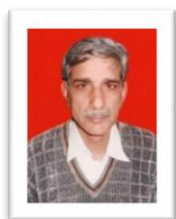


Effect of Various Concentrations of Rogor and Nuvan on Nitrogen Fixcation Parameters of *Vigna Mungo*



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Abstract

The pesticides are of great importance as they control the growth of pests on crops. These chemicals check the germination, growth and multiplication of pathogens or directly destroy them by toxicity. However, serious limitations for using these pesticides have been highlighted in recent years like accumulation of pesticide residues in crops and other products, which are used as food and fodder. The overuse of these pesticides not only cause environmental pollution but also affects other parameters of crop plants especially growth, physiology, yield and nodule formation in legume plants and also other nitrogen fixation parameters. Use of such chemicals no doubt eradicates the fungi and insects from legume plants but the use of these chemicals may adversely affect growth and nitrogen fixation.

The crop selected for present studies i.e. *Vigna mungo* (urdbean) is important pulses of north India. Studies on effect of pesticides on plant growth and nitrogen fixation parameters of this legume was conducted and following parameters were selected for investigation. Effect of pesticides on nitrogen fixation parameters - nodule number, nodule volume, nodule fresh weight, nodule dry weight, infected and non-infected area of nodule. The nodulation parameters are also affected by pesticides concentration in both the crops. Very less effect was recorded in lower concentration, i.e., 0.5% but as the concentration of pesticides is increased there is progressive decrease in nodule number, nodule fresh weight, dry weight, infected and non-infected area, etc. The decrease in nodulation parameters with increasing concentration of pesticide is comparable with the findings of Mehta and Johari (1985), Johanson and Home (1973). The decreased nodulation parameters may be attributed to high chemical pesticides, which decrease the growth of bacteria in soil or check interaction of rhizobia with legumes. It is, therefore, concluded that the nodulation parameters, i.e., nodule number, nodule fresh weight, nodule dry weight, and infected, non-infected and cross-section area of nodules have similar response to pesticide concentrations, being inhibitory on increasing the concentration of pesticides.

Keywords: *Vigna*, Rogor, Nuvan, Nodules.

Introduction

Nodules, the site for symbiotic nitrogen fixation, generally develop in root by the division of cortical cells of root after the entry of nitrogen fixing bacteria *Rhizobium* in them, mostly in leguminous plants. According to Jordan (1984), there are about 700 genera and about 14000 species of leguminous plants of which about 20% are able to produce root nodules (Hopkins, 1999). However, only about 0.5% of the leguminous plants have been studied in relation to the nodule bacteria (Jordan, 1984). The symbiosis between rhizobia and legumes is the main source of biologically fixed nitrogen for the agricultural system. To understand the environmental effect of symbiosis, there is a need to study the development of the root nodules in which nitrogen fixation takes place (Hungria and Bohrer, 2000).

For the present study, nodulation parameters – nodule number, nodule fresh weight, nodule dry weight and developmental aspects as infected and non-infected area of the nodules were considered to observe effect of pesticides (rogor and nuvan) on the root nodules of *Vigna mungo*.

Aim of the Study

The aim of the current studies is to find the Effect of various concentrations of rogor and nuvan on nitrogen fixation parameters of *vigna mungo*.

Review of Literature

Alexander D B and Zuberer D A in the year 1989 studied the Impact of soil environmental factors on rates of N₂ fixation associated with roots of intact maize and sorghum plants. In the year 1980 Bal A K, Shantharam S and Verma D P S analysed Changes in the outer cell wall of Rhizobium during development of root nodule symbiosis in Soybean. Becker M, Ladha J K and Ottow J C G in 1990 studied the Growth and nitrogen fixation of two stem-nodulating legumes and their effect as green manure on lowland rice. Bergersen F J and Briggs B J in 1958. Studies on the bacterial component of soybean root nodule: Cytology and organization in host tissue. Burns R C and Hardy R W F (1975) Nitrogen fixation in bacteria and higher plants. pp 1-189. Goodchild D J and Bergersen F J in the year 1966 Electron microscopy of the infection and subsequent development of soybean nodule cells.

Materials and Methods

The study of different nodulation parameters was done on per plant basis by taking nodule number, nodule fresh weight and nodule dry weight. The plants were uprooted from wet fields and roots were washed carefully to remove soil particles. The nodules were separated with the help of forceps, washed and counted. Fresh weight of nodules was taken after properly blotting the nodules to remove extra water. For taking dry weight, the nodules were first kept in oven at 80°C (±2°C) for 24 hours.

