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Effect of Season and Plant Growth Regulators on Crop Growth and Yield in Dolichos Bean [*Lablab purpureus* (L.) Sweet]

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ABSTRACT

The field experiments were carried out during 2016-17 at Department of Seed Science and Technology, UAS Dharwad. There are 18 treatment combinations involving two seasons viz., kharif season 2016 and rabi season 2016-17 and plant growth regulators as other factor viz., G_1: Control, G_2 : GA_3 @ 50 ppm, G_3 : NAA @ 40 ppm, G_4 : Cycocel @ 100 ppm, G_5 : Mepiquat chloride @ 50 ppm, G_6 : Nitrobenzene @ 200 ppm, G_7: TIBA @ 50 ppm, G_8 : Brassinosteroids @ 200 ppm, G_9 : GA_3 @ 5 ppm + IAA @ 5 ppm. The results shows that more number of branches (9.83) per plant at harvest , higher relative chlorophyll content (SPAD value) (49.76), days to flower initiation (41.59) and also for less days to 50 % flowering (45.97) days and early (51.91) days to pod initiation and (90.50) days to pod maturity compared to kharif season (S_1) except plant height. Among the plant growth regulator foliar spray, higher plant height and number of branches (114.80 cm and 10.87, respectively) at harvest, higher relative chlorophyll content (SPAD value) (51.08) ,early flower initiation , pod maturity was recorded in NAA @ 40 ppm and least was seen in control plots (G_1) followed by in nitrobenzene @ 200 ppm. The interaction effect was found to be non significant However, foliar spraying of NAA @ 40 ppm recorded higher growth and yield attributing parameters as compared to control.

Key words: *Dolichos bean, Rabi season, NAA, nitrobenzene, SPAD value and Seed yield.*

INTRODUCTION

Dolichos Bean or Hyacinth Bean (*Dolichos lablab L.*) is also called as Indian bean. It is originated in India and belongs to the family Fabaceae Sub. Family Papilionoideae. 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. It is a bushy, semi erect, perennial herb showing no tendency to climb. The leaves are made up of three leaflets each 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.

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It contains up to five seeds. The crop prefers relatively cool seasons with temperature ranging from 14 ^{0} to 28 °C. Its wild forms are found in India. Karnataka contributes a major share, nearly 90 percent in terms of both area and production in the country. Karnataka state records production about 18,000 tonnes from an area of about 85,000 hectares[1]. 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

It is generally grown under *kharif* season but late *kharif* cultivation is also practised. Non availability of quality seeds, absence of suitable seed production technology, heavy flower dropping and heavy incidence of pest and diseases, inadequate post harvest handling operations and lack of knowledge about varieties by farmers lead to fall in productivity. It could be enhanced by developing suitable low cost seed production technology by combining conventional and scientific 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 agricultural problems. Went[21] stated that without hormones there would be no growth. Lever[10] considered the influence of economic factors on the future of growth regulators in relation to their use in field crops. Keeping this background in view, the present investigation was initiated with an objective to enhance the crop growth and productivity of this crop by use of plant growth regulators.

MATERIAL AND METHODS

The *kharif* field experiment was conducted at the Main Agricultural Research Station Farm, University of Agricultural Sciences, Dharwad while the *rabi* field experiment in the Saidapur Farm and laboratory studies in Seed Science and Technology department, University of Agricultural Sciences, Dharwad. It is situated under the Agro Climatic Zone-8 (Northern Transitional tract) of Karnataka State. The soil of the experimental site was medium deep black clay. The experiment comprised of two seasons and plant growth regulators with 18 treatment combination. The experiment was laid out in factorial RBD with three replications. The seeds were sown at 45 x 15 cm spacing and entire quantity of fertilizer 25:50:25 kg NPK per ha was applied as a basal dose. Routine cultural operations were attended to keep the plots free from weeds. The observations were recorded on plant growth and yield in both the season.

