Physical properties and milling characteristics of green gram varieties

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 Received: 12.1.2017/Accepted: 16.3.2017

ABSTRACT

Twelve different green gram varieties procured from the AICRP on Mung bean, Urd bean, Lentil, Lathyrus, Rajmash and Peas, Main Agriculture Research Station, University of Agricultural Sciences, Dharwad, Karnataka were analysed for their physical properties and milling characteristics. Length, breadth and length-breadth ratio ranged from 3.70-5.05 and 3.25-3.90 mm and 1.13-1.38 respectively. Highest length and breadth were recorded by variety DDG-3. Different varieties exhibited 100-kernel weight, 100-kernel volume and bulk density values of 3.55-6.44 g, 5.20-6.30 ml and 0.67-1.20 g/ml respectively. Variety DGG-3 recorded higher value for 100-kernel weight, 100-kernel volume and bulk density. Milling of different varieties of green gram yielded 8.45-10.07 per cent husk, 76.15-78.55 per cent Dhal recovery, 4.43-5.64 per cent brokens, 5.23-6.73 per cent powder and 0.90-3.31 per cent milling loss. Dhal recovery was highest in DGG-3 (78.55%) and least in Selection-04 (76.15%). In general small seeded varieties produced higher Dhal yield. The results of the present study revealed that elite entries were on par with released varieties with regard to physical properties and milling characteristics.

Keywords: Kernel; brokens; varieties; physical properties; milling characteristics

INTRODUCTION

Legumes are widely grown throughout the world and their dietary and economic importance is well established. They are rich in protein and essential amino acids like lysine which perform significant role in human nutrition. Legumes not only add variety to human diet but also serve as economical source of supplementary proteins (20-30% of protein) for a large population in developing countries like India where majority of the population is vegetarian (Tresina et al 2014). Plant proteins are cheaper than animal proteins therefore people consume legume seeds worldwide as major source of protein especially in developing countries. There is great need to increase the production and utilization of pulses. In this regard breeders have a great responsibility to release high yielding varieties with high nutritional value, good cooking quality characteristics and acceptable in nature (Petchiammal and Hopper 2014).

Legumes unfortunately contain greater quantities of anti-nutritional factors like tannins, flavonoids, oxalates, polyphenols, proteinase inhibitors etc. Anti-nutritional factors are those which interfere with the absorption of nutrients. For example proteinase inhibitors present in plant foods may prevent the digestive enzymes from functioning and thus affecting digestion of foods which will limit the release of nutrients from the food that is consumed. Traditional processing methods viz soaking, cooking, sprouting, fermentation and dehulling can improve nutritional quality by increasing digestibility and destroying anti-nutritional factors.

One of the important legumes like green gram which is short season summer growing crop grows widely throughout tropics and subtropics of the world. It is also known as Moong and golden gram. Green gram is the third most important legume crop in India. This plant is a native of India and since ancient times it has been in cultivation but its production is now common throughout Asia and other tropical countries. It is widely grown in Asia particularly in Thailand, India and Pakistan. Major states growing green gram in India are Rajasthan, Maharashtra, Karnataka, Andhra Pradesh, Orissa, Bihar and Tamil Nadu (Anwar et al 2007). It is an excellent source of protein, low in fat

and contains good amount of minerals and vitamins. It is free from heaviness and tendency to flatulence which is associated with other legumes (Habibullah et al 2005). The present investigation was undertaken to study the physical properties and milling characteristics of green gram varieties.

MATERIAL and METHODS

Twelve different varieties were procured from the AICRP on Mung bean, Urd bean, Lentil, Lathyrus, Rajmash and Peas, Main Agriculture Research Station, University of Agricultural Sciences, Dharwad, Karnataka.

Grains of all the varieties were thoroughly cleaned and stored in airtight containers before use.

Physical properties of green gram grains

The various physico-chemical properties like 100-grain weight, 100-grain volume and bulk density were determined by method described by Khattak et al (2007) while the average length and breadth of the randomly picked ten grains were measured in millimeter with the help of digital vernier callipers and the length-breadth ratio was obtained by dividing the length of a single grain by the corresponding breadth to determine the size and shape (Yadav et al 2007).

Milling characteristics of green gram grains

One kg of grain was milled in CFTRI Dhal making machine and the splits, broken grains and husk were weighed separately to estimate the Dhal recovery of grains (Agrawal and Singh 2003).

Statistical analysis

The results were statistically analysed by one way ANOVA followed by paired t-test using SPSS software.

