The Pharma Innovation Journal 2020; 9(12): 27-29

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2020; 9(12): 27-29

www.thepharmajournal.com
Received: 15-10-2020
Accepted: 22-11-2020

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Impact of plant growth regulators in lab Lab (*Dolichos lablab* L.) on yield and yield contributing characters

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Abstract
The present investigation was carried out with an objective to study the yield response of various Plant Growth Regulators in Lab lab (*Dolichos lablab* L.) at University Orchard, Department of Vegetable Crops, Horticultural College and Research Institute, TNAU, Coimbatore during 2015 to 2018. The experiment was laid out in Factorial Randomized Block Design with nine treatments and three replications. The treatment were T1 – Water Spray (control), T_2 – NAA @ 50 ppm,T_3 –NAA @ 100 ppm, T_4 –Ethrel @ 250 ppm, T_5 – Ethrel @ 500 ppm, T_6 –Cycocel @ 500 ppm, T_7 –Cycocel @1000 ppm, T_8 –Nitrobenzene @ 50 ppm and T_9 – Nitrbenzene @100 ppm. The foliar sprays were imposed on 30, 60 and 75 days after sowing. Studies revealed that the yield and yield contributing characters of Dolichos bean differed significantly due to foliar spray treatments of different plant growth regulators. Among the different foliar treatments, NAA @ 100 ppm (T_3) and NAA @ 50 ppm (T_2) recorded earlier flowering (44.88 days and 44.07 days respectively) followed by Nitrobenzene 50 ppm (T8) (45.59 days) found to be the best. Application of NAA @100 ppm recorded the highest number of flowers/plant (241.85 flowers/plant), number of fruits/plant (178.91/plant) and highest yield/plant (0.39 kg) as compared to control.

Keywords: Dolichos bean, foliar spray, plant growth regulators, NAA, yield and contributing traits

Introduction
Dolichos bean or Hyacinth Bean (*Dolichos lablab L.*) is also called as Indian bean is an ancient legume crop widely grown throughout the world as vegetable or pulse for human consumption or as animal forage or feed. It originated in India and belongs to the family Fabaceae Sub. family Papilionoideae. The crop is gaining popularity among vegetable growers due to higher remuneration and steady market demand. The crop is mostly grown throughout tropical regions of Asia, Africa and America. In India, it is grown as a field crop in Tamil Nadu, Andhra Pradesh, Karnataka, Madhya Pradesh, Kerala and Maharashtra.

Dolichos is called as *'Avarai'* in Tamil. Apart from being` a good source of protein, minerals and vitamins (Parmar *et al*., 2013) [7]. It also has antihypertensive property (Singhal *et al*., 2014) [12] and mainly grown for the consumption of green pods, green seeds and dry seeds as pulse. Dolichos bean is largely grown for consumption as human food. Immature pods and mature are cooked and consumed as vegetable or salads. Lablab beans are also known to posses medicinal value. Seeds are alexeritic, antispasmodic, aphrodisiac, febrifugal and stomachic while leaves are used for the treatment of colic, gonorrhea and leukorrhea. Being a legume, it fixes atmospheric nitrogen to the extent of 170 kg per ha besides leaving enough crop residues to enrich the soils with organic matter.

The plant is a bushy, semi erect, perennial herb showing no tendency to climb. The leaves are made up of three leaflets each measuring up to 15 cm long. The inflorescence is made up of racemes of many flowers. Some cultivars have white flowers and others may have purplish or blue. The fruit is a legume pod variable in shape, size and colour and the pod contains up to five seeds. The crop prefers relatively cool seasons with temperature ranging from 14 to 28 °C. Its wild forms are also found in India. Karnataka contributes a major share, nearly 90 percent in terms of both area and production in the country and holds is producing about 18,000 tonnes from an area of about 85,000 hectares.

This crop is cultivated generally in *kharif* season. Photosensitivity, indeterminate growth habit and most importantly heavy flower dropping and lack of knowledge on foliar spraying of growth regulators among farmers leads to failure in realisisng higher productivity. The scope for increasing the productivity is by identification of suitable growth regulators and the dosage for the increased yield that could reduce the of cost management practices for achieving the

commercial success of the crop. In contrast to the breeding approach which is difficult and costly, foliar application of plant growth regulators is an easy, low cost and low risk technique and alternative approach to overcome the above obstacles. Keeping this background in view, the present investigation was initiated with an objective to enhance the growth and productivity of this crop by use of plant growth regulators.