For the analysis of infected and non-infected area of the root nodule, the nodules of control and treated plants were harvested, washed and fixed in FAA. The fixed nodules were washed, dehydrated and cleared in alcohol : xylol series and infiltrated with wax. Blocks were prepared and microtomed. The sections were spreaded and stained with metachromatic toluidine blue, differentiated in alcohol and after dehydration and clearing mounted in DPX. From these sections infected and non-infected areas of the nodules were noted. More details of the methods are described in chapter 3, i.e., materials and methods.

Results and Discussion

The results of effect of various concentration of rogor on nitrogen fixation parameters of *Vigna mungo* sample I are shown in table 1 and fig. 1 A, B and C, which showed that the nodule numbers were 10.08, 10.07, 9.25, 8.73, 8.10, 7.35, 6.57, 4.56. The nodule fresh weights were 0.278, 0.277, 0.245 mg, and 0.223, 0.185, 0.162 mg, and 0.137, 0.108 mg. The nodule dry weights were 0.037, 0.036, 0.040 mg, and 0.050, 0.015, 0.013 mg, and 0.020, 0.005 mg. The infected nodule areas were 6.15, 6.14, 6.09 mm², and 5.97, 5.63, 5.14 mm², and 4.59, 3.94 mm². The non-infected areas were 1.20, 1.19, 1.03 mm², and 0.98, 0.87, 0.64 mm², and 0.49, 0.37 mm² and the cross-section areas of nodules were 7.35, 7.33, 7.12 mm², and 6.95, 6.50, 5.78 mm², and 5.08, 4.31 mm² for increasing concentrations of rogor, i.e., 0.0%, 0.5%, 1.0%, 1.5%, 2.0%, 2.5%, 5.0% and 7.5% respectively for all the above parameters. No results were obtained for 10.0% Rogor concentration.

The results shown in table 2 and figure 2A, B

and C are for the effects of various concentrations of rogor on nitrogen fixation parameters of *Vigna mungo* sample II which indicated that the number of nodules were 11.01, 11.02, 10.04, 9.21, 8.74, 8.12, 7.34, 5.12, the fresh weights of nodules were 0.289, 0.288, 0.254 mg, and 0.235, 0.194, 0.167 mg, and 0.135, 0.109 mg. The dry weights of nodules were 0.036, 0.034, 0.028 mg, and 0.022, 0.015, 0.014 mg, and 0.01, 0.008 mg. The infected areas of nodule were 6.19, 6.18, 6.08 mm², and 5.97, 5.55, 5.12 mm², and 4.52, 3.92 mm². The non-infected areas of nodules were 1.13, 1.12, 1.05 mm², and 0.98, 0.85, 0.63 mm², and 0.491, 0.344 mm² and the cross-section areas of nodules were 7.32, 7.3, 7.13, 6.95, 6.4, 5.75, 5.01, 4.26 mm² for increasing concentrations of rogor on *Vigna mungo*, i.e., 0.0%, 0.5%, 1.0%, 1.5%, 2.0%, 2.5%, 5.0%, 7.5% respectively in all the above parameters. No results were obtained at 10.0% concentration of pesticide.

The results depicted in table 3 and figure 3A, B and C are for the effects of various concentrations of nuvan on nitrogen fixation parameters of *Vigna mungo* sample I which indicated that the number of nodules were 10.89, 10.88, 9.36, 8.74, 8.10, 7.35, 6.57, 4.52. The fresh weights of nodules were 0.278, 0.277, 0.246 mg, and 0.223, 0.186, 0.164 mg, and 0.134, 0.103 mg. The dry weights of nodules were 0.033, 0.032, 0.027 mg, and 0.014, 0.013, 0.011 mg, and 0.010, 0.007 mg. The infected areas of nodule were 6.17, 6.161, 6.08 mm², and 5.97, 5.63, 5.19 mm², and 4.56, 3.92 mm². The non-infected areas of nodules were 1.13, 1.14, 1.08 mm², and 0.98, 0.87, 0.64 mm², and 0.49, 0.34 mm² and the cross-section areas of nodules were 7.30, 7.28, 7.16 mm², and 6.95, 6.50, 5.83 mm², and 5.05, 4.26 mm² for increasing concentrations of nuvan on *Vigna mungo*, i.e., 0.0%, 0.5%, 1.0%, 1.5%, 2.0%, 2.5%, 5.0%, 7.5% respectively in all the above parameters. No results were obtained at 10.0% concentration of pesticide.

