

# Evaluation of Cluster Bean (*Cyamopsis Tetragonoloba* (L.) Taub) Genotypes for Fruit and Gum Yield

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**Abstract** — An experiment on evaluation of cluster bean genotypes was conducted at the department of vegetable crops, Horticultural College and Research Institute, Periyakulam. Fifty genotypes of gum type of cluster bean from NBPGR, Regional Station Jodhpur, two varieties viz., Thar Bhadavi and the check variety Pusa Navbahar were collected for the study. The collected fifty two (Ct - 1 to Ct - 52) genotypes were evaluated for their growth, yield and gum content for three seasons from November 2013 to February 2015. The data collected from the 52 genotypes. The three seasons data were pooled and statistically analysed. From the above study it is concluded that the variety Pusa Navbahar (Ct - 52 check variety) recorded highest total fruit yield per plant, fruit length, number of seeds per fruit and seed yield per plant than other genotypes taken for evaluation. The same genotype Ct - 52 also recorded the highest guar gum content of 13.44 per cent followed by 12.94 per cent in Ct - 39 and the lowest gum yield of 5.79 per cent was observed in Ct - 47.

**Index Terms** — Cluster bean, Evaluation, Genotype, Guar gum.

## I. INTRODUCTION

Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub) is an indigenous drought hardy, deep rooted, annual legume. It is one of the important and potential vegetable cum industrial crop grown for its tender fruits for vegetable purpose and for endospermic gum (30-35%). Tender fruits are nutritionally rich in energy (16Kcal), moisture (81 g), protein (3.2 g), fat (1.4 g), carbohydrate(10.8 g), Vitamin A (65.3IU), Vitamin C (49 mg), calcium (57 mg) and iron (4.5 mg) for every 100 g of edible portion [7], [19], [20]. In India, cluster bean occupies an area of 2.20 million hectares with a production of 0.60 million tonnes. It is cultivated under larger area in Rajasthan (18.18 lakh ha) followed by Gujarat (2.27 lakh ha), Haryana (1.27 lakh ha) and Punjab (0.14 lakh ha). In north India it is mainly cultivated for gum present in its endosperm called as guar gum, whereas in South India it is being cultivated for vegetable purpose in a quite negligible contribution [2], [7]. United States, Norway, China, Russia and Germany are the major importers of guar gum from our country [19]. India has exported 3,81,880.16 metric tonnes

of guar gum to the world for the worth of Rs. 3,261.60 crores during the year 2019-20 (<http://agriexchange.apeda.gov.in>). Endosperm gum of guar seeds are used in many sectors of industries like textile, food products, pharmaceuticals, cosmetics, water treatment, mining, drilling, explosives, confectioneries and many more [15]. Guar gum is one of the best thickening additives, emulsifying additives and stabilizing additives [8], [5], [10]. With a view to exploit the industrial benefits of gum types of cluster bean, an experiment was conducted to evaluate the cluster bean genotypes for growth, yield and gum content.

## II. MATERIALS AND METHODS

Fifty genotypes of gum type of cluster bean from NBPGR, Regional Station Jodhpur, two varieties namely Thar Bhadavi and Pusa Navbahar were collected for the study and evaluated at the department of Vegetable Crops, Horticultural College and Research Institute, Periyakulam. Collected genotypes were raised for three seasons on November 2013, July 2014 and December 2014 respectively in a randomized block design with two replications. The seeds were sown at a spacing of 45cm between the rows and 20 cm between the plants. All the cultural operations recommended for cluster bean cultivation were followed uniformly to all the genotypes. Five representative plants in each replication and treatment of experimental plot were tagged and data on growth, fruit yield and gum content were recorded in all the three seasons. The data collected on Plant height at Harvest (cm), No of Branches /plant, No of flower clusters /plant, Days to 50% flowering, No of fruits / cluster, No of fruits/ plant, Individual fruit weight (g), Fruit yield /plant (g), No of seeds / fruit, Seed yield/plant (g/plant), Gum content (%) in all the three seasons were pooled and statistically analyzed [11].

## III. RESULTS AND DISCUSSION

Evaluation of 52 genotypes of cluster bean showed significant variations for plant growth, yield and gum content and these variations of cluster bean genotypes was found to be in agreement with the results obtained by [12], [17], [19], [20]. In vegetable crops 50 percent flowering is considered as one of the important traits for selection of genotypes for earliness and to be involved in crop improvement programme. Among the 52 genotypes evaluated, the days taken to produce 50 per cent flowers showed significant difference among the genotypes. It ranges between 31 days to 38 days. Genotypes Ct - 27, Ct - 30, Ct - 33, Ct - 40, Ct - 44, Ct - 47, Ct - 49, Ct - 50 and Ct - 52 took minimum of 31 days for 50 per cent flower production and the genotypes viz., Ct - 2, Ct - 3, Ct - 14, Ct

Published on October 25, 2020.

