IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
e ISSN-0976-593X Volume **10** | Issue 1 | January, 2015 | 74-79
DOI: 10.15740/HAS/IJPS/10.1/74-79
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RESEARCH ARTICLE

Role of growth boosters on the yield of urd bean (*Phaseolus mungo*)

■ **SANJEEV KUMAR, A.K. KATIYAR AND ANUJ KUMAR**

SUMMARY

The field experiments were conducted in *Kharif* 2013 and 2014 in Muzaffarnagar district of Uttar Pradesh on black gram (Urd) to assess the contribution of growth boosters commercially available in the market. For this purpose Aminos, Biozyme, Tracel and Planofix were sprayed on standing crop at 30 and 50 days after sowing. The seed of black gram was inoculated prior to sowing for all the treatments except control. Growth boosters were applied as alone and also their dual combinations. The data were recorded on plant growth characters at 40 and 70 days after sowing and yield attributing character were recorded at harvest. Among single applied growth boosters, Aminos (yield 8.90 and 9.32 q/ ha) contributed more as plant growth and yield attributing characters followed planofix (yield 8.66 and 9.11 q/ ha), tracel (yield 8.33 and 8.86 q/ ha) and biozyme (yield 8.10 and 7.86 q/ ha).Highest plant growth, yield attributing character and grain yield (yield 10.10 and 10.66 q/ ha) observed from dual application of aminos + planofix followed by aminos+ tracel (yield 9.90 and 10.35 q/ ha) aminos+ biozyme (9.86 and 10.26 q/ ha), biozyme+ planofix, planofix+ tracel and biozyme+ tracel from both the years of experiments.

Key Words : Black gram, Aminos, Biozyme, Tracel, Planofix, *Rhizobium*

How to cite this article : Kumar, Sanjeev, Katiyar, A.K. and Kumar, Anuj (2015). Role of growth boosters on the yield of urd bean (*Phaseolus mungo*). *Internat. J. Plant Sci.*, **10** (1): 74-79.

Article chronicle : Received : 07.11.2014; **Revised :** 01.12.2014; **Accepted :** 18.12.2014

India is the largest producer and consumer of pulses in the world. Major pulses grown in India include chickpea or bengalgram (*Cicerarietinum*), pigeonpea or red gram (*Cajanuscajan*), lentil (*Lens culinaris*), urdbean or black gram (*Vigna mungo*), mungbean or green gram (*Vigna radiata*), lablab bean (*Lablabpurpureus*), moth bean (*Vigna aconitifolia*), horse gram (*Dolichosuniflorus*), pea (*Pisum sativum* var. arvense), grass pea or khesari (*Lathyrus sativus*), cowpea (*Vigna unguiculata*) and broad bean orfaba bean (*Viciafaba*). More popular among these are chickpea, pigeonpea, mungbean, urdbean and lentil. In general, pulsesare mostly grown in two seasons: the warmer, rainy seasonor *Kharif* (June-October) and the cool, dry season or *Rabi* (October-April). Chickpea, lentil and dry peas are grown in the *Rabi* season, while pigeonpea, urdbean, mungbean, and cowpea are grown during the *Kharif* season.Among various pulse crops, chickpea dominates with over 40 per cent share of total pulse production followed by pigeonpea (18-20%), mungbean (11%),urdbean (10-12%), lentil (8-9%) and other legumes (20%) (IIPRvision 2030).