The results of effects of various concentrations of nuvan on nitrogen fixation parameters of *Vigna mungo* (sample II) are shown in table 4 and figure 4 A, B, C. The results showed that the number of nodules were 11.09, 11.08, 10.07, 9.25, 8.52, 7.34, 6.52, 4.18. The fresh weights of nodules were 0.277, 0.276, 0.252 mg, and 0.240, 0.196, 0.171 mg, and 0.138, 0.119 mg, the dry weights of nodules were 0.034, 0.033, 0.027 mg, and 0.023, 0.019, 0.018 mg, and 0.017, 0.004 mg. The infected areas of nodules were 6.13, 6.12, 6.04 mm², and 5.97, 5.63, 5.14 mm², and 4.57, 3.97 mm². The non-infected areas of nodules were 1.15, 1.14, 1.05 mm², and 0.97, 0.84, 0.65 mm², and 0.49, 0.37 mm². The cross-section areas of the nodules were 7.28, 7.26, 7.09, 6.94, 6.47, 5.79, 5.06, 4.34 mm² for increasing concentration of nuvan, i.e., 0%, 0.5%, 1%, 1.5%, 2%, 2.5%, 5%, 7.5%, respectively in all the above parameters. No results were obtained at 10.0% concentration.

Conclusion

As shown by the above results, the nodulation parameters were affected by different effluent concentrations in both the crops. Very less effect was recorded in lower concentration, i.e., 0.5%

but as the concentration of pesticide was increased then there was a progressive decrease in nodule number, nodule fresh weight, nodule dry weight, infected and non-infected areas and cross section area of nodules. The decrease in nodulation parameters with increasing concentrations of pesticides is comparable with the findings of Mehta and Johari (1985), Johanson and Hume (1973).

The decreased nodulation parameters may be attributed to high concentration of pesticide, which either decreases the number and growth of bacteria in soil or check interaction of rhizobia with legumes. It is therefore concluded that the nodulation parameters, i.e., nodule number, nodule fresh weight, nodule dry weight, nodule infected, non-infected and cross-section areas of nodules have similar response to different pesticide concentrations being inhibitory to these nodule parameters with increasing concentrations of pesticides.

Reference

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Table 1 Effects of Various Concentrations of Rogor on Nitrogen Fixation Parameters of *Vigna mungo* (Sample I)

Treatment	Nodule Number	Nodule Fresh Weight	Nodule Dry Weight	Infected Area	Non Infected Area	Cross Section Area
0.0 %	10.08±0.89	0.278±0.03	0.049±0.00	6.15±0.54	1.20±0.06	7.35
0.5 %	10.07±0.81	0.277±0.03	0.046±0.00	6.14±0.46	1.19±0.14	7.33
1.0 %	9.25±0.76	0.245±0.02	0.040±0.00	6.09±0.43	1.03±0.02	7.12
1.5 %	8.73±0.64	0.223±0.02	0.030±0.00	5.97±0.39	0.98±0.03	6.95
2.0 %	8.10±0.57	0.185±0.01	0.015±0.00	5.63±0.26	0.87±0.03	6.50
2.5 %	7.35±0.54	0.162±0.01	0.013±0.00	5.14±0.22	0.64±0.04	5.78
5.0 %	6.57±0.52	0.137±0.01	0.011±0.00	4.59±0.17	0.49±0.05	5.08
7.5 %	4.56±0.49	0.108±0.01	0.005±0.00	3.94±0.16	0.37±0.02	4.31
10.0 %	0.00	0.00	0.00	0.00	0.00	0.00

Figure 1(A) Effects of Various Concentrations of Rogor on Nodule Number of *Vigna mungo* (Sample I)

