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Effects of nitrogen and growth regulators on yield *Phaseolus mungo* L.

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Abstract

A field experiment was carried out the effect of growth regulator, organic and inorganic foliar nutrition on yield and yield attributes of blackgram. Field experiment was conducted in the department of crop physiology at Vindhya Science & Agricultural Research Institute, Raushar, Rewa (M. P.) during 2014 to 2015. Study the effect of basal application of nitrogen in combination with foliar spray of urea and plant growth regulators. Among the treatments, the basal application of nitrogen 25kg ha^{-1} with foliar spray of urea 2% and 0.1 ppm brassinolide significantly expressed the higher values in growth attributes. Among the treatments T_7 performed its superiority and had higher leaf area (102.7, 246.0, 567.0 and 494.3 mg g^{-1}) at vegetative stage, flowering stage, pod filling stage and harvest stage respectively.

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

1. Introduction

In Madhya Pradesh, blackgram is grown in the large area about 5.08 lakh hectare with the production upto 1.65 lakh tonnesand productivity only up to 375 kg/ha, quite low thanour 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) [1] and on chickpea (Shrivastava *et al.*, 2001) [2] have inspired to take similar work in case of blackgram.

Nutrients play an important role in boosting the crop production. Phosphorus (P) is an essential and pivotal plant nutrient next to nitrogen which is required in large quantity for better growth of legume plant types. Being a constituent of high energy phosphate bonds of ATP, Phosphorus is of prime importance in the formation and transiocation of carbohydrates, fatty acids and other compounds. Among the major plant nutrients, P requirement of legume crop plants is quite high as compared to nitrogen and potassium.

Black gram (*Phaseolus mungo*) is a widely grown grain legume and belongs to the family fabaceae and assumes considerable importance from the point of food and nutritional security. It is a short duration crop suitable for multiple cropping systems and intercropping. The average productivity of pulses in Rewa district is about (432kg ha^{-1}) which is very low when compared to Indian average of 610 kg ha^{-1}. Black gram is basically indeterminate in habit of flowering and fruiting and there is a continuous competition for available assimilates between vegetative and reproductive sinks throughout the growth period. Since, the source is highly limited in pulses with lowering translocation of assimilates to the growing reproductive sinks. Hence, leaf area is a important parameter to obtain higher source in terms of higher assimilation production. Apart from this, major physiological constraints are flower drop and fruit drop (Ojeaga and Ojehoman, 1972) [3]. Therefore, present study was conducted to study the effect of nitrogen and plant growth regulators as a soil and foliar applications on growth attributes and yield of black gram.

2. Material and Methods

The field experiment was conducted during rainy season of 2014 and 2015 at the Vindhya Science & Agricultural Research Institute, Raushar, Rewa (M. P.). The soil was sandy loam in texture with N, P, K of 207, 21, 554 kg ha^{-1}. The experiment consist of nine treatments were laid out in randomized block design with three replications. The treatments are, T_1 (control), T_2 (N 25 kg ha^{-1} + Urea 2% + NAA 40ppm), T_3 (N 50 kg ha^{-1} + CCC 200 ppm), T_4 (N 25 kg ha^{-1} + Urea 2% + CCC 200ppm), T_5 (N 25 kg ha^{-1} + Urea 2% + Humic acid 0.1%), T_6 (N 25 kg ha^{-1} + Urea 2% + Salicylic acid 100 ppm), T_7 (N 25 kg ha^{-1} + Urea 2% + Brassinosteriod 0.1 ppm), T_8 (N 25 kg ha^{-1} + Urea 2% + $ZnSO_4$ 0.5% + $FeSO_4$ 0.5% + Borax 0.2%), T_9 (N 25 kg ha^{-1} + water spray), were imposed at 25 DAS and 10 days after the first spray. Leaf area was recorded by using leaf area meter (Model LICOR 3100). The samples were oven dried at 70°C for about 72 hours and dry weight was recorded. Leaf Area Index, Crop Growth Rate, Net Assimilation Rate, Specific Leaf Weight were calculated by employing the formula (Pearce *et al.* 1968, Watson, 1956) [4, 5].

