.330*
3.	C	4.6590	5.841	11.045†	3.4766	6.606	10.082*	4.485	7.329	11.814‡
4.	D	4.6590	5.841	10.501*	3.7760	7.152	10.929†	4.585	7.512	12.090*
5.	E	4.4190	6.118	11.330†	3.9770	7.517	11.494†	4.685	9.420	12.379†
6.	F	5.1810	6.262	11.444†	4.0600	8.362	12.422†	4.885	8.058	12.944†

* $P < 0.05$; † $P \leq 0.04$; ‡ P = ns

Sewage wastewater was effective as reported by Dhankar *et al.*[9] in pot culture. Wheat crop after 9% sewage concentration showed increase in the nitrate reductase activity. Bengal gram (*Cicer arietinum*) showed increase in chlorophyll content by the use of pre-treated distillery effluent in some cases[10]. Similarly, sunflower is draught and frost resistant but it cannot withstand acidic soil[11]. So best growth performance was observed in flyash amended soil. This is so because flyash ameliorates soil acidity and reduces aluminium toxicity[12].

In the light of the above findings the present work was undertaken applying 30% flyash to the acidic soil and periodical spray of indole acetic acid, gibberellic acid and their combined solutions (two times in 100 days). Better results were obtained as described in Table-3. Hormones regulate biochemical processes by acting upon specific enzymes. Auxin (IAA) and GA both induce growth by increased amino acid uptake by the cells. Auxin increases RNA synthesis, gibberellin increases protein synthesis and prevents leaf senescence[13]. Again Ca from flyash helps auxin induced cell elongation[14]. All these facts confirm the present findings in different plant species where chlorophyll content increased.

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