Material and Methods

The field experiment was conducted at the University Orchard, Department of Vegetable Crops, Horticultural College and Research Institute, TNAU, Coimbatore. The soil of the experimental site was medium clay loam. The experiment comprised of six cropping seasons and plant growth regulators with nine treatment combination. The experiment was laid out in factorial RBD with three replications. The seeds were sown at 45 x 15 cm spacing and routine cultural operations were adopted to keep the plots free from weeds other stress. The growth regulators were sprayed at 30, 60 and 75 days after planting. The bio metric observations were recorded on five randomly selected plants from each plot. The data was analyzed by adopting the standard procedure of Panse and Sukhatme (1985) [6] and using TNSTAT software. Wherever, the results were found significant, critical differences (CD) were computed at 5 per cent level of probability to draw statistical conclusions.

Table 1: Treatment details

Treatment Details
T1- Water spray (Control)
T2 - NAA @ 50 ppm
T3 -NAA @ 100 ppm
T4 - Ethrel @ 250 ppm
T5 - Ethrel @ 500 ppm
T6 - Cycocel @ 500 ppm
T7- Cycocel @ 1000 ppm
T8- Nitrobenzene @ 50 ppm
T9 - Nitrobenzene @ 100 ppm

Results and Discussion

The plant growth and developmental characters, flowering and quality parameters are generally influenced by several biotic, abiotic, agronomic and management practices besides genetic makeup of a every genotype. In this study, the quantitative characters with respect to different plant growth regulators spray has been recorded in dolichos bean. The plant growth regulators sprays are known to exert significant influence on plant structure, crop growth, maturity and pod yield in lab lab. In the present study also, plant growth regulators have showed the marked stimulatory effect on various crop growth, flowering, maturity and pod yield irrespective of the season.

The higher green pod yield 0.39 kg per plant was recorded may be due to higher plant height and number of branches at 30, 60 DAS and number of harvest was significantly higher in NAA @ 100 ppm (T3) and was least in control plot. The plant height (97.18 cm) and number of branches (56.60) was also markedly maximum in the above treatment. Application of plant growth regulators alone influenced the height of plant beneficially during early growth stage. This might be due to presences sufficient amount of available nitrogen in the soil at this stage. However, spraying of plant growth regulators showed significant differences and found better in respect of height of plant than water spray alone (T_1Conrol). Singh *et al.* 2018 [11], Rathod *et al*., 2015 [10] and Deotale *et al.* (1993) [3] reported maximum height of lab lab and French bean. The days taken for first flowering and days to 50% flowering was significantly less in NAA @ 100 ppm (T_3) (44.88 and 57.24 days, respectively) followed by (45.07 and 59.29 days, respectively) in NAA @ 50 ppm (T_2). Similar findings were also reported by earlier workers (Pramoda and Sajjan, 2018 and Jaisankar and Manivannan, 2018) [9, 5] in Lablab and Imami *et al*., 2011[4] in chickpea.

The treatment (T_3) GA_3 100 ppm produced maximum number of flowers / plant (241.85), Number of spikes / plant (19.47) and maximum number of nodes on the main stems (62.47) followed by treatment (T_8) Nitrobenzene @ 50 ppm registered the best performance for the above characters. Similar results were also reported by earlier workers Upadhayay *et al*. (2010) [13], Patil *et al.*2005 [8] and Dahmardeh *et al.*, 2010 [2]. Further, it was reported that Planofix (NAA) has showed beneficial effecton preventing flower drop in legume cropswhich may beperhaps due to maintenance of favorable balance of endogenous hormones related to flowering and phonological traits which in turn resulted in decrease in flower drop butincrease of pod yield per hectare. Similar reports were also reported by Pramoda and Sajjan, 2018 [9] and Jaisankar and Manivannan, 2018 [5], Dahmardeh *et al.*, 2010 [2] and Upadhayay, 2010 [13] in lablab and chick pea.

The maximum number of harvestable green pods per plant was recorded in treatment T_3 NAA @100 ppm (178.91 pods / plant), while minimum number of pods per plant was recorded in treatment T_4 Ethyrel @ 250 ppm (125.40 pods). The highest Pod length (13.69 cm)and pod width (2.61 cm) recorded in the treatment T_3 NAA @ 100 ppm followed by Treatment T_8 Nitrobenzene @ 50 ppm. Individual pod weight is one of the important yield contributing character and it was highest in the Treatment T_3NAA @100 ppm followed by T_2 NAA @50 ppm and T_8 Nitrobenzene @ 50 ppm. The maximum yield in treatment $T_3$was due to more number of pods and large sized green pods as well as increased vegetative growth, which might have increased the synthesis of carbohydrates which ultimately promoted maximum growth and higher yield. It has been also reported that, the secretes of hormones like IAA, Cytokinin, Auxin and GA which might have been another factor for increasing the yield. The above results corroborates with Pramoda and sajjan, 2018 [9], Jaisankar and Manivannan, 2018 [5] and Brown *et al.* (1993) [1].