RESULTS AND DISCUSSION

Influence of season (S)

The plant growth, flowering, seed yield and quality parameters are generally are influenced by several biotic, abiotic, agronomic and management practices besides genetic makeup of a genotype. In this study, seasonal differences with respect to plant growth regulators has been recorded in dolichos bean. Significant variation in plant height at 30, 60 DAS and at harvest was observed. In general *kharif* season (S_1) recorded more plant height of 26.67 cm, 56.96 cm and 108.74 cm at 30, 60 DAS and at harvest, respectively (Table 1). 1,281 seed yield kg per ha was recorded during rabi season. The increased seed yield may be attributed to numerically more number of branches and relative chlorophyll (SPAD value) did not differ much were observed in *rabi* season (S_2) at 30, 60 DAS and at harvest respectively as compared to *kharif* season (S_1). The relative higher chlorophyll content (SPAD value) (37.65, 49.76 and 36.53) were obtained in *rabi* season (S_2) at 30, 60 DAS and at harvest, respectively (Table 2) as compared to *kharif* season (S_1). Leaf chlorophyll content is an indicator of the physiological status of a plant. (SPAD chlorophyll meter reading) (SCMR) and it is an important indicator of photo-synthetically active light transmittance characteristics of the leaf[16], which is dependent on the unit amount of chlorophyll (chlorophyll density) per unit leaf area. In general, chlorophyll content was increased from 30 DAS to 60 DAS and decreased thereafter. Consistently superior growth performance with higher plant height, number of branches

in *rabi* season may be attributed to the prevalence of cool day temperature during *rabi* season Moderately good humid climate and bright sunny period during the grand vegetative stage period in the transitional tract of Dharwad region. This congenial weather conditions might have enhanced the carbohydrate metabolism, accumulation and physiological process[2] leading to better growth parameters.

The days to flower initiation, days to 50 % flowering, days to pod initiation and days to pod maturity was generally controlled and influenced by the photoperiod of the environment prevailing during crop growth period. The *rabi* season (S_2) took numerically less (41.59) days to initiate flowering and also significantly for less days to 50 % flowering (45.97) days and (51.91) days less to pod initiation and (90.50) days as compared to *kharif* season (S_1) which took more days (Table 2 and 3). These findings are in agreement with findings of Ramteke[14] concluded that the number of days required by chick pea genotypes for flower initiation, 50 per cent flowering, pod formation and maturity were less in the *rabi* season compared to *kharif* season. Such earliness in flowering may be related to the photoperiod and lower temperature obtained during vegetative growth of plants as evident in the present study with higher number of branches and relative chlorophyll content (SPAD value) in *rabi* season which might have resulted in efficient bio-physiological processes and higher photosynthetic activity and metabolism leading to earliness in flowering behaviour unlike in *kharif* season. These findings were also in conformity with the work of Patel and Hemantaranjan, Verma and Promilakumari[20], Aziz and Rehman[3] and Merwade[11] in bengal gram and Sudeep kumar[19] in field bean. Similar reports of seasonal variations on days to flower initiation and 50 per cent flowering, pod initiation and pod maturity were made in chick pea by Merwade[11], Bulla[4] and Chandrashekhar[5] in french bean.

Influence of plant growth regulators (G)

The plant growth regulators sprays are known to exert significant influence on plant structure, crop growth, maturity and seed yield in different pluses. In the present study also, plant growth regulators have showed the marked stimulatory effect on various crop growth, flowering, maturity and seed yield irrespective of the season.

The higher seed yield 1,360 kg per ha may be due to higher plant height and number of branches at 30, 60 DAS and at harvest was significantly higher in NAA @ 40 ppm and was least in control plots. The plant height and number of branches at 30, 60 DAS and at harvest was markedly maximum (26.77, 59.41 and 114.80 cm and 4.09, 7.8 and 10.87, respectively) (Table 1). On the contrary at 30, 60 and 90 DAS and at harvest significantly higher relative chlorophyll content (SPAD value) (39.69, 51.08 and 38.47, respectively) (Table 2) was recorded in NAA @ 40 ppm and was least in control plots (G_1). Similar results were observed in chick pea[8] but after 60 days of sowing in both the season chlorophyll content decreased and this might be due to the plants reaching maturity and becoming yellow leaf, shredding and drying of leaves occur. However, at harvest, there was no difference observed between growth regulator concentrations. These results indicated that planofix (NAA) treatment has showed stimulatory influence with growth parameters over control and other growth regulators. These findings are in conformity in other crops like chickpea[15], green gram[6] and black gram[9].