Agriculture productivity is very important to produce

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better quality and yieldleads to profitability. However, to achieve this goal with advancement oftechnology, use of excess fertilizer and pesticides in not adequate, now thetime is to look at Bio-technological tools to achieve the goal of farmers. For this purpose plants growth boosters may become a new techniques to increase productivity. The requirement of growth boosters, amino acids, micronutrients in essential quantities is well known as a means to increase yield.The foliar application of growth boostersis based on its requirement by plants.The plant absorbs amino acids, micronutrients, hormones and enzymes through stomataand used as ingredients in the process of protein synthesis. Most of the Indian farmers traditionally using recommended seed and fertilizers practices to produce their crops with their limited resources. There are many growth boosters available in the market which can increase productivity with minimum cost. For this purpose experiments were planned to assess the contribution of aminos, tracel, biozyme and planofix on legume blackgram (Urd) Palaniappan and Balasubramaniyam (1989) reported the yield of cereals and legumes, maximized by increasing plant density by increasing application of growth regulators. Sen and Swain (1994) also observed the effect of biozyme on grains under irrigated conditions. Jana and Paria (1996) calculated the best treatment was 0.5 per cent spray of tracel on vegetables followed by aminos 0.2- 0.4 per cent at flowering and pod development stage growth and yield of pea. Ali *et al.* (2012) observes the efficacy of nutrients and a growth regulator against urd yield and control bean leaf crinkle virus (ULCV) was observed on four mungbean. Zn and B (fashion) was found second more effective treatment and reduced the disease and increased yield.

Sindhu and Daderwal (2000) competition for nodulation among rhizobia in legume-*Rhizobium* symbiosis.

MATERIAL AND METHODS

The field experiments were conducted in *Kharif* 2013 and 2014 at Muzaffarnagar of Uttar Pradesh by using commercial growth boosters available in market on sprayed on standing crop of blackgram (Urd) at initial growth stage and just before flowering. Before sowing seeds were inoculated with *Rhizobium* culture except control uniformly. The growth boosters were used in separate treatment and also with their combinations at 30 and 50 days after sowing. The experiments were conducted in RBD with three replication, data were recorded at 40 and 70 days after sowing (DAS) growth stage and at crop harvest. The growth promoter's descriptions as follows:

Aminos :

It is an amino acid based bio-stimulants, used 500 ml/ hectare at flower initiation stage.

Bio-zyme :

It contains plant growth regulators as cytokinin, auxineprecursors, enzyme and amino acids specially blended to retain their stability over long periods. Used 400 ml/ hect.sprayed at flowering stage.

Planofix :

It is a Nephaline acetic acid (NAA) used 100 ml/ hectare. Spray was done at evening time to protect from sunlight. Lakshmamma and Rao (1996) recommended spray of 20 ppm NAA twice at 50 per cent flowering stage, decrease flower drop and increased seed yield in *Vigna mungo.*

Tracel :

It is a mixture of micronutrient available in powder form and used 4 kg tracel dissolved in 500 liter of water spray at flower initiation stage.

The experimental site having soil loam soil with 7.3 pH and sowing was done in the second week of July in both the years.

RESULTS AND DISCUSSION

The growth boosters were applied at 30 and 50 days after sowing. The effects of different treatments were recorded at three times during crop season in both the years. Plant height, nodule number, nodule dry weight was recorded at 40 and 70 days after sowing and The yield attributes number of pods per plant, number of grain per plant, plant dry weight per plant, grain yield q/ha and thousand grain weight recorded at harvest. Khan and Prakash (2014) revealed that the seedinoculation with *Rhizobium* culture significantly increased growth attributes *viz.*, plant height, numberof primary and secondary branches plant, number and dry weight of nodules plant, seed and stover yield.

It was revealed from the data that at 40 DAS maximum plant height (34.66 cm), nodule number per plant (7.66), nodule dry weight (27.00 mg per plant) and plant dry weight (3.56 g/ pl.) recorded from application of aminos among single applied growth boosters. Lowest plant height (30.66 cm), nodule number per plant (4.66), nodule dry weight (17.66 mg per plant) and plant dry weight (2.53 g/pl.) recorded from control treatment followed by *Rhizobium* inoculated treatment. Ravindra and Chandra (2008) also recorded significant increases of 20.8 and 23.5 per cent in grain yields and numerical increases of 13.2 and 14.0 per cent in straw yields over *Rhizobium* sp. and PSB alone inoculation, respectively. It is also observed that at 40 DAS maximum plant height (35.63 cm), nodule number per plant (8.33), nodule dry weight (28.33 mg per plant) and plant dry weight (3.43 g/pl.) recorded from aminos+ Planofix growth boosters applied in combination followed by aminos+tracel, aminos+biozyme, biozyme + planofix, planofix+tracel and biozyme+tracel compared to single applied growth boosters and *Rhizobium* application.

