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RESEARCH PAPER

Comparative evaluation of quality parameters of different varieties of cowpea, horse gram (protein content and cooking quality) and guar (% gum content and viscosity profile)

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ABSTRACT

Seed samples of combined varietal trial (AVT-II,AVT- I AND IVT(N+S) of guar, horse gram and cowpea obtained from various centers of All India Network Project on Arid Legumes were assessed for their quality characteristicsas:copwpea, horse gram for protein content and cooking quality and guar for per cent gum content and viscosity profile to assess their potential use in the food industry. The findings showed that genotype RGr-13-2 showed maximum mean gum content of 30.83 per cent, genotype National Check RGC-1066 showed maximum viscosity content of 2800cp, On the basis of mean value, the highest protein content was observed in VLG-39 (29.20 %), The minimum mean cooking time required for CRHG-23 (101 min). On the basis of mean value, the highest protein content was observed in Goa Local (29.43 %) On the average of mean value, the minimum cooking time was observed in genotype GC-901(42 min). Durgapura ranked 1st in gum content (30.71 %) followed by Parbhani (29.01%).). Location wise, Jodhpur ranked 1st in viscosity of 2765cp followed by Durgapura (2443cp).

Key Words : Cowpea, Horse gram, Guar gum, Protein, Cooking, Viscosity

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Legumes are good sources of cheap and widely available proteins for human consumption. They are staple foods for many people in different parts of the world Youseff *et al*. (1989). Legume seeds have an average of twice as much protein as cereals and the nutritive value of the proteins are usually high Vijayakumari *et al*. (1997). Legumes seeds are of prime importance in human and animal nutrition due to their high protein content Singh *et al*. (2004) (20- 50%) and have historically been utilized mainly as the whole seeds Saio and Monma (1993). As good sources of proteins, carbohydrates, several water-soluble vitamins and minerals, legumes in general make a major contribution to human nutrition. However, other underutilised legumes, such as horse gram (*Macrotyloma uniflorum* L.) have been recognised as potential sources of protein and other

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nutrients (Prinyawiwatkul *et al.*, 1996; National Academy of Sciences, 1979).

Guar bean is commercially grown for its seed, which contains guar gum. Guar gum is derived from the seeds of plant Cyamopsistetragonolobus, a pod bearing legume grown commercially in India, Pakistan and the southwestern United States. Among various commercially utilizable seed gums, guar gum and its derivatives occupy a very important place, as it is a rich source of high quality galactomannan polysaccharide. Due to its unique rheology modifying properties, guar gum and its derivatives are widely used across a broad spectrum of industries food, cosmetics, textile, paints, mining, oil-well drilling, construction etc Sharma *et al.* (2009).

Cowpea [*Vigna unguiculata* (L.) Walp.], is a leguminous plant belonging to the *fabaceae* family. Cowpea, like other grain legumes is an important foodstuff in tropical and subtropical countries (Chinma *et al.*, 2008) because of its use mainly, as a grain crop, a vegetable or fodder for animals. Cowpea is highly valued for its ability to tolerate drought and the high protein content of about 25 per cent (IITA, 2007). These qualities make it a choice crop forcatering for the food security needs of societies. Nutrients provided by cowpea make it extremely valuable where many people cannot afford proteins from animal sources such as meat and fish (Akpapunam and Sefa-Dedeh, 1997).

Horse gram is a minor, under-exploited legume of tropics and subtropics grown mostly under dry land agriculture. It is an important source of protein, iron and molybdenum.Horse gram is low in fat and is excellent source of protein, dietary fibre, a variety of micronutrients and phytochemicals (Kadam and Salunkhe, 1985; Siddhuraju and Becker, 2007).

The objective of this research was to evaluate seed samples of combined varietal trial (AVT-II,AVT- I and IVT (N+S) of guar, horse gram and cowpea from various co-ordinated trials obtained from different centers of All India Network Project on Arid Legumes for quality attributes such as protein content and cooking quality of horse gram and cowpea and per cent gum content and viscosity profile of guar to compare and to get acquainted with the high yielding variety.

