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Full Length Research Paper

Biochemical Effect of Rourkela Steel Plant Slag on *Vigna radiata* Plant

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ARTICLE DETAILS

ABSTRACT

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Key words:

Rourkela Steel Plant,
Steel Slag, Slag cement,
Vigna radiata (Green
Gram), Shoot region

The *Vigna radiata*, alternately known as the green gram and it is a plant species belongs to family *Fabaceae*. It is an important pulse which is consumed all over the world. It has the excellent source of protein, fiber, minerals, vitamins, etc. It can be cultivated on wide range of soil. For the best result, when grown on well drained loamy soils are not suitable for cultivation. Rourkela is an industrial area and there is growing concern in the air pollution. Rourkela Steel Plant generates waste slag in huge amount for about 772,476 tons per year. it is considered as an environmental problem. It can have adverse effect impacts on crops on their growth stage. But now a day's waste slag can be treated as fertilizers, cement, bricks, landfills, etc. Slag was used as fertilizers in rice, wheat, maize crops. Industrialization has led to production of large amount of heavy waste material in the environment. To maintain our ecological balance, this waste material can be used or recycled back to the environment in a positive way. The present work was to study the effect of steel plant waste slag on the shoot region i.e; leaves, flowers and fruit in different concentration of slag treatment resulted variable impact in green gram plant but it is insignificant.

1. Introduction

Mung Bean is the main source of human food and animal feeds, it has a very important role in maintaining the soil fertility by enhancing the physical properties and fixing atmospheric Nitrogen. This crop is cultivated in several countries of Asia, Africa and South America. In the U.S most Mung Beans are grown in Oklahoma. Mung Bean has special features such as it matures early, supply of good yield, drought resistance property. This property makes it very highly responsive in the time of scarcity of rainfall. Pulses generally fix atmospheric Nitrogen which boost crop yield. This Plant is an annual, erect or semi- erect, reaching a height of 0.5-1.25m. It is slightly hairy and has a well-developed root system. The Beans are small, ovoid in shape and green in colour. The stems are many branched, sometimes, trifoliate with elliptical to ovate leaflets 6-16cm long x 4-14cm broad. The flowers are papilionaceous greenish or pale yellow in colour. The pods are long, cylindrical, and hairy. They contain 7-15 small, cube shaped seeds. This plant has a growth period of 90 to 120 days.

2. Growth stages

2.1 Germination: The seed germination takes place within 4-5 days but the actual rate of germination varies according to the amount of moisture introduced during germination stage. Epigeal with the stem and cotyledons emerging from the seedbed.

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2.2 *Post germination*: Mung Bean sprouts and the seed splits and a soft whitish root grows.

2.3 *Maturation*: The maturation period is up to 60 days. It forms multiple branches with seed pods. Most of the seeds become darker, while some remain green. This has an indeterminate flowering habit. This means that they do not have a defined flowering period and will continue to flower while there is presence of sufficient amount of moisture.

3. Materials and Methods

3.1 Study site

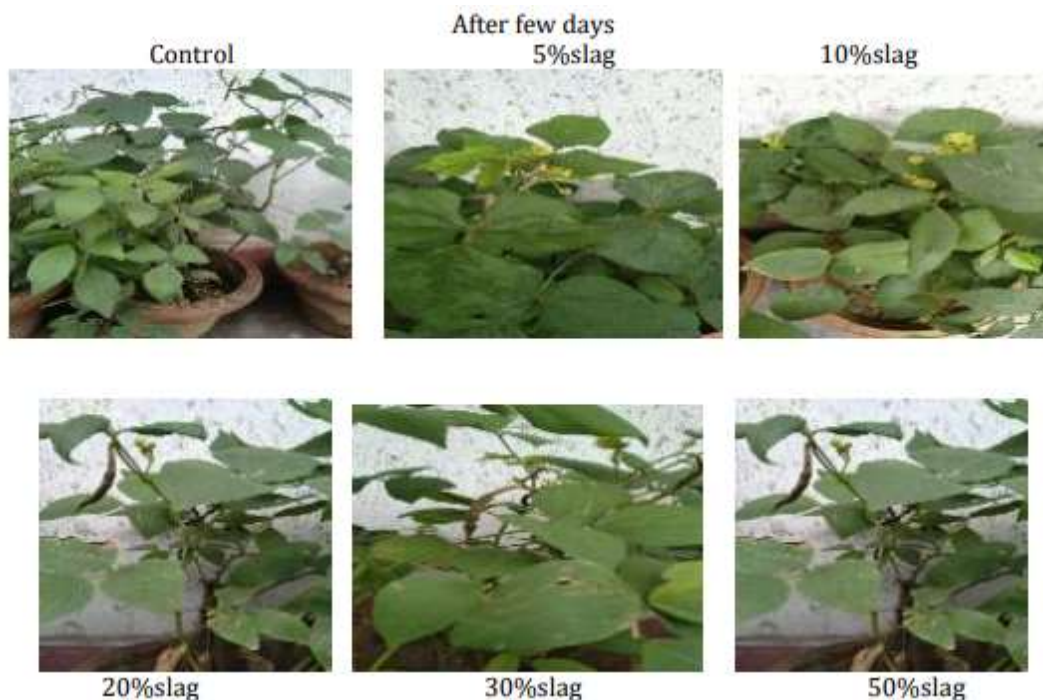
This research was conducted in the Garden of Municipal College, Uditnagar Rourkela. (22°13'30"N and 84°51'50.76"E) Odisha, India.