The data were recorded at 70 DAS maximum plant height (56.33 cm), nodule number per plant (21.66), nodule dry weight

(77.00 mg per plant) and plant dry weight (3.70 g/pl.) from application of aminos among single applied growth boosters. Lowest plant height (50.00 cm), nodule number per plant (15.00), nodule dry weight (60.66 mg per plant) and plant dry weight (3.06g/pl.) recorded from control treatment followed by alone *Rhizobium* inoculation. It was also observed at 70 DAS maximum plant height (62.33 cm), nodule number per plant (25.66), nodule dry weight (92.33 mg per plant) and plant dry weight (4.46g/pl.) recorded from aminos+ Planofix growth boosters applied in combination followed by aminos+tracel, aminos+biozyme, biozyme+planofix, planofix+tracel and biozyme+tracel, also compared with single applied growth boosters and alone *Rhizobium* application during first year of experimentation (Table 1). Lakshmamma and Rao (1996) said the application of growth boosters increased plant ht. DW and to increased seed yield in urd (Black gram).Surendra *et al*.

Table 1 : Effect of growth boosters on growth characters of black gramin *Kharif* 2013

Treatments	Pl. ht. cm 40 DAS	Nodule no./pl. 40 DAS	Nod dry wt. mg/pl.	Pl. dry wt. g 40 DAS	Pl. ht. cm 70 DAS	Nodule no./pl. 70 DAS	Nod dry wt. mg/pl	Pl. dry wt. g /pl
Control	30.66	4.66	17.66	2.53	50.00	15.00	60.66	3.06
Rhizobium	31.33	6.00	26.00	2.76	52.00	16.66	65.66	3.23
R+ Aminos	34.66	7.66	27.00	3.56	56.33	21.66	77.00	3.70
R+ Biozyme	31.66	6.25	26.20	2.83	54.66	19.00	71.66	3.43
R+ Planofix	32.66	7.00	26.66	3.26	55.33	20.66	72.66	3.53
R+ Tracel	34.00	6.50	26.33	3.13	55.66	19.33	72.33	3.50
R+ Amino+ Biozyme	35.33	8.15	27.53	3.23	60.33	24.33	82.33	4.20
R+ Biozyme+ Planofix	35.26	8.10	27.40	3.20	60.66	23.86	80.33	3.95
R+ Planofix+ Tracel	34.90	7.90	27.33	2.96	58.66	23.60	78.66	3.90
R+ Biozyme+ Tracel	34.80	7.83	27.10	2.86	58.33	22.66	78.00	3.82
R+ Aminos+ Tracel	35.43	8.24	27.70	3.30	61.66	24.66	87.66	4.38
R+ Aminos+ Planofix	35.63	8.33	28.33	3.43	62.33	25.66	92.33	4.46
	NS	NS	*	**	**	**	**	**
S.E.±	2.021	0.764	1.673	0.148	1.046	1.079	4.464	0.112
C.D. (P=0.05)	5.929	2.243	4.909	0.435	3.069	3.166	13.09	0.331

* and ** indicate significance of values at P=0.05 and 0.01, respectively NS= Non-significant

Table 2 : Effect of growth boosters on yield attributes of black gram in *Kharif* 2013

Treatments	Pods/ pl.	Pl. dry wt./ pl. g at harvest	Grain/ pl.	Grain yield q/ ha.	Thousand grain wt. g
Control	5.0	1.36	7.66	7.33	74.63
Rhizobium	6.0	1.43	9.66	7.66	74.74
R+ Aminos	7.33	1.63	11.66	8.90	75.21
R+ Biozyme	6.00	1.46	10.33	8.10	74.98
R+ Planofix	6.33	1.50	11.33	8.66	77.62
R+ Tracel	6.16	1.46	10.66	8.33	74.97
R+ Amino+ Biozyme	8.13	1.93	13.33	9.86	77.05
R+ Biozyme+ Planofix	7.96	1.86	12.66	9.66	76.54
R+ Planofix+ Tracel	7.86	1.83	12.33	9.33	76.37
R+ Biozyme+ Tracel	7.33	1.76	12.00	9.10	75.86
R+ Aminos+ Tracel	8.33	2.10	13.66	9.90	77.21
R+ Aminos+ Planofix	8.66	2.20	14.33	10.10	77.66
	*	**	**	*	NS
S.E.±	0.941	0.097	0.308	0.487	4.445
C.D. (P=0.05)	1.441	0.284	0.904	0.844	13.03