The days taken days to flower initiation and 50 % flowering was significantly less in NAA @ 40 ppm (40.28 and 43.98 days, respectively) followed by (40.80 and 44.48 days, respectively) in nitrobenzene @ 200 ppm. Days taken days to pod initiation and days to pod maturity was significantly less in NAA @ 40 ppm (47.84 and 85.22 days, respectively) followed by (49.55 and 87.49 days respectively) in nitrobenzene @ 200 ppm (Table 3). Similar findings were also reported by earlier workers[12] in mung bean, Saishankar[17] in green gram and Subbain and Chamy[18] in green gram.

Influence of interaction effect of season and plant growth regulators (S × G)

The seed yield of any crop is a complex heritable character and influenced by many morphological and physiological characteristics of the plant interplaying with season and crop management practices. Several plant growth regulators are known to influence these characteristics in several ways it is well accepted fact that normal plant growth and development is resulted by specific hormones synthesized by the plant itself. The production of these hormones in plants is under genetic control and these are called as growth regulators.

The interaction between season and plant growth regulator foliar spray did not differed significantly. The plant height at 30, 60 DAS and at harvest were numerically higher in the interaction of $S_1 \times G_3$ and lower in $S_2 \times G_1$ interaction. The number of branches at 30, 60 DAS and at harvest were numerically higher in the interaction of $S_1 \times G_3$ and lower in $S_2 \times G_1$ interaction The plant height and number of branches at 30, 60 DAS and at harvest were markedly maximum (Table 1) (27.78, 61.12 and 114.88 cm, respectively in $S_1 \times G_3$ and (4.16, 7.99 and 10.90, respectively in $S_2 \times G_3$). On the contrary at 30, 60 DAS and at harvest significantly higher relative chlorophyll content (SPAD values) (52.68) recorded (Table 2) (41.34, and 39.30, at 30 DAS and harvest, respectively) were recorded in $S_2 \times G_3$ and least was in $S_1 \times G_3$ interaction.

The days taken days to flower initiation and 50 % flowering was numerically less in $S_2 \times G_3$ (39.29 and 38.40 days, respectively) followed by (39.82 and 45.19 days, respectively) in $S_1 \times G_3$. The days taken days to pod initiation and pod maturity was significantly less in $S_2 \times G_3$ (46.87 and 84.00 days, respectively) followed by (48.06 and 85.00 days, respectively) in $S_2 \times G_4$ interaction (Table 3). Similarly non-significant differences were observed between the plant growth regulators 1,375 kg seed yield per hectare (Table 3) recorded in the interaction of $S_2 \times G_3$ and the lower results were observed in the interaction of $S_1 \times G_3$. Similar observations were also seen by Patil *et al*.[12,13] that in gram plant height was increased maximum by treatment nitrobenzene (20 %) and minimum in control. The days to 50 % flowering maximum and no. of pods per plant showed significant results by the treatment of nitrobenzene (20 %) over all treatments, nitrobenzene (20 %) showed statistically significant results over all treatments[15].

Table 1: Effect of season and plant growth regulators on plant height and number of branches per plant at different growth stages in dolichos bean cv. HA-4

Treatments	Plant height (cm)			Number of branches		
	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest
Season (S)						
S_1-*Kharif*-2016	26.67	56.90	108.74	3.50	7.08	9.71
S_2-*Rabi*-2016-17	24.85	54.94	105.90	3.47	7.12	9.83
S. Em. ±	0.63	0.62	0.83	0.09	0.15	0.22
C. D. at 5%	0.80	1.78	2.40	NS	NS	NS
Plant growth regulators (G)						
G_1: Control	24.09	52.74	97.54	2.98	6.01	7.92
G_2 : GA_3 @ 50 ppm	26.61	54.26	110.22	3.49	6.68	9.87
G_3 : NAA @ 40 ppm	26.77	59.41	114.80	4.09	7.81	10.87
G_4 : Cycocel @ 100 ppm	24.20	55.81	100.11	3.14	7.11	9.35
G_5 : Mepiquat chloride @ 50 ppm	26.16	54.97	103.97	3.44	7.03	9.88
G_6 : Nitrobenzene @ 200 ppm	26.53	57.57	111.12	3.96	7.42	9.99
G_7 : TIBA @ 50 ppm	24.81	56.06	107.80	3.29	7.27	9.94
G_8 : Brassinosteroids @ 200 ppm	26.08	55.20	108.30	3.38	7.15	9.58
G_9 : GA_3 @ 5 ppm + IAA @ 5 ppm	26.60	57.30	112.05	3.58	7.40	9.99
S. Em. ±	1.33	1.32	1.77	0.18	0.33	0.42
C. D. at 5%	NS	3.78	5.09	NS	0.95	1.21
Interactions (S G)						
S_1G_1	24.54	53.46	98.09	3.02	6.23	7.86