RESEARCH METHODOLOGY

Seed samples of combined varietal trial (AVT-II, AVT- I and IVT(N+S)) of guar, horse gram and cowpea obtained from different centers of All India Network Project on Arid Legumes are:

Guar :

CAZG-13-1, HG 2-20 (C), RGr-13-2, HG-13-1, RGr-14-4, GAUG-1106, RGr-14-1, HG-126, RGr-14-3, RGC-1033 (C), GAUG-1015, HG-563 (C), RGr-14-5, RGr-14-2.

Horse gram :

CRHG-23, CRHG-19 (C), CRHG-22, BGHG-1, VLG-39, BHG-13-2, VLG-15 (C),VLG-38, BHG-13-1.

Cowpea :

GC-901,KBC-4,TPTC-29,RC-101 (C),GC-13-1 (GC-1002), TC-142,KBC-6,CPD-172,GC-1106,PGCP-24,HG-14, PGCP-23,GC-1105,PGCP-11, KBC-9, PGCP-27, TC-141, GC-3 (C), GC-1110, CPD-165, KBC-7, Goa Cowpea-3, KBC-8, PGCP-12, KBC-5, PTB-1, Pant Lobia-3, DC-16, PGCP-28, PCP-0306-1, Phule-CP-05040, DC-15, Goa Local,COCP-7

Extraneous matter such as unhealthy seed, infected seed, sand and chaff were removed from the seeds. The samples were separately ground with an attrition mill and sieved to a particle size of 1mm. Flour samples were packed and stored in an air tight labelled plastic bottles prior to analysis for protein analysis.

Determination of per cent gum content and measurement of viscosity :

Gum content of guar seed genotypes received from various centers of AINP on Arid Legumes was determined as per method of Rodge *et al.* (2006). The mature seeds were cleaned, boiled in 2 per cent alkali (NaOH) for 5-10 min, washed, neutralized with acid, rewashed with water and dehusked. Dehusked seeds were dried to desire moisture content and converted into splits which were utilized to get per cent (crude) gum content.

Viscosity profile (rheology) of 1 per cent (w/v) guar gum solution :

Viscositymeasurements of 1 per cent gum solution was carried out as per method of Gomber *et al.* (2013) using Brookfield viscometer (T=37±1^{0}C, Spindle No. 64, 60RPM).

Determination of protein and cooking time as cooking quality

Protein content of horse gram and cowpea was determined as per method of AOAC (2000) and cooking quality was determined by measuring the cooking time required for horse gram and cowpea seeds as per method of Akinyele *et al*. (1986).

Cooking time :

Cooking time of each cowpea variety was determined according to the method of Akinyele *et al*. (1986) with slight modifications in terms of quantity of water and seeds used. Cooking time was determined by noting the time in minutes required for soft cooking as assessed by pressing the cooked seeds between two fingers until no hard material was found.

RESULTS AND REMONSTRATION

Per cent gum content of guar genotypes grown under combined trial (AVT-I and IVT) of different locations during *Kharif* -2014 prescribed in Table 1 showed that per cent gum content was varied from 26.33 to 34.80 per cent in Durgapura, 25.16 to 32.0 per cent in Jodhpur, 26.13 to 33.16 per cent in Parbhani and 26.20 to 32.10 per cent in S K Nagar centers, respectively. Genotype HG-126 from Durgapura showed highest gum content (34.80%) while RGr-13-2 from Jodhpur had highest gum content of 32.0 per cent. On the other hand genotype RGr-14-5(33.16%) from Parbhani and genotype RGr-14-4 (32.10%) from SK Nagar had the highest gum content in respective centers.Considering all these genotypes in overall centers per cent gum content was varied from 25.16 to 34.80 per cent. The guar genotype RGr-13-2 showed maximum mean gum content of 30.83 per cent followed by national check HG- 2-20 (30.77 %). Location wise, Durgapura ranked 1st in mean gum content (30.71%) followed by Parbhani (29.01%).