* and ** indicate significance of values at P=0.05 and 0.01, respectively NS=Non-significant

(2013) experimentd undertaken under field condition to study the effect of nutrients and plant growth regulators on growth and productivity of black gram significant increase in the N and P content of the leaf due to basal application of nitrogen 25 kg per hectare with foliar spray of urea 2 per cent and 0.1 ppm brassinolide. The leaf potassium (K) content was also greatly enhanced by the basal application of nitrogen 25 kg per hectare with foliar spray of urea 2 per cent and 0.1 ppm brassinolide treatment.

The yield contributing character were concern, lowest pods per plant (6.00) observed from *Rhizobium* inoculation alone followed by control (5.0) treatment. Application of alone growth boosters was consider, aminos contributed more pod yield (7.33 pods/ pl.) followed by planofix (6.33 pods/ pl.), tracel (6.16 pods/ pl.) and biozyme (6.00 pods/ pl.), respectively. Maximum pod per plant (8.66 pods/ pl.) were obtained from spray of aminos + planofix treatment followed by aminos+ tracel (8.33 pods/ pl.), aminos +biozyme (8.13 pods/ pl.) and biozyme+ planofix (7.96 pods/ pl.) among applied growth boostersin combinations. Similar observations were found from number of grains per plant as related to pods per plant. Maximum plant dry weight (2.20 g/ plant) was recorded by combined spray of aminos + planofix treatment followed by aminos+ tracel (2.10 g/ plant), aminos+ biozyme (1.93 g/ plant), biozyme+ planofix (1.86 g/ plant) and planofix+ tracel (1.83 g/ plant). Among single application maximum plant dry wt. (1.63g/ plant) was found with application of aminos followed by planofix (1.50 g/ plant), tracel and biozyme (1.46 g/ plant). Highest grain yield (10.10 q/ ha.) were obtained from combined application of aminos+ planofix, followed by aminos+ tracel (9.90 q/ha), aminos+ biozyme (9.86 q/ ha), biozyme+ planofix (9.66 q/ha). Among single applied growth boosters highest yield (8.90 q/ ha) were found from aminos and followed by planofix (8.66 q/ ha), tracel (8.33 q/ ha) and biozyme (8.10 q/ ha). It was note that *Rhizobium* inoculation was more contribute (7.66 q/ ha) compared to control (7.33 q/ ha) treatment in the first year (*Kharif* 2013) experimentation (Table 2). Subbain *et al.* (1989) also reported that planofix (NAA) two foliar spray 20 and 40 ppm to black gram at flower initiation stage on black gram increased yield 10-15 per cent over control. Baghel and Yadava (1994) reported seed yield of black gram were highest with application of 30 ppm planofix (NAA). Thousand grain wt. were almost same from biozyme+ tracel and aminos+ tracel, lowest from biozyme application alone which was near to control treatment.Mathanet all (1996) also found application of NAA yield increased by 14 to 15 per cent compare to control. It was reveled from the data that at 40 DAS maximum plant height (33.66 cm), nodule number per plant (7.66) and nodule dry weight (25.33 mg per plant) and plant dry weight (3.76 g/pl.) recorded from application of aminos among single applied growth boosters. Lowest plant height (28.33 cm), nodule number per plant (5.00), nodule dry weight (16.33 mg per plant) and plant dry weight (2.00g/pl.) recorded from control treatment followed by *Rhizobium* inoculated treatment. It was also observed that at 40 DAS maximum plant height (35.33 cm), nodule number per plant (8.66), nodule dry weight (26.66 mg per plant) and plant dry weight (4.23g/pl.) recorded from aminos + Planofix growth boosters applied in combination followed by aminos + tracel, aminos + biozyme, biozyme + planofix, planofix + tracel and biozyme + tracel compared to single applied growth boosters and rhizobium application. Kumar *et al.* (2013) reported