S_1G_2	27.12	54.50	110.09	3.59	6.60	9.59
S_1G_3	27.78	61.20	114.88	4.03	7.64	10.83
S_1G_4	24.46	56.17	100.12	3.01	7.00	10.41
S_1G_5	27.54	55.18	107.96	3.52	6.88	9.90
S_1G_6	27.04	58.39	112.21	3.66	7.23	9.99
S_1G_7	27.29	57.47	110.69	3.26	7.49	9.66
S_1G_8	27.32	56.82	111.45	3.44	7.47	10.47
S_1G_9	26.95	59.01	113.22	3.94	7.18	9.74
S_2G_1	22.33	52.02	96.99	2.94	5.79	8.06
S_2G_2	26.11	54.03	110.36	3.40	6.77	10.15
S_2G_3	25.76	57.69	114.72	4.16	7.99	10.90
S_2G_4	23.95	55.45	100.10	3.23	7.22	9.09
S_2G_5	24.78	54.75	99.98	3.36	7.19	10.07
S_2G_6	26.02	56.75	110.04	3.50	7.07	9.77
S_2G_7	23.63	54.64	104.90	3.31	7.30	10.22
S_2G_8	24.84	53.59	105.16	3.32	7.38	9.63
S_2G_9	26.24	55.59	110.87	3.99	7.37	10.24
Mean	**25.76**	**55.92**	**107.30**	**3.48**	**7.10**	**9.77**
S. Em. ±	1.88	1.86	2.50	0.26	0.47	0.59
C. D. at 5%	NS	NS	NS	NS	NS	NS

NS - Non-significant

Table 2: Effect of season and plant growth regulators on relative chlorophyll content (SPAD value) and days to flower initiation and 50 % flowering in dolichos bean cv. HA-4

Treatments	Relative chlorophyll content (SPAD value)			Days to flower initiation	Days to 50 % flowering
	30 DAS	60 DAS	At harvest		
Season (S)					
S_1-*Kharif*-2016	37.04	46.36	34.20	42.41	49.76
S_2-*Rabi*-2016-17	37.65	49.76	36.53	41.59	45.97
S. Em. ±	1.07	1.01	0.63	0.33	0.99
C. D. at 5%	NS	2.95	NS	NS	2.84
Plant Growth regulators (G)					
G_1: Control	36.33	43.11	31.64	44.08	50.90
G_2 : GA_3 @ 50 ppm	38.56	47.07	35.83	43.00	46.35
G_3 : NAA @ 40 ppm	39.69	51.08	38.47	40.28	43.98
G_4 : Cycocel @ 100 ppm	37.46	46.22	36.05	41.86	46.51
G_5 : Mepiquat chloride @ 50 ppm	37.08	47.55	35.38	42.91	48.55
G_6 : Nitrobenzene @ 200 ppm	38.63	49.94	36.27	40.80	44.48
G_7 : TIBA @ 50 ppm	33.36	46.17	34.47	41.98	50.03
G_8 : Brassinosteroids @ 200 ppm	37.16	47.16	34.39	42.23	49.15
G_9 : GA_3 @ 5 ppm + IAA @ 5 ppm	38.85	49.28	36.39	40.91	45.01
S. Em. ±	2.27	2.14	1.33	0.70	2.10
C. D. at 5%	NS	6.16	3.83	2.01	6.03
Interactions (S G)					
S_1G_1	36.00	42.09	31.36	45.06	59.33
S_1G_2	39.41	46.57	35.64	43.67	48.05
S_1G_3	38.33	49.49	37.64	39.82	45.19
S_1G_4	36.49	47.80	34.10	41.55	47.71
S_1G_5	36.48	47.96	32.83	43.25	48.05
S_1G_6	38.16	50.70	36.20	41.52	45.65
S_1G_7	32.61	44.87	37.57	42.13	49.16
S_1G_8	36.80	48.08	33.02	42.42	49.00
S_1G_9	39.07	48.82	34.94	42.30	55.74
S_2G_1	36.67	44.14	31.93	43.10	49.86
S_2G_2	37.71	47.57	36.02	42.33	46.86
S_2G_3	39.05	52.68	39.30	39.29	38.40
S_2G_4	38.42	49.57	38.01	42.17	47.36
S_2G_5	37.67	47.14	37.94	42.56	46.50
S_2G_6	39.09	49.18	36.33	40.73	44.03
S_2G_7	34.11	47.46	35.62	41.83	49.24
S_2G_8	37.52	46.23	35.76	42.04	46.55
S_2G_9	38.64	49.75	37.84	40.30	44.95
Mean	**37.35**	**47.78**	**35.37**	**42.00**	**47.95**
S. Em. ±	3.21	3.03	1.88	0.99	2.97
C. D. at 5%	NS	8.71	NS	NS	NS

