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# EFFECT OF DECAPITATION AND PGRS ON PARAMETERS OF PLANT GROWTH ANALYSIS OF CLUSTER BEAN (*CYAMOPSIS TETRAGONOLOBA* TAUB.) CV. PUSA NAVBAHAR

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***Abstract***

*An experiment was conducted to study the "Effect of decapitation and PGRs on growth and seed yield of cluster bean (Cyamopsis tetragonoloba Taub.)" cv. Pusa Navbahar with 3 (three) decapitation treatments and 4(four) Plant growth regulators each at two concentration with control in factorial randomized design with three replication at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during summer 2014. The results showed significant differences among the yield parameters due to decapitation treatment. Growth parameters viz; Days to 50 % flowering, plant height and number of leaves per plant were found non-significant at 75 and 90 DAS. The effects of decapitation and PGR's on physiological parameters viz; LA and LAI of plant were found non-significant at 60 and 90 DAS. At 60 DAS fresh weight and dry matter content of plant were found non-significant. Whereas, at 60 DAS CGR values were found significant (0.0016 g/cm$^2$/day) under the treatment $D_3$ (decapitation at 45 DAS) whereas, NAR values were found non-significant in analysis. Under Plant growth regulators treatments Physiological parameters viz; LA, LAI and fresh weight and dry matter content of plant were also found 60 and 90 DAS registered non-significant results. Whereas, CGR (0.0019 g/cm$^2$/day) and NAR values (0.0274 g/cm$^2$/day) were found significant under the treatment $P_1$ (Control). Different combination of decapitation and PGRs treatments recorded significant results on physiological parameters at various growth stages viz; LAI (0.0428) by the treatment combination of $D_2P_2$. Whereas, LA and LAI at 60 DAS and 90 DAS recorded non-significant results in different combinations except CGR (0.0021 g/cm$^2$/day) and NAR (0.0311 g/cm$^2$/day) at 60 DAS which were found significant due to interaction between decapitation and PGRs treatments. At all the growth stages, interaction between $D_1P_1$ (without decapitation and no spray) and $D_3P_2$ (Decapitation at 45 DAS and $GA_3$ 25 mg l$^{-1}$) recorded significantly higher values for all the physiological parameters. Fresh weight of plant and dry matter content of plant were found non-significant in analysis*

***Key words:*** *Cluster bean, Decapitation, PGR's, Sink, Source, Abscission,*

## Introduction

Cluster bean (*Cyamopsis tetragonoloba* (L) Taub.) popularly known as *guar* is an important legume vegetable crop. Cluster bean is grown for its young tender green immature pods, which are used as a nutritive vegetable. It can be grown on a almost all types of soil. It can grow well in *kharif* and summer seasons. In spite of commercial importance of cluster bean crop in our daily diet and wide spread cultivation, availability of pure and a good quality seed is not satisfactory. Seed is the most important input for increasing the vegetable production and productivity. Quantity and quality of seed will have a direct effect on availability of fresh vegetable in the market. High seed quality comprising, high germination and vigour, which are required for higher and quality vegetable production. Clipping of main shoot is called decapitation, which modify the growth and play an important role in diversification of food materials from sink to source *i.e.* seed yield and seed quality and also reduce the maturity period. Due to the wide spread cultivation and nutritive important in our daily life, demand for seed requirement is increasing day by day, but availability of pure and good quality seed is not available at proper time. Various attempts have been made to increase production of seed with better quality. Plant growth regulators (PGRs) are known to improve physiological efficiency including photosynthetic ability of plants and offer a significant role in realizing higher crop yields. The PGRs are also known to enhance the source-sink relationship and stimulate the translocation of photo-assimilates, thereby increasing the productivity. Though, the plant Growth regulators have great potential, its application and accrual assessment etc. have to be judiciously planned in terms of optimal concentration, stage of application, species specificity and seasons. In their wide spectrum of effectiveness on every aspect of plant growth, even a modest increase of 10-15 per cent could bring about an increment in the gross annual productivity by 10-15 m tonne. (Sharma and Lashkari, 2009).

