

Effect of 2,4 D Pesticide on the Seedling and Germination of “*Vigna unguiculata*” (cowpea)

P. Ganga suresh¹, M.Rajkumarbharathi²

¹Sri Ram Nallamani Yadava college of arts and science, Kodikurichi-627 804, Tamilnadu.

²Sri Paramakalyani Centre for Environmental Sciences, Manonmaniam Sundaranar University, Alwarkurichi – 627 412, Tamilnadu.

Abstract - The organic herbicides are cheaper, more effective and possess long soil persistence. They are generally less toxic to animals than other pesticides. 2,4D (2,4 Dichlorophenoxy acetic acid) is the most effective post emergence herbicide. The present investigation is to study the biochemical effect of foliar spray and use of herbicides on “*Vigna unguiculata*” (cowpea) post emergence herbicide (2,4D) increase the growth of *Vigna unguiculata* at the 5 ppm concentration. The application of 2,4D also increases the content of total protein, nitration and legheamoglobin. The enzyme peroxidase and nitrate reductase activity was also increased at 5 ppm concentration.

I. INTRODUCTION

Over 100 organic herbicides are available for weed control in the USA. The number of extents considerably if the numerous formulations considered. The herbicides are classified into seven types such as growth regulator, amino acid synthesis inhibitors, lipid synthesis inhibitor, seedling growth inhibitors, photosynthesis, cell membrane disruptors and pigment inhibitors (Jeffrey L. Gunsolus, 2002).

The organic herbicides are cheaper, more effective and possess long soil persistence. So it leads to long environmental problems (CRC hand book volume III). They are generally less toxic to animals than other pesticides. The organic herbicides are applied to the plant through foliage or roots. All the herbicides may affect the herbs and they also reduce the crop yield at high concentration change the biochemical and physiological aspects. In the present study the growth regulator herbicides like 2,4D.

2,4 D is the most effective post emergence herbicides. It is the member of the phenoxy family of herbicides, may be classified under in growth regulators. It was introduced in 1946 in the form of chlorinated or astragalus and is one of the fastest growing herbal medicines in the world. The main uses in agriculture are wheat and small grains, sorghum, maize, rice, sugarcane, low soybean, border land and pasture. It is also used for roadside, non-crop areas, forest, lawn and field care and mourning rights (Swansboro, 2004). It was applied to foliage in plants of *Vigna unguiculata*.

Vigna unguiculata (cowpea) belongs to the family leguminasea, subfamily fabaceae and Genus vigna. It is grown throughout India for its long green pods are vegetable seeds as pulp and foliage as vegetable and as fodder. *Vigna unguiculata* (cowpea) can be grown successfully both in spring summer and rainy seasons in logging. According to Vard court (1970) there are five subspecies of *Vigna unguiculata* which is classified on the basis of variations in growth habit, size and position of pods, shape and colour of seeds. Two subspecies are wild type and other three are cultivars. *Vigna sinensis* are the subspecies of *Vigna unguiculata*. It is a common cow pea consists of small seeds of 30-90 cm long plant (Sampson, 1936).

II. MATERIALS AND METHODS

Soil: Red soil and dry manure were used in the ratio of 2:1 for our study

Seeds: Uniform size seeds of *Vigna unguiculata* were selected. They were surface sterilized by 0.1% mercuric chloride. 10 seeds were sown in each pot for our experimental work.

Herbicide and Treatments:

The foliar spray herbicide 2,4 – D was choosen and was dissolved in 100ml of water. From this different ppm solution (5,25,50,100 ppm) was prepared for application.

Irrigation:

Water was irrigated daily.

Observation:

On the 15th day, the plant were treated with 5,25, 50,100 ppm of 2,4 D war given as foliar spray. Sampling was done on the 5th, 10th, and 15th day after treatment.

