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Observation of root nodulation on blackgram (*Phaseolus mungo* L.)

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Abstract

A field experiment was carried out the experimental findings indicated that legume root-nodules fix substantial amount of nitrogen under field conditions. Root-nodulation studies indicated that all the plant growth regulator were found significantly superior to control (no growth regulator) with respect to root-nodule formation. Amongst the growth regulators, triacontanols i.e. Vipul, TATA, Miraculan and N-triacontanol (Grocel) and NAA performed the best in encouraging higher number of root-nodules/plant. Field experiment was conducted in the department of crop physiology at Vindhya Science & Agricultural Research Institute, Raushar, Rewa (M.P.) during 2019 to 2020.

Keywords: nitrogen, plant growth regulators, yield, *Phaseolus mungo*

1. Introduction

In developing countries like India, raise in population has increased the demand for agricultural products. India population continues to grow at a rate of 1.8 to 1.9% annually. Currently, India is producing two hundred million tons of food grains per annum. It will be increased to 350-375 million tons per annum over the next 2-3 decades (Daniel, 2000) ^[1]. Singh, (2001) ^[2] reported that increasing demand for agricultural products will lead to demand for chemical fertilizers. These chemicals used in the field trials lead to many problems like pollution, host resistance and bio magnification. Gryndler, (2000) ^[3] has demonstrated that the soil borne microorganisms interacts with the plant roots and soil constituents at the root-soil interface.

In Madhya Pradesh, blackgram is grown in the large area about 5.08 lakh hectare with the production upto 1.65 lakh tonnes and productivity only up to 375 kg/ha, quite low than our expectations. Thus, there is need to enhance the productivity of blackgram through recently developed agricultural technology including the use of plant growth regulators. Increasing cost of chemical fertilizers and their scarcity in Indian market has insisted upon to search out other input resources like growth regulators which are not only economical but also eco-friendly and pollution-free.

Blackgram is a major rainy season pulse crop of Rewa region. Its productivity can be enhanced by applying phosphorus and plant growth regulators (PGR's). The encouraging results of experiments on PGR's on soyabean (Agnihotri, 1999) ^[4], and on chickpea (Shrivastava *et al.*, 2001) ^[5] have inspired to take similar work in case of blackgram.

2. Material and Methods

The field experiment was conducted during rainy season of 2019 and 2020 at the Vindhya Science & Agricultural Research Institute, Raushar, Rewa (M.P.). The root nodulation study was made in each treatment after 50 days of sowing of blackgram crop. The nodules were collected when the soil was completely wet soon after the rains. This condition facilitated the early uprooting of root nodules attached to them. For this purpose five plants were randomly selected and taken out from each plot very carefully by digging the soil up to 20-35 cm deep around the root-zone. The root along with the soil stucked to it was dipped in to the water kept in a bucket and washed and the root-nodules were detected and collected and in the envelope. The total number of root nodules were counted and average nodule number/plant was worked out by dividing the total counts by five. The data collected during this study was subjected to statistical analysis variance (ANOVA) to compare the difference among all the treatments.

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3. Result and Discussion

The number of root nodules were influenced significantly due to PGR treatment in both the year as revealed from table 1. The higher number of root nodules i.e. 24.26 / plant in first year and 24.08 nodules/plant in second year were obtained due to application of triacontanol (Vipul). This growth regulator was found significantly superior to almost all the rest of the PGR treatment was NAA (phytofix) which

produced 22.98 to 23.21 root nodules /plant in both the years. Triacontanol and miraculin also proved to be influential and thereby stood the third best treatments, the two years average number of root nodules were 22.90/plant. Triacontanol (TATA) and grocel proved equally effective (22.36-22.39 nodules /plant). The control water spray treatment proved to be the least influential, thereby resulted in lower root nodules i.e. 17.10 to 16.48.

Table 1: Numbr of root-nodules/plant of blackgram (DU-4) as influenced by different growth regulators.