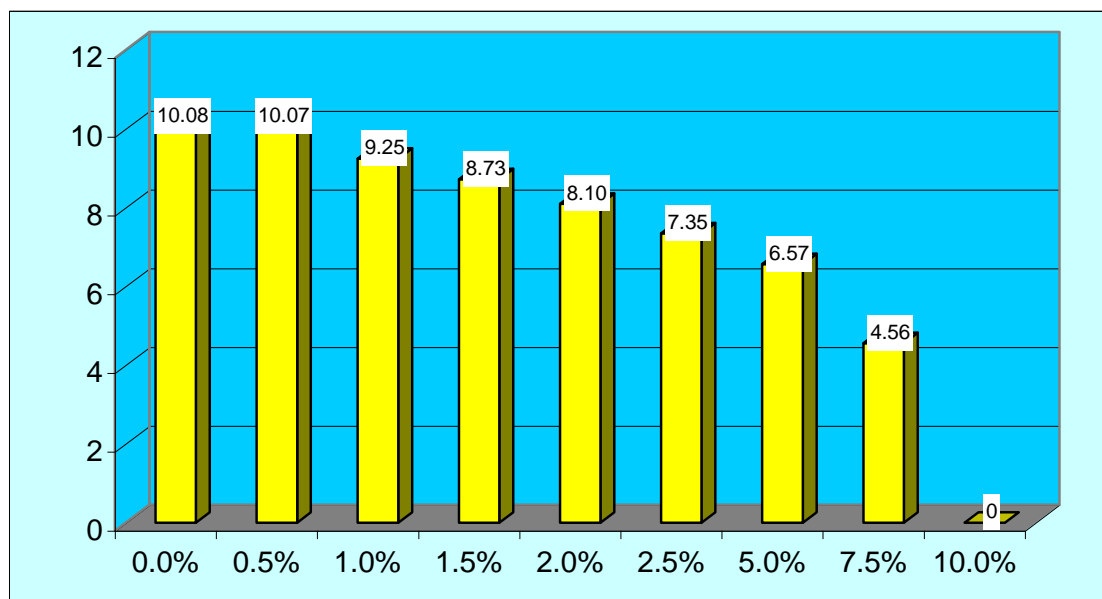


Figure 1(B) Effects of Various Concentrations of Rogor on Nodule Fresh Weight and Dry Weight of *Vigna mungo* (Sample I)

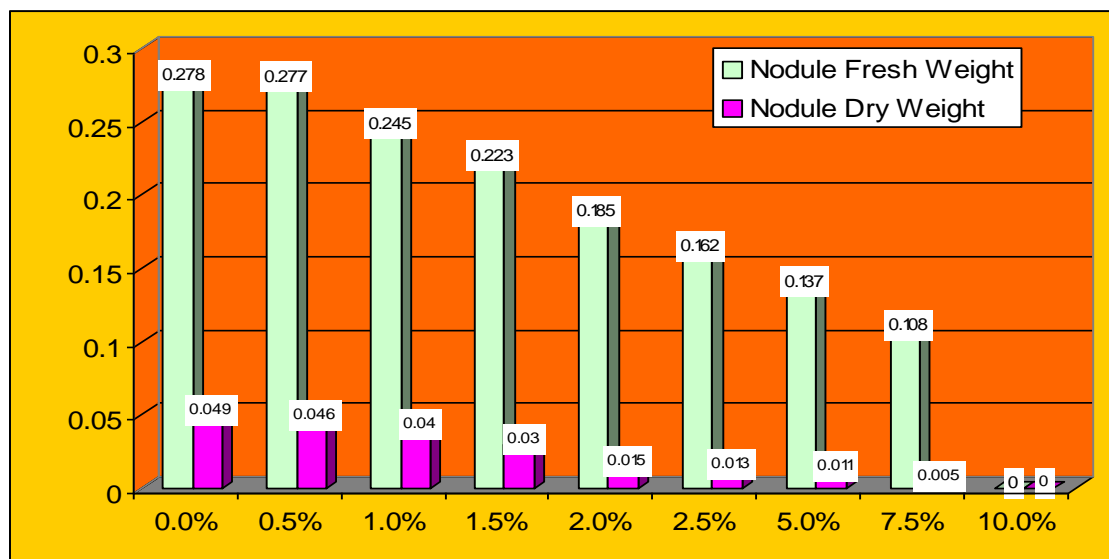


Figure 1(C) Effects of Various Concentrations of Rogor on Nodule Infected, Non infected and Cross Sectional Area of *Vigna mungo* (Sample I)

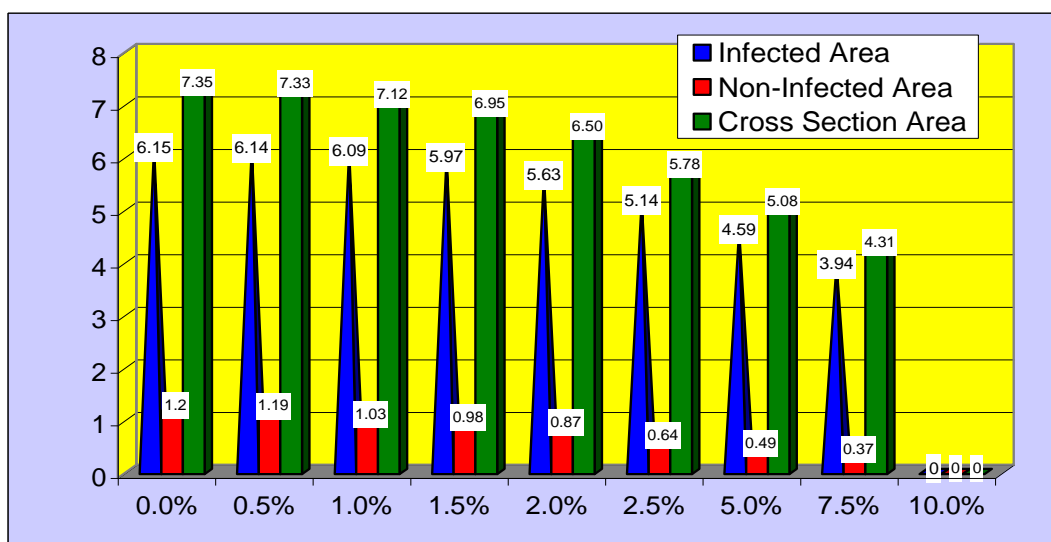


Table 2 Effects of Various Concentrations of Rogor on Nitrogen Fixation Parameters of *Vigna mungo* (Sample II)

