Annals of the Sri Lanka Department of Agriculture. 2001. 3: 195-200.

VARIABILITY IN RECOVERY RATE AND QUALITY OF PIGEON PEA DHAL PRODUCED BY FMRC DHAL PROCESSING MACHINE

A. MALIMA PERERA
Field Crops Research and Development Institute, Maha Illuppllama

ABSTRACT

Pigeonpea is dehulled into dhal for improving its palatability and taste. Processing is one of the key factors identified in the commercial and domestic adoption of pigeonpea in Sri Lanka. There was no mechanism to accommodate grains of various sizes for dehulling and splitting. As a result, a small-scale processing machine has been developed at the Farm Machinery Research Centre (FMRC) that can be used to process high quality decorticated splits (dhal) of various grain legumes. Evidence showed the importance of physical properties of seeds and pre-treatments given to pigeonpea seeds in order to get quality dhal with high recovery rate. Therefore, two oil treatments (coconut and sunflower), chemical treatment (1% aqueous solution of bicarbonate) and control (sun dried) were employed to study the recovery rate and dhal quality of three newly developed varieties (MPG537-MI12, ICPL87 and ICPL90050) and recommended variety 'Prasada' by using FMRC dhal processing machine. Dhal yield of pigeonpea ranges between 59-63% for sunflower oil, 63-71% for coconut oil, 56-65% for 1% aqueous solution of sodium bicarbonate and 41-59% for control. Considerable variability in dhal yield (41-71%) and quality was observed when grains were pre-treated with different pre-treatments showing coconut oil would be the best. The highest dehulling losses observed in ICPL87 (15% brokens; 23% powder and husk). It is also reported that recommended variety 'Prasada' gives high quality dhal with favourable characteristics. Further, results showed the suitability of FMRC dhal processing machine in producing high quality pigeonpea dhal with recovery rate.

KEYWORDS: Dehulling losses, Seed treatments, Pigeon pea, Seed processing

INTRODUCTION

Pigeonpea (*Cajanus cajan* L.) is predominantly consumed as decorticated dry split cotyledons (Nene *et al.*, 1990). The seed coat is often indigestible and sometimes causes a bitter taste. Therefore, it is mostly consumed after dehulling to improve their palatability and taste (Faris and Singh, 1990). Hence, it is necessary to have special seed treatment to dissolve the glue that binds the cotyledons of seeds to the seed coat. It is evident that dehulling quality is highly dependent on physical properties of seeds and pre-treatments. Dhal with a lesser or no husk, yellow in colour and sharp edges of splitted cotyledons, can be sold in the market at a higher price. Further, pre-treatments given to pigeonpea seeds before dehulling considerably influence the cooking time. The cooking quality of pigeonpea is basically assessed by its cooking time (Singh *et al.*, 1992). Water treatment has not been used in order to minimize the practical problems and to reduce cost of production.

Manually operated stone mills have been traditionally used to process dhal from cowpea and a lesser extent from other grain legumes (Nimal Jayantha and Saxena, 1998). There was no mechanism to accommodate grains of various sizes for dehulling and splitting. As a result, a small-scale processing machine has been developed at the Farm Machinery Research Centre (FMRC) that can be used to process high quality decorticated splits (dhal) of various grain legumes. The facility of cleaning and grading of grain or splits is added advantage of the machine. The machine is capable of producing high quality dhal and may help to solve one of the key problems in introducing pigeonpea at domestic and commercial levels. Therefore, a trial was conducted with the objectives of studying the genetic variability of different varieties on recovery rate and quality of dhal produced by FMRC dhal processing machine (used for dehulling, splitting, cleaning and grading of grains and dhal) giving different pre-treatments to pigeonpea seeds.

MATERIALS AND METHODS

The seed material for the present study consisted of three newly developed varieties (MPG537MI-2; ICPL87 and ICPL90050) and the recommended variety 'Prasada'. Bulk samples of seeds were used for the study. The seed colour was estimated by visual evaluation. Hundred seeds were counted and weighed. Average of two replicates of each variety was recorded. Seed samples were sun-dried to about 8% moisture level and graded to keep the uniformity of grain. Pigeonpea grains were treated with sunflower oil, coconut oil, 1% aqueous solution of sodium bicarbonate and non-treated as control.

