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Research Notes

Batter quality –Need for Traditional Indian Fermented Urdbean - Rice Food

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Legumes have come to occupy a special place in human nutrition. They are second only to cereals as a source of protein, carbohydrates, minerals and B- complex vitamins. Legumes are rich sources of polyphenolic compounds, present in plants. Dark coloured legumes like red kidney beans, blackgram and soybean have higher amount of these polyphenolic compounds. Pulses are sometimes referred as to the 'poor man's meat and rich man's vegetable. Among pulses, blackgram *(Vigna mungo* (L.) Hepper) is one of the important grain legumes. The specialty of balckgram in idly preparation is owing to the mucilaginous material present in it, which is absent in other edible legumes. The mucilaginous material is a complex carbohydrate containing galactose and arabinose together with a small amount of rhamnose and galactoronic acid.

Fermented foods of south India such as idli and dosa are acidic products of cereal and legumes fermented by bacteria, yeasts and also natural fermentation. Idli is fermented steamed bread like cake and an important source of protein and energy in the diet of many southern Indians. Because idli is easily digested, it is often consumed by infants and invalids. It may be consumed twice a day for breakfast and supper, the average person consuming two or three cakes at a meal. In view of this, 60 blackgram germplasm were evaluated in this study to determine the variability in the population, correlation among the quality traits, assess the batter quality of the genotypes and to find out the relationship between grain characters and batter quality.

Sixty genotypes of blackgram were sown at Millet Breeding Station, Tamil Nadu Agricultural University, Coimbatore, India in randomized block design with three replications with a spacing of 30 cm x 15 cm. Five randomly selected competitive plants per replication in each genotype were used to record observations on protein content, apparent grain volume, initial batter volume, raise in batter volume and final batter volume and seed yield per plant and the average was taken for analysis. The genotypic and phenotypic variances and heritability in the broad sense were estimated by following Lush (1940). The range of heritability was categorized as suggested by Robinson *et al* (1949). The association between yield and component traits and among themselves were computed based on genotypic and phenotypic correlation coefficients (Goulden, 1952).

Out of the sixty genotypes seeds of AC 267, AC 227, LU 249, P 136, P 133/32, P 209, P 287, P 338 were brown, seeds of LABBG 226, P 132/1 were green and seeds of other genotypes were black in colour. The seed sample was obtained by selecting seeds from each plant at random and the total nitrogen content was estimated (Lowry *et al.* (1951) by following microkjeldahl method and the content of nitrogen was multiplied by the factor

Table 1. Estimates of variability and genetic parameters of 60 genotypes of blackgram

S. No.	Characters	Mean	PCV %	GCV %	Heritability %	Genetic advance	GA as % of mean
1	Grain yield (gm)	8.85	12.89	12.81	98.70	2.32	26.21
2	Protein content (%)	21.16	6.53	6.23	91.10	2.59	12.25
3	Apparent grain volume (ml)	73.16	5.09	4.04	62.70	4.81	6.58
4	Initial batter volume (ml)	491.72	7.95	7.66	92.80	74.98	15.19
5	Raise in volume (ml)	588.92	15.41	14.95	94.90	175.70	29.84
6	Final batter volume (ml)	414.33	16.47	16.35	98.70	138.63	33.46

Table 2. Correlation among quality characters and grain yield

S. No	Characters		Protein content	Apparent grain volume	Initial batter volume	Raise in volume	Final batter volume	Grain yield
1	Protein content	G	**1.000**	-0.277*	0.055	-0.124	-0.068	0.007
		p	**1.000**	-0.164	0.048	-0.094	-0.044	-0.003
2	Grain volume	G		**1.000**	0.249	0.223	0.035	0.595**
		p		**1.000**	0.1 03	0.122	0.012	0.323*
3	Initial batter vol.	G			**1.000**	0.341**	0.300*	-0.057
		p			**1.000**	0.325*	0.269*	-0.051
4	Raise in volume	G				**1.000**	0.875**	0.192
		p				**1.000**	0.840**	0.184
5	Final batter vol.	G					**1.000**	0.084
		p					**1.000**	0.080
6	Grain yield	G						**1.000**
		p						**1.000**

* Significant at 5% level ** Significant at 1 % level
G- Genotypic correlation P -Phenotypic correlation

6.25 to obtain crude protein content and expressed in g/100 g of seed on moisture free basis.