Table 3 : Effect of growth boosters on plant growth characters of black gram in *Kharif* 2014

Treatments	Pl. ht. cm 40 DAS	Nodule no./ pl. 40 DAS	Nod dry wt. mg/pl.	Pl. dry wt. g 40 DAS	Pl. ht. cm 70 day spray	Nodule no./ pl. 70 days	Nod dry wt. mg/plant	Pl. dry wt. g /plant
Control	28.33	5.00	16.33	2.00	48.50	14.00	58.33	2.96
Rhizobium	29.66	5.33	19.00	2.33	50.33	15.33	62.00	3.33
R+ Aminos	33.66	7.66	25.33	3.76	54.66	18.66	68.00	3.90
R+ Biozyme	32.33	6.66	23.00	2.86	52.66	17.00	65.00	3.43
R+ Planofix	32.66	7.33	24.66	3.56	53.86	17.66	67.66	3.77
R+ Tracel	33.00	7.00	24.33	3.23	53.66	17.33	66.66	3.66
R+ Amino+ Biozyme	34.33	8.00	26.10	3.93	58.00	21.66	75.33	4.80
R+ Biozyme+ Planofix	34.16	7.96	26.00	3.90	57.33	21.33	73.33	4.70
R+ Planofix+ Tracel	33.95	7.66	25.66	3.86	56.66	20.60	71.66	4.16
R+ Biozyme+ Tracel	33.76	7.33	25.33	3.46	56.33	19.66	69.00	4.13
R+ Aminos+ Tracel	34.66	8.33	26.33	4.10	59.33	22.66	77.66	4.90
R+ Aminos+ Planofix	35.33	8.66	26.66	4.23	60.33	23.33	79.33	4.96
	NS	NS	*	**	**	**	**	**
S.E.±	1.196	0.778	2.173	0.207	1.813	1.354	5.198	0.213
C.D. (P=0.05)	4.326	2.285	5.157	0.511	4.125	3.876	8.745	0.445

* and ** indicate significance of values at P=0.05 and 0.01, respectively NS = Non-significant

increase in growth with the basal application of RDFas a basal dose and application of foliar nutrition might be dueto the fact that foliar application of NAA promoting the apicaldominance, cell elongation and shoot development. Foliarapplication of chelated micronutrient enhances the synthesisof carbohydrates and protein.

The data were recorded at 70 DAS maximum plant height (54.66 cm), nodule number per plant (18.66), nodule dry weight (66.00 mg per plant) and plant dry weight (3.90 g/pl.) from application of aminos among single applied growth boosters. Lowest plant height (48.50 cm), nodule number per plant (14.00), nodule dry weight (58.33 mg per plant) and plant dry weight (2.96g/pl.) recorded from control treatment followed by alone *Rhizobium* inoculation. It was also observed at 70 DAS maximum plant height (60.33 cm), nodule number per plant (23.33), nodule dry weight (79.33 mg per plant) and plant dry weight (4.96 g/pl.) recorded from aminos+ Planofix growth boosters applied in combination followed by aminos+tracel, aminos+biozyme, biozyme+planofix, planofix+tracel and biozyme+tracel, also compared with single applied growth boosters and alone *Rhizobium* application during second year of experimentation (Table 3). Singh and Chandel (2005) reported highest grain, straw and biological yields and protein content were recorded under Biozyme crop' spray 400 ml/ha + half of recommended NPK. This was also observed by Raut *et al.* (1995) that seed yield was highest with biozyme spray containing cytokinins, Auxines, Enzyme and Amino acids. Thousand grain wt. were almost same from biozyme+ tracel and aminos+ tracel, lowest from biozyme application alone which was near to control treatment. Sen *et al.* (1998) said that application of biozyme @ 15 kg in wheat crop along with NPK was highest yield produced.

