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GROWTH AND PIGMENT ANALYSIS OF A LEGUMINOUS CROP (*Cajanus cajan* L.) WITH AN INSECTICIDE (TAFGOR).

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Abstract: The article takes into an account of the extraction of different types of pigments of Pigeon pea with an insecticide (TAFGOR) in a laboratory condition. Pigeon pea is a perennial, tropical legume grown mainly in India. It belongs to the family Fabaceae. Though largely considered an Orphan crop, it has a huge untapped potential for improvement both in quality and quantity of production in Africa. Dimethoate is a widely used organophosphate and acaricide. TAFGOR (30% EC of Dimethoate) is an Acetylcholine esterase inhibitor and also can be used to show the toxic effect on some legume crops like pigeon pea. It is highly effective in controlling and sucking the pests. It is highly compatible with other insecticides and fungicides. The present paper is aimed at studying the effects of Dimethoate on different pigment contents of widely cultivated crop, pigeon pea (*Cajanus cajan* L.). variety- Manak, Different concentrations of the stress (TAFGOR) were prepared by using distilled water as the solvent from the above stock solution.0,10,20,30,40,50,60,70,80,90,100,200,300,400,500,600,700,800,900,1000PPM. This experiment is done under laboratory conditions with sowing 10 seeds in 21 germination bowls which contain 200 gm. of soil and sand (3:1). The emergence of radicle and plumule is considered as the index of germination. The seedlings are then exposed to light after germination. The following day, after the exposure of seeds to light, there is rapid elongation of radicle and plumule. On 9th day, it is observed that 100% germination in control. So, we observed the germination and leaf emergence of seeds which are shown in different concentrations of TAFGOR, then we measured the length of shoot and root. It is observed with both the fresh weight of root and shoot and dry weight of root and shoot (by keeping in Oven for 15 minutes). On 10th day, in *Cajanus cajan* L. seedlings grow at 0,50,100, 200, 400, 600, 800 and 1000 PPM TAFGOR treatment, we have done the pigment analysis. There is an inverse relationship between the percentage of seed germination and concentration of TAFGOR i.e. with increase in concentration there is decrease in germination of seeds. The morphological studies also show that, at control the length of the shoot and root is maximum, but when the concentration of the stress increases, the length decreases sharply due to more toxicity. At 1000 PPM, the length is recorded minimum. The fresh and dry weight of root and shoot decreases from control to the 1000 PPM of TAFGOR treated seedlings. The pigment content of *Cajanus cajan* L. increases at 400 PPM but after that it decreases with increase in concentration.

I. INTRODUCTION

Pigeon pea belongs to the family Fabaceae. Which is also considered as an Orphan crop, it has a huge untapped potential for improvement both in quality and quantity of production in Africa. These are rich source of protein, carbohydrates and certain minerals. Its seed is made up of three anatomical structures; the seed coat, cotyledons and the embryonic tissue. The cotyledons contain about 90% proteins, 95% fat, 86% carbohydrates, 83% minerals and most of the phosphorus of the whole seed. The seed coat contains most of the non-digestible carbohydrates and relatively higher proportion of calcium and iron. The cotyledons are the major sources of nutrients (Salunkhe et al., 1986). Pigeon pea uniquely combines optimal nutritional profiles and high tolerance to environmental stresses, high biomass productivity Biotic stress occurs as a result of damage done to an organism by other living organisms, such as bacteria, viruses, fungi, parasites. (e.g. insecticides, pesticides and fungicides etc). Pesticides or agro-chemicals are chemicals designed to combat the attacks of various pests in agricultural and horticultural pests. Insecticides are an invaluable tool and anthropogenic stressor widespread environmental occurrence that are subjected to biased perception based on the targeted applications, market value of use and regulatory requirements. Among different insecticides, the organochlorine (OC) insecticides, used successfully in controlling a number in of diseases. The introduction of other insecticides- organophosphate (OP) in the 1960s, carbamates in 1970s, pyrethoids in 1980s contributed greatly to pest control and agricultural output. Dimethoate is a widely used organophosphate and acaricide. TAFGOR (30% EC of Dimethoate) is an Acetylcholine esterase inhibitor and also can be used to show the toxic effect on some legume crops like pigeon pea. It is highly effective in controlling and sucking the pests. It is highly compatible with other insecticides and fungicides.