Treatment	Nodule Number	Nodule Fresh Weight	Nodule Dry Weight	Infected Area	Non Infected Area	Cross Section Area
0.0 %	11.01±0.91	0.289±0.03	0.036±0.00	6.19±0.58	1.13±0.18	7.32
0.5 %	11.02±0.84	0.288±0.03	0.034±0.00	6.18±0.54	1.12±0.14	7.30
1.0 %	10.04±0.78	0.254±0.03	0.028±0.00	6.08±0.47	1.05±0.10	7.13
1.5 %	9.21±0.64	0.235±0.02	0.022±0.00	5.97±0.42	0.98±0.09	6.95
2.0 %	8.74±0.61	0.194±0.02	0.015±0.00	5.55±0.38	0.85±0.08	6.40
2.5 %	8.12±0.59	0.167±0.02	0.014±0.00	5.12±0.29	0.63±0.06	5.75
5.0 %	7.34±0.54	0.135±0.01	0.010±0.00	4.52±0.21	0.49±0.05	5.011
7.5 %	5.12±0.49	0.109±0.01	0.008±0.00	3.92±0.19	0.34±0.04	4.264
10.0 %	0.00	0.00	0.00	0.00	0.00	0.00

Figure 2(A) Effects of Various Concentrations of Rogor on Nodule Number of *Vigna mungo* (Sample II)

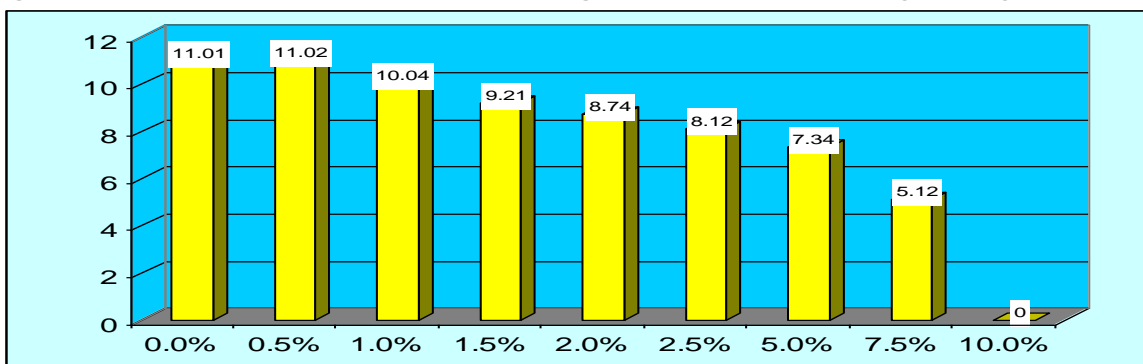


Figure 2(B) Effects of Various Concentrations of Rogor on Nodule Fresh Weight and Dry Weight of *Vigna mungo* (Sample II)

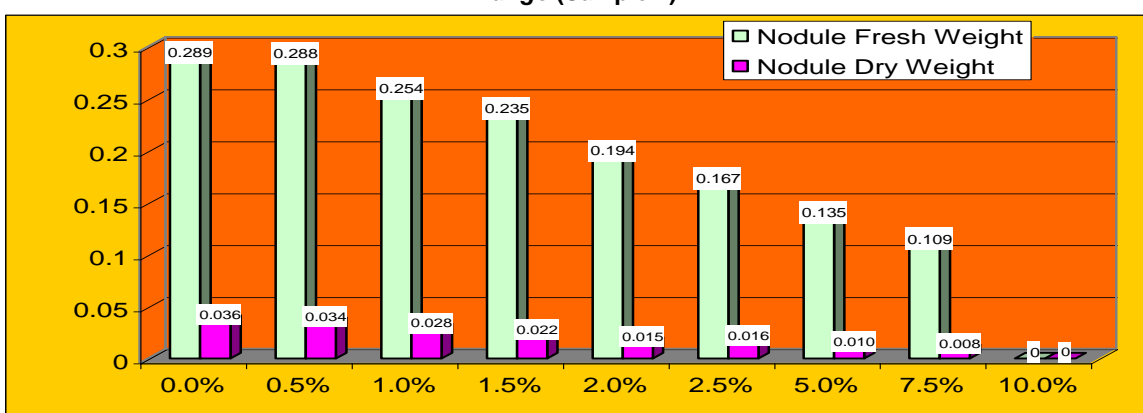


Figure 2(C) Effects of Various Concentrations of Rogor on Nodule Infected, Non infected and Cross Sectional Area of *Vigna mungo* (Sample II)