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-20 and Ct - 23 took maximum of 38 days for 50 per cent flower production. The variation in days taken for 50 per cent flowering in cluster bean was also reported [13], [17].

TABLE 1: PERFORMANCE OF CLUSTER BEAN GENOTYPES FOR GROWTH CHARACTERS

Genotype	Plant height at Harvest (cm)	No of Branches /plant	No of flower clusters /plant	Days to 50% flowering
Ct-1	165.90	7.10	18.73	36.00
Ct-2	175.93	7.33	14.03	38.00
Ct-3	141.80	9.27	15.20	38.00
Ct-4	141.13	5.43	4.67	34.00
Ct-5	151.83	9.10	13.03	36.00
Ct-6	144.50	6.20	7.53	35.00
Ct-7	164.57	4.40	6.43	35.00
Ct-8	182.93	2.40	11.63	36.00
Ct-9	144.13	5.10	5.47	37.00
Ct-10	138.80	8.37	15.03	37.00
Ct-11	126.07	8.47	18.33	34.00
Ct-12	166.57	11.97	14.13	33.00
Ct-13	155.50	5.10	8.37	36.00
Ct-14	192.97	7.30	15.83	38.00
Ct-15	126.43	9.27	17.90	33.00
Ct-16	165.87	5.33	12.07	34.00
Ct-17	171.90	4.50	18.03	36.00
Ct-18	143.80	7.47	19.83	34.00
Ct-19	143.83	5.70	16.27	36.00
Ct-20	153.83	11.13	16.17	38.00
Ct-21	199.00	8.23	16.73	36.00
Ct-22	183.27	2.07	24.67	33.00
Ct-23	154.17	2.60	13.87	38.00
Ct-24	134.47	7.00	15.63	36.00
Ct-25	154.20	4.53	17.50	36.00
Ct-26	143.80	7.20	19.07	33.00
Ct-27	124.73	11.10	20.27	31.00
Ct-28	164.90	9.27	12.73	33.00
Ct-29	133.43	8.20	12.80	36.00
Ct-30	173.90	1.57	8.83	31.00
Ct-31	154.87	1.23	36.33	35.00
Ct-32	155.20	1.00	5.53	34.00
Ct-33	167.90	7.27	16.27	31.00
Ct-34	166.23	1.00	9.47	33.00
Ct-35	114.73	8.23	18.47	33.00
Ct-36	143.13	8.97	17.83	32.00
Ct-37	141.80	8.27	20.27	35.00
Ct-38	123.77	1.00	8.37	36.00
Ct-39	134.10	5.03	21.37	34.00
Ct-40	165.23	1.00	12.20	31.00
Ct-41	114.07	1.00	9.70	34.00
Ct-42	127.77	1.00	9.67	36.00
Ct-43	154.17	1.00	8.77	32.00
Ct-44	164.57	5.30	18.57	31.00
Ct-45	159.53	1.00	8.77	33.00
Ct-46	154.87	2.57	6.57	36.00
Ct-47	146.17	0.97	8.43	31.00
Ct-48	114.73	4.03	9.30	32.00
Ct-49	144.80	8.30	12.80	31.00
Ct-50	136.13	1.00	7.43	31.00
Ct-51	125.07	1.00	7.53	33.00
Ct-52	101.80	1.00	21.70	31.00
SEd	1.40	0.84	0.81	2.34
CD(.05)	2.81	1.53	1.60	4.23

Plant height during harvesting time was observed to be the highest in Ct - 21 (199.00 cm) followed by Ct - 14 (192.97 cm) and the lowest plant height of 101.80 cm was recorded in Ct - 52 (Pusa Navbahar). Maximum number of branches among the cluster bean genotypes evaluated was recorded in the genotype Ct - 12 which produced 11.97 branches followed by Ct - 20 (11.13 branches) and no branches were observed in the genotypes Ct - 31, Ct - 32, Ct - 38, Ct - 40, Ct - 41, Ct - 42, Ct - 43, Ct - 45, Ct - 47, Ct - 50, Ct - 51, Ct - 52 and these results are in accordance with earlier findings [9], [12], [13], [17]. Number of flower

clusters produced per plant was found to be the highest in the genotype Ct - 22 (24.67) followed by Ct - 52 (23.20) and the lowest number of 4.67 flower clusters per plant was observed in the genotype Ct - 4. Regarding number of fruits per cluster, the highest value was recorded in the genotype Ct - 50 (17.43 fruits per cluster) followed by Ct - 31 (15.07 fruits per cluster) and the genotype Ct - 15 & Ct - 20 recorded the lowest number of fruits per cluster (5.30 fruits per cluster) [6]. Total number of fruits per plant was higher in the genotype Ct - 5 (148.33 fruits / plant) followed by the genotype Ct - 24 (141.93 fruits per plant) and the lowest number of fruits per plant was observed in Ct - 6 (31.83 fruits/plant) [1], [16]. Similar results were also reports by various authors in cluster bean [3], [14], [18], [20].