Idli batter is a cereal-pulse combined food and principally consists of rice and blackgram. The ratio of the rice and blackgram used in the study was 4:1 v/v as used conventially in households. Parboiled, milled rice of C 20R variety obtained from paddy breeding station, TamilNadu Agricultural University, Coimbatore was used along with blackgram for rice component. Split dhal of blackgram genotypes were cleaned, sun dried for a day and were stored in containers. For estimating the batter quality of each genotype 50 g of

Table 3. Mean performance of 60 genotypes of blackgram for grain quality characters

Genotypes	Protein content (%)	Apparent grain volume ml/50g	Batter volume ml/50g	Raise in volume ml/50g	Final volume ml/50g
AC 210	19.60	78.33	486.67	576.67	363.33
AC 227	22.50	74.00	513.33	600.00	413.33
AC 264	20.80	73.00	506.67	573.33	390.00
AC 287	21.63	72.33	506.67	560.00	353.33
AC 291	20.93	80.67	423.33	550.00	350.00
AC 43	20.10	70.67	493.33	756.67	463.33
AC 218	21.60	71.33	493.33	540.00	346.67
AC 267	23.33	70.67	493.33	520.00	390.00
Co 2	20.60	70.67	506.67	543.33	413.33
Co 4	22.77	79.33	560.00	620.00	433.33
Co 5	20.97	70.67	450.00	763.33	513.33
COBG 593	22.83	70.67	413.33	670.00	453.33
Composite	19.83	74.00	493.33	536.67	390.00
LABBG 226	22.33	70.67	513.33	636.67	413.33
LU 162	22.33	68.67	486.67	563.33	383.33
LU 222	19.87	70.67	493.33	566.67	383.33
LU 246	18.60	78.33	493.33	553.33	340.00
LU 249	18.70	71.33	506.67	560.00	356.67
M 1	21.13	72.33	493.33	536.67	390.00
M 10	22.10	72.33	493.33	526.67	346.67
Mahesan	24.30	68.67	493.33	526.67	390.00
Mavalore	18.87	74.00	486.67	530.00	450.00
P 131	23.13	70.67	493.33	550.00	346.67
P 132/1	21.70	72.33	440.00	530.00	350.00
P 133/1	21.13	79.33	506.67	633.33	406.67
P 133/18	20.50	80.00	460.00	743.33	506.67
P 133/27	21.70	70.67	523.33	700.00	570.00
P 133/32	21.10	78.33	580.00	886.67	656.67
P 136	19.67	88.33	506.67	526.67	373.33
P 177	19.93	78.33	493.33	673.33	446.67
P 2	19.37	70.67	513.33	640.00	416.67
P 206	22.67	71.33	513.33	746.67	513.33
P 209	21.67	70.67	460.00	553.33	380.00
P 227	21.73	79.33	593.33	656.67	433.33
P 231	22.23	72.33	493.33	580.00	416.67
P 238	20.27	70.67	470.00	536.67	410.00
P 287	21.70	80.00	506.67	533.33	360.00
P 30	22.13	81.00	506.67	526.67	343.33
P 30/1	23.33	70.00	493.33	563.33	410.00

Contd...

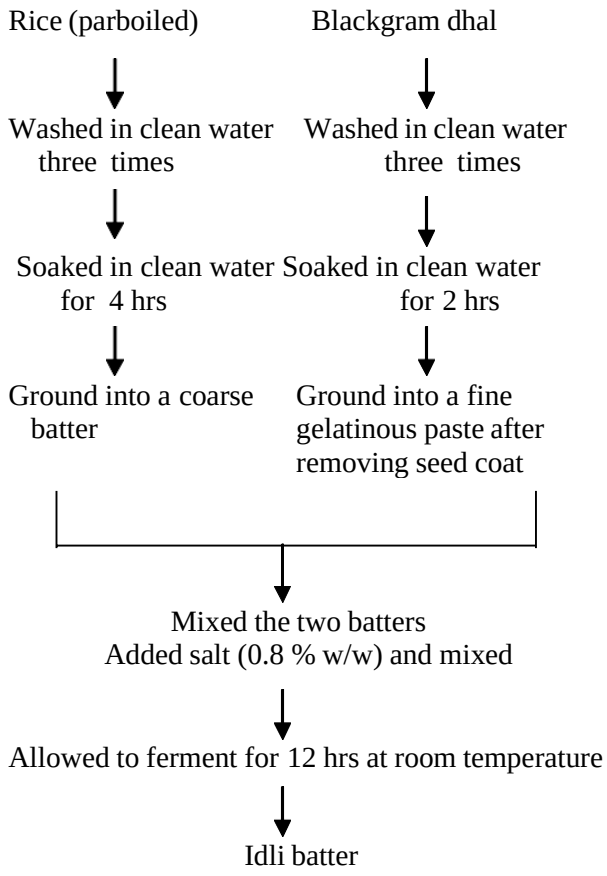
Table 3. Contd....