3. Result and Discussion

The Leaf area index was varied significantly by the basal application of nitrogen along with foliar spray of plant growth regulators. The highest value was recorded in T_7 from vegetative state (0.34) to harvest stage (1.65) as compared to control (0.28 to 1.18) followed by T_3 (0.33 to 1.64). The LAI increased upto pod filling stage and declined in harvest stage. The normal recommended dose of nitrogen along with foliar spray of urea 2% and Brassinosteriod 0.1 ppm resulted in a remarkable improvement in LAI with 35 and 40 per cent increase during flowering and pod filling stages of the crop. This finding was close conformity with the results of Nithila (2007) [7] in groundnut with 31 per cent increased in LAI. As per the report of Braun and Wild (1984) [8], high LAI at the time of pod formation stage of mustard was associated with high rate of current photosynthesis with better translocating efficiency of the crop, which intimately reflected on pod yield. Kelaiya *et al.* (1991) [9] further explained that Brassinolide promoted the leaf area development in crop plants due to increase in leaf number.

The leaf area was increased from vegetative stage to pod filling stage and declined thereafter. Among the treatments T_7 performed its superiority and had higher leaf area (102.7, 246.0, 567.0 and 494.3 mg g^{-1}) at vegetative stage, flowering stage, pod filling stage and harvest stage respectively. This treatment was followed by T_3 (96.7, 236.8, 560.0 and 484.3) recorded higher leaf area as compared to other treatments. The percent increase recorded by T_7 over the control showed 42.5 at vegetative stage, 39.7 at pod filling stage. 40.6 at harvest stage (Table 1). The present study indicated that the increase in leaf area was observed with basal application of nitrogen 25 kg ha^{-1} along with foliar spray of Brassinosteriod 0.1 ppm and urea 2%. Sakurai and Fujioka (1993) [6] had opined that the, Brassinosteriod showed favourable influence on leaf area due to its relationship with phytochrome, which mediated regulation of growth and also induced the cell enlargement.

A close correlation between the number of flowers produced during the early reproductive phase and productivity was reported in pulses. In this study, number of flowers per plant was greatly influenced by the effective role of nutrients and plant growth hormones. The number of flowers was enhanced by about 34 percent over control (table 2). Pod number was greatly influenced by the nutrients and g worth hormones. In this present study the treatmental combination (N 25 kg ha^{-1} + Urea 2% + BR 0.1 ppm) caused more than 50 percent improvement in setting of pods. Number of seeds per pod was effectively influenced by the treatmental combination of nutrients and plant growth hormones. Urea with brassinosteroid spray maintained highest number of seeds per pod as compared to urea with CCC. The production of higher seed yield due to growth regulators may be attributed to the fact that plants treated with growth regulators remained physiologically more active to build up sufficient food reserves for developing flowers and seeds. The result of the present study indicated that the treatment combination (N 25 kg ha^{-1} + BR 0.1 ppm + Urea 2%) was found to be the most effective treatment in improving the grain yield by 27 percent over control. The overall results as revealed that basal application of nitrogen 25 kg ha^{-1} with foliar spray of urea 2% and 0.1 ppm brassinolide is advantageous and can be recommended for adoption by the farmers