TABLE 2: PERFORMANCE OF CLUSTER BEAN GENOTYPES FOR FRUIT CHARACTERS

Genotype	No of fruits / cluster	No of fruits/ plant	Individual fruit weight (g)	Fruit yield /plant (g)
Ct-1	6.00	117.13	1.60	187.47
Ct-2	9.87	140.60	0.90	126.57
Ct-3	9.10	126.40	1.40	177.00
Ct-4	12.30	68.23	0.80	54.60
Ct-5	12.77	148.33	1.10	163.17
Ct-6	6.13	31.83	2.20	70.00
Ct-7	11.17	79.23	2.30	182.20
Ct-8	7.70	84.23	1.80	151.63
Ct-9	9.33	49.43	1.60	79.07
Ct-10	6.60	90.10	1.90	171.17
Ct-11	7.67	127.10	1.90	241.53
Ct-12	6.87	90.13	2.10	189.30
Ct-13	12.00	104.17	2.10	218.73
Ct-14	5.97	82.27	2.60	213.90
Ct-15	5.37	92.47	2.10	194.17
Ct-16	7.57	87.43	1.80	157.43
Ct-17	6.90	113.37	2.10	238.07
Ct-18	7.07	134.33	2.00	268.70
Ct-19	6.90	113.17	1.60	181.07
Ct-20	5.33	82.40	2.10	173.03
Ct-21	7.50	121.80	2.00	243.57
Ct-22	5.47	127.87	1.60	204.60
Ct-23	7.40	98.17	2.20	215.97
Ct-24	9.37	141.93	1.60	227.10
Ct-25	6.53	110.67	2.10	232.43
Ct-26	5.83	98.50	2.00	197.03
Ct-27	6.50	126.57	2.30	291.13
Ct-28	8.47	112.83	2.40	270.77
Ct-29	8.87	111.20	2.10	233.53
Ct-30	10.30	86.13	2.50	215.30
Ct-31	15.07	108.27	2.10	227.37
Ct-32	8.70	44.67	2.60	116.13
Ct-33	7.47	114.63	2.00	229.27
Ct-34	13.87	141.17	1.50	211.77
Ct-35	6.20	113.13	1.40	158.33
Ct-36	6.60	109.83	2.00	219.63
Ct-37	6.33	121.50	2.10	255.17
Ct-38	9.23	70.87	1.60	113.33
Ct-39	6.23	131.13	1.40	183.57
Ct-40	7.47	97.93	2.30	225.27
Ct-41	8.70	82.90	2.70	232.80
Ct-42	8.37	93.50	1.90	177.63
Ct-43	14.53	128.77	1.60	206.00
Ct-44	6.87	123.17	2.00	246.37
Ct-45	12.33	91.87	2.40	220.47
Ct-46	11.10	65.77	1.40	92.07
Ct-47	14.20	113.63	2.30	261.40
Ct-48	9.43	82.50	3.10	255.77
Ct-49	7.47	95.30	2.00	190.60
Ct-50	17.43	120.40	1.40	168.57
Ct-51	9.97	75.60	2.20	166.33
Ct-52	7.53	141.83	2.40	297.87
SEd	0.12	1.25	0.06	3.66
CD(.05)	0.24	2.46	0.13	7.25