NS - Non-significant

Table 3: Effect of season and plant growth regulators on days to pod initiation and days to pod maturity in dolichos bean cv. HA-4

Treatments	Days to pod initiation	Days to pod maturity	Seed yield per ha (kg)
Season (S)			
S_1-*Kharif*-2016	53.31	93.24	1,246
S_2-*Rabi*-2016-17	51.91	90.50	1,281
S. Em. ±	0.38	0.94	8
C. D. at 5%	1.09	2.71	24
Plant Growth regulators (G)			
G_1: Control	57.90	98.07	1,183
G_2 : GA_3 @ 50 ppm	52.69	91.93	1,276
G_3 : NAA @ 40 ppm	47.84	85.22	1,360
G_4 : Cycocel @ 100 ppm	49.41	90.99	1,252
G_5 : Mepiquat chloride @ 50 ppm	57.25	92.93	1,268
G_6 : Nitrobenzene @ 200 ppm	49.55	87.49	1,299
G_7 : TIBA @ 50 ppm	52.26	93.69	1,197
G_8 : Brassinosteroids @ 200 ppm	53.44	92.92	1,252
G_9 : GA_3 @ 5 ppm + IAA @ 5 ppm	53.18	91.46	1,280
S. Em. ±	0.80	0.94	17
C. D. at 5%	2.41	2.83	48
Interactions (S G)			
S_1G_1	57.92	99.72	1,158
S_1G_2	53.06	92.79	1,256
S_1G_3	48.81	86.44	1,344
S_1G_4	50.76	96.62	1,226
S_1G_5	58.00	93.15	1,255
S_1G_6	49.79	89.98	1,290
S_1G_7	52.19	94.29	1,179
S_1G_8	55.70	93.85	1,242
S_1G_9	53.60	92.32	1,260
S_2G_1	56.58	94.72	1,209
S_2G_2	52.31	91.06	1,296
S_2G_3	46.87	84.00	1,375
S_2G_4	48.06	85.00	1,277
S_2G_5	57.79	92.71	1,281
S_2G_6	49.32	92.00	1,308
S_2G_7	52.32	90.09	1,216
S_2G_8	51.18	94.35	1,261
S_2G_9	52.76	90.59	1,301
Mean	**52.61**	**91.87**	**1,262**
S. Em. ±	1.14	2.83	23
C. D. at 5%	NS	NS	NS

NS - Non-significant

CONCLUSION

The results of the present investigations indicated that the effect of season and plant growth regulators on growth and seed yield parameters in Dolichos bean [*Lablab purpureus* (L.) Sweet] shows that the *kharif* sown crop was recorded higher growth and yield attributing parameters in *rabi* season as compared to *kharif* season. Similarly among the plant growth regulator foliar spray produced higher plant height and number of branches (114.80 cm and 10.87, respectively)

at harvest obtained in NAA @ 40 ppm. At 60 DAS significantly higher relative chlorophyll content (SPAD value) (51.08) was recorded in NAA @ 40 ppm and least was seen in control. The days taken to flower initiation and days to 50 % flowering was significantly less in NAA @ 40 ppm, (40.28 and 43.98, days respectively) followed by (40.80 and 44.48 days, respectively) in nitrobenzene @ 200 ppm. The days taken pod initiation and days to crop maturity was less in NAA @ 40 ppm (49.41 and 90.99 days, respectively) followed by (49.55 and 87.49 days, respectively) in nitrobenzene @ 200 ppm. The interaction effect was found to be non-significant for majority of the characters studied. However, foliar spray with NAA @ 40 ppm recorded higher crop growth, seed yield and quality parameters compared control and other plant growth regulators spray during rabi season.

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