Viscosity profile (cp) of 1 per cent gum solution of guar genotypes grown under combined trial (AVT-I and IVT) of different locations during *Kharif* -2014 prescribed in Table 2 showed that the viscosity of guar genotypes from Durgapura centre was ranged between 1890 to 2930 cp, 2200 to 3500 cp. for Jodhpur centre,1890 to 2640 cp. for Parbhani centre and 1470 to 2720 cp. for S K Nagar centre, respectively. Considering all these genotypes in overall centers viscosity of these gum solutions varied from 1470 to 3500 cp. National check genotype RGC-1066 (2930 cp) from Durgapura,

Table 1 : Per cent gum content of guar genotypes

Sr. No.	Genotypes	Durgapura	Jodhpur	Parbhani	S K Nagar	Mean	Rank
1.	CAZG-13-1	29.63	30.71	29.33	27.60	29.32	7
2.	HG 2-20 (C)	28.90	31.90	31.53	30.76	30.77	2
3.	RGr-13-2	32.13	32.00	30.83	28.36	30.83	1
4.	HG-13-1	31.36	25.50	29.66	28.90	28.86	10
5.	RGr-14-4	30.76	28.40	27.70	32.10	29.74	5
6.	GAUG-1106	29.66	28.26	27.46	30.43	28.95	8
7.	RGC-1066 (C)	28.33	27.50	30.76	31.90	29.62	6
8.	RGr-14-1	28.96	28.16	30.50	28.06	28.92	9
9.	HG-126	34.80	27.10	26.23	30.83	30.49	4
10.	RGr-14-3	26.33	28.20	28.30	30.36	28.30	12
11.	RGC-1033 (C)	33.03	25.16	25.60	26.20	27.50	15
12.	GAUG-1015	26.40	28.46	30.96	27.00	28.21	13
13.	HG-563 (C)	30.43	28.16	27.00	27.00	28.15	14
14.	RGr-14-5	32.73	28.30	33.16	28.13	30.58	3
15.	RGr-14-2	34.34	28.03	26.13	26.56	28.77	11
	Mean	30.71	28.38	29.01	28.94		
	Rank	1	4	2	3		
	S.E.±	0.025	0.034	0.035	0.022		
	C.D. (P=0.05)	0.143	0.196	0.204	0.131		

Each value is average of three determinations

RGr-14-4(3500 cp), RGr-14-2 (2640 cp) from Parbhani and national check RGC-1066 (2720 cp) showed highest viscosity in respective centers. Maximum mean viscosity was observed in national check RGC-1066 (2800 cp) followed by the HG-13-1 (2608 cp). Location wise, data on viscosity profile revealed that maximum mean viscosity was observed at Jodhpur (2765 cp) followed by Durgapura (2443 cp).

Per cent protein content and cooking time (min) of horse gram genotypes grown under combined trial (AVT-II,AVT-I and IVT(N+S) during *Kharif* - 2014 prescribed in Table 3 showed that protein content in horse gram genotypes from S K Nagar varied in the range of 24.79 to 29.20 per cent. The protein content was higher as per the reported values of Jain *et al*. (2012) *i.e.* 15.10 to 15.32 per cent and in comparison with the reported values

Table 2 : Viscosity profile (cp) of 1 per cent gum solution of guar genotypes

Sr.No.	Genotypes	Durgapura	Jodhpur	Parbhani	S K Nagar	Mean	Rank
1.	CAZG-13-1	2580	2980	1890	1920	2343	11
2.	HG 2-20 (C)	2630	2730	2150	2050	2390	9
3.	RGr-13-2	2770	2870	2440	2340	2605	3
4.	HG-13-1	2690	3040	2400	2300	2608	2
5.	RGr-14-4	2400	3500	2080	2070	2513	4
6.	GAUG-1106	2590	2790	2180	2170	2433	7
7.	RGC-1066 (C)	2930	2990	2560	2720	2800	1
8.	RGr-14-1	2830	2200	2330	1470	2208	14
9.	HG-126	2350	2450	2130	2350	2320	12
10.	RGr-14-3	2360	2690	2600	2400	2513	4
11.	RGC-1033 (C)	1890	2940	2430	2130	2348	10
12.	GAUG-1015	2250	2410	2310	2210	2295	13
13.	HG-563 (C)	2060	2560	2050	2000	2168	15
14.	RGr-14-5	2100	3000	2500	2400	2500	6
15.	RGr-14-2	2220	2320	2640	2540	2430	8
	Mean	2443	2765	2313	2205		
	Rank	2	1	3	4		
	S.E.±	8.139	5.713	5.104	5.499		
	C.D. (P=0.05)	46.846	32.833	29.370	31.653		