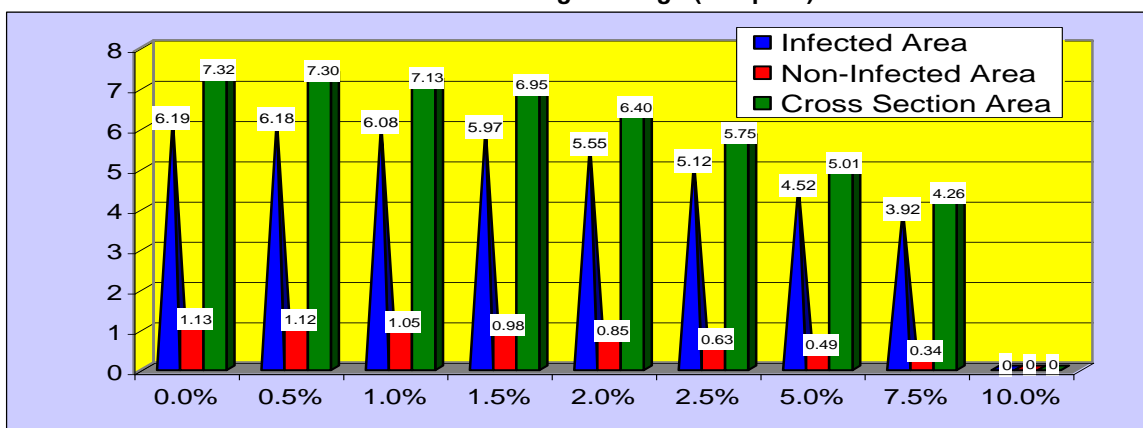


Table 3 Effects of Various Concentrations of Nuvan on Nitrogen Fixation Parameters of *Vigna mungo* (Sample I)

Treatment	Nodule Number	Nodule Fresh Weight	Nodule Dry Weight	Infected Area	Non Infected Area	Cross Section Area
0.0 %	10.89±0.96	0.278±0.03	0.033±0.00	6.17±0.58	1.13±0.13	7.30
0.5 %	10.88±0.83	0.277±0.02	0.032±0.00	6.161±0.57	1.14±0.11	7.28
1.0 %	9.36±0.74	0.246±0.02	0.027±0.00	6.08±0.56	1.08±0.10	7.16
1.5 %	8.74±0.71	0.223±0.02	0.014±0.00	5.97±0.52	0.98±0.11	6.95
2.0 %	8.10±0.68	0.186±0.01	0.013±0.00	5.63±0.48	0.87±0.09	6.50
2.5 %	7.35±0.64	0.164±0.01	0.011±0.00	5.19±0.45	0.64±0.05	5.83
5.0 %	6.57±0.54	0.134±0.01	0.01±0.00	4.56±0.39	0.49±0.04	5.05
7.5 %	4.52±0.51	0.103±0.01	0.007±0.00	3.92±0.31	0.34±0.04	4.26
10.0 %	0.00	0.00	0.00	0.00	0.00	0.00

Figure 3(A) Effects of Various Concentrations of Nuvan on Nodule Number of *Vigna mungo* (Sample I)

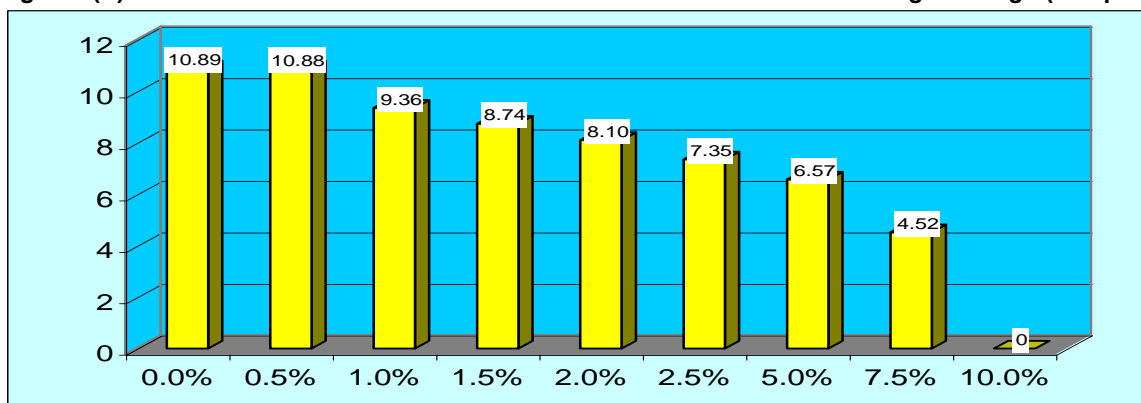


Figure 3(B) Effects of Various Concentrations of Nuvan on Nodule Fresh Weight and Dry Weight of *Vigna mungo* (Sample I)