RESULTS and DISCUSSION

Data on length, breadth and length-breadth ratio are presented in Table 1. All the above characteristics differed significantly among the varieties. Length ranged from 3.70-5.05 mm. Highest length was observed in DDG-3 followed by BGS-9 (5.04 mm) and DGGV-02 (4.98 mm) and least in DGG-8 (3.70 mm). Breadth varied from 3.25-3.90 mm and DGG-3 recorded highest breadth (3.90 mm) followed by BGS-9 (3.65 mm) and DGGV-02 (3.61 mm) whereas DGG-8 recorded least breadth (3.25 mm). Length-breadth ratio of green gram varied from 1.13-

Table 1. Grain dimensions of green gram varieties

Varieties	Grain dimensions		
	Length (mm)	Breadth (mm)	Length/breadth ratio
Released variety			
DGGV-02	4.98 ± 0.22	3.61 ± 0.19	1.37 ± 0.03
BGS-9	5.04 ± 0.11	3.65 ± 0.17	1.38 ± 0.09
Selection-04	4.31 ± 0.02	3.36 ± 0.08	1.28 ± 0.03
China moong	4.22 ± 0.02	3.31 ± 0.11	1.27 ± 0.04
IPM-02-14	4.19 ± 0.07	3.31 ± 0.04	1.26 ± 0.03
Pusa Baisaki	4.25 ± 0.10	3.56 ± 0.21	1.19 ± 0.05
Elite entry			
DGG-1	4.36 ± 0.14	3.46 ± 0.06	1.25 ± 0.05
DGG-3	5.05 ± 0.12	3.90 ± 0.21	1.29 ± 0.04
DGG-5	3.94 ± 0.15	3.36 ± 0.09	1.17 ± 0.07
DGG-6	4.03 ± 0.27	3.29 ± 0.03	1.22 ± 0.09
DGG-7	3.88 ± 0.14	3.32 ± 0.16	1.16 ± 0.04
DGG-8	3.70 ± 0.05	3.25 ± 0.06	1.13 ± 0.03
Mean ± SD	4.33 ± 0.12	3.45 ± 0.12	1.25 ± 0.05
SEm±	0.08	0.08	0.03
CD	0.24*	0.24*	0.10*
F-value	33.56	6.35	6.10

Values are mean of three replications, SEm= Standard error of mean, CD= Critical difference, *Significant at 5% level of significance

1.38 mm. BGS-9 recorded highest length-breadth ratio (1.38 mm) followed by DGGV-02 (1.37 mm) and DDG-3 (1.29 mm) and DGG-8 recorded least length-breadth ratio.

Giizel and Sayar (2012) reported that length varied from 9.72-23.25 mm and width from 7.46-15.56 mm in chickpea varieties. Table 2 presents comparison of grain dimension between released and elite entries. Data show that there was significant difference in length and length-breadth ratio and no significant difference in breadth was found between released and elite entries. The released varieties registered higher values compared to elite entries. Similarly Agrawal and Singh (2003) reported that significant difference was observed with regard to physical properties among the varieties which may be due to varietal differences.

Table 3 depicts the results of 100-kernel weight, 100-kernel volume and bulk density of green gram varieties. All the parameters differed significantly among the varieties. 100-kernel weight ranged between 3.55-6.44 g. DGG-3 recorded highest (6.44 g) 100-kernel weight followed by DGGV-02 (5.61 g) and BGS-9 (4.73 g) and least was observed in DGG-8 (3.55 g). 100-kernel volume and bulk density ranged between 5.20-6.30 ml and 0.67-1.20 (g/ml) respectively.

Table 4 represents the comparison between released and elite entries for 100-kernel weight, 100-kernel volume and bulk density. Data show that there was no significant difference between two groups with regard to physical properties whereas released varieties registered higher values compared to elite entries except bulk density.

Table 2. Comparison of length, breadth and length/breadth ratio between released and elite entries of green gram varieties

Varieties	Length (mm)	Breadth (mm)	Length-breadth ratio
Released varieties	4.50 ± 0.40	3.47 ± 0.15	1.30 ± 0.58
Elite entries	4.17 ± 0.49	3.44 ± 0.24	1.21 ± 0.05
t-value	3.54*	0.44^{NS}	8.05**

Values are mean of three replications, SEm= Standard error of mean, CD= Critical difference, *Significant at 5% level of significance, **Significant at 1% level of significance, NS= Non-significant