Table 3 : Per cent protein content and cooking time (min) of horse gram genotypes

Sr. No.	Genotypes	Protein content (%)		Cooking time (min)	
		S K Nagar	Rank	S K Nagar	Rank
1.	CRHG-23	24.79	9	101	5
2.	CRHG-19 (C)	24.93	8	103	4
3.	CRHG-22	27.00	4	103	4
4.	BGHG-1	25.22	7	103	4
5.	VLG-39	29.20	1	122	1
6.	BHG-13-2	29.10	3	121	2
7.	VLG-15 (C)	26.20	6	122	1
8.	VLG-38	29.18	2	122	1
9.	BHG-13-1	26.82	5	108	3
	Mean	24.75			
	S.E. ±	0.048		0.440	
	C.D. (P=0.05)	0.140		1.283	

of 17.9 – 25.3 per cent (Sudha *et al*., 1995) and 22.0 per cent (Gopalan *et al.*, 1989) for horse gram cultivars.The highest protein content was observed in the VLG-39 (29.20%) followed by BHG-13-2 (29.10%). The minimum protein content was observed in the national check CRHG-23 (24.79%). The cooking time required

Table 4 : Per cent protein content and cooking time (min) of cowpea genotypes

Sr. No.	Genotypes	Protein content (%)				Cooking time (min)			
		Parbhani	Madurai	Mean	Rank	Parbhani	Madurai	Mean	Rank
1.	GC-901	22.18	• •	22.18	25	42	• •	42	20
2.	KBC-4	25.98	22.48	24.23	14	48	47	47.5	18
3.	TPTC-29	26.50	21.35	23.93	17	56	55	55.5	9
4.	RC-101 (C)	23.96	21.15	22.56	22	55	54	54.5	11
5.	GC-13-1 (GC-1002)	27.80	22.11	24.96	11	51	60	55.5	9
6.	TC-142	27.53	23.70	25.62	9	56	55	55.5	9
7.	KBC-6	21.75	21.35	21.55	30	54	57	55.5	9
8.	CPD-172	24.20	20.53	22.37	24	55	56	55.5	9
9.	GC-1106	23.60	20.03	21.82	28	50	46	48	17
10.	PGCP-24	21.31	21.31	21.31	31	46	43	44.5	19
11.	HG-14	•	• •			•	• •		
12.	PGCP-23	24.53	28.07	26.30	6	60	62	61	1
13.	GC-1105	22.81	24.38	23.60	18	59	58	58.5	4
14.	PGCP-11	23.92	21.41	22.67	21	52	56	54	12
15.	KBC-9	20.43	27.96	24.20	15	57	58	57.5	6
16.	PGCP-27	26.10	27.77	26.94	5	52	54	53	13
17.	TC-141	21.13	23.08	22.11	26	59	60	59.5	3
18.	GC-3 (C)	22.93	20.66	21.80	29	48	49	48.5	16
19.	GC-1110	20.75	• •	20.75	32	52	• •	52	15
20.	CPD-165	23.25	20.93	22.09	27	55	53	54	12
21.	KBC-7	25.80	24.03	24.92	12	53	52	52.5	14
22.	Goa cowpea-3	24.08	• •	24.08	16	51	• •	51	15
23.	KBC-8	25.36	• •	25.36	10	55	• •	55	10
24.	PGCP-12	27.49	22.10	24.80	13	55	56	55.5	9
25.	KBC-5	23.38	22.48	22.93	20	61	60	60.5	2
26.	PTB-1	23.78	20.97	22.38	23	61	50	55.5	9
27.	Pant Lobia-3	26.70	27.53	27.12	4	50	52	51	15
28.	DC-16	25.83	20.97	23.40	19	49	48	48.5	16
29.	PGCP-28	27.28	• •	27.28	3	56	• •	56	8
30.	PCP-0306-1	28.30	23.16	25.73	8	54	55	54.5	11
31.	Phule-CP-05040	27.20	22.72	24.96	11	56	57	56.5	7
32.	DC-15	• •	26.22	26.22	7	• •	52	52	15
33.	Goa Local	• •	29.43	29.43	1	• •	56	56	8
34.	COCP-7	• •	27.59	27.59	2	• •	58	58	5
	Mean	24.53	23.41			53.6	54.25		
	Rank	1	2			2	1		
	S.E. ±	0.015	0.020			0.259	0.284		
	C.D. (P=0.05)	0.081	0.108			1.142	1.583		

