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# Performance of dolichos bean (*Lablab purpureus* L.) varieties as influenced by growth stimulants on quality and economics under southern Telangana conditions

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**Abstract**
An experimental study entitled "Studies on performance of dolichos bean (*Lablab purpureus* L.) varieties as influenced by growth stimulants under Southern Telangana conditions'' was carried out during the late *rabi* season of January to April 2024 at PG research block, College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana Horticultural University. The research aimed to assess the pod quality of dolichos bean with different varieties and growth stimulants. The experiment followed a Factorial Randomized Block Design (FRBD) with two factors: varieties and growth stimulants. Significant difference was observed for all the parameters under study. Results revealed that highest protein content (24.90%) was recorded in the treatment combination of $V_4G_2$- CO (GB) 14 + Humic acid @ 1000 ppm and $V_3G_2$- Arka Sambhram + Humic acid @ 1000 ppm and highest crude fiber content (12.00%) was recorded in the treatment combination of $V_4G_1$- CO (GB) 14 + Triacontanol @ 2 ppm and highest benefit cost ratio (2.75:1) was recorded under treatment combination of $V_4G_2$- CO (GB) 14 + Humic acid @ 1000 ppm. These findings suggest that CO (GB) 14 with humic acid @ 1000 ppm is highly effective in improving quality and economics of dolichos bean under Southern Telangana conditions.

**Keywords:** Dolichos bean, varieties, Growth stimulants, protein, crude fiber content, economics

## Introduction
Dolichos bean (*Lablab purpureus* L.) is an important leguminous vegetable belonging to the family Fabaceae. India is the center of diversity for dolichos bean and large number of indigenous strains are available in Northern India (Dhillon and Kumar, 2015) [5]. Dolichos is a multi-utility and multi-beneficial leguminous crop. It occupies a unique position as vegetable among the leguminous crops, due to its high nutritive value and a good source of proteins, minerals and vitamins (Ananth and Kumar, 2018) [2]. Its green, delicious immature pods and seeds are consumed as vegetable. After maturity, dry seeds are harvested, stored and consumed as a pulse throughout the year (Raghu *et al.*, 2018) [11]. It is a multipurpose tropical legume valued as a vegetable, pulse, fodder and green manure crop (Vaijayanthi *et al.*, 2019) [14]. This crop fixes atmospheric nitrogen in a symbiotic relationship with *rhizobium* bacteria in the soil (Karla, 2009) [7].

The dwarf varieties (Determinate bush-type) have a potential for more extensive cultivation of the crop, because plants require no support system, the pods mature uniformly and the crop is amenable to mechanical harvesting which will reduce cost and labour. The dwarf bushy determinate cultivars can be cultivated throughout the year as they are photo-insensitive (Maneesha, 2020) [9].

Though dolichos bean bush type can be grown throughout the year, non-availability of quality seed, absence of suitable seed production technology, heavy premature flower drops hinder pod production, heavy incidence of pests and diseases, nutrient deficiencies, inadequate post-harvest handling operations and farmers lacking knowledge about varieties lead to decrease in productivity. To maximize the harvest, it is necessary to deal with these potential issues faced by the growers throughout the growth cycle of the dolichos bean crop. Besides, modern cultivation

practices rely on chemical fertilizers to increase the production which adversely affect soil efficiency and also have huge impacts on human health. Growth stimulants like humic acid, nitrobenzene and triacontanol enhance nutrition efficiency, abiotic stress tolerance (Bashir *et al.*, 2021) [16]. These growth stimulants can be used as a tool in complementing the use of chemical inputs. Identification of suitable variety of dolichos bean as well as growth stimulants and their dosage for the increased and consistent yield would reduce the cost of management practices for achieving the commercial success of the dolichos bean. Further, in contrast to the breeding approach, which is difficult and costly, foliar application of plant growth stimulants is an easy, low cost, low risk technique and an alternative approach to overcome the above obstacles.

Thus, to overcome the obstacles the present investigation titled, "Performance of dolichos bean (*Lablab purpureus* L.) varieties as influenced by growth stimulants under Southern Telangana conditions" was conducted.

