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EFFECT OF FLY ASH ON REPRODUCTIVE BIOLOGY OF OIL YIELDING PLANT *Brassica juncea var. pusa Bold*

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ABSTRACT
The present paper deals the impact of fly ash on oil yielding plant. Fly ash is a major pollutants emitted by thermal power plant has a numerous macro and micro elements which are required by the plants for its normal growth and development. Hence the study carried out its possibility of utilization in the field and its effect on Reproductive Biology of ***Brassica juncea*** (L.) Czern. & Coss. var. ***pusa*** Bold. The study focuses effect of different concentration of fly ash on days to flower, pollen viability, pollen germination and female reproductive part of *Brassica*.

KEY WORDS: - fly ash, pollutants, flower and pollen.

INTRODUCTION

Fly ash generated during combustion of coal in thermal power plant. Thermal power stations are one of the major emission sources of solid, liquid and gaseous pollutants. These wastes are a combination of many macro and micro nutrients. Fly Ash has been proposed as an amendment for agricultural soils due to its potentiality to improve the physical and chemical properties of the soils. Thereby it is improving soil fertility and crop yield. The potential benefit of fly ash, addition to soil include improved texture, improved water holding Capacity, increased pH and also increases concentration of most macro and micronutrients. These studies have indicated that fly ash can be used as a source of essential plant nutrient (Marten, 1971; Plank and Martens, 1973). Impact of fly ash is not only on the growth and metabolic aspects of the plants, it also affect reproductive behavior of the plants, especially on pollens. Pollen germination, pollen tube growth and pollen pistil interactions are an important component of plant life cycle. Pollen grains become favorite system for studying a range of biological problems, particularly in monitoring toxic effects of chemical and pollutants(Wolters and Martens 1987; Kriston and Kappler 1990; Pfahler 1992). The production of viable pollen is not enough for ensuring proper seed set. The pollen has to be effectively transferred to the stigma, germinate there and send forth pollen tubes that should reach embryo sac and the egg, hence the fertilization completes. It is there fore important to ensure the capacity and capability of pollen to germinate on the stigma in natural conditions and also if it is treated with fly ash mixed soil.

MATERIALS AND METHODS

Field preparation

Total number of beds were- 06, Bed size for *Brassica*- 4 x 2 feet, Distance between two rows- 45 c.m, Distance between two plants- 15 c.m,, Interspacing between beds- 1.5 feet.The plots were treated with fly ash mixed soil with the concentrations of Control, 20%, 40%, 60%, 80%, and 100%.

Soil Ash Analysis

Physical and chemical properties of soil mixed with fly ash have taken from different beds which made by fly ash and soil i.e. Control, 20%, 40%, 60%, 80%, and 100%. Almost all the soil ash analysis was done at air dried basis. pH was measured by glass electrode method(Mishra 1968), EC described by Richard(1954),OC and CEC determined by Jackson (1973), Moisture content, water holding capacity, Total N measured by Piper 1966 and P and K described by Jackson (1973).

Samplings for reproductive Biology

Crop growth under different treatments was monitored and measured under Days to flower, Pollen viability test, Average length of stigma, style and ovary. Hence after completion of the field trials showing the difference between treatments on average number of siliqua per plant, average number of seeds in each siliqua and average weight of thousands seeds obtained during research also noted and tabulated in table no -1.

During Flowering period, flowers were collected for pollen Biology. Male sterility was tested through pollen viability. The technique was followed by Stanley and Linsken (1974). Pollen germination test done by Brewbacker and Kwacks (1963). Development of female reproductive organs was also studied through measuring style, stigma and ovaries through Ocular Micrometer.

Sr.No	Concentration of fly ash	Days to flower	Average No. of Siliqua	Average No. of seeds in each siliqua	Average weight of 1000 seeds in gms
1	Control	71	73.61	8.52	340
2	20%	70	77.68	8.96	362
3	40%	70	82.06	8.98	465
4	60%	75	70.84	6.42	328
5	80%	82	53.52	4.60	301
6	100%	84	27.68	4.42	85

RESULTS

TABLE 2. summarize the results of pH, EC, OC, CEC, moisture content, water holding capacity and total N, P, K.