II.MATERIALS & METHODS

1. SELECTION OF PULSE CULTIVARS: *Cajanus cajan* L. is a common pulse crop in Odisha and is widely cultivated. The seeds of pigeon pea (*Cajanus cajan* L.) of variety Manak, were procured from the Pulse Research Institute (CPRI) Ratanpur, Berhampur.

2.TEST CHEMICAL: - TAFGOR insecticide (Dimethoate) was used as test chemical was guaranteed at reagent from Rallis limited, India. First stock solution was prepared by dissolving 1g of test chemical in 1L of distilled water. Different concentrations of the stress (TAFGOR) were prepared by using distilled water as the solvent from the above stock solution. 10,20,30,40,50,60,70,80,90,100,200,300,400,500,600,700,800,900,1000PPM (different concentrations of solutions) and control was prepared by proportional dilution with distilled water which is used for various treatments.

3. GERMINATION STUDIES: - The seeds of *Cajanus cajan* L. showed 90% germination in few days. For germination studies, plastic bowls were used for the study by making holes at the bottom. Then surface sterilized soil was added to 3/4th volume of bowls. 10 number of seeds were kept in each bowl at uniform distance in all the sets. There are 21 concentrations of this test chemical 100,200,300,400,500,600,700,800,900,1000PPM and control was sprayed on the plastic bowls before adding the seeds to the soil. The bowls were incubated in the dark at room temp (32ºC) and then kept under the light bulb. The emergence of radicle or plumule was considered as an index of germination.

4. MORPHOLOGICAL STUDIES:- The growth of plant was evaluated by measuring the shoot and root length of seedling on 9th day. 15cm. scale was used for the experiment of the shoot and root length. Shoot length & Root length: From each replicate 10 seedlings were selected randomly & length of root and shoot were measured with the help of a scale. Shoot weight & Root weight: Ten seedling of each replicate were taken. The shoots were separated from the roots. These were washed thoroughly, surface dried by means of blotting paper. Then fresh weight of roots & shoots was taken separately by a single pan in a electronic balance. The weighed materials were kept in an oven for 24 hours at a temperature of 80˚C & their dry weight recorded.

5. ESTIMATION OF CHLOROPHYLL:- The fresh samples of shoot materials of the 10 days old seedlings were collected. Care was taken for separation of each control and treated samples. A known quantity of about 100mg of samples of weighed shoot material was taken in a mortar and pestle and macerated to a paste by adding 80% acetone was added, stirred thoroughly and again centrifuged (10min). The pellet was discarded and the supernatant was kept for chlorophyll estimation. The absorbance of each extract was determined in a spectrophotometer at a wavelength of 645 and 663 nm wavelength. The total chlorophyll, chl. a and chl. b content was measured by recording the absorbance of the extract at 645 and 663 nm wavelength and the values were calculated by using the formula given by Arnon (1949).

Chl. a= (12.7× O.D at 663nm) - (2.63× O.D at 645nm)
Chl. b= (22.9× O.D at 645nm) - (4.68× O.D at 663nm)
Total Chlorophyll= (20.2× O.D at 645nm) + (8.02× O.D at 663nm)
Pheophytin = (6.75× O.D at 666 nm) + (26.03× O.D at 666 nm)
Carotenoid = DVK / 2500 [∵ D= O.D at 470 nm, V= volume and K=1(Dilution factor)

III.GRAPHS AND TABLES

Table-1: -Effect of different concentration of insecticide (in PPM) on the seed germination, leaf emergence of *Cajanus cajan* L. noted after 9 days of sowing.

Concentration (in PPM)	Percentage of Seed Germination	Percentage of Leaf Emergence
0 (control)	100	100
10	100	90
20	100	80
30	90	80
40	90	70
50	90	70
60	90	70
70	80	60
80	80	50
90	80	50
100	70	50
200	70	50
300	60	40
400	60	40
500	50	40
600	50	40
700	50	40
800	50	30
900	40	30
1000	40	30

Graph-1:-Clustered column chart showing percentage of seed germination and leaf emergence of *Cajanus cajan* L. seeds treated with different concentrations of insecticide (in PPM) 9 days old seedling.

