



Research Article

Response of growth, seed yield and its quality to source manipulation and plant growth regulators in cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] cv. PUSA NAVBAHAR

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Abstract : An investigation was carried out to study the response of growth, seed yield and its quality in cluster bean cv. PUSA NAVBAHAR to source manipulation and spraying of plant growth regulators. The experiment was carried out with three source manipulation treatments (Decapitation) and spraying of three plant growth regulators (NAA, GA₃ and thiourea) at flowering stage along with water spray as control. Without decapitation treatment recorded significantly the maximum number of leaves, leaf area and dry weight of plant at harvest. Decapitation at 70 days after sowing observed significantly the maximum number of pods/plant, weight of 1000 seeds and the highest seed yield with better quality seeds. Spraying of GA₃ 40 mg/l at flowering stage recorded the maximum number of leaves, leaf area, leaf area index and dry weight of plant at harvest stage. Spraying of thiourea 500 mg/l registered maximum number of pods/plant, weight of 1000 seeds and seed yield with good quality seeds. Combination of decapitation at 70 days after sowing and spraying of thiourea 500mg/l at flowering stage recorded the maximum weight of 1000 seeds with good seed quality.

Key Words : Decapitation, Source manipulation, PGRs, Seed yield, Cluster bean

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INTRODUCTION

Cluster bean [*Cyamopsis tetragonoloba* (L) Taub.] is an important annual legume vegetable crop. It can be grown on soil of low fertility as well as drought prone arid and semi arid area. Pusa Navbahar is most popular variety of cluster bean for vegetable purpose. It is grown for its young tender green

immature pods, which are used as a nutritive vegetable. It is single stem and pods are about 15 cm in length, tender, green in colour and have less fibre. It is cultivated during summer and rainy seasons. In Gujarat cluster bean is grown about 30,962 ha of land with the production of 2, 83,466 MT green pods during the year 2010-11 (Anonymous, 2011). Due to the wide spread cultivation and nutritive important in our daily life demand for seeds requirement is increasing day by day but, availability of pure and good quality seeds is not satisfactory. Various attempts have been made to increase production of seed with better quality seed but, results are not satisfactory. Hence, the present experiment was carried out to study the response of growth, seed yield and its quality to source manipulation (Decapitation) and plant growth regulators in cluster bean.

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EXPERIMENTAL METHODS

A field study was undertaken during summer season of 2008-2009 and 2009-2010 at Main Vegetable Research Station, Anand Agricultural University, Anand. The experiment was laid out in factorial randomized block design replicated thrice. Total 21 treatment combinations comprised of three source manipulation treatments (Decapitation- removal of terminal portion) without decapitation (D_1), decapitation at 70 days after sowing (D_2) and decapitation at 90 days after sowing (D_3) with the seven plant growth regulator treatments along with water spray as control. The plant growth regulators were NAA (20 and 40 mg/l), GA_3 (20 and 40 mg/l) and thiourea (500 and 1000 mg/l). All the concentrations of plant growth regulators were sprayed at flowering stage. Five tagged plant from each net plots were selected for measuring growth parameters and number of pods/plant. Seed yield from each net plot was weighed and then, it was calculated for hectare. Weight of 1000 seed was measured by counting the 1000 seeds at random and weighing them in electronics balance. Seed germination percentage and seedling vigour were assessed as per the ISTA procedure (Anonymous, 1985) at 10th days.

EXPERIMENTAL RESULTS AND ANALYSIS

The results obtained from the present study have been discussed in detail under following heads :

Response of source manipulation (Decapitation) treatments:

The data presented in Table 1 showed significant response of source manipulation on growth parameters. Treatment D_1 (Without decapitation) recorded significantly the maximum number of leaves (45.15), leaf area (1574.41 cm²), leaf area index (1.166) and dry weight of plant (77.71g). This might be due to continuous growth of apical bud resultant more number of leaves as well as growth and ultimately dry matter. These results are in accordance with the finding of Yadav and Dhukia (1994) and Arora *et al.* (1998) in cluster bean.

Source manipulation treatments recorded significant differences for seed yield and its quality parameters (Table 2). Treatment D2 (Decapitation at 70 days after sowing) registered significantly the highest number of pods per plant (138.00), weight of 1000 seeds (37.00 g) and seed yield (971.47 kg/ha). This might be due to checking of the vegetative growth phase and diversification of photosynthetic materials towards the source *i.e.* pods and seeds at optimum growth stage. These results are in accordance with findings of the Argall and Stewart (1984) in cowpea, Yadav and Dhukia (1994) and Yadav *et al.* (1993) in cluster bean. Seed quality parameters Vigour index-I and Vigour index-II were found significantly the highest in treatment D2 (9.49 and 0.187, respectively). These results are in accordance with the findings of Sajjan *et al.* (2004). Germination percentage was found non-significant. Similar results were also found by Arora *et al.* (1998) in cluster bean.