BIOCHEMICAL ANALYSIS

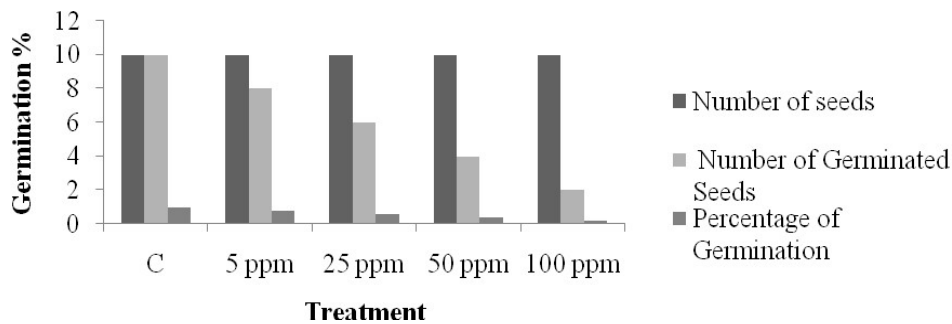
The various biochemical analysis such as aminoacid, proline, phenol, chlorophyll, nitrogen, acetic acid, leghaemoglobin, peroxidase, protein and nitrate reductase were made at the different time interval by Sadhasivam and Manickam (2005).

III. RESULTS AND DISCUSSION

Effect of 2,4D on germination of seeds of Vigna unguiculata

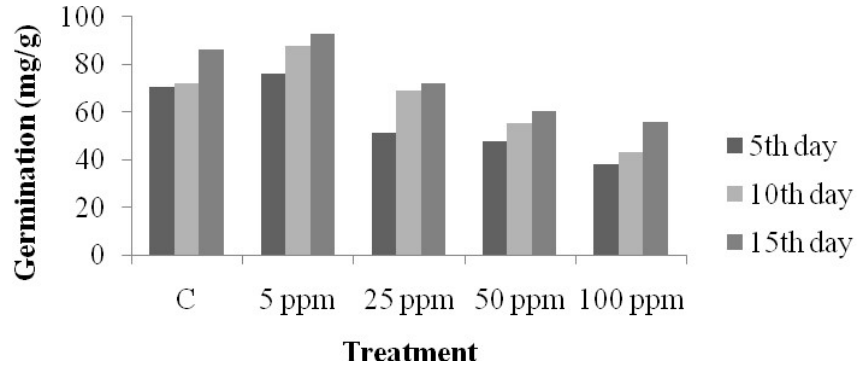
The percentage of germination is decreased when increased the concentration of 2,4D herbicide in comparison to control at early stage of growth but plant recouped at later stage. The King *et al* 1951 have reported that 2,4 D are strongly inhibitory to seedling establishment di cotyledons are more severely affected mono cotyledons are also sensitive that the elongation of the radical. 10 seeds were sown in each pot for our experimental work. Of these 10 seedling were found in the control pot. 8 seeds were germinated in the 5 ppm concentration of 2,4 D and 7 seeds were germinated in 25 ppm concentration. 5 seeds were germinated in the 50 ppm concentration. (Graph 1).

Table1. Effect of different concentration of 2,4D on the germinated seeds (%)

*Morphological effect of 2,4D on day after the treatment*

A bending of stems or leaf petioles down wards when application of 2,4 D to the plant *Vigna unguiculata*, similar effects with 2,4D reported in sugar beet by Jeffrey and Gunsolus (2002). The gall us formation also after herbicide treatment plant compared to control. In freshly excised, tissue cell division take place only in presence of 2,4D while increase in RNA and Protein procide the addition of 2,4D, DNA synthesis is promoted only in association with cell division after 2,4D has been added. A synthetic auxin such as 2,4D has been reported as the agent necessary for the initial induction of callus formation (Atkin and Barton, 1973) chang and foy, 1971 reported that seedling inhibited by auxin herbicide are typically severely mal formed and may show abnormal swelling and callus growth (Graph 2).