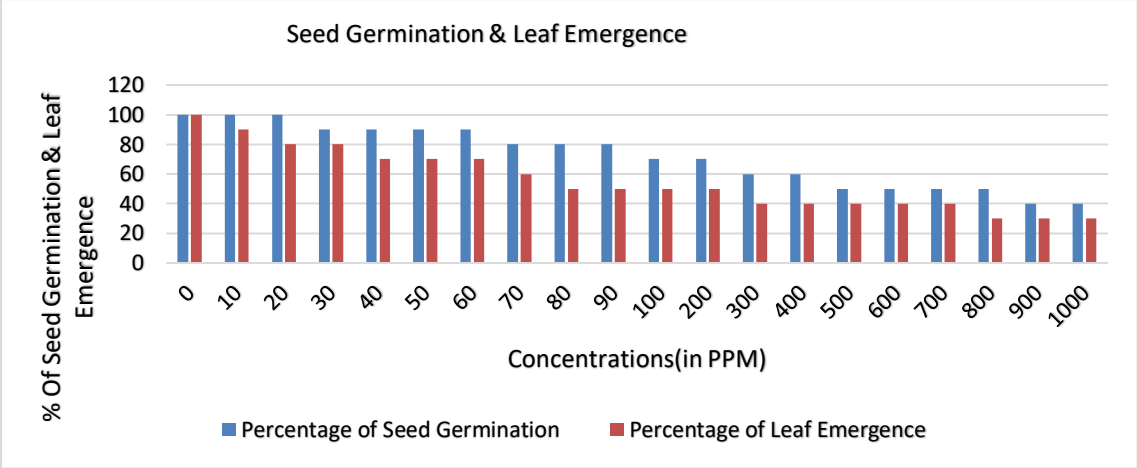
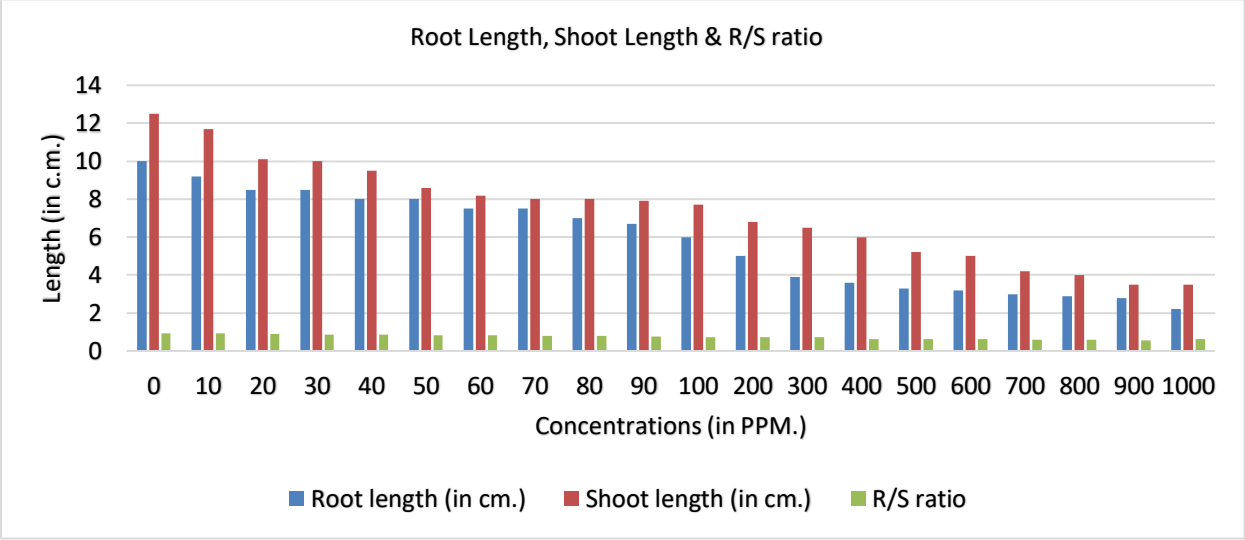


Table 2& 3: - Effect of different concentrations of insecticide (in PPM) on length of root, shoot, R/S ration and % change of fresh and of dry weight of 9 days old. of *Cajanus cajan* L. seedling with control.