Oil treatments (sunflower and coconut)

After pitting operation (cracking the seed coat by milling unit, to facilitate the entry of oil through seed coat), grains were thoroughly mixed (manually) with 1% oil (by weight) followed by sprinkling small quantities of water and the oiled-grains were then sun-dried for 2-3 days to keep the moisture level at 8%.

Chemical treatments

Grains were soaked in aqueous solution of sodium bicarbonate and sun-dried for 2-3 days to keep the moisture level at 8%.

Control

Grains were sun-dried to keep the moisture level at 8%.

The decorticating of whole seed samples to prepare dhal was done using FMRC (Farm Machinery Research Centre, Maha Illuppallama) dhal processing machine (Nimal Jayantha and Saxena, 1998). A 5 kg of grain samples was processed with two replicates. After dehulling, the processed material was separated into dhal, brokens, and powder and husk fractions. The dhal cleaning and grading compartment consists of a series of sievers and facilitates to collect the graded material to a separate hopper. All the determinations were done in 2 replicates. Standard errors (SE) were determined by a one-way analysis of variance and are indicated in the tables as the pooled error of replicates.

RESULTS AND DISCUSSION.

Comparison of dehulling pre-treatments

Table 1 shows the data on dhal yields of pigeonpea varieties obtained by different methods of pre-treatments. A statistical comparison between different pre-treatments for dehulling indicated that there were significant differences ($p>0.01$) in dhal yield of pigeonpea. A large variability in dehulling quality of pigeonpea genotypes was observed when pre-treated with coconut oil, sunflower oil, 1% aqueous solution of sodium bicarbonate and control. The highest dhal yields was obtained from grains with coconut oil. 'Prasada'. MPG587MI-2, ICPL87 and ICPL90050 yielded 71%, 70%, 63% and 70% dhal respectively when pre-treated with coconut oil. A small variability in dhal yield (41-59%) of these varieties was obtained in non-treated (control) and it also produced the lowest dhal yield. When seeds were pre-treated with coconut oil gave average dhal yield of 69% for the different varieties and this recovery is in acceptable level with the commercial dhal mills (≥70%) in India (Singh *et al.*, 1992).

Dehulling losses

The main objective of dehulling is to remove the seed coat from the cotyledons. Table 2 summarizes the data on dehulling losses in terms of brokens, powder and husk fractions in case of dhal yield of pigeonpea genotypes obtained by different pre-treatments for dehulling. The dehulling losses were the highest (15% brokens, 23% powder and husk) in ICPL87. This may be due to the different seed sizes of the varieties, Furthe-, resistance to seed splitting during

dehulling and a loosely bound state of seed coat to the cotyledons might be the major reasons for further dehulling losses.

Table 1. Percentage dhal yield of pigeonpea genotypes obtained by different pre-treatments for dehulling.

Genotypes	*% dhal yield*			
	Sunflower oil	*Coconut oil*	*1% Sodium bicarbonate*	*Control*
Prasada	59	71	65	41
MPG537MI-2	63	70	63	43
ICPL87	63	63	56	59
ICPL90050	61	70	62	49
Means	61.53	68.62	61.55	48
SEM	±4.84	±3.96	±10.39	±4.93

Table 2. Variability in dhal yield and losses (%) in pigeonpea varieties.

Genotypes	*Dhal yield (%)*		*Brokens (%)*		*Powder & Husk (%)*	
	Range	*Mean*	*Range*	*Mean*	*Range*	*Mean*
Prasada	41-71	56.1	9-18	13.5	15-19	17.0
MPG537MI-2	43-70	56.8	8-17	12.8	17-20	18.6
ICPL87	56-63	59.6	14-15	14.7	16-29	22.6
ICPL90050	49-70	59.6	9-17	13.4	15-21	18.2

Variability in dhal yield of pigeonpea

As shown in table 2, a variability existed in dehulling quality of pigeonpea genotypes. Dhal yield of pigeonpea ranges between 59-63% for sunflower oil, 63-71% for coconut oil, 56-65% for 1% sodium carbonate and 41-59% for control. In an overall, dhal yield of pigeonpea varieties ranging from 41-71% with a mean of 56%.