Table 1 : Response of growth to source manipulation (Decapitation) and plant growth regulators in cluster bean cv. PUSA NAVBAHAR (Pooled data of two years)

| Treatments | Number of leaves | Leaf area (cm ²) | Leaf area index | Dry weight of plant (g) |
|---|--------------------|------------------------------|-----------------|-------------------------|
| Source manipulation (Decapitation) | | | | |
| D_1 - (Without decapitation) | 45.15 | 1574.41 | 1.166 | 77.71 |
| D_2 - (decapitation at 70 DAS) | 26.46 | 938.18 | 0.695 | 67.83 |
| D_3 - (decapitation at 85 DAS) | 29.01 | 1040.92 | 0.771 | 62.61 |
| S.E. \pm | 0.64 | 23.87 | 0.018 | 1.11 |
| C.D. (P=0.05) | 1.81 | 67.17 | 0.050 | 3.13 |
| Plant growth regulators (G) | | | | |
| G_1 -Water spray (Control) | 30.86 | 987.13 | 0.731 | 63.56 |
| G_2 -NAA 20mg/l | 31.62 | 995.69 | 0.738 | 68.67 |
| G_3 -NAA 40mg/l | 31.91 | 1183.47 | 0.877 | 70.28 |
| G_4 - GA_3 20 mg/l | 32.56 | 1277.88 | 0.947 | 68.43 |
| G_5 - GA_3 40 mg/l | 39.13 | 1553.57 | 1.151 | 74.72 |
| G_6 -Thiourea 500 mg/l | 34.48 | 1240.26 | 0.917 | 72.97 |
| G_7 -Thiourea 1000 mg/l | 34.24 | 1053.51 | 0.780 | 67.06 |
| S.E. \pm | 0.98 | 36.46 | 0.027 | 1.70 |
| C.D. (P=0.05) | 2.76 | 102.61 | 0.076 | 4.79 |
| Interaction | | | | |
| D x G | NS | NS | NS | Sig |
| C.V. (%) | 12.39 | 13.06 | 13.06 | 10.40 |
| NS=Non-significant | Sig. - Significant | | | |

Table 2 : Response of seed yield and its quality to source manipulation (Decapitation) and plant growth regulators in cluster bean cv. PUSA NAVBAHAR (Pooled of two years)

| Treatments | Number of pods/plant | Weight of 1000 seeds(g) | Seed yield kg/ha | Germination (%) | Vigour index-I | Vigour index-II |
|---|----------------------|-------------------------|------------------|-----------------|----------------|-----------------|
| Source manipulation (P) | | | | | | |
| D ₁ - (Without pinching) | 107.94 | 34.67 | 889.13 | 95.05 | 8.31 | 0.167 |
| D ₂ - (Pinching at 70 DAS) | 138.00 | 37.00 | 971.47 | 96.02 | 9.49 | 0.187 |
| D ₃ - (Pinching at 85 DAS) | 104.73 | 34.76 | 891.13 | 94.45 | 7.79 | 0.169 |
| S.E. ± | 1.66 | 0.34 | 9.92 | 0.73 | 0.20 | 0.002 |
| C.D. (P=0.05) | 4.67 | 0.95 | 27.90 | NS | 0.55 | 0.005 |
| Plant growth regulators (G) | | | | | | |
| G ₁ -Water spray (Control) | 103.95 | 34.65 | 813.46 | 87.11 | 6.11 | 0.152 |
| G ₂ -NAA 20mg/l | 114.03 | 34.61 | 864.61 | 92.22 | 7.64 | 0.167 |
| G ₃ -NAA 40mg/l | 115.86 | 35.20 | 879.45 | 94.94 | 7.60 | 0.175 |
| G ₄ -GA ₃ 20 mg/l | 117.72 | 36.80 | 992.81 | 99.22 | 9.87 | 0.183 |
| G ₅ -GA ₃ 40 mg/l | 116.22 | 35.02 | 936.31 | 98.94 | 8.73 | 0.180 |
| G ₆ -Thiourea 500 mg/l | 136.01 | 37.22 | 1030.36 | 99.56 | 10.54 | 0.194 |
| G ₇ -Thiourea 1000 mg/l | 114.42 | 34.83 | 903.68 | 94.22 | 9.29 | 0.171 |
| S.E. ± | 2.53 | 0.52 | 15.15 | 1.12 | 0.30 | 0.003 |
| C.D. (P=0.05) | 7.13 | 1.45 | 42.62 | 3.14 | 0.85 | 0.007 |
| Interaction | | | | | | |
| D x G | NS | Sig | NS | NS | Sig | Sig |
| C.V. (%) | 9.19 | 6.17 | 7.05 | 4.97 | 14.95 | 6.47 |
| NS=Non-significant | | Sig.-Significant | | | | |

Response of plant growth regulators:

Response of growth parameters found significant results to plant growth regulators (Table 1). Treatment G₅ (GA₃ 40 mg/l) recorded significantly the highest number of leaves (39.13), leaf area (1553.57 cm²), leaf area index (1.151) and dry weight of plant (74.72 g) followed by treatment G₆ (thiourea 500 mg/l) and G₃ (NAA 40 mg/l). This might be due to synergistic effect of GA₃ in stimulation of cell division and cell elongation, which ultimately affect overall growth of the plant. Similar results were also recorded by Raghava *et al.* (1996) in cow pea and Singh *et al.* (2004) in cluster bean.

Seed yield and its quality parameters were also found significant result (Table 2). Treatment G₆ (thiourea 500mg/l) recorded significantly the maximum number of pods per plant (136.01), weight of 1000 seeds (37.22 g) and seed yield (1030.36 kg/ha) followed by treatment G₄ (992.81 kg/ha). Same treatment also recorded maximum germination percentage (99.56), vigour index-I (10.54) and vigour index-II (0.194) followed by treatments G₄ (GA₃ 20 mg/l) and G₅ (GA₃ 40 mg/l). This might be due to stimulation of natural hormones by exogenous application of plant growth regulators which accelerate the overall growth of plant resultant more number of pods and increase size of seeds ultimately more yield with good quality seed. Similar results were also found by Hunje *et al.* (1985) in cow pea and Sharma *et al.* (2004) in cluster bean.

Interaction:

Interaction between source manipulation (Decapitation) and plant growth regulators found significant results for dry weight of plant, weight of 1000 seeds and vigour index-I and vigour index-II.

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