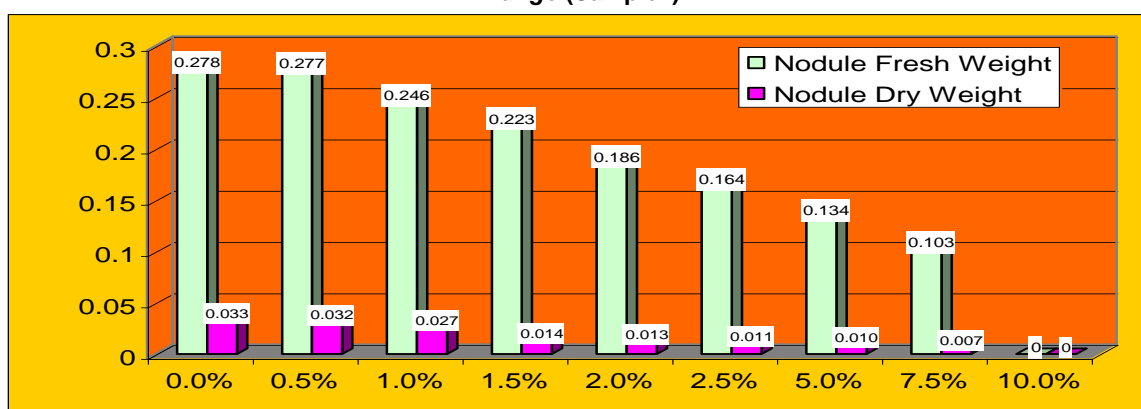


Figure 3(C) Effects of Various Concentrations of Nuvan on Nodule Infected, Non infected and Cross Sectional Area of *Vigna mungo* (Sample I)

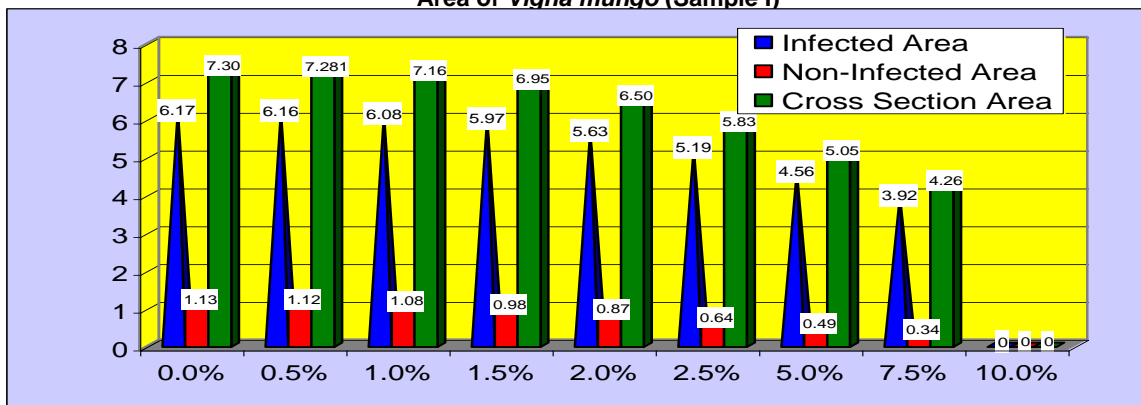


Table 4 Effects of Various Concentrations of Nuvan on Nitrogen Fixation Parameters of *Vigna Mungo* (Sample II)

Treatment	Nodule Number	Nodule Fresh Weight	Nodule Dry Weight	Infected Area	Non Infected Area	Cross Section Area
0.0 %	11.09±0.98	0.277±0.04	0.034±0.02	6.13±0.58	1.15±0.08	7.28
0.5 %	11.08±0.97	0.276±0.03	0.033±0.01	6.12±0.57	1.14±0.06	7.26
1.0 %	10.07±0.96	0.252±0.03	0.027±0.00	6.04±0.54	1.05±0.04	7.09
1.5 %	9.25±0.88	0.240±0.03	0.023±0.00	5.97±0.49	0.97±0.05	6.94
2.0 %	8.52±0.85	0.196±0.02	0.019±0.00	5.63±0.42	0.84±0.02	6.47
2.5 %	7.34±0.81	0.171±0.02	0.018±0.00	5.14±0.41	0.65±0.02	5.79
5.0 %	6.52±0.78	0.138±0.01	0.017±0.00	4.57±0.39	0.49±0.01	5.06
7.5 %	4.18±0.76	0.119±0.01	0.004±0.00	3.97±0.32	0.37±0.01	4.34
10.0 %	0.00	0.00	0.00	0.00	0.00	0.00