Table 2. Effect of different concentration of 2,4D on the total protein content (mg/g) in leaves fresh weight of *Vigna unguiculata*.



Effect of 2,4D on total protein, total nitrogen and total free amino acid content in leaves

The protein and total nitrogen content are increased at 5ppm concentration of 2,4D compared with control. Increased the concentration of 2,4D decreased the concentration of both total protein and total nitrogen content. The concentration of total protein was increased in 5 ppm concentration than the con troll and decreased in the concentration of 25 ppm, 50 ppm and 100 ppm respectively. The observations were made in the 5th day, 10th day and 15th day of germination. (Graph 3 and 4).

Table 3. Effect of different concentration of 2,4D on the total nitrogen content (mg/g) in leaves fresh weight of *Vigna unguiculata*.

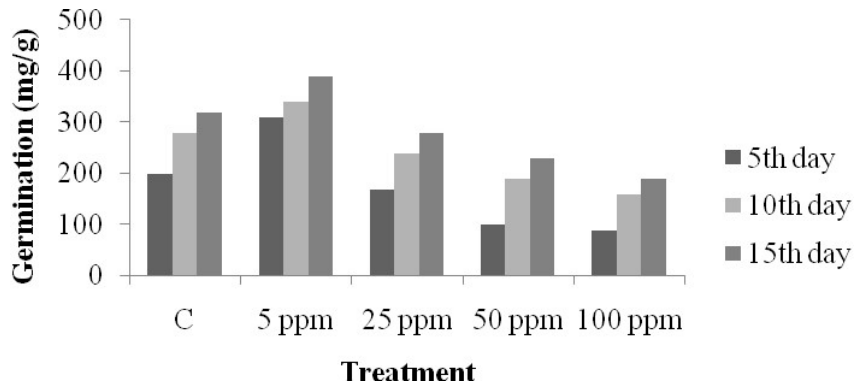
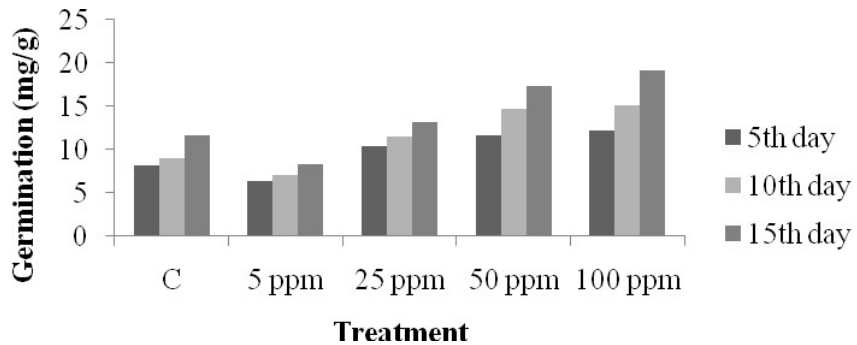


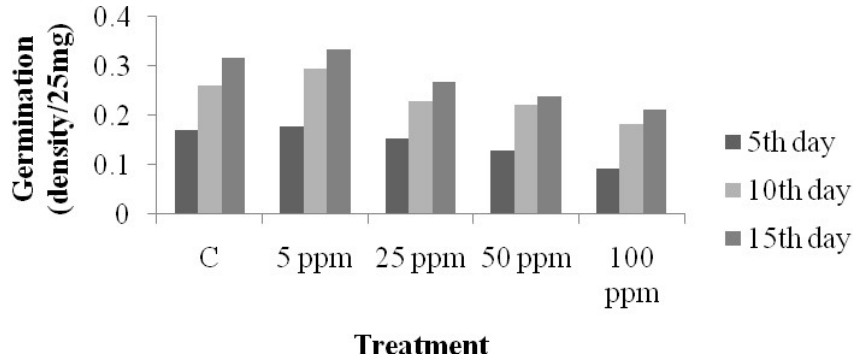
Table 4. Effect of different concentration of 2,4D on the total free amino acid content (mg/g) in leaves fresh weight of *Vigna unguiculata*.