Concen--tration (in PPM)	Root length (in cm.)	Shoot length (in cm.)	R/S ratio	% of Fresh weight of Root (in mg.)	% of Fresh weight of shoot (in mg)	% of Dry weight of Root (in mg)	% of Dry weight of Shoot (in mg)
0	10	12.5	0.93	100	100	100	100
10	9.2	11.7	0.93	104	103.63	85.71	88.88
20	8.5	10.1	0.91	128	107.27	85.71	88.88
30	8.5	10.0	0.87	148	109.09	75.00	85.71
40	8.0	9.5	0.85	140	112.72	75.00	85.69
50	8.0	8.6	0.84	176	114.54	71.42	77.77
60	7.5	8.2	0.84	96	98.18	71.42	77.42
70	7.5	8.0	0.80	92	94.54	70.00	74.23
80	7.0	8.0	0.78	84	90.90	67.50	73.67
90	6.7	7.9	0.77	72	83.63	64.20	70.57
100	6.0	7.7	0.73	96.66	88.33	60.10	69.78
200	5.0	6.8	0.72	93.33	88.33	60.10	68.88
300	3.9	6.5	0.71	90.00	83.33	57.54	67.77
400	3.6	6.0	0.64	86.66	76.66	57.03	65.77
500	3.3	5.2	0.63	86.66	71.66	55.24	60.46
600	3.2	5.0	0.62	83.33	70.00	54.00	58.34
700	3.0	4.2	0.60	80.00	61.66	53.76	55.55
800	2.9	4.0	0.60	76.66	55.00	52.96	54.32
900	2.8	3.5	0.57	66.66	51.66	51.50	50.44
1000	2.2	3.5	0.62	63.33	48.33	50.00	46.33

Graph-2:- Clustered column chart showing the length of shoot and root (in cm.) and R/S ration of *Cajanus cajan* L. seed treated with different concentrations of insecticide (in PPM) of 9 days old seedling.



Graph-3:-Clustered column chart showing the percentage of change in fresh and dry weight of root and shoot of *Cajanus cajan* L. seed treated with different concentrations of insecticide (in PPM) of 9 days old seedling.