Genotypes	Protein content (%)	Apparent grain volume ml/50g	Batter volume ml/50g	Raise in volume ml/50g	Final volume ml/50g
P 338/3	20.63	80.67	460.00	516.67	336.67
P 49	17.60	70.67	460.00	490.00	340.00
P 57	21.60	70.67	486.67	636.67	533.33
P 241	20.83	74.00	506.67	540.00	410.00
P 37	23.10	70.67	486.67	526.67	400.00
P 38	21.13	70.67	506.67	536.67	390.00
P 47	20.80	70.67	486.67	558.33	396.67
Pant U 19	21.63	70.67	513.33	660.00	460.00
Pant U10	22.27	70.67	493.33	550.00	450.00
PBG 4	20.27	70.00	413.33	560.00	410.00
PHM 25	21.70	72.33	386.67	453.33	373.33
PLS 364/77	19.97	80.67	523.33	696.67	463.33
PLS 364/79	22.00	72.33	460.00	606.67	390.00
PLS 364/83	20.27	70.67	486.67	480.00	326.67
PLS364/25	21.50	71.33	493.33	536.67	393.33
PLS 364/68	23.50	62.33	486.67	520.00	376.67
Vamban 1	19.57	70.67	493.33	666.67	443.33
Vamban 2	18.50	70.67	500.00	810.00	640.00
Vamban 3	21.13	70.67	506.67	550.00	353.33
Vridujjam	20.33	70.67	493.33	666.67	466.67
G.M	21.16	73.16	491.72	588.92	414.33
C.D	6.53	5.98	6.90	6.55	16.26

blackgram split dhal was measured in a measuring cylinder. Correspondingly rice quantity was used 4 times of the volume of the split dhal of blackgram. Parboiled rice was washed 2-3 times and blackgram dhal was washed 3 times in clean water to remove husk and any adhering dirt. Rice was soaked for 4 hrs and the blackgram dhal was soaked for 2 hours. The soaked rice and blackgram dhal were ground separately in a stone grinder. The amount of water added was 1.5 to 2 times the dry weight of the ingredients. The rice was ground to give a coarse batter and the blackgram was ground to give a smooth gelatinous ball of paste, when lifted by hand. The batters were mixed together and 0.8 per cent salt was added and mixed well with hand. Idli batter was incubated at room temperature and the fermentation was allowed to take place for 12 hours. When ratios of rice: blackgram (Kasturiba and Phadnis, 1991) 1:1, 2:1, 3:1 and 4:1 were fermented for 0, 12, 18 and 24 hours, increase in fermentation time increased the content of thiamine with maximum increase at 18 hours. For estimating the apparent grain volume, 50 g of split dhal of each genotype was measured in a measuring cylinder. The initial batter volume was estimated by measuring

the rice + blackgram batter in a measuring cylinder, soon after grinding, mixing of rice batter and blackgram batter. The raise in batter volume was calculated by deducting the initial batter volume from fermented rice + blackgram batter volume. The fermented rice + blackgram volume was recorded without disturbing the batter. The final batter volume was estimated by measuring the rice + blackgram batter after gentle stirring. This final batter is utilized for idli preparation. Hesseltine (1979) and Vijayakhader (1979) reported the nutritive value of idli based on rice and blackgram and the importance of fermented foods of Mid Asia, the Middle East and Africa.