Effect of 2,4D on leg haemoglobin content as optical density/25mg nodule fresh. Weight of Vigna unguiculata

On the 5th, 10th, 15th, day the nodule number in 5ppm concentration of 2,4D increase the over the control. 2,4 D atrazine and simazine at low concentration in pisum. Sativum and *Vigna sinensis* had little effect of nodulation but high concentration adversely affected the nodulation and nitrogen fixation. 5ppm had greater amount of legheamoglobin content when compared to that of control. There is also gradual reduction in 25/50 ppm and 100 ppm. There is due to inhibitory effect on nodulation. Amount of nitrogen fixed would be very low due to lesser haemoglobin content (Graph 5).

Table 5. Effect of different concentration of 2,4D on the leg haemoglobin content as optical density/ 25mg nodules in leaves fresh weight of *Vigna unguiculata*.



Effect of 2,4D on peroxidase and nitrate reductase activity in fresh leaves of Vigna unguiculata

The peroxidase activity was increased than the control in all the concentration in all days of germination. The nitrate reductase activity was also increased more are less same in the concentration to control. (Graph 6 and 7).

Table 6. Effect of different concentration of 2,4D on the peroxidase content (units/g) in leaves fresh weight of *Vigna unguiculata*.

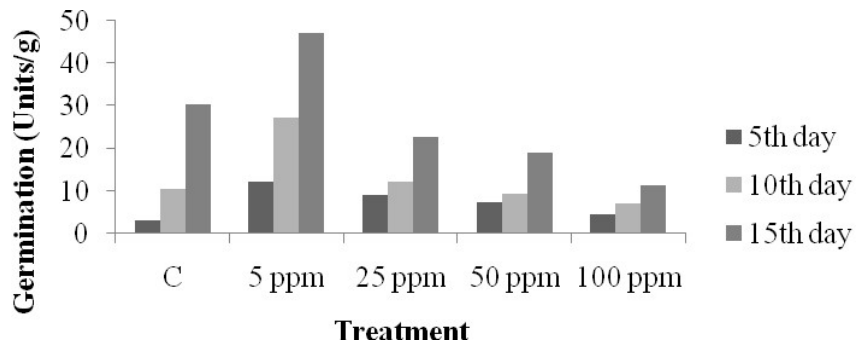
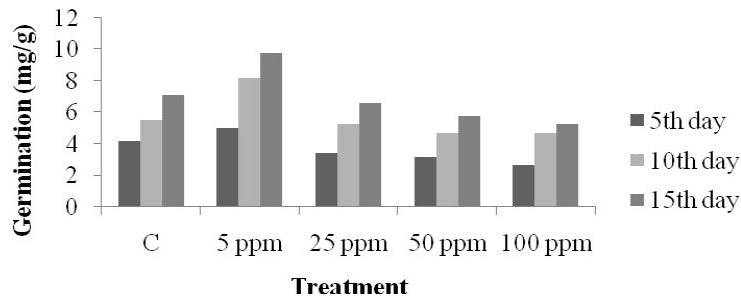


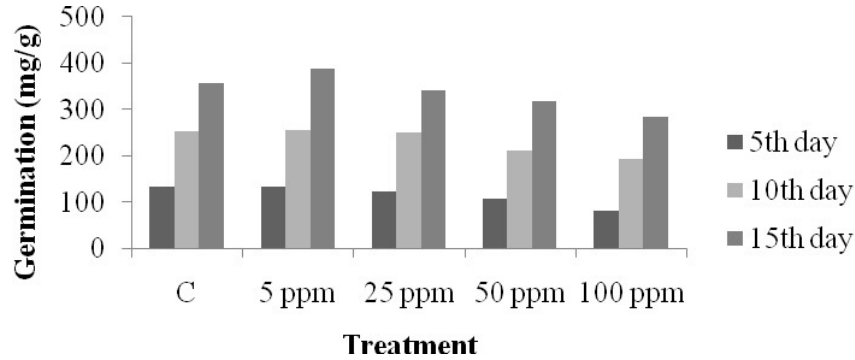
Table 7. Effect of different concentration of 2,4D on the nitrate reductase content (mg/g) in leaves fresh weight of *Vigna unguiculata*.