3.2 Methodology

To study the effects of Steel Plant waste slag on growth of leaves, flowers and fruit of *Vigna radiata* plant in garden soil "Pot Experiment" was conducted. The experiment was carried using rounded design six pots. Six earthen pots (size r.23cm and h.28.5cm) were taken each containing 7 kg of dried garden soil. The experiment was started on 27th. April, 2022, and it was considered as the day zero. After the addition of garden soil in the pot, the waste steel slag was added in each pot (except the control pot) separately slag at the rate of 125g,250g,500g,750g and 1000g per pot i.e; 5% slag, 10% slag, 20% slag, 30% slag and 50% slag. One untreated pot was kept as control. On the next day 10 Green Gram (*Vigna radiata*) seeds were sown in each pot and on the next day plumule and radicle was risen and after one week thin plants were grown in the pot. Throughout at an uniform level by watering at every alternative day. Ten seeds were sown in each pot and in the control pot 8 plants grown and 2 halt, 5% steel slag 9 plants grown and 1 halt, 10% steel slag 7 plants grown and 3 halt, 20% steel slag 8 plants grown and 2 halt, 30% steel slag 10 plants grown, 50% steel slag 8 plants grown and 2 halt.

As this green gram grows very rapidly at 7 days interval plant leaves, flowers and fruits growth were taken for 90 days for different analysis. In this plant we have counted the number of leaves grown in each plant of the six pots, number of flowers in plant, number of fruit formation in each plant.





4. Result and Discussion

Table – 1. Mean (Number Of Leaves)

Days	Control	Pot Experiment				
		5% Slag	10% Slag	20% Slag	30% Slag	50% Slag
14	5	5	5	5	5	4.25
21	8.25	8.42	8.57	8.37	8.7	8.42
28	12	12.14	12	11.75	11.8	11.42
35	16.87	17	16.57	17.5	18.7	16.1
42	20.37	20.37	19.87	18.7	20.1	20
49	20	21	19	18	19	19

Table – 2. Mean (Number Of Flowers)

Days	Control	Pot Experiment				
		5% Slag	10% Slag	20% Slag	30% Slag	50% Slag
30	4.5	5.1	3.6	4.1	2.8	4.5
37	5	5.3	4	4.5	3	5
44	6.2	6.5	5.3	6.2	4.4	6.5
51	8.1	7.5	8	8.5	8.3	8
58	5.2	5.5	6.2	6.5	7.1	8
65	4	4.5	5	4.3	4.2	5

Table – 3. Mean (Number Of Fruit)

Days	Control	Pot Experiment				
		5% Slag	10% Slag	20% Slag	30% Slag	50% Slag
51	2.5	4.3	5	4.8	3.5	3
58	3	4	5	3.5	4.1	4.5
65	3.8	4.2	6.3	3.8	4.8	5
72	4.2	5	7	4.1	5.2	5.4
79	5	5.2	7.5	5.2	5.8	5.9
86	5.5	5.5	7	6.5	6	6.5

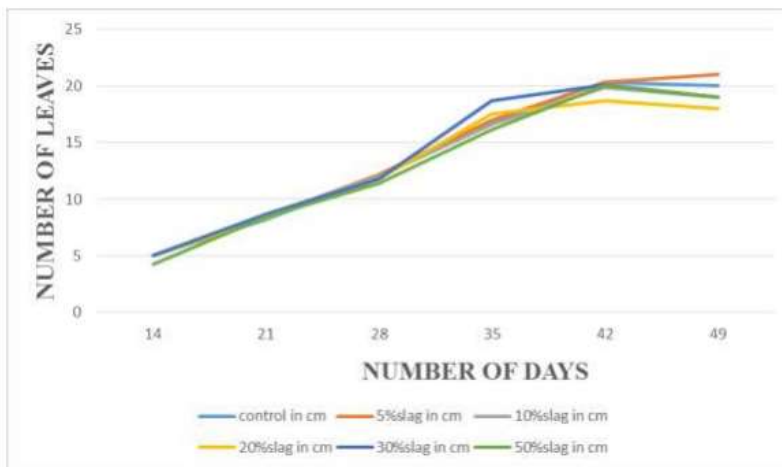


Fig. 1 Number of leaves

Number of leaves of *Vigna radiata* plant data were collected from six randomly distributed pots at seven days interval. In 5% slag concentration, we observed that the number of leaves were quite increased in 10% slag concentration there is also slight increase in number of leaves due to stimulatory effect.. In 20% slag concentration there is sudden decrease in the number of leaves due to presence of some toxicant might have affected the growth of the leaves. In 30% slag concentration there is sudden increase in the number of leaves. In 50% slag concentration there is again sudden decrease in the number of leaves due to senescence of leaves or due to presence of some toxicant material. This result indicates unfavorable soil condition in slag treated in pots for plant leaves and senescence of leaves. The result is quite insignificant ($F=0.208$).