## Materials and Methods

The experiment was conducted during the late rabi season from January 2024 to April 2024 at College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana Horticultural University, Telangana which is situated at a Latitude of 17°.32' N and Longitude 78°.40' E and at an altitude of about 536 m above mean sea level (MSL). The field experiment was laid out in factorial randomized block design with two factors (varieties and growth stimulants). The five varieties were $V_1$- Arka Amogh, $V_2$- Arka Jay, $V_3$- Arka Sambhram, $V_4$- CO (GB) 14 and $V_5$- Konkan Bhushan and four growth stimulants were $G_1$- Triacontanol @ 2 ppm, $G_2$- Humic acid @ 1000 ppm, $G_3$- Nitrobenzene @ 200 ppm and $G_4$- Control. These twenty treatment combinations were replicated thrice. Data on protein content (%), crude fiber content (%) and benefit cost ratio were recorded and subjected to statistical analysis, Analysis of variance was worked out using standard statistical procedures as described by Panse and Sukhatme (1985) [10]. Standard Error of Mean (S.Em ±), Critical Difference (CD) at 5% probability and Co-efficient of Variance (CV %) was worked out for the interpretation of the results.

**Protein content (%):** The Lowry reaction for protein estimation is an extension of the biuret method. This method was developed by Lowry *et al.* (1951) [8] which is about 10 times more sensitive than the biuret method. Hence, it was followed to determine the protein content of enzyme extracts.

### Reagents

- **Reagent A:** 2% Sodium carbonate (anhyd.) in 0.1N NaOH.
- **Reagent B:** 0.5% Copper sulphate ($CuSO_4$. $5H_2O$) in 1% sodium potassium tartrate (prepared fresh).
- **Reagent C (Alkaline copper solution):** 50 ml of reagent A was mixed with 1ml of reagent B just prior to use.
- Folin-Ciocalteau reagent (Reagent D) was prepared by diluting the commercial reagent (2N) with an equal volume of water on the day of use.
- Stock standard protein solution was prepared by dissolving 50 mg of bovine serum albumin per 50 ml of water.
- Working standard solution was prepared by diluting 10 ml of the stock solution to 50 ml water to obtain 200 µg protein per ml.

### Methods

**Extraction of protein from sample**

- 0.5 g of the sample was ground with a suitable solvent system (Water or buffer) in a pestle and mortar.
- Centrifuge and use the supernatant for protein estimation.

**Estimation of protein**

- 0.2, 0.4, 0.6, 0.8 and 1.0 ml of the working standard solution was pipetted out into a series of test tubes.
- 0.1 ml and 0.2 ml of the sample was pipetted into two other test tubes.
- The volume was made up to 1 ml with water in all the tubes. A tube with 1ml of water serves as the blank.
- 5 ml of solution C was added, mixed well and incubated at room temperature for 10 min.
- 0.5 ml of reagent D was added and mixed well immediately and incubated at room temperature in the dark for 30 min.
- Absorbance at 660 nm was read against the blank.
- A standard graph was drawn, to calculate the amount of protein in the sample and express the results as mg/g or mg/100 g sample or percentage.

**Calculation**

$$\text{Protein content (\%)} = \frac{\text{OD (test)}}{\text{OD (std)}} \times \frac{\text{Conc (std)}}{\text{Aliquot (test)}} \times 100$$

**II. Crude fiber content (%):** The fiber content of the sample was determined by boiling the sample with 1.25 per cent dilute $H_2SO_4$, washed with water, further boiled with 1.25 per cent dilute NaOH and the remaining residue after digestion was taken as crude fiber AOAC. (1990) [3].

**Procedure**

- 1.0 g of moisture and fat free powdered extrudates were weighed and placed in the fiber bags.
- The glass spacer was kept into the bags.
- The bags were loaded in the sample carousel at the previewed positions 1-6.
- The sample carousel was put into the glass container carefully and added with 500 ml of 1.25 per cent dilute $H_2SO_4$.
- The glass container axial was heated for 30 min.
- After completion of time, the bags were washed by boiling with 500 ml distilled water for 30 min and then 500 ml of 1.25 per cent NaOH was added and left for another 30 min for heating.
- Later again 500 ml of distilled water was added and boiled for further 30 min.
- The residue was transferred to empty crucible and weighed as ($W_1$), then dried at 100 °C for four hours in hot air oven, transferred to dessicator for cooling and weighed ($W_2$).
- The crucible was incinerated in a muffle furnace at 600 °C for 3 hrs. Then crucible was cooled in dessicator and weighed ($W_3$).