S. No.	Treatments	Number of root-nodules/plant		Mean
		2019	2020	
1.	Triacontanol (Miraculan)	22.82	22.98	22.9
2.	Triacontanol (Vipul)	24.26	24.08	24.17
3.	Triacontanol (TATA)	21.96	22.76	22.36
4.	Photosynth (Paras)	22.18	22.14	22.16
5.	Mixtalol	21.66	21.64	21.65
6.	Cytozyme	19.14	21.80	20.47
7.	Biozyme	20.74	19.18	19.96
8.	Hico-emulsion 110-R	21.63	22.15	21.89
9.	Ergostim	20.68	19.70	20.19
10.	N.A.A. (Phytofix)	22.98	23.21	23.095
11.	C.C.C. (Microcil)	20.40	19.42	19.91
12.	C.C.C. (Cycocel)	20.27	20.78	20.525
13.	N-triacontanol (Grocel)	21.92	22.86	22.39
14.	Water spray only	17.10	16.48	16.79
	S.Em.±	1.77	2.05	1.84
	C.D. (5%)	1.84	2.38	2.106

Biological nitrogen fixation by symbiotic bacteria in root-nodules of legume plants blackgram is one of them, is quantitatively one of the most important ways in which atmospheric nitrogen enters the biosphere. Biosphere is that part of the earth's envelope in which living organisms exist

in their natural state. It has been well established that the fast growing symbiotic bacteria (*Rhizobium* sp.) present in the legume root-nodules fix substantial amount of nitrogen under field conditions.

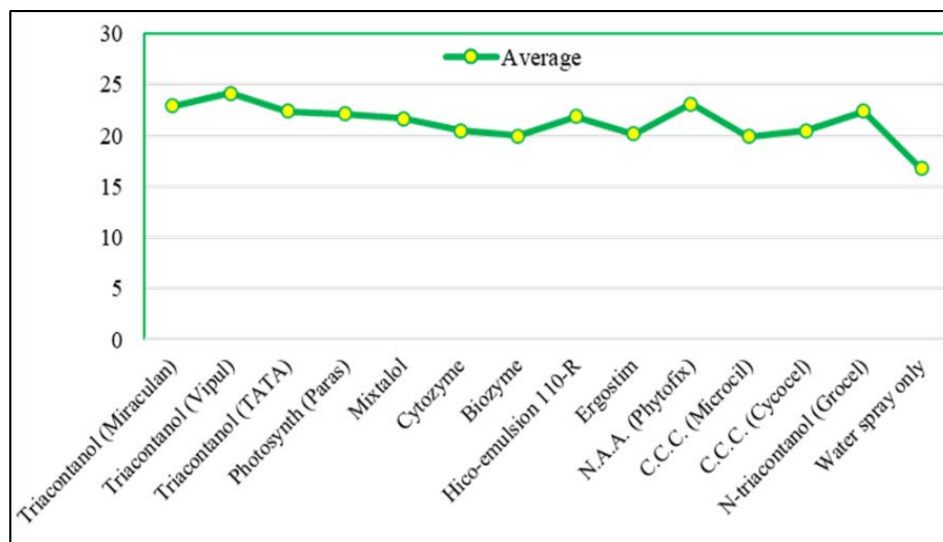


Fig 1: Average root-nodules/plant of blackgram (DU-4) as influenced by different growth regulators

Root-nodulation studies indicated that all the plant growth regulator were found significantly superior to control (no growth regulator) with respect to root-nodule formation. Amongst the growth regulators, triacontanols i.e. Vipul, TATA, Miraculan and N-triacontanol (Grocel) and NAA performed the best in encouraging higher number of root-nodules/plant. Similar effects of IAA (Indole acetic acid) on greengram and triacontanol (Vipul) on blackgram have also been reported by Tomar *et al.* (1993) [6], Shah *et al.* (1994) [7] & Shukla and Dixit (1996) [8].

4. Conclusion

The experimental findings indicated that legume root-nodules fix substantial amount of nitrogen under field conditions. Root-nodulation studies indicated that all the plant growth regulator were found significantly superior to control (no growth regulator) with respect to root-nodule formation. Amongst the growth regulators, triacontanols i.e. Vipul, TATA, Miraculan and N-triacontanol (Grocel) and NAA performed the best in encouraging higher number of root-nodules/plant.

5. Acknowledgement

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