## Materials And Methods

A field study was undertaken during summer season of 2014 at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. There were twenty treatment combinations comprising Decapitation at 45 DAS and $D_4$ - Decapitation at 60 DAS. five different three decapitation treatments along with control *i.e.* $D_1$- Without decapitation (control), $D_2$- Decapitation at 30 DAS, $D_3$- PGRs treatments along with control *i.e.* $P_1$ - No spray (Control), $P_2$- $GA_3$ 25 mg l$^{-1}$, $P_3$- $GA_3$ 50 mg l$^{-1}$, $P_4$ - Thiourea 500 mg l$^{-1}$ and $P_5$- Thiourea 1000 mg l$^{-1}$ in a Randomized Block Design (Factorial) with three replications. All the concentration of PGR's were

applied at flowering stage. Five tagged plant from each net plot were selected for recording observations of growth parameters. Leaf area was measured by leaf area meter, in which randomly selected leaves from five selected plants were used and after computing the result, it was worked out as the average leaf area in centimeter square. The LAI was calculated with the help of following formula:

$$LAI = \frac{\text{Leaf area (LA)}}{\text{Land area (P)}}$$

**Crop Growth Rate (CGR)**

It depends on LAI and NAR can be computed as:

$CGR = LAI \times NAR$

$$\frac{La}{P} = \frac{1}{LA} \times \frac{dw}{dT} \times \frac{1}{P} = \frac{1}{dT} \times \frac{dw}{P} = \frac{1}{T_2 - T_1} \times (W_2 - W_1)$$

Where,

$W_1$ = Total Dry weight of the plant (g) at time $T_1$ interval

$W_2$ = Total Dry weight of the plant (g) at time$T_2$ interval

$T_2 - T_1$ = Time interval in days

P = Land (ground) area ($cm^2$)

**Net Assimilation Rate (NAR)**

Net Assimilation Rate is the rate of dry weight increase per unit leaf area per unit time.

It was calculated by using following formula and expressed as weight / area/ time *i.e* g $cm^{-2}$ $day^{-1}$.

$$NAR = \frac{W_2 - W_1}{A_2 - A_1} \times \frac{(\text{Log}^e A_2 - \text{Log}^e A_1)}{T_2 - T_1}$$

Where,

$W_2 - W_1$= Change in DW at time intervals $T_2$ and $T_1$

$A_2 - A_1$= Change in leaf area at time intervals $T_2$ and $T_1$

**Results And Discussion**

The results obtained from the present investigation have been discussed in details as under:

**Effect of decapitation:**

Looking to the physiological parameters *i.e.* fresh weight, dry weight, LA, LAI, CGR and NAR of plant it showed non-significant differences among the decapitation treatments except CGR and NAR. This may be due to defoliation senescence of mature leaves at later stage. Both the physiological parameters *viz;* CGR and NAR were found higher in treatment $D_3$ (Decapitation at 45 DAS) *i.e.* CGR (0.0016 g/$cm^2$/day) and NAR (0.0243 g/$cm^2$/day). This might be due to adverse effect of decapitation on vegetative growth and accumulation of metabolites and photosynthetic product, resulting in increasing number of leaves $plant^{-1}$ and leaf area and due to these CGR and NAR values were increased. This type of result is also reported by Argall and Stewart (1984) in cowpea; Satodiya *et al.* (2011) and Yadav *et al.* (1993) in cluster bean.