• - Sample not germinated

• • -sample not received from the centre

for horse gram genotypes varied from 101 to 122 min. The results were higher as compared to values reported by Jain *et al.* (2012) *i.e.* 50 to 60 min. The minimum cooking time required for CRHG-23 (101 min). The maximum cooking time required for the genotypes VLG-39 (122 min.).

Per cent protein content and cooking time (min) of cowpea genotypes grown under combined trial (AVT-II, AVT- I and IVT (N+S)) during *Kharif* -2014 prescribed in Table 4 revealed that the protein content of cow pea genotypes from Parbhani centre was found in the range 20.43 to 28.30 per cent and 20.03 to 29.43 per cent from Madurai centre. The results were in comparison with the reported values of F. Appiah *et al.* (2011). Genotype PCP-0306 (28.30%) and Goa local (29.43 %) showed maximum protein content in respective centres. Considering all these genotypes in overall centres the protein content was in the range of 20.03 to 29.43 per cent. On the basis of mean value, the highest protein content was observed in the Goa local (29.43%) followed COCP-7 (27.59%). The minimum mean protein content was observed in the GC-1110 (20.75%). Location wise, maximum protein was found in Parbhani (24.53%).

The cooking time required for the genotypes of cowpea from Parbhani centre was found in the range 42 to 61 min and 43 to 62 min for Madurai centre. Considering all these genotypes in overall centres the cooking time required for the genotypes of cowpea varied from 59 to 62 min. On the average of mean value, the minimum cooking time was observed in genotype GC-901 (42 min.). The maximum cooking time required for the genotype PGCP-23 (61 min.) Location wise, minimum mean cooking time was found in Parbhani (53.6 min).

Conclusion :

The findings of this study show that :

The data on gum content of guar genotypes of combined Trial were varied from 25.16 to 34.80 per cent. In genotype RGr-13-2 showed maximum mean gum content of 30.83 per cent followed by HG-2-20 (30.77%). Location wise, Durgapura ranked 1st in gum content (30.71 %) followed by Parbhani (29.01%).

The data on viscosity content of guar genotypes of combined Trial were varied from 1470 to 3500cp. In genotype National Check RGC-1066 showed maximum viscosity content of 2800cp followed by HG-13-1 (2608cp). Location wise, Jodhpur ranked 1st in viscosity of 2765cp followed by Durgapura (2443cp).

Horse gram samples grown under combined Trial had protein content in the range of 24.79 to 29.20 per cent. On the basis of mean value, the highest protein content was observed in VLG-39 (29.20 %) followed BHG-13-2 (29.10%). The cooking time required for horse gram genotypes varied from 101 to 122 min. The minimum mean cooking time required for CRHG-23 (101 min).

The protein content of cowpea genotypes of combined Trial was in the range of 20.03 to 29.43 per cent. On the basis of mean value, the highest protein content was observed in Goa Local (29.43 %) followed COCP-7 (27.59%). The cooking time required for the genotypes of cowpea varied from 59 to 62 min. On the average of mean value, the minimum cooking time was observed in genotype GC-901(42 min).

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