Effect of 2,4D on chlorophyll content in fresh leaves of Vigna unguiculata

On 5th, 10th, 15th day, the chlorophyll content of leaves were decreased when increasing the concentration of 2,4 D herbicide. It was increased only at 5ppm concentration in comparison to control is depicted (Graph 8).

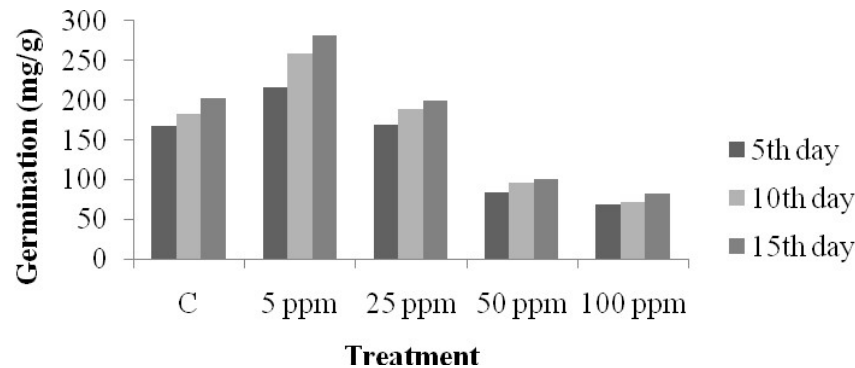
Table 8. Effect of different concentration of 2,4D on the chlorophyll content (mg/g) in leaves fresh weight of *Vigna unguiculata*.



Effect of 2,4D on indole acetic acid content of fresh leaves of Vigna unguiculata

The concentration of indole acetic acid is increased at 5ppm concentration and decreased at increasing the concentration of 2,4D is depicted. The growth regulator (2,4D) act as a synthetic auxin that disrupt hormone balance (Jeffrey L.Gunsolus) (Table 9).

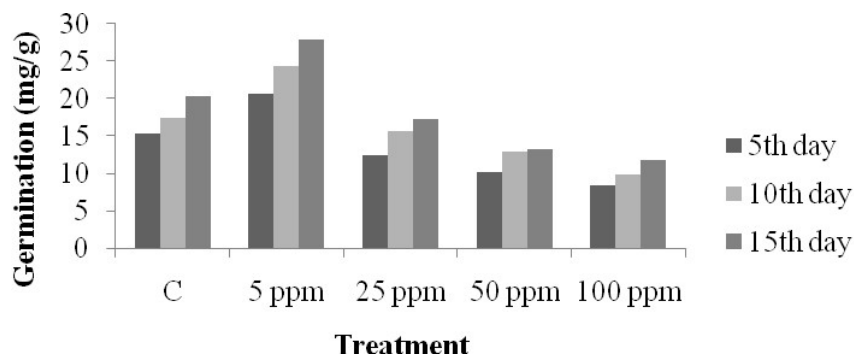
Table 9. Effect of different concentration of 2,4D on the indole-3-acetic acid content (mg/g) in leaves fresh weight of *Vigna unguiculata*.



Effect of 2,4 D on phenol content in fresh leaves of Vigna unguiculata

Aromatic compounds with phenols, hydrolyzed groups are widely found in the plant kingdom. They are present in all parts of the plant. Phenols are resistant to diseases and pests in plants. The phenol concentration is also decreased when increasing the concentration of 2,4D on 5th, 10th, 15th day plant. It was increased only at 5 ppm concentration in comparison to control is increased (Table 10).