**Effect of Plant growth regulators:**

Results of various physiological parameters *viz.* LA, LAI, fresh weight and dry weight of plant showed non-significant differences at 60 and 90 DAS. However, CGR and NAR was found significant at 60 DAS. The maximum CGR (0.0019) and NAR (0.0274) of plant were found at 60 DAS and was recorded under the treatment $D_1$ (No spray). CGR had significant and positive correlation with bio-chemical and physiological processes that increased size of photosynthetic area, which contributed for biological yield. Present findings are in accordance with the reports of Yadav and Sreenath (1975), Shinde *et al.* (1991), Ganiger *et al.* (2002) in cowpea for LA; Mohandasss and Rajesh (2003) for LAI as well as dry matter production in cowpea and Burman *et al.* (2003) for dry matter accumulation in cluster bean

**Conclusion**

In the light of result obtained from present investigation, it may be inferred, while comparing effect of decapitation growth parameters *viz;* days to 50% flowering, plant height and number of leaves $plant^{-1}$ at 60 and 90 DAS, number of cluster per plant, were found to be non-significant. The effect of decapitation treatments on physiological parameters *viz;* fresh weight of plant, dry matter content of plant, LA, LAI and NAR were found non-significant at 60 and 90 DAS. However, CGR was significant. In terms of effect of PGRs Growth parameters *viz;* days to 50% flowering, plant height and number of leaves $plant^{-1}$ at

60 and 90 DAS were found non-significant. Result of various physiological parameters *viz;* fresh weight of plant, dry matter content of plant, LA and LAI were found non-significant at 60 DAS. Although, at 60 DAS CGR and NAR registered higher values in treatment $P_1$ (Control). Looking to the interaction effect between decapitation and PGR's treatments on days to 50 % flowering, plant height and number of leaves plant$^{-1}$ showed non-significant differences at 75 and 90 DAS. Different combination of decapitation and PGR's treatments recorded significant result at various stages for physiological parameters *viz;* LAI, CGR and NAR at 60 DAS LAI under the treatment $D_2P_2$. The treatment combination of $D_1$ $P_1$ registered higher crop growth rate in analysis. Interaction effect between $D_3$ $P_2$ recorded maximum NAR.

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Table 1: Effect of PGR's on growth characters

| A. Decapitation | Days to 50% flowering | Plant height (cm) 75 DAS | Plant height (cm) 90DAS | No. of leaves plant$^{-1}$75 DAS | No. of leaves plant$^{-1}$90 DAS | No. of cluster per plant | Fresh weight of plant (t ha$^{-1}$) | Dry matter contentof plant (kg ha$^{-1}$) |
|---|---|---|---|---|---|---|---|---|
| $D_1$ : Control | 22.23 | 70.19 | 114.76 | 14.67 | 21.01 | 21.00 | 7.71 | 1.68 |
| $D_2$ : Decapitation (30 DAS) | 22.67 | 69.42 | 106.16 | 13.82 | 21.21 | 20.78 | 7.53 | 1.59 |
| $D_3$ : Decapitation (45 DAS) | 23.60 | 70.30 | 103.56 | 13.92 | 20.33 | 20.53 | 7.11 | 1.63 |
| $D_4$ : Decapitation (60 DAS) | 22.33 | 70.48 | 107.74 | 13.86 | 21.32 | 21.50 | 8.16 | 1.77 |
| S.Em± | 0.40 | 1.00 | 3.42 | 0.40 | 0.50 | 0.59 | 0.29 | 0.07 |
| C.D. @ 5 % | NS | NS | NS | NS | NS | NS | N.S. | N.S. |
| **B. Plant growth regulators** | | | | | | | | |
| $P_1$ : No spray | 22.42 | 67.71 | 116.10 | 13.19 | 20.14 | 21.65 | 7.30 | 1.54 |
| $P_2$ : $GA_3$ 25 mg l$^{-1}$ | 23.25 | 69.16 | 107.43 | 15.05 | 21.44 | 20.24 | 7.10 | 1.80 |
| $P_3$ : $GA_3$ 50 mg l$^{-1}$ | 23.33 | 70.11 | 104.17 | 13.54 | 20.93 | 21.14 | 7.66 | 1.65 |
| $P_4$ : Thiourea 500 mg l$^{-1}$ | 22.00 | 71.07 | 104.41 | 14.21 | 20.98 | 21.02 | 7.61 | 1.64 |
| $P_5$ : Thiourea 1000 mg l$^{-1}$ | 22.67 | 72.42 | 108.15 | 14.35 | 21.35 | 20.70 | 8.46 | 1.71 |
| S.Em± | 0.45 | 1.11 | 3.82 | 0.45 | 0.56 | 0.66 | 0.33 | 0.08 |
| C.D. @ 5 % | NS | NS | NS | NS | NS | NS | N.S. | N.S. |
| **C. Interaction D X P** | | | | | | | | |
| S.Em± | 0.89 | 2.23 | 7.65 | 0.91 | 1.21 | 1.33 | 0.65 | 0.15 |
| C.D. @ 5 % | NS | NS | NS | NS | NS | NS | N.S. | N.S. |
| C.V. (%) | 6.81 | 5.53 | 12.26 | 11.20 | 9.32 | 11.00 | 14.77 | 15.91 |