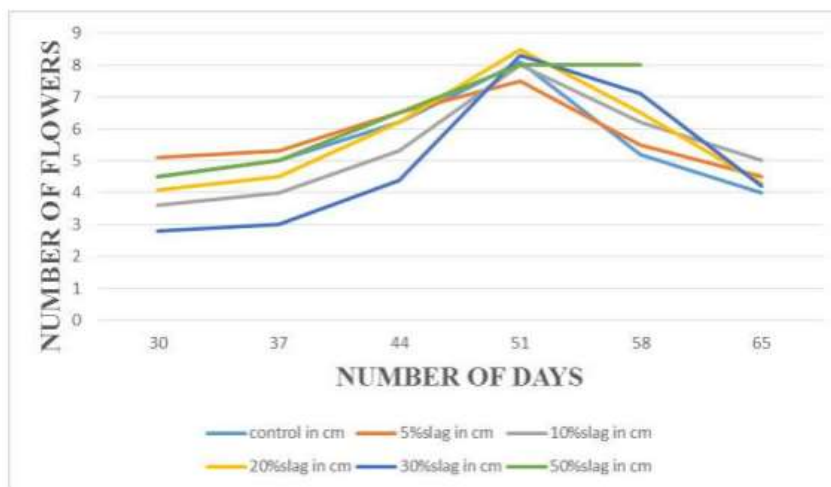


Fig. 2 Number of flowers

Number of flowers of *Vigna radiata* plant data were collected from six randomly distributed pots at seven days interval. In 5% slag concentration, we observed that the number of flowers was quite increased in 10% slag concentration there is slight decrease in number of flower. In 20% slag concentration there is sudden increase in the number of flowers due to stimulatory effect. In 30% slag concentration there is sudden increase in the number of leaves because there might be inadequate temperature, moisture or some toxicant present in the soil. In 50% slag concentration there is sudden increase in the number of flowers. This result indicates unfavorable soil condition in slag treated in pots for plant flower and the result is quite insignificant ($F=0.431$).

Number of fruit of *Vigna radiata* plant data were collected from six randomly distributed pots at seven days interval. In 5% slag concentration, we observed that the number of fruit were quite less in 10% slag concentration there is slight increase in number of fruit. In 20% slag concentration there is sudden decrease in the number of fruit due to light, temperature, soil. In 30% slag concentration there is sudden increase in the number of fruit. In 50% slag concentration there is increase in the

number of fruit. This result indicates that it affected soil condition in slag treated in pots for plant fruit and the result is quite insignificant ($F=0.106$)

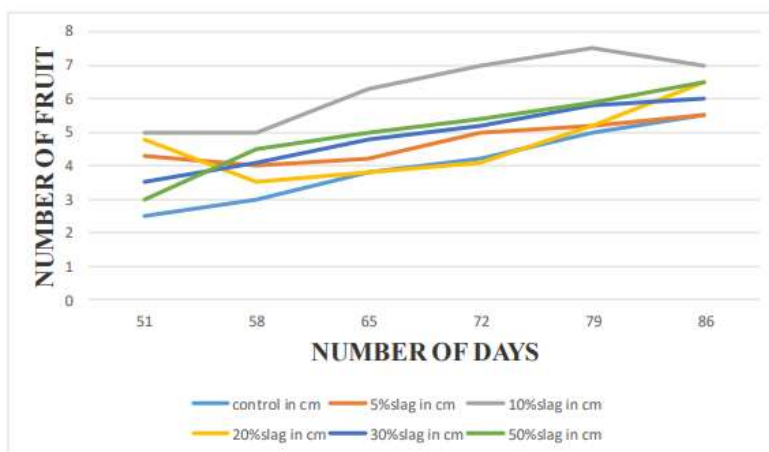


Fig. 3 Number of fruits

5. Conclusion

The present study indicates that Rourkela Steel Plant waste slag has Positive Effect (Stimulatory Effect) on the number of leaves, flowers and fruit of Moong Plant at lower concentration (5%) but at higher concentration (10,20%,30%,50%) it has adverse effect on the plant, though it is insignificant this may be due to presence of some heavy metal (Cd, Ni, Pb) in slag which may have inhibitory effect.

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