



Determination of Shape of Different Varieties of Raw Rice by Projection Method

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ABSTRACT: *Paddy (orzya sativa L.) is the worlds most important food crop and is primary food source for over one third of the worlds population. The objectives were to analyse the shape of raw rice varieties in terms of roundness roundness ratio and sphericity. Jirafull, sarna, komal, sonam, gurmarima, goraknath, ir36, mansuri, karhani, rambhog, which are the very common varieties of rice found, the shape of the raw rice was measured using the projection method. Among the selected varieties roundness value of raw rice varies from 0.45-0.71 for raw rice roundness is highest for jirafull and the lower for ir36. The value of roundness ratio of raw rice varies from 0.034-0.557 for raw rice sphericity is highest for jirafull and lowest for ir36. The value of sphericity of raw rice varies from 0.31-0.48. This study can be useful for designing of various types of processing and handling device and equipment for rice.*

INTRODUCTION

Rice is one of the most important food crops of India in term of both area, production and Consumer preference. India is the second largest producer and consumer of rice in the world. Rice production in India crossed the mark of 100 million MT in 2011-12 accounting for 22.81% of global production in that year. Word rice production of rice has risen steadily from about 200 million tons of paddy rice in 1960 to 600 million tons in 2004. Milled rice is about 68% of paddy rice by weight. In the year 2004, the top three producers were China (31% of world production), India (20%), and Indonesia (9%). The role of agricultural production remains cardinal to feed the growing population of over 6 billion people, gradually increasing on a yearly basis (Traore, 2005). To meet the nutritional needs of such a large population, it would require increasing agricultural productivity through expansion of cultivated land areas, development of crops with high yield potential, vigorous protection of yields losses due to insect-pest and improving soil fertility (Traore, 2005). Rice has potential wide range of food categories. Besides having nutritional and medicinal benefits, the by - products of rice are equally important and beneficial.



Some of the rice by-products are rice husks, rice bran, broken rice, rice flour, rice milk, rice pudding, rice starch, rice straw, rice beverage, rice paper, rice glue, rice cakes (mocha), rice vinegar, rice soya milk, rice yeast and rice based food products. Rice is marketed according to three grain size and shape classes (long, medium and short). Kernel dimensions are primary quality factors in most phases of processing, drying, handling equipment, breeding and grading. Grain size and shape are the first quality grading.

The marketing values of rice as an agricultural product depend on its physical qualities after the processing. The percentage of whole grain is the most important parameter for the rice processing industry. The physical properties such as size and shape (roundness, roundness ratio and sphericity) are important in designing a particular equipment or determining the behaviour of the product for its handling. The shape of product is an important parameter which affects conveying characteristics of solid materials by air or water. The shape is also considered in calculation of various cooling and heating loads of foods materials. Data on physical properties of grain are essential for the design of equipment for handling, aeration, and storage as well as processing cereals, grains and other agricultural materials. Basically physical properties of agricultural material are grain weight, roundness.

The marketing values of rice as an agricultural product depend on its physical qualities after the harvesting. The percentage of wholegrain is the most important parameter for the rice processing industry (Marchezan, 1991)[4]. Broken grain has half the market value of head rice (head rice=75-100% of whole kernel) (Trop Rice International Rice Research Institute, 2004). As enlisted above, the machinery and operations when improperly designed may generate rice kernel cracking and breakage and consequently a low marketing price. The knowledge of the physical properties of the agricultural products is no fundamental importance during the harvesting of grains, and operating different equipments used in post harvesting main processing operations of these products. The information related to porosity and specific gravity, within other physical characteristics of the agricultural products, are of paramount importance for studies involving heat and mass transfer and air movement through the bulk grain. In addition, together with moisture content, volume, specific gravity and porosity are the basic parameters for studying the drying and storage of agricultural products and to preview the quality loss of the



material until its marketing time. The specific gravity could be defined as the ratio between the mass of a body and its volume. This concept applied to the individual grain, it determines the real specific gravity of the individual grain.

MATERIAL AND METHODS

In this chapter, the general method is discussed that is used for determination of shape of agricultural product. Shape is important properties to describe an object satisfactory while shape is the rigid form of the body. The most common methods used for this purpose are follows:-

1. Charted standard method
2. Projection method

SELECTION OF SAMPLE:-

The varieties of rice are selected on this project. Varieties Jirafull, Saran, Goraknath, Komal, Ir36, Gurmarima, Karhani, Sonam, Mansuri, Rambhog, are obtained. After the selection of different varieties of rice, measured its roundness roundness ratio and sphericity of 5 grains on every raw rice and cooked rice samples. The average of every sample of rice are selected for projection on the graph.