**Table 2: Effect of decapitation and PGR's on growth of cluster bean**

| A. Decapitation | Leaf Area ($cm^2$) 60 DAS | Leaf Area ($cm^2$) 90 DAS | Leaf Area Index (LAI) 60 DAS | Leaf Area Index (LAI) 90 DAS | Crop Growth Rate (CGR) at 60 DAS ($g/cm^2/day$) | Net Assimilation Rate (NAR) at 60 DAS ($g/cm^2/day$) |
|---|---|---|---|---|---|---|
| $D_1$ : Control | 53.18 | 27.19 | 0.0393 | 0.0202 | 0.0015 | 0.0222 |
| $D_2$ : Decapitation (30 DAS) | 54.50 | 27.59 | 0.0405 | 0.0204 | 0.0014 | 0.0234 |
| $D_3$ : Decapitation (45 DAS) | 52.22 | 25.32 | 0.0389 | 0.0189 | 0.0016 | 0.0243 |
| $D_4$ : Decapitation (60 DAS) | 55.00 | 25.78 | 0.0409 | 0.0191 | 0.0012 | 0.0227 |
| S.Em± | 1.44 | 0.81 | 0.0011 | 0.0006 | 0.000023 | 0.0009 |
| C.D. @ 5 % | NS | NS | NS | NS | 0.000067 | NS |
| **B. Plant growth regulators** | | | | | | |
| $P_1$ : No spray | 51.85 | 25.61 | 0.0385 | 0.0190 | 0.0019 | 0.0274 |
| $P_2$ : $GA_3$ 25 mg $l^{-1}$ | 57.44 | 26.05 | 0.0428 | 0.0193 | 0.0014 | 0.0251 |
| $P_3$ : $GA_3$ 50 mg $l^{-1}$ | 50.85 | 27.40 | 0.0377 | 0.0203 | 0.0010 | 0.0204 |
| $P_4$ : Thiourea 500 mg $l^{-1}$ | 53.46 | 28.25 | 0.0398 | 0.0208 | 0.0014 | 0.0210 |
| $P_5$ : Thiourea 1000 mg $l^{-1}$ | 55.02 | 25.04 | 0.0408 | 0.0187 | 0.0015 | 0.0219 |
| S.Em± | 1.61 | 0.81 | 0.0012 | 0.0006 | 0.00003 | 0.0010 |
| C.D. @ 5 % | NS | NS | 0.0034 | NS | 0.0001 | 0.0029 |
| **C. Interaction D X P** | | | | | | |
| S.Em± | 3.23 | 1.63 | 0.0024 | 0.0012 | 0.0001 | 0.0020 |
| C.D. @ 5 % | NS | NS | 0.0068 | NS | 0.0001 | 0.0058 |
| C.V. (%) | 10.43 | 10.72 | 10.25 | 10.95 | 6.34 | 15.25 |



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