Figure 4(A) Effects of Various Concentrations of Nuvan on Nodule Number of *Vigna mungo* (Sample II)

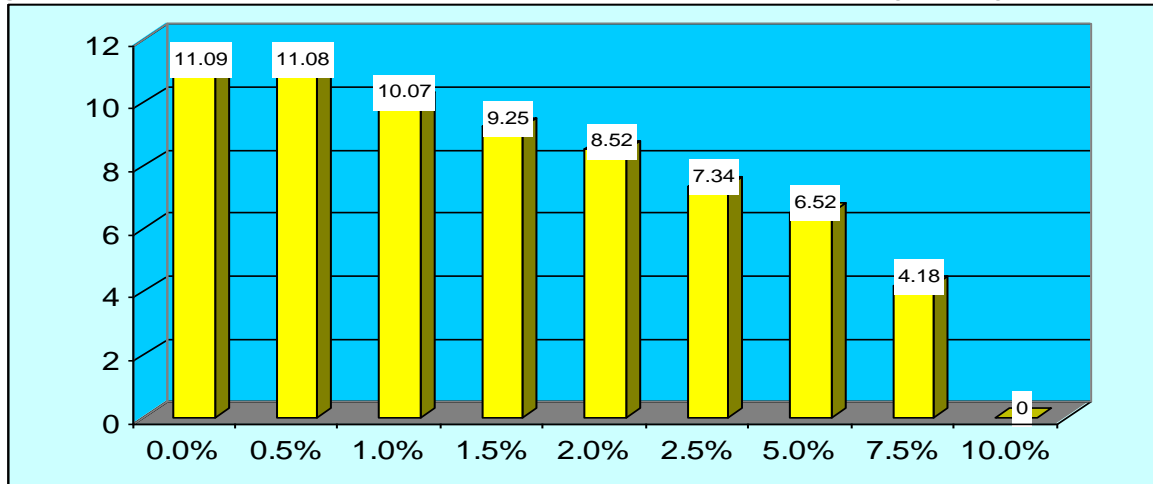


Figure 4(B) Effects of Various Concentrations of Nuvan on Nodule Fresh Weight and Dry Weight of *Vigna mungo* (Sample II)

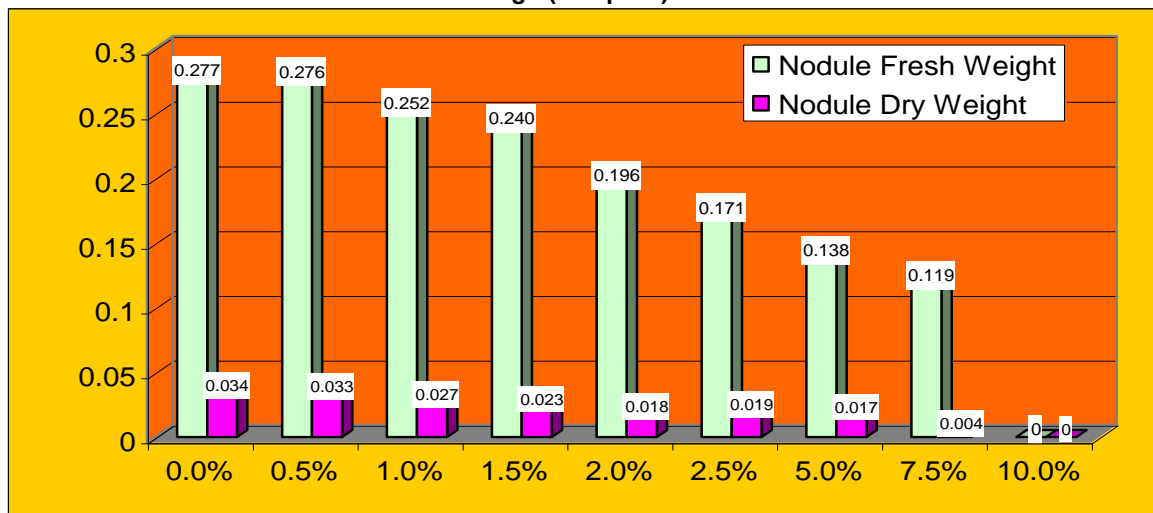


Figure 4(C) Effects of Various Concentrations of Nuvan on Nodule Infected, Non infected and Cross Sectional Area of *Vigna mungo* (Sample II)