Physical characteristics of grains and dhal quality

The 100 grain mass of these varieties showed significant differences (table 3). The present results suggest that losses in terms of brokens, and powder and husk fraction would be more, if grains of genotypes are large as in ICPL87. No differences were observed in grain colour. Appearance of dhal plays an important role in determining the quality of dhal. Degree of dehusking of dhal varied significantly giving lesser degree to grains treated with coconut oil followed by sunflower oil and a higher degree to grains with non-treated. Variety 'Prasada' exhibited high quality dhal with yellow in colour, more uniformity and shining effect. Size of splitted cotyledons is comparable with lentils and less breakages in edges of cotyledons. Contrary, MPG537MI-2 exhibited dhal with yellow and green in colour while dull white and yellow colour observed in ICPL87.

Table 3. Physical characteristics of grains and dhal quality of pigeonpea varieties.

Genotypes	*Seed colour*	*100 seed weight (g)*	*Dhal colour*	*Breakages in edges of cotyledons*
Prasada	Brown	8.7	Yellow with shine	Less
MPG537MI-2	Brown	8.6	Yellow & Green	Less-more
ICPL87	Brown	11.1	White & Yellow	More
ICPL90050	Brown	8.4	Yellow with dull	Less-more
Mean		9.14		
SEM		±0.23		

CONCLUSION

Considerable variability in dhal yield and quality was observed when grains of pigeonpea pre-treated with different treatments showing coconut oil would be the best. It is also reported that recommended variety 'Prasada' gives high quality dhal with favourable characteristics that can substitute or compete with lentils. Therefore, it would be very important to consider the quality attributes and consumer acceptance of dhal before releasing a pigeonpea variety.

Further, results showed that FMRC dhal processing machine could be successfully used in processing high quality pigeonpea dhal with high recovery rate. This may lead to solve a key problem identified in the commercial and domestic adoption of pigeonpea in Sri Lanka. Finally, it should be mentioned that these observations were made on a few number of genotype.

ACKNOWLEDGEMENTS

Author wishes to thank the Deputy Director of FMRC, Maha Illuppallama and his staff for assisting her in using FMRC dhal processing machine. The dedicated work of staff of pigeonpea breeding division, FCRDI, Maha Illuppallama is highly acknowledged.

REFERENCES

Faris, D.G. and U. Singh. 1990. Pigeonpea: Nutrition and products. In. The Pigeonpea. Eds. Y.L Nene, Susan, D. Hall and V.K. Sheila. CAB, International University Press, Cambridge, 401p.

Nimal Jayantha, H.M. and K.B. Saxena. 1998. A new small-scale processor for pulses. Information Bulletin no. 54, The International Crops Research Institute for Semi-Arid Tropics (ICRISAT), Pathancheru 502 324 Andhra Pradesh, India.

Nene, Y.L. and V.K.Sheila. 1990. Pigeonpea: Geography and importance. In: The Pigeonpea Eds Y.L. Nene, D.Susan, Hall and V.K.Sheila. CAB, International University Press, Cambridge. Pp.1-14.

Singh, U., B.A.S Santosa and P.V. Rao. 1992. Effect of dehulling methods and physical characteristics of grains on dhal yield of pigeonpea (*Cajanus cajan* L.) genotypes. Journal of Food Science and Technology. 29: 350-353.

Umaid Singh, Paleti Venkateswara Rao, Nukala Subrahmanyam and Kulbhushan Saxena. 1992. Cooking characteristics, chemical composition and protein quality of newly developed genotypes of pigeonpea (*Cajanus cajan* L). Journal of Science Food Agric. 61: 395-400.