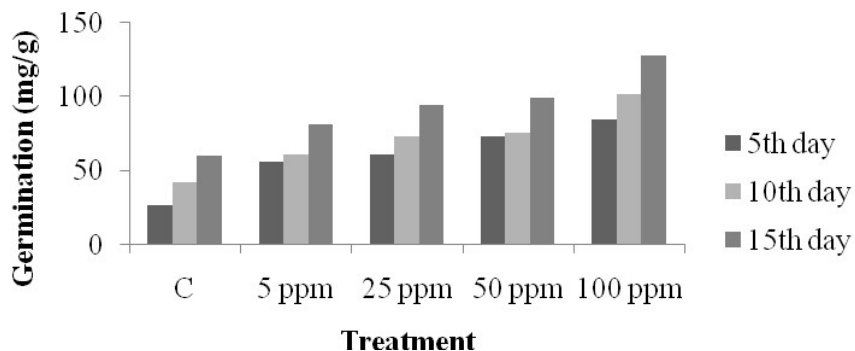
Table 10. Effect of different concentration of 2,4D on the phenol content (mg/g) in leaves fresh weight of *Vigna unguiculata*.



Effect of 2,4D on proline content in fresh leaves of *Vigna unguiculata*

Proline is a basic amino acid in high percentage in basic proteins. Free proline is said to play a role in plants under stress conditions. Many workers have reported a several fold increase in the proline content under physiological and biological stress condition. From on 5th, 10th, 15th day analysis the proline content is increased when increasing the concentration of 2,4 D in comparison to control is depicted (Table 11).

Table 11. Effect of different concentration of 2,4 D on the proline content (mg/g) in leaves fresh weight of *Vigna unguiculata*.



Post emergence herbicide (2,4 D) is increased the growth at 5ppm level and decreased the growth when increasing the concentration of 2,4D. The total protein, total nitrogen, leghaemoglobin is increased at 5ppm. Increased concentration of 2,4D decreases the content of total protein, nitrogen and leghaemoglobin. The peroxidase and nitrate reductase enzyme activity also increased at 5ppm and its activity is low when increasing the concentration of 2,4 D. Chlorophyll content also increased at low concentration. It also decreases the increased concentration of 2,4 D. From this result suggest that 5ppm level of herbicide can be used in the field.

IV. SUMMARY AND CONCLUSION

Post emergence herbicide (2,4 D) increases the growth at 5 ppm level and decreased the growth when increasing the concentration of 2,4 D. The total protein, total nitrogen, leghaemoglobin was increased at 5 ppm. The increased concentration of 2,4 D decreases the content of total protein, nitrogen and leghaemoglobin. The peroxidase and nitrate reductase enzyme activity was also increased at 5 ppm.

REFERENCES

- [1] Atkin, R.K. And Barton, G.E. (1973). *J.exp.Bot.*24, 689-699.
- [2] CRC hand book of pest management in agriculture volume III 75-77.
- [3] King, L.J and Kramer, JA, Boyce Thompson Inst. Pl. Res 1951, 16.267 J.L Gunsolus (2002) Herbicide Resistant weeds (Reviewed 1999) Regional Extension Publication 468.
- [4] Jeffrey L.Gunsolus (2002) Herbicide mode of action (Reviewed 1999) Regional Extension Publication No 372.
- [5] Swansboro, (2004) Industry Task force II on 2,4 D Research DATA. Pp. 247-25.
- [6] Sadhasivam, S.and Manickam, A. 2005. Biochemical methods. New age international publishers pvt ltd, New Delhi. Pp. 33-211.
- [7] Sampson (1936) Kew Bull Addl.Ser 12, p234.
- [8] Vardcourt, B. (1970) Kew Bull., 24: 507-69.