Table 3. Physical properties of green gram varieties

Variety	100-kernel weight (g)	100-kernel volume (ml)	Bulk density (g/ml)
Released variety			
DGGV-02	5.61 ± 0.09	6.00 ± 0.29	0.94 ± 0.04
BGS-9	4.73 ± 0.22	5.80 ± 0.29	0.82 ± 0.05
Selection-04	4.43 ± 0.02	5.60 ± 0.29	0.79 ± 0.05
China moong	4.07 ± 0.10	5.40 ± 0.29	0.75 ± 0.04
IPM-02-14	4.11 ± 0.17	5.60 ± 0.29	0.74 ± 0.05
Pusa Baisaki	4.25 ± 0.21	5.80 ± 0.29	0.73 ± 0.05
Elite entry			
DGG-1	4.30 ± 0.13	5.60 ± 0.29	0.77 ± 0.05
DGG-3	6.44 ± 0.18	6.30 ± 0.00	1.02 ± 0.00
DGG-5	3.62 ± 0.04	5.30 ± 0.29	0.68 ± 0.05
DGG-6	3.69 ± 0.03	5.40 ± 0.299	0.68 ± 0.07
DGG-7	3.59 ± 0.05	5.20 ± 0.29	0.69 ± 0.06
DGG-8	3.55 ± 0.11	5.30 ± 0.29	0.67 ± 0.04
Mean ± SD	4.37 ± 0.08	5.80 ± 0.26	0.75 ± 0.05
SEm±	0.08	0.16	0.03
CD	0.23*	0.49*	0.09*
F-value	135.6	3.43	3.31

Values are mean of three replications, SEm= Standard error of mean, CD= Critical difference, *Significant at 5% level of significance

Results of milling characteristics of green gram varieties are presented in Table 5. The husk varied from 8.45-10.07 per cent whereas IPM-02-14 (10.07%) recorded higher value and DGG-3 (8.45%) had least value. Dhal recovery ranged from 76.15-78.55 per cent; DGG-3 registered high value (78.55%) and least was found in Selection-04 (76.15%). The brokens and powder varied from 4.43-5.64 and 5.23-6.73 per cent respectively. Milling loss ranged from 0.90-3.31 per cent, DGG-1 recording higher (3.31%) values and least was found in Chinamoong (0.90%). Table 6 depicts the comparison of milling characteristics between released and elite entries of green gram varieties. There was significant difference in all the milling characteristics. The elite entries had higher Dhal recovery compared to released varieties. Agrawal and Singh (2003) reported that husk varied between 10.05-11.80 per cent and Dhal recovery between 67.78-71.08 per cent. Less than 10 per cent of the grains were collected as brokens which is unavoidable in milling of pulses. In general bold-seeded varieties produced slightly higher per cent of powder than small-seeded varieties. Total milling loss varied between 2.48-6.06 per cent which can be attributed to

Table 4. Comparison of physical properties between released and elite entries of green gram varieties

Varieties	100-kernel weight (g)	Volume (ml)	Bulk density (g/ml)
Released varieties	4.53 ± 0.58	5.70 ± 0.24	0.79 ± 0.04
Elite entries	4.21 ± 1.14	5.51 ± 0.37	0.75 ± 0.07
t-value	0.79^{NS}	0.54^{NS}	0.47^{NS}

Values are mean of three replications, SEm= Standard error of mean, CD= Critical difference, NS= Non-significant

Table 5. Milling characteristics of green gram varieties (%)

Variety	Husk	Dhal	Brokens	Powder	Milling loss
Released variety					
DGGV-02	10.00	76.85	5.23	6.20	1.72
BGS-9	9.87	77.22	5.63	6.35	0.93
Selection-04	10.05	76.15	5.59	6.46	1.75
Chinamoong	9.80	77.15	5.42	6.73	0.90
1PM-02-14	10.07	76.23	5.63	6.70	1.37
Pusa Baisaki	9.90	76.59	5.64	6.65	1.22
Elite entry					
DGG-1	9.10	77.25	4.96	5.38	3.31
DGG-3	8.45	78.55	4.83	5.85	2.32
DGG-5	8.90	77.85	4.67	5.73	2.85
DGG-6	8.83	78.07	4.98	5.23	2.89
DGG-7	8.97	77.97	4.78	5.42	2.86
DGG-8	9.05	78.37	4.43	5.76	2.39
Mean	9.42	77.35	5.15	6.04	2.04

Values are mean of three replications, SEm= Standard error of mean, CD= Critical difference

Table 6. Comparison of milling characteristics between released and elite entries green gram varieties (%)

Varieties	Husk	Dhal	Brokens	Powder	Milling loss
Released varieties	9.94	76.69	5.52	6.62	1.32
Elite entries	8.88	78.01	4.78	5.57	2.77
t-value	12.53*	5.79*	5.38*	6.32*	11.09*

Values are mean of three replications, SEm= Standard error of mean, CD= Critical difference. *Significant at 5% level of significance

small size of the varieties since they had higher proportion of husk and Dhal recovery. All the varieties varied significantly in all the studied parameters and there was no significant difference in the released and elite entries. It can be concluded that elite entries were on par with released varieties with regard to physical properties and milling characteristics.

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