Fig 1. Flow chart for the preparation of idli batter



Results and Discussion

The present investigation was conducted for assessing the genetic potentiality of the 60 genotypes of blackgram for the quality characters. Yield is a complex trait and in order to achieve a higher level of yield, the understanding of the intricate nature and association of yield contributing characters is a must in any crop. The major products prepared from the grain are the unique South Indian foods like idli, dosai, blackgram vada and appalam and genetic variability studies on the grain quality characters of blackgram are very much limited. The variability and genetic

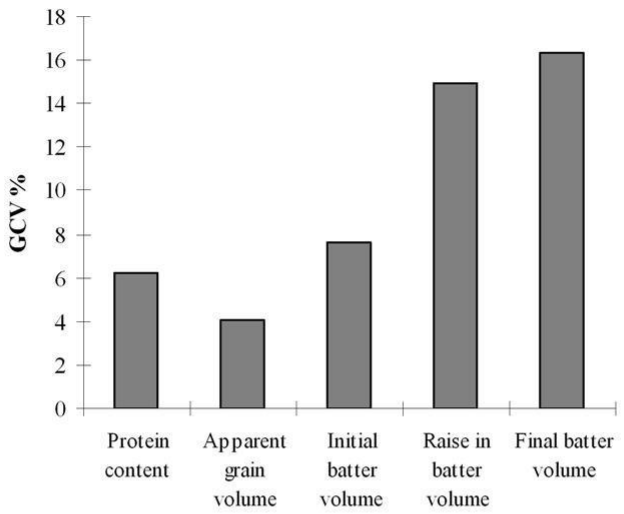


Fig.1. GCV (%) estimates of grain quality characters during *rabi*

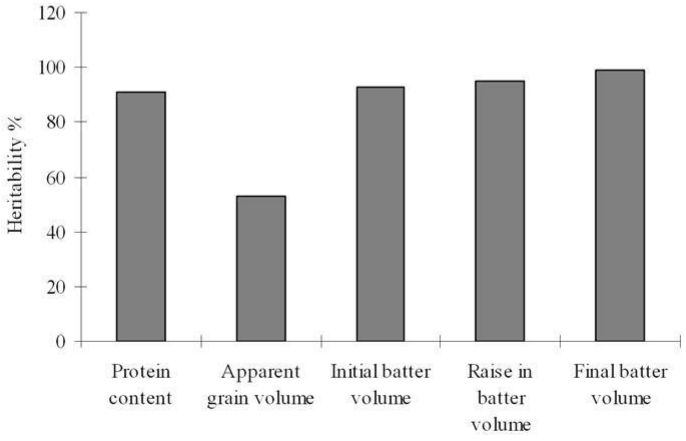


Fig.2. Heritability (%) estimates of grain quality characters during *rabi*

parameters of six traits estimated and are presented in Table 1 and Fig 2 and 3. The GCV per cent was found to be less than PCV per cent for all the traits studied. The maximum PCV (16.47 %) and GCV (16.35 %) were observed for final batter volume. The minimum PCV (5.09 %) and GCV (4.04 %) were recorded for apparent grain volume. The GCV per cent of protein content was 6.23 %. This trait had high heritability and moderate genetic advance as percentage of mean indicating the governance of this character by additive genes and possibility of exploitation of this character by pedigree breeding. The raise in batter volume and final batter volume showed high GCV per cent indicating the presence of high genetic variability. These traits also showed high heritability and high GA as percentage of mean indicating the presence of additive gene in controlling this trait. Similar results were obtained by Sharma (1995) and Sandhu *et al*. (1991). Heritability (h^2) value was the maximum for grain yield and final batter volume (98.70 %) followed by raise in batter volume, initial batter volume.