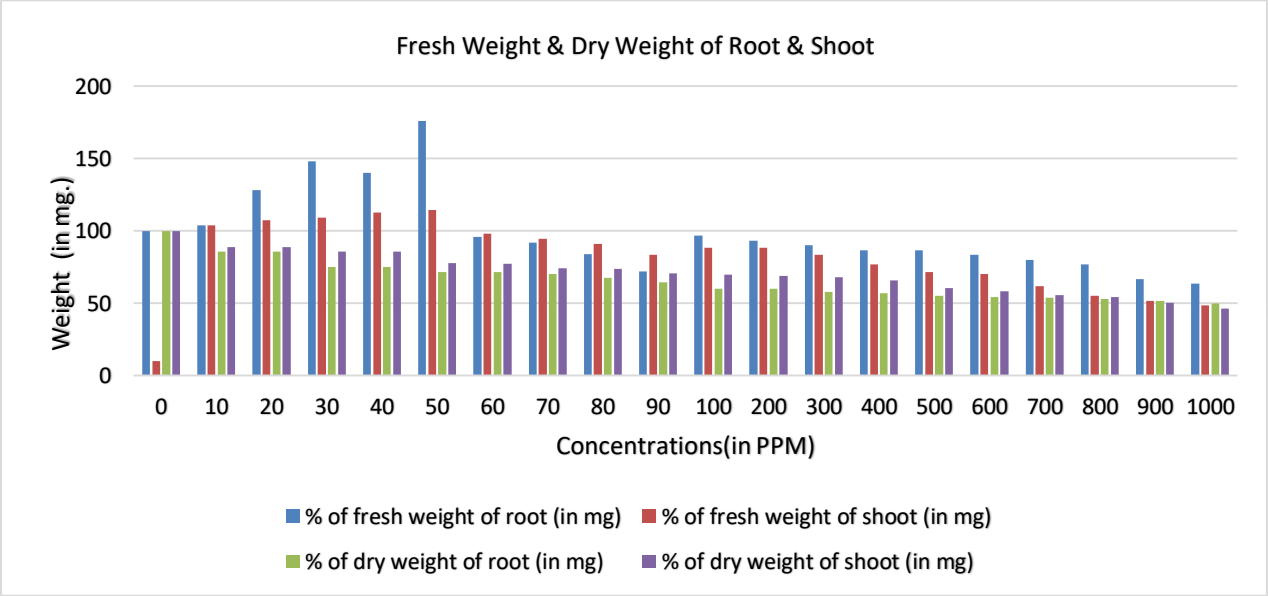
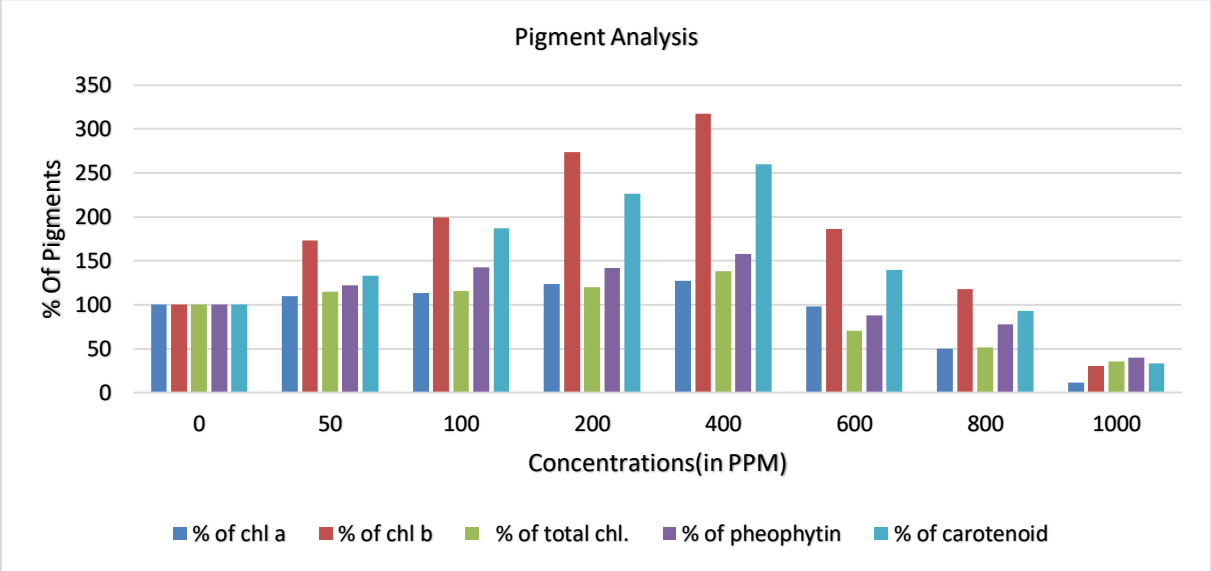


Table- 4: - Effect of different concentrations of insecticide (in PPM) on the fresh weight of *Cajanus cajan* L. seedling of 9 days old and percentage change with control. Figures in parenthesis show the % change (+/-) from the control value.

Concentration (in PPM)	% of chl. a	% of chl. B	% of total chl.	% of pheophytin	% of carotenoid
0 (control)	100	100	100	100	100
50	109.8	173.5	114.8	122	133.3
100	113.3	199.5	115.7	142.4	186.7
200	123.6	274	120	142.1	226.7
400	127.1	317.5	138.3	158	260
600	98.38	186.4	70.42	87.72	140
800	50	117.5	51.31	78.03	93.33
1000	11.39	30.49	35.51	39.98	33.33

Graph-4: - Clustered column chart showing the percentage of change in pigment content (chl. a, chl. b and total chlorophyll) carotenoid and pheophytin of *Cajanus cajan* L. seed treated with different concentrations of insecticide (in PPM) of 9 days old seedling.