**Calculation**

$$\text{Fiber content (\%)} = \frac{W_2\text{-}W_1}{W_1} \times 100$$

**III. Economics**

**Cost of cultivation (Rs. ha$^{-1}$)**

The cost of cultivation for each treatment was worked out by

considering the cost of all the operation right from preparation of land to harvesting of crop and expressed as Rs. ha$^{-1}$.

**Gross returns (Rs. ha$^{-1}$)**
Gross return in terms of rupees per hectare was calculated on the basis of marketable pod yield and prices in the market during the time of study and expressed as Rs. ha$^{-1}$.

**Net returns (Rs. ha$^{-1}$)**
Net return was worked out by subtracting the total cost of cultivation from gross returns for each treatment and expressed as Rs. ha$^{-1}$.

**Benefit to cost ratio:** The benefit to cost ratio was also calculated for each treatment by using the following formula suggested by Subbareddy and Raghuram (1996).

$$\text{B: C ratio} = \frac{\text{Gross returns}}{\text{Cost of cultivation}}$$

## Results and Discussion

### Quality parameters

**Protein content (%):** The data on protein content as influenced by dolichos bean varieties, growth stimulants and their interactions were presented in Table 1 and Fig 1.

The data revealed that there was significant variation among varieties. $V_1$- Arka Amogh recorded maximum protein content (23.43%) which was statistically on par with $V_3$- Arka Sambhram (22.65%) and $V_4$- CO (GB) 14 (22.58%) followed by $V_2$- Arka Jay (20.96%). Minimum protein content was observed in variety $V_5$- Konkan Bhushan (17.39%). Growth stimulants showed significant variation among the treatments. $G_2$- Humic acid @ 1000 ppm recorded maximum protein content (24.27%) followed by $G_1$- Triacontanol @ 2ppm (22.35%) and $G_3$- Nitrobenzene @ 200 ppm (20.70%). Minimum protein content was recorded in $G_4$- Control (18.27%). The interaction effect of varieties and growth stimulants recorded significant variation among the treatments. The maximum protein content (24.90%) was recorded under $V_3G_2$- Arka Sambhram + Humic acid @ 1000 ppm and $V_4G_2$- CO (GB) 14 + Humic acid @ 1000 ppm treatment combination. Minimum protein content (13.47%) was recorded under $V_5G_4$- Konkan Bhushan + Control treatment combination. The significant differences in protein content among varieties are largely attributed to genetic variations, environmental factors and interactions between genotype and environment, which influence the biosynthesis and accumulation of proteins in different varieties. This result is supported by Verma *et al.* (2014) [15] in dolichos bean. The increase in protein content is attributed to the presence of nitrogen in humic acid, which increases nitrogen availability for plants, facilitating uptake and translocation to seeds. The absorbed nitrogen is then integrated into amino acids, the building blocks of proteins, resulting in elevated protein content in seeds. Present results were similar to the findings of Al Azee *et al.* (2023) [1] in broad bean, Deotale *et al.* (2017) [4] in pigeon pea and El-Bassiony *et al.* (2010) [6] in snap bean.

**Crude fibre content (%)**: The data on crude fiber content as influenced by dolichos bean varieties, growth stimulants and their interactions were presented in Table 1 and Fig 1.

The data from Table observed that there was significant variation among varieties. The maximum fibre content (11.24%) was recorded in $V_4$- CO (GB) 14 which was statistically on par with $V_1$- Arka Amogh (11.04%) followed by $V_2$- Arka Jay and $V_3$- Arka Sambhram (10.75%). Minimum fibre content was observed in variety $V_5$- Konkan Bhushan (10.69%). Growth stimulants showed significant variation among the treatments. Among the treatments, $G_1$- Triacontanol @ 2 ppm produced maximum fibre content (11.44%) which was on par with $G_2$- Humic acid @ 1000 ppm (11.29%) followed by $G_3$- Nitrobenzene @ 200 ppm (10.69%). Minimum fibre content was recorded in $G_4$- Control (10.16%). The interaction effect of varieties and growth stimulants recorded significant variation among the treatments. The maximum fibre content (12.00%) was recorded under $V_4G_1$- CO (GB) 14 + Triacontanol @ 2 ppm treatment combination which was on par with $V_1G_2$ (11.67%), $V_1G_1$ (11.50%) and $V_4G_2$ (11.47%). The minimum fibre content (10.00%) was recorded under $V_5G_4$, $V_3G_4$ and $V_1G_4$ treatment combinations. The significant differences in fibre content among varieties are largely attributed to genetic variations, environmental factors and interactions between genotype and environment. Present results were similar to the findings of Verma *et al.* (2014) [15]. Triacontanol might have enhanced photosynthetic activity, leading to increased carbohydrate production and improved nutrient uptake, particularly carbon, nitrogen and potassium, which are essential for fiber synthesis. This combination might have resulted in a greater availability of carbohydrates for fiber production, ultimately leading to increased fiber content. Similar result was also reported by El-Bassiony *et al.* (2010) [6] in snap bean.