TABLE 3: PERFORMANCE OF CLUSTER BEAN GENOTYPES FOR SEED CHARACTERS

Genotype	No of seeds / fruit	Seed yield/ plant (g/plant)	Gum content (%)
Ct-1	4.10	21.20	8.75
Ct-2	5.57	17.17	8.07
Ct-3	6.27	18.19	9.24
Ct-4	5.47	12.08	11.03
Ct-5	6.10	11.55	8.82
Ct-6	7.37	9.39	7.87
Ct-7	7.23	7.60	12.31
Ct-8	5.37	13.49	11.31
Ct-9	5.07	14.96	10.83
Ct-10	5.67	14.55	12.68
Ct-11	5.33	26.51	12.12
Ct-12	4.70	9.07	12.44
Ct-13	5.17	26.47	11.30
Ct-14	4.37	27.65	11.57
Ct-15	4.23	24.73	12.78
Ct-16	5.97	9.93	10.03
Ct-17	5.27	11.75	11.27
Ct-18	5.57	20.24	12.60
Ct-19	5.20	19.33	10.96
Ct-20	6.10	19.56	11.33
Ct-21	5.07	21.77	12.44
Ct-22	8.07	12.83	12.52
Ct-23	6.10	17.41	9.25
Ct-24	5.17	12.98	6.56
Ct-25	4.20	27.53	9.70
Ct-26	5.70	15.20	8.62
Ct-27	5.10	14.97	12.66
Ct-28	5.10	25.50	12.85
Ct-29	5.03	22.41	12.71
Ct-30	5.27	16.14	12.03
Ct-31	5.23	14.95	12.22
Ct-32	6.07	8.61	12.28
Ct-33	5.37	14.92	9.09
Ct-34	4.90	15.39	9.73
Ct-35	5.20	10.34	12.30
Ct-36	5.10	27.54	12.23
Ct-37	4.47	21.29	9.82
Ct-38	5.83	15.74	12.86
Ct-39	5.83	17.24	12.94
Ct-40	6.27	17.34	7.86
Ct-41	6.17	19.47	11.31
Ct-42	5.90	25.46	12.24
Ct-43	7.23	26.61	12.98
Ct-44	6.00	27.53	6.10
Ct-45	7.30	27.64	12.69
Ct-46	7.60	23.46	12.30
Ct-47	6.17	27.34	5.79
Ct-48	7.30	27.56	11.46
Ct-49	6.10	27.22	12.29
Ct-50	5.37	20.84	12.51
Ct-51	6.13	23.41	12.46
Ct-52	8.47	28.67	13.44
SEd	0.09	0.20	0.06
CD (.05)	0.17	0.39	0.12

In any of vegetable crop, the number and weight of fruits should be higher to get more fruit yield per plant. Cluster bean fruit is valued as vegetable under rain fed condition apart from its seed production. Among the 52 cluster bean genotypes evaluated, maximum individual fruit weight of 3.1 g per fruit was observed in the fruits collected from the genotype Ct - 48 followed by Ct - 41 which recorded 2.7 g per fruit and the lowest individual fruit weight of 0.90 and 0.80 g per fruit were recorded in the genotypes Ct - 2 and Ct - 4. Total fruit yield per plant was the highest in the genotype Ct - 52 (Pusa Navbahar) which recorded 297.87 g per plant followed by Ct - 27 (291.13 g) and the lowest was recorded in Ct - 4 (54.6 g/ plant). In cluster bean the guar gum is produced from its seeds. So, the highest number of seeds and seed weight are preferred to get more gum yield. In the present Number of seeds per fruit and seed yield per plant

was also higher in the genotype Ct - 52 (8.47 seeds per fruit and 28.67 g respectively) [4], [9], [13], [17].

Evaluation of cluster bean genotypes showed a considerable variation among the genotypes taken for the study. The highest guar gum content of 13.44 per cent was observed in Ct- 52 followed by 12.94 per cent in Ct – 39 and the lowest gum yield of 5.79 per cent was observed in Ct - 47. Similar variations in gum content among the cluster bean genotypes [5].

#### IV. CONCLUSION

Evaluation of 52 cluster bean genotypes shown that a considerable variation among them for earliness, fruit yield, seed yield and gum content. variation in biometric and quality content of cluster bean genotypes varied significantly as follows, Node of first flowering was observed between 1 and 3, Days taken for 50 per cent flowering ranged from 31 to 38 days after sowing, Plant height ranged from 123 cm to 213 cm, Number of branches per plant ranged from 1 to 12.2, Number of flower clusters per plant ranged from 5.4 to 25.2, Number of pods per cluster ranged between 5.5 and 12.5 and Number of pods per plant ranged from 46.4 to 184.9. With regard s to the individual fruit weight it ranged from 0.9 g to 3.6 g. The Fruit yield per plant was observed from 64.8g to 361.2g, and Guar gum content ranged between 6.56 to 13.44 Among these genotypes Pusa Navbahar (Ct-52) exhibited the highest guar gum content (13.44 per cent) and seed yield (28.67 g/plant) followed by Ct – 28 which recorded the seed yield of 25.50 g per plant with gum content of 12.85 per cent. For vegetable purpose, the same genotype Ct – 52 recorded the highest fruit yield (297.87 g per plant) number of flower clusters per plant (21.70), number of fruits per plant (141.83 fruits per plant) followed by the genotype Ct – 28.

#### ACKNOWLEDGMENT

We would like to acknowledge the scientists of NBPGR, Regional Station, Jodhpur, Rajasthan for providing the seed material for conducting the study

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