The yield contributing character were concern, lowest pods per plant (6.10) observed from rhizobium inoculation alone followed by control (5.25) treatment. Application of alone growth boosters was consider, aminos contributed more pod yield (7.86 pods/ pl.) followed by planofix (7.80 pods/ pl.), tracel (7.56 pods/ pl.) and biozyme (6.33 pods/ pl.), respectively. Maximum pod per plant (9.21 pods/ pl.) were obtained from spray of aminos + planofix treatment followed by aminos+ tracel (9.12 pods/ pl.), aminos +biozyme (9.00 pods/ pl.) and biozyme+ planofix (8.66 pods/ pl.) among combined applied growth boosters. Similar observations were found from number of grains per plant as related to pods per plant. Maximum plant dry weight (2.45 g/ plant) was recorded by combined spray of aminos + planofix treatment followed by aminos+ tracel (2.36 g/ plant), aminos+ biozyme (2.33 g/plant), biozyme+ planofix (2.10 g/ plant) and planofix+ tracel (1.90 g/ plant). Sindhu and Daderwal (2000) also stated that competition for nodulation among rhizobia in legume-*Rhizobium* symbiosis increases with the support of inoculation. Among single application maximum plant dry wt. (1.86g/ plant) was found with application of aminos followed by planofix (1.73 g/ plant), tracel (1.65 g/ plant) and biozyme (1.58g/ plant. Highest grain yield (10.66 q/ ha.) were obtained from combined application of aminos + planofix, followed by aminos+ tracel (10.35 q/ha), aminos+ biozyme (10.26 q/ ha), biozyme+ planofix (9.95 q/ha). Among single applied growth boosters highest yield (9.32 q/ ha) were found from aminos and followed by planofix (9.11 q/ ha), tracel (8.86 q/ ha) and biozyme (7.86 q/ ha). It was note that *Rhizobium* inoculation was more contribute (7.86 q/ ha) compared to control (7.45 q/ ha) treatment in the second year (*Kharif* 2014) experimentation (Table 4). Dathe and Lara (1990) observed yield improvement in soybean by foliar application

Table 4 : Effect of growth boosters on yield attributes of black gram in *Kharif* 2014

Treatments	Pods/pl.	Pl. dry wt./ pl. g at harvest	Grain/pl.	Grain yield q/ ha.	Thousand grain wt. g.
control	5.25	1.28	7.33	7.45	73.66
Rhizobium	6.10	1.36	7.66	7.86	75.40
R+ Aminos	7.86	1.86	10.33	9.32	78.21
R+ Biozyme	6.33	1.58	9.46	7.86	75.78
R+ Planofix	7.80	1.73	9.85	9.11	77.62
R+ Tracel	7.56	1.65	9.56	8.86	76.67
R+ Amino+ Biozyme	9.00	2.33	11.20	10.26	80.32
R+ Biozyme+ Planofix	8.66	2.10	11.30	9.95	79.46
R+ Planofix+ Tracel	7.95	1.90	10.82	9.86	79.15
R+ Biozyme+ Tracel	7.67	1.85	10.76	9.65	78.68
R+ Aminos+ Tracel	9.12	2.36	12.33	10.35	80.75
R+ Aminos+ Planofix	9.21	2.45	12.66	10.66	81.66
	*	**	**		NS
S.E.±	1.113	0.186	0.423	0.541	5.532
C.D. (P=0.05)	2.241	0.308	0.848	0.734	8.843

* and ** indicate significance of values at P=0.05 and 0.01, respectively NS= Non-significant

of Biozyme and NAA on soybean. Mahala *et al.* (2001) observed the significant contribution of plant growth regulators on growth and yield of blackgram (*Vigna mungo*) at varying levels of phosphorus. It was concluded that *Rhizobium* inoculation increased yield compared to control treatment. Also concluded that all growth boosters increased yield parameters when applied singly are different combinations.Kim and Chung (1993) also concluded that growth regulators were applied on two cultivars of soybean. This increased seed yield significantly with NAA.Chandrasekhar and Bangarusamy (2003) recorded maximizing the yield of mungbean by foliar application of growth regulating chemicals and nutrients. Dixit and Elamathi (2007) also support the effect of foliar application of DAP, micronutrients and NAA on growth and yield of green gram (*Vigna radiata* L.) to increase yield.

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