Sr. No.	% of fly Ash	pH	EC(mg)	OC%	CEC(mg)	Moisture Content %	Maximum Water Holding Capacity%	Available Nutrient Content(ppm)		
								N	P	K
1	Con	7.6	0.07	0.29	3.19	0.11	40.1	126	80	76
2	20%	7.7	0.12	0.25	3.2	0.20	41.0	119	65	78
3	40%	7.7	0.23	0.28	3.33	0.22	43.1	120	70	78
4	60%	7.9	0.29	0.28	2.86	0.25	48.5	122	72	80
5	80%	8.0	0.38	0.34	1.79	0.28	50.0	130	66	85
6	100%	8.5	1.23	0.42	0.43	0.32	55.6	128	70	96

Soil fly ash pH varies from 7.60 to 8.50. The Soil ash pH increase in the fly ash into the soil, the pH was also increased up to the higher level. EC is an index for assessing the salt concentration in the soil with the amendment of fly ash.EC concentration is increasing at the high concentration treatment. OC is an indication of organic fraction of the soil and fly ash which consists of decomposing plant and animal residues including cells and tissues of microorganism and the biochemical substances synthesized in the soil (Piper 1966).OC was increased at the higher level of fly ash. CEC is one of the most important physical chemical properties of soil fertility and in turn productivity. CEC was decreased as higher concentration of fly ash incorporated in the soil. Moisture content and water holding capacity was also increased with the incorporation of different concentration of fly ash. Available Nitrogen content was also increased with the increase of fly ash up to 80%. Later available phosphorus was decreased with the increase of fly ash and potassium content was increased with the increased of fly ash.

Effect of fly ash on Reproductive Biology

Effect of fly ash on *Brassica* plant measured at first on reproductive biology with Days to flower. Based on this we could be measure the final yield. Out of 6 treatments the early flowering was noted in 20% and 40% treatments and the days to flower was 70 days each respectively. Control flowered after one day i.e. 71 days and 80% and 100% fly ash treatments delayed and flowered in 82 and 84 days after sowing respectively. Effect of fly ash on *Brassica* Plant measured for pollen Viability. The maximum pollen viability percentage was recorded in control, 20%, 40% and 60% treatments with the value of 98% each. Minimum viability was recorded in the 80% and 100% with values of 82% and 37%. Pollen germination counted and tabulated in table no-3. At high concentration of fly ash pollen germination inhibited. From the release of pollen from anthers to the penetration of the Micropyle by the pollen tube tip there are numerous steps where the interaction between pollen and pistil can be regulated. The maximum no. of viable pollens on stigma and maximum no. of pollen tubes was observed under 40% fly ash treatments. Average viable pollen observed under control and 20% fly ash. Minimum observation found on 60%, 80% and 100% fly ash Treatments.

TABLE 3 - Effect of fly ash on Pollen germination studies of *Brassica juncea var. pusa Bold*

Sr. No.	Fly Ash %	T.T.C %	B.K. Medium%
1.	Con	98	92
2.	20%	98	95
3.	40%	98	95
4.	60%	98	90
5.	80%	82	78
6.	100%	37	43

TABLE 4. Effect of fly ash on Average length of female reproductive part of *Brassica juncea var. pusa Bold*

Sr. No.	Fly Ash %	Average length (mm)		
		Stigma	Style	Ovary
1.	CON	0.15	0.30	0.14
2.	20 %	0.24	0.36	0.21
3.	40 %	0.23	0.27	0.24
4.	60 %	0.19	0.27	0.18
5.	80 %	0.18	0.23	0.18
6.	100 %	0.16	0.20	0.11

Effect of fly ash on stigma, style and ovary was also measured for various treatments. Stigma length was higher for 20% and 40% fly ash Treatments, Style length was higher in 20% and 40% treatments, Ovary was measured large in size for 20% and 40% treatments and has tabulated in table no.4

DISCUSSION

Results from plot experiments in India with sugar beat indicated that application of 4% and 8% w/w fly ash increased both soil pH and conductivity but 2% w/w improved plant growth and increased yields. Although Cd, Cu, Fe, Mn, Ni and Pb accumulated in large amount in plants. (Singh *et al.,* 1994). Addition of fly ash in different percentage can change the soil pH and electrical conductivity (Clair *et al*., 1993).experiment concluded with the pH and electrical conductivity increased with values of 7.6 to 8.5 and EC values with 0.07mg to 1.23mg in the incorporation of higher percentage. Amendment of agriculture soil with fly ash can improve organic carbon, moisture content and maximum water holding capacity and decreased the cation exchange capacity in to soil with high concentration of fly ash. Available nutrient content N and K were increased with increase of fly ash and P was average with increase of fly ash.

The result of this experiment indicate that the application of fly ash with soil at level of 20% to 40% is increasing the plant growth and reproductive capability of plant but maximum quantity at level from 60%, 80% and 100% inhibited the plant growth as well as reproductive capacity of plants. Higher concentration of fly ash were markedly reduced the growth and germination of pollen and also reduced the Interaction between pollen and pistil on the stigmatic region. Less concentration of fly ash is responsible for germinating more no of pollen grains on stigma. It covers the need, the Utility benefits and the apprehensions regarding use of fly ash in optimum quantity in agriculture

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