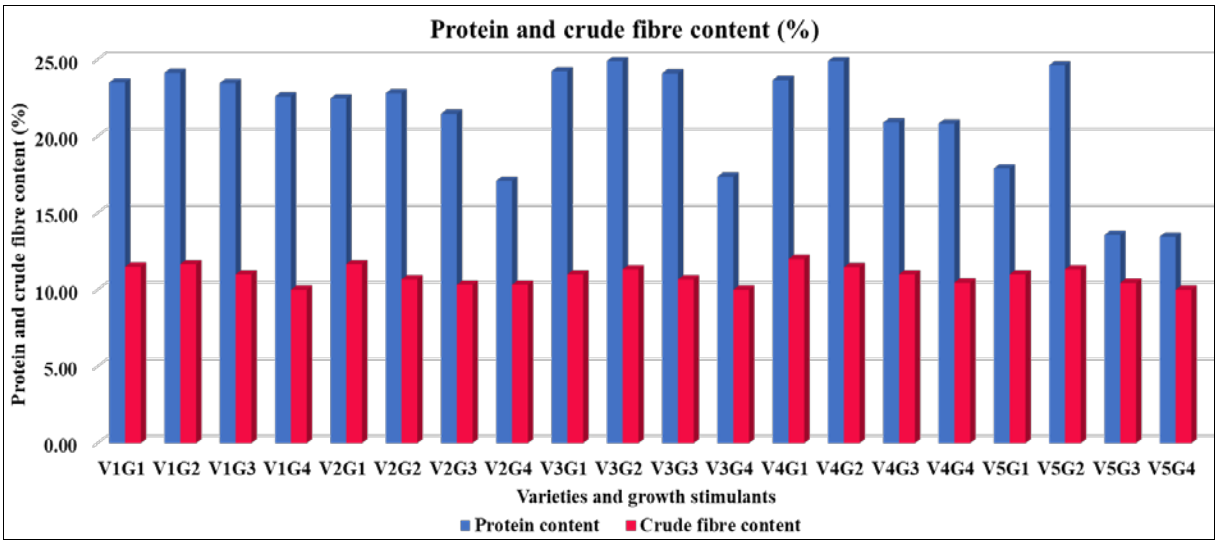
### Economics

**B: C ratio:** The data pertaining to benefit cost ratio as influenced by dolichos bean varieties and growth stimulants and their interactions were presented in Table 1.

Among the treatment combinations, $V_4G_2$- CO (GB) 14 + Humic acid @ 1000 ppm was found to be the best treatment which recorded the highest gross returns (Rs. 7,46,122 ha$^{-1}$), net returns (Rs. 4,75,028 ha$^{-1}$) and the maximum benefit cost ratio of 2.75:1 compared to other treatment combinations in dolichos bean. The significant differences in economic performance among the varieties and growth stimulants were due to their productivity and environmental adaptability. The treatment combination $V_4G_2$-CO (GB) 14 + Humic acid @ 1000 ppm produced higher gross returns, this is reflected in the higher net returns and BCR. The results are similar to the findings of Rawat *et al.* (2015) [12] in cluster bean and Raziq *et al.* (2016) in french bean.