IV.RESULT

This experiment is done under laboratory conditions with sowing 10 seeds in 21 germination bowls which contain 200 gm. of soil and sand (3:1). The emergence of radicle and plumule is considered as the index of germination. So, we observed the germination and leaf emergence of seeds which are shown in different concentrations of TAFGOR, then we measured the length of shoot and root. It is observed with both the fresh weight of root and shoot and dry weight of root and shoot (by keeping in Oven for 15 minutes). On 10th day, in *Cajanus cajan* L. seedlings grow at 0,50,100, 200, 400, 600, 800 and 1000 PPM TAFGOR treatment, we have done the pigment analysis. The percentage of germination of seeds of 20 different concentrations along with control are shown in Table-1 and Graph-1. There is an inverse relationship between the percentage of seed germination and concentration of TAFGOR i.e. with increase in concentration there is decrease in germination of seeds. Root and shoot lengths are measured after 9 days of exposure to the test chemical (TAFGOR). Data with respect to root and shoot lengths, Ratio of Root and Shoot lengths and their percent changes are given in Table-2 and Graph-2 and 3. Data clearly indicates that there is a sharp decline in the root and shoot length of seedlings. corresponding to increase in concentration. The ratio of root and shoot length decreases constantly from control (0.93) to 1000 PPM (0.62). The fresh and dry weight of root and shoot 63.33,48.33,50.00,46.33 decreases from control to the 1000 PPM of TAFGOR treated seedlings. There are visible morphological changes seen in the roots which appear different from that of the control. Roots become short in higher concentrations of TAFGOR and developments of lateral roots are less in comparison to the control.

Pigments viz. Chlorophyll-a, Chlorophyll-b, total Chlorophyll, Pheophytin and Carotenoids are presented in Table-3, and Graph-4 At the 400 PPM the chlorophyll-a percentage increases upto 127.10% and finally it decreases to 11.39%. chlorophyll-b is 317.53% and decreases to 30.49%. total chlorophyll increases upto 138.29%. At 1000 PPM the percentage of total chlorophyll is 35.51%. carotenoid is increases upto 260%. At 1000 PPM of carotenoid is 33.33%. and at 400 PPM the percentage of pheophytin is 158.01%. At 1000 PPM the percentage of pheophytin is 39.98%. The pigment content increases and finally it decreases because of more toxicity.

V.DISCUSSION

The productivity of pigeon pea is remained stagnant in India in recent years due to lack of suitable seed production technology, inefficient harvest and post-harvest operations, improper storage, management practices etc. pigeon pea seed is bound to deteriorate both quantitatively and qualitatively due to attacks of several insect pests at both pre and post-harvest stages. Among several insect pests, pulse beetle or bruchid is a serious storage pest which causes major losses in pigeon pea as it lays eggs on seeds in field itself, even before harvest and becomes a serious pest during storage. There is a need to preserve high quality of pigeon pea seeds by controlling storage pests at both pre-and post-harvest levels by using suitable chemicals. Under this background, the present studies were conducted to know the effect of stages of harvesting, pre-harvest period. Storage fungi have been reported to invade and destroy seeds of several species (Gupta et al., 1993). Under favorable conditions they can invade any kind of seeds.

VI.SUMMARY AND CONCLUSION

The percentage of seed germination is maximum which decreases on increasing the concentration of the TAFGOR. It shows the sharp declination of the seed germination percentage from control to 1000 PPM. The morphological studies also show that, at control the length of the shoot and root is maximum, but when the concentration of the stress increases, the length decreases sharply due to more toxicity. At 1000 PPM, the length is recorded minimum. The fresh and dry weight of root and shoot decreases from control to the 1000 PPM of TAFGOR treated seedlings. The pigment content of *Cajanus cajan* L. increases at 400 PPM but after that it decreases with in concentration.

VII.REFERENCES

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