Table 1: Effect of nitrogen nutrition and growth regulators on black gram

		Treatments											CD (P=0.05)
		T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	Mean	SED	
TDMP (g plant $^{-1}$)	VS	1.82	1.93	1.95	2.06	1.88	1.87	2.12	1.91	1.86	1.93	0.07	0.18
	FS	3.84	4.21	4.41	4.70	3.96	3.95	4.85	4.14	4.16	4.25	0.18	0.36
	PFS	8.88	10.04	10.30	10.43	9.53	9.78	10.57	9.3	9.28	9.79	0.42	0.88
	HS	13.67	15.50	15.65	16.15	15.43	14.69	17.13	14.42	14.57	15.25	0.63	1.35
Leaf Area (mg g^{-1})	VS	84.8	95.2	96.7	95.8	92.8	94.2	102.7	95.6	90.1	94.21	3.96	8.41
	FS	182.1	213.1	236.8	228.1	197.7	208.3	246.0	217.0	195.2	213.8	8.93	18.95
	PFS	403.4	509.1	560.0	541.0	475.2	491.3	567.0	526.5	451.2	502.7	20.9	44.31
	HS	353.6	415.1	484.3	475.3	447.6	421.6	494.3	448.0	397.5	437.5	18.24	38.68
Leaf Area Index	VS	0.27	0.31	0.31	0.33	0.32	0.30	0.33	0.31	0.30	0.31	0.01	0.03
	FS	0.62	0.72	0.78	0.75	0.65	0.68	0.83	0.73	0.66	0.71	0.02	0.06
	PFS	1.36	1.71	1.86	1.81	1.58	1.63	1.88	1.75	1.51	1.68	0.05	0.13
	HS	1.17	1.37	1.61	1.58	1.48	1.40	1.64	1.51	1.32	1.45	0.05	0.11

VS= Vegetative stage, FS = Flowering stage, PFS = Pod Filling Stage, HS = Harves stage

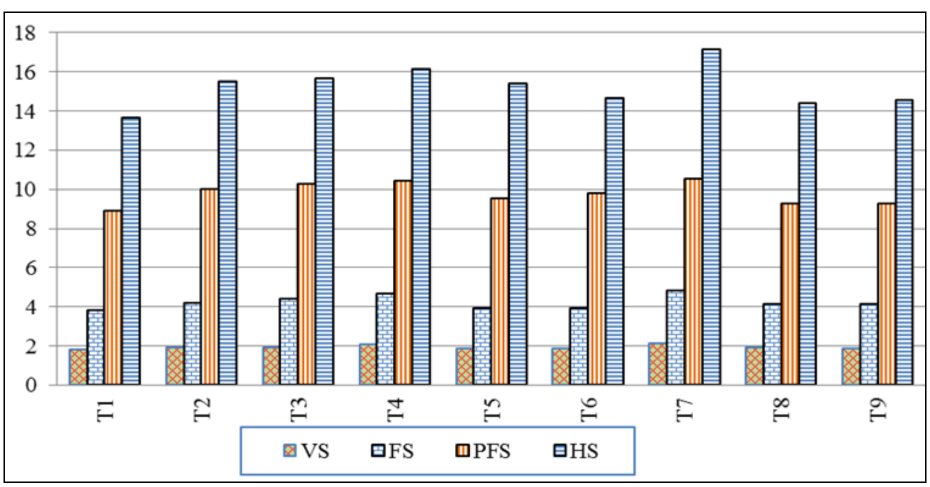

Fig 1: Graphics analysis of TDMP (g plant $^{-1}$)

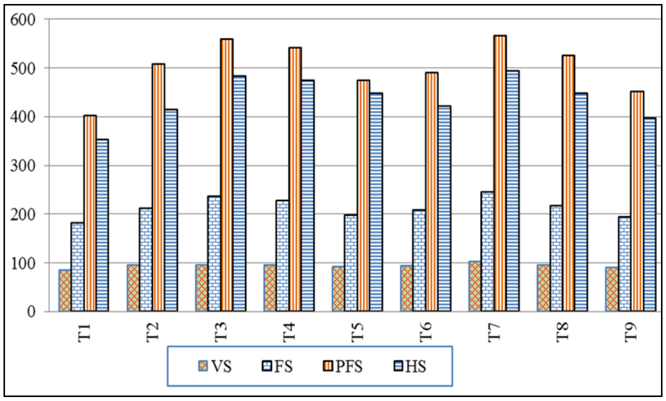

Fig 2: Graphics analysis of Leaf Area (mg g^{-1})