PROJECTION METHOD:-

It is used for irregular shaped agricultural products. This method is suitable for shape determination of vegetable and fruits like tomato, carrot, apples etc. It may also be successfully used for small grains like sorghum and millet seed. In this method, the object is placed in natural rest position and its projection is used for determination of shape of object .scanned file of paddy or rice sample (avg. Sample) is projected on chart paper with the help of projector.

A) ROUNDNESS:-

Roundness is a measure of the sharpness of the corners of the solid. Several methods have been proposed for estimating roundness. Those least objectionable are given below (curry, 1951)



$$\text{Roundness} = \frac{A_p}{A_c} \dots\dots\dots i \text{ eq.}$$

Where,

A_p = largest projected area of object in natural rest position

A_c = area of smallest circumscribing circle

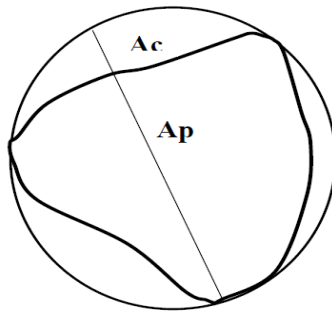


Fig. :- Roundness

B) ROUNDNESS RATIO:-

It is the ratio of radius of curvature, (r), of the sharpest corner and mean radius of the particles, (R) and is given by

$$\begin{aligned} \text{Roundness ratio} &= \frac{\text{Radius of curvature (r)}}{\text{mean radius of the particle}} \\ &= \frac{(r)}{R} \end{aligned}$$

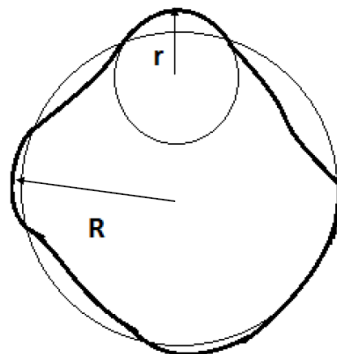


Fig. Roundness ratio



SPHERICITY:-

Sphericity may be defined as the ratio of the diameter of a sphere of the same volume as that of the particle and the diameter of the smallest circumscribing sphere or generally the largest diameter of the particle. This parameter shows the shape character of the particle relative to the sphere having same volume.