**Table 1:** Effect of varieties and growth stimulants on quality parameters in Dolichos bean

| Treatments | Protein content (%) | Crude fiber content (%) | Gross returns (Rs. ha$^{-1}$) | Net returns (Rs. ha$^{-1}$) | Benefit cost ratio |
|---|---|---|---|---|---|
| $V_1$ | 23.43 | 11.04 | 2,95,140 | 31,542 | 1.12 |
| $V_2$ | 20.96 | 10.75 | 3,17,008 | 53,410 | 1.20 |
| $V_3$ | 22.65 | 10.75 | 3,33,651 | 70,052 | 1.26 |
| $V_4$ | 22.58 | 11.24 | 6,22,867 | 3,52,969 | 2.31 |
| $V_5$ | 17.39 | 10.69 | 5,19,125 | 2,49,527 | 1.94 |
| SE(m) ± | 0.37 | 0.10 | 9,686 | 4,399 | 0.04 |
| CD (5%) | 1.05 | 0.29 | 27,838 | 12,644 | 0.10 |
| $G_1$ | 22.35 | 11.44 | 4,27,333 | 1,60,253 | 1.60 |
| $G_2$ | 24.27 | 11.29 | 4,65,343 | 1,98,689 | 1.74 |
| $G_3$ | 20.70 | 10.69 | 4,10,030 | 1,43,230 | 1.53 |
| $G_4$ | 18.27 | 10.16 | 3,65,128 | 1,03,828 | 1.39 |
| SE(m) ± | 0.33 | 0.09 | 8,664 | 3,935 | 0.03 |
| CD (5%) | 0.94 | 0.26 | 24,899 | 11,309 | 0.09 |
| $V_1G_1$ | 23.50 | 11.50 | 3,08,278 | 43,058 | 1.16 |
| $V_1G_2$ | 24.13 | 11.67 | 3,52,968 | 88,174 | 1.33 |
| $V_1G_3$ | 23.47 | 11.00 | 2,84,260 | 19,320 | 1.07 |
| $V_1G_4$ | 22.60 | 10.00 | 2,35,054 | -24,386 | 0.91 |
| $V_2G_1$ | 22.47 | 11.67 | 3,65,423 | 1,00,203 | 1.38 |
| $V_2G_2$ | 22.80 | 10.67 | 3,19,282 | 54,488 | 1.20 |
| $V_2G_3$ | 21.47 | 10.33 | 3,20,994 | 56,054 | 1.21 |
| $V_2G_4$ | 17.10 | 10.33 | 2,62,334 | 2,895 | 1.01 |
| $V_3G_1$ | 24.23 | 11.00 | 4,06,701 | 1,41,481 | 1.53 |
| $V_3G_2$ | 24.90 | 11.33 | 3,71,737 | 1,06,943 | 1.40 |
| $V_3G_3$ | 24.10 | 10.67 | 2,92,186 | 27,246 | 1.10 |
| $V_3G_4$ | 17.37 | 10.00 | 2,63,979 | 4,540 | 1.02 |
| $V_4G_1$ | 23.67 | 12.00 | 5,77,069 | 3,05,549 | 2.13 |
| $V_4G_2$ | 24.90 | 11.47 | 7,46,122 | 4,75,028 | 2.75 |
| $V_4G_3$ | 20.90 | 11.00 | 6,19,613 | 3,48,373 | 2.28 |
| $V_4G_4$ | 20.83 | 10.47 | 5,48,665 | 2,82,925 | 2.07 |
| $V_5G_1$ | 17.90 | 11.00 | 4,79,191 | 2,10,971 | 1.79 |
| $V_5G_2$ | 24.63 | 11.33 | 5,36,607 | 2,68,813 | 2.00 |
| $V_5G_3$ | 13.57 | 10.45 | 5,33,096 | 2,65,156 | 1.99 |
| $V_5G_4$ | 13.47 | 10.00 | 5,15,607 | 2,53,168 | 1.96 |
| SE(m) ± | 0.74 | 0.20 | 19,372 | 8,799 | 0.07 |
| CD (5%) | 2.11 | 0.58 | 55,676 | 25,287 | 0.21 |
| CV (%) | 5.95 | 3.24 | 8.05 | 22.15 | 8.03 |




$V_1$- Arka Amogh, $V_2$- Arka Jay, $V_3$- Arka Sambhram, $V_4$- CO (GB) 14, $V_5$- Konkan Bhushan
$G_1$- Triacontanol @ 2 ppm, $G_2$- Humic acid @ 1000 ppm, $G_3$- Nitrobenzene @ 200 ppm and $G_4$- Control

**Fig 1:** Effect of varieties and growth stimulants on protein and crude fiber content (%) in dolichos bean

## Conclusion

It can be concluded that varieties and growth stimulants significantly influenced the growth and quality of the dolichos bean. The treatment combination $V_4G_2$- CO (GB) 14 + Humic acid @ 1000 ppm proved the best to improve the quality and economics of dolichos bean under the Southern Telangana Zone.

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