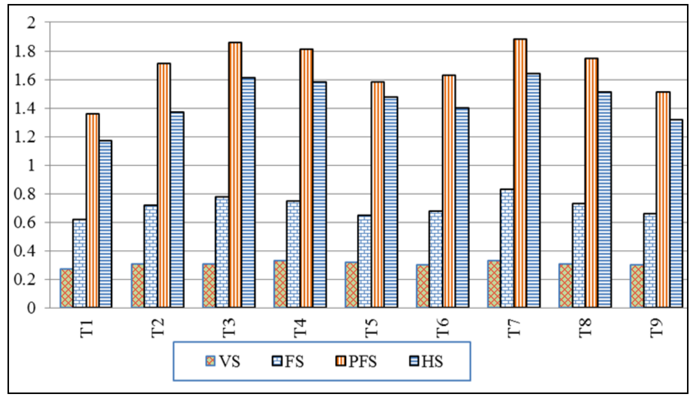

Fig 3: Graphics analysis of Leaf Area Index

Table 2: Effect of nitrogen nutrition and growth regulators on yield and yield components in black gram.

	Treatments											CD (P=0.05)
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	Mean	SED	
No. of flowers $plant^{-1}$	72.0	85.1	85.2	89.5	78.7	82.5	97.6	82.6	74.4	83.07	3.28	6.97
No. of pods $plant^{-1}$	18.1	25.3	27.9	28.1	21.6	24.5	28.4	26.7	20.5	24.57	1.00	2.12
No. of seeds $plant^{-1}$	5.1	6.3	6.4	6.6	5.4	5.7	7.2	5.3	5.1	5.90	0.24	0.53
100 seed weight (g)	3.6	4.1	4.2	4.8	4.4	4.6	5.1	4.1	3.6	4.28	0.16	0.35
Grain yield kg ha^{-1}	705.1	719.4	845.7	567.8	728.5	738.1	893.2	732.4	710.1	737.81	32.55	69.01

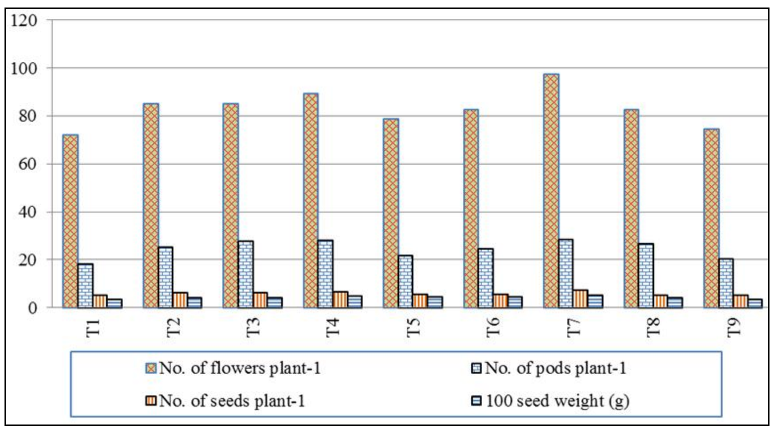

Fig 4: Graphics analysis of effect of nitrogen nutrition and growth regulators on yield and yield components in black gram.

The major portion of nitrogen requirement of blackgram crop is met with through biological nitrogen fixation by inoculating the seed with effective *Rhizobium* bacteria i.e. bio fertilizer before sowing. But the requirement of phosphorus which is essential for root growth and root nodulation has to be fulfilled largely by the chemical fertilizers.

Therefore, under the low-input production technology to our formers, the enhancement of the availability of soil reserve (soil fixed) phosphorus as well as fertilizer phosphorus applied to the soil is a must by the seed inoculation with another important bio fertilizer.

4. Conclusion

Black gram (*Phaseolus mungo* L.) starch was isolated. The starch yield was 45% on flour weight basis. Starch granule size ranged from 7.5–28.5 µm (length) to 7.5–27.0 µm (width). Hylum length ranged from 25–100% of the starch granule length. Amylose content of starch was 26.65% (starch basis). Gelatinization temperature range for the starch was 71.5–74.0°C. Unlike several legume starches, black gram starch had a peak viscosity as indicated by Brabender Viscoamylograph. The starch viscosity was dependent on pH and ionic strength. The raw as well as cooked starch was resistant to hog pancreatic α-amylase hydrolysis in vitro.

5. Acknowledgement

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6. References

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