The genotypic correlation coefficient was higher than the phenotypic correlation coefficient for all the characters (Table 2). Regarding the association of quality characters with grain yield, apparent grain volume alone had highly significant correlation with grain yield. Regarding inter relationship between quality characters, apparent grain volume had significant negative correlation with protein content. The raise in batter volume and final batter volume had significant positive correlation with initial batter volume. This indicates that the initial batter volume may be taken as criteria for evaluating the genotype's final idli batter volume. Moreover, an increase in raise in batter volume also increased the final batter volume (Table 3). However, few genotypes showed a reduction in final batter volume after stirring compared to the initial batter volume and a raise in batter volume did not accompany an increase in final batter volume (CO 2, CO 4). Identification of the cause for this reduction in final batter volume needs further investigation. The traditional method of grinding of rice and blackgram and allowing for natural fermentation was tested. Protein content of blackgram is also equivalent to that of other grain legumes and it serves as a protein source. Blackgram in combination with rice aids in the natural fermentation of rice+ blackgram batter due to *Leuconostoe mesenteriods* present in blackgram. During natural fermentation, the blackgram + rice batter becomes a dough type bread which after steaming results in a soft edible food cake[5]. Leavening of the batter occurs by the production of the acid and CO_2 by *Leuconostoe mesenteriods* during fermentation. The quality of blackgram genotypes for idli preparation is determined by the apparent grain volume (volume measured in a convenient container in house holds/in lab measured in measuring cylinder), initial batter volume, raise in batter volume after fermentation and final batter volume after stirring.

The *per se* performance of seed protein content ranged from 17.60 to 24.30 per cent (Table 3) and the genotype having the highest protein content was Mahesan (24.30%) followed by PLS 364/68, AC 267 and P 30/1. Volume of the grain varied from 65.67 (PLS 364/ 68) to 88.33 ml/50 g (P136). Initial batter volume of the grain ranged from 386.67 (PHM 25) to 593.33-ml/50 g (P 227). Raise in batter volume ranged from 453.33 (PHM 25) to 886.67 ml/50 g (P 133/32) and also final batter volume ranged from 326.67 (PLS 364/ 83) to 656.67 ml/ 50 g (P133/32). Table 1 indicates that initial batter volume may be taken as criteria for evaluating the genotypes

final batter volume. Moreover, an increase in batter volume also increased the final idli batter volume (Fig.1). However a few of the genotypes showed a reduction in final batter volume after stirring compared to the initial batter volume and a raise in batter volume caused decrease in final batter volume (CO 2, CO 1) identification of the cause for this reduction in final batter volume.

One of the top ranking genotypes for final batter volume namely P 206, showing a high raise in batter volume (746 ml/50 g) did not cause any increase in final batter volume compared to the initial batter volume. The genotypes P 133/32 has occupied either on one of the top three ranks for grain yield, initial batter volume, raise in batter volume and final batter volume and the grain colour of this genotype was brown.

References

Lowry, O.H., Rose brough, N.J, Farr and Randal, R.J. (1951). Protein measurement with folin phenol reagent. *J. Biol. Chem.*,, **193:** 265-275.

Kasturiba, B and Phadnis, L. 1991. Effect of different Cereal – Pulse ratios on thiamine content in idli.. *Mysore J. Agric. Sci.*,, **25:** 80-82.

Hesseltine, C.W. Some important fermented foods of Mid Asia, Middle East and Africa. 1979**.** *Jou. Am. Oil Chem. Soc.,* **56:** 367-374.

Vijayakhader. (1979). Studies on the nutritive value of Dhokla based on rice, Bengal gram and curd. *Indian J. Nutt. Dietet.,* **16:** 316.

Steinkraus, K.H., Vanveen, A.G. and Thiebeau, D.B. (1967). Studies on idli- An Indian fermented blackgram - rice food. *Food Technol.,* **21:** 916.

Goulden, C.H. (1952). Methods of statistical analysis. John Wiley and Son. Inc., New York.

Lush, J.L. (1940). Intra sire correlation and regression of offspring on dams as a method of estimating heritability of characters. *Proc. Amer. Soc. Animal Production,* **33:** 293 – 301.

Robinson, H.F., Comstock, R.E. and Harvey, P.H. (1949). Estimates of heritability and the degree of dominance in corn (*Zea mays*). *Agron. J.,* **41:** 353 – 359.

Santhu, T.S., Gumber, R.K. and Bhullar, B.S. (1991). Correlated response of grain yield and protein content in Chickpea. *Legume Res.,* **14:** 45-47.

Sharma, V.K. Jaidev. (1995). Genetic variability for protein and its association with seed yield trait in *Vigna* analysis Germplasm. *Legume Res.,* **18:** 35-40.