Conclusion

The results of the present experiment indicated that, the effect of plant growth regulators on growth and yield contributing characters in Dolichos bean [*Lablab purpureus*(L.)] revealed that the treatment, NAA @ 100 ppm (T3) registered best performance in almost all the characters studied in this experiment *viz.*, plant height (97.18 cm), number of branches per plant (56.60), days to first flowering (44.88), days to 50% flowering (57.24), numbsr of nodes on main stem (62.47), number of spikes/ plant (19.47), number of flowers / plant (241.85), Individual weight / pod(12.77 g) and total green pod yield (0.39 kg). From the above it is concluded that the treatment NAA @ 100 ppm could be used as foliar spray and it may be considered as feasible technology for the farmers to get big harvest in lablab cultivation with the productivity.

Table 2: Effect of growth regulators in six different seasons on growth, yield and quality characters of bush type lab lab (*Lablab purpureus (L.)*

Treatment	1	2	3	4	5	6	7	8	9	10	11	12	13
T1	88.53	43.93	37.75	48.96	62.49	15.58	188.01	72.79	136.68	10.67	2.35	8.05	0.24
T2	87.58	55.07	48.01	45.07	59.29	17.89	213.87	68.13	161.67	12.32	2.46	12.27	0.32
T3	97.18	62.47	56.60	44.88	57.24	19.47	241.85	65.46	178.91	13.69	2.61	12.77	0.39
T4	82.27	42.09	35.41	49.17	64.02	15.58	187.22	77.76	125.40	10.54	2.33	8.55	0.25
T5	78.48	38.48	37.25	52.49	65.78	15.50	183.70	80.90	144.35	9.92	2.14	7.99	0.22
T6	81.85	50.67	42.75	47.50	60.34	15.75	191.63	74.20	153.66	10.69	2.33	8.05	0.23
T7	88.20	52.67	51.23	49.36	61.78	17.56	201.41	69.79	163.92	12.05	2.42	7.36	0.33
T8	90.11	60.89	52.78	45.59	57.75	19.14	227.66	68.09	174.88	13.07	2.52	10.95	0.34
T9	85.73	51.76	49.56	47.50	61.26	17.64	212.70	72.58	150.58	12.12	2.42	8.12	0.33
Seasons													
1	83.53	37.19	40.37	36.83	52.67	16.56	244.33	75.44	136.44	11.44	2.44	9.37	0.26
2	85.21	38.47	43.21	40.56	60.00	17.67	241.56	72.33	165.44	12.26	2.41	9.29	0.26
3	89.58	56.34	48.88	39.67	61.67	15.78	181.78	74.89	119.90	11.50	1.83	9.42	0.21
4	87.76	56.92	46.04	55.56	66.67	17.11	215.11	68.22	138.89	12.00	2.49	9.35	0.26
5	86.77	58.11	47.57	56.56	65.89	17.67	174.22	74.76	183.22	11.43	2.60	9.41	0.52
6	87.10	58.33	48.14	57.18	59.74	17.96	175.03	67.49	182.80	11.42	2.60	9.23	0.26
Treatments													
SEd	0.52	0.35	0.28	0.34	0.51	0.16	1.78	1.06	1.55	0.1	0.02	0.08	0.01
CD @ 0.05%	1.04	0.68	0.55	0.68	1.01	0.32	3.52	2.09	3.07	0.21	0.04	0.16	0.01
CD @ 0.01%	1.38	0.91	0.72	0.9	1.34	0.42	4.68	2.78	4.08	0.27	0.06	0.21	0.01

1. Plant height (cm)
2. No. of nodes on main stem
3. No. of branches
4. Days to 1st flowering
5. Days to 50% flowering
6. No. of spikes/ plant
7. No. of flowers / plant
8. Days to first harvest
9. Number of harvestable green pods/plant
10. Pod length (cm)
11. Pod width (cm)
12. Individual pod weight (g)
13. Total green pod yield (Kg)

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