$$\text{Sphericity} = \frac{D_i}{D_c}$$

Where,

D_i = diameter of largest inscribed circle and

D_c = diameter of smallest circumscribed circle

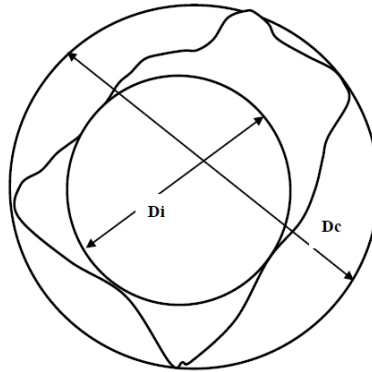


Fig. :- Sphericity



Fig. :- projection of rice on graph paper

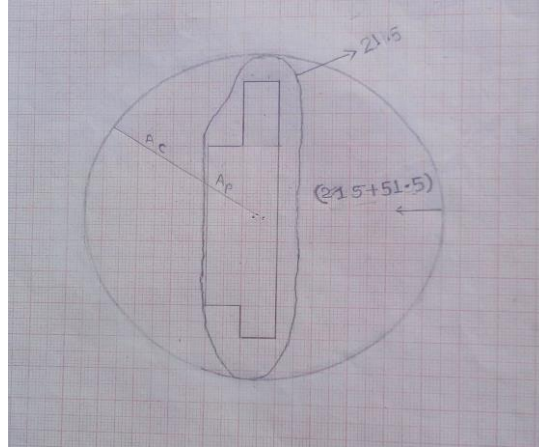


Fig. - Projection on a graph for calculation of roundness

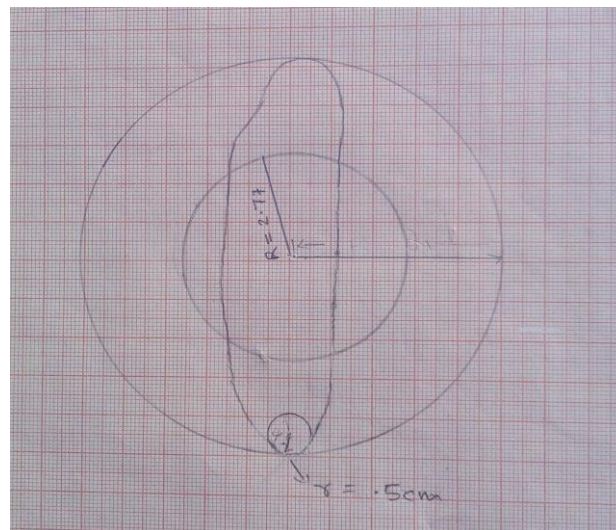


Fig.:- Projection on a graph for calculation of roundness ratio

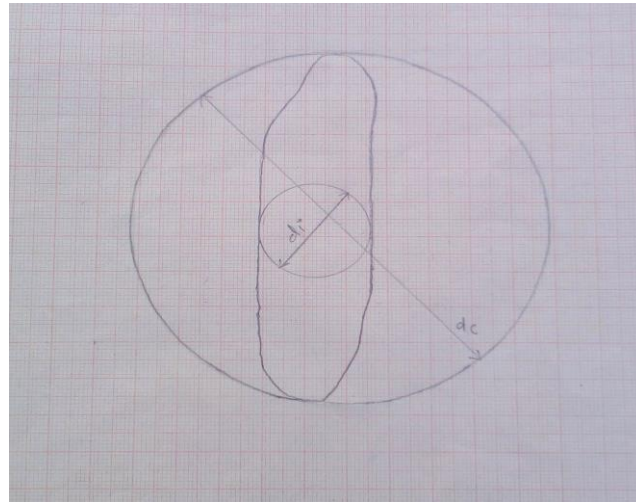


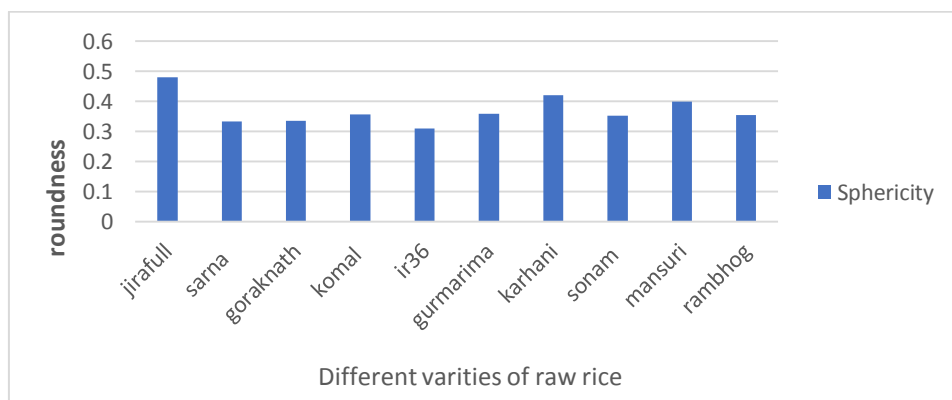
Fig. :- Projection on a graph for calculation of sphericity

RESULT AND DISCUSSION

The shape of rice such as Roundness, Roundness Ratio and Sphericity of rice were evaluated and the result obtain are tabulated in tables.

The changes of Roundness, Roundness Ratio and Sphericity of different varieties of rice are presented in tabulated in tables. The Roundness, Roundness Ratio and Sphericity of different varieties of raw rice and cooked rice are also presented by graph.

Graphical representation Roundness of raw rice and:-

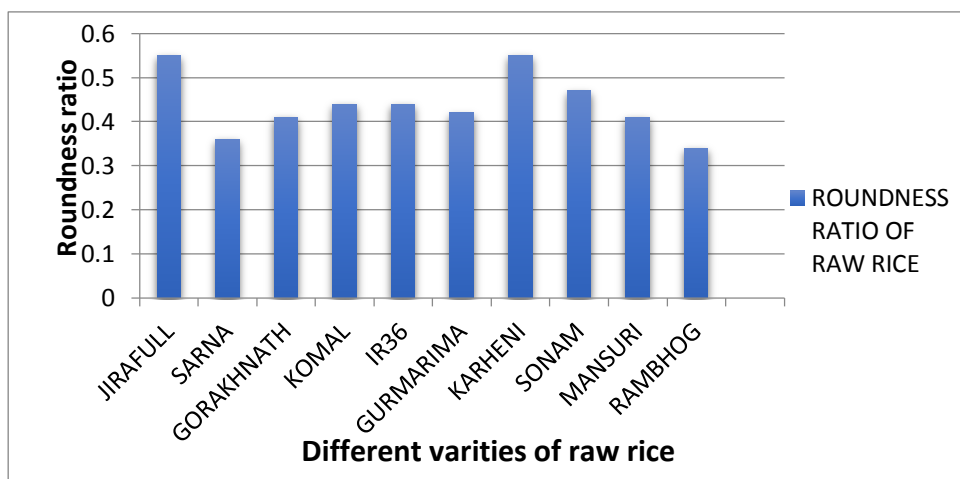


Roundness indicated the circularity of the grain. Among the selected varieties of rice, the roundness of raw rice in descending order is Jirafull (0.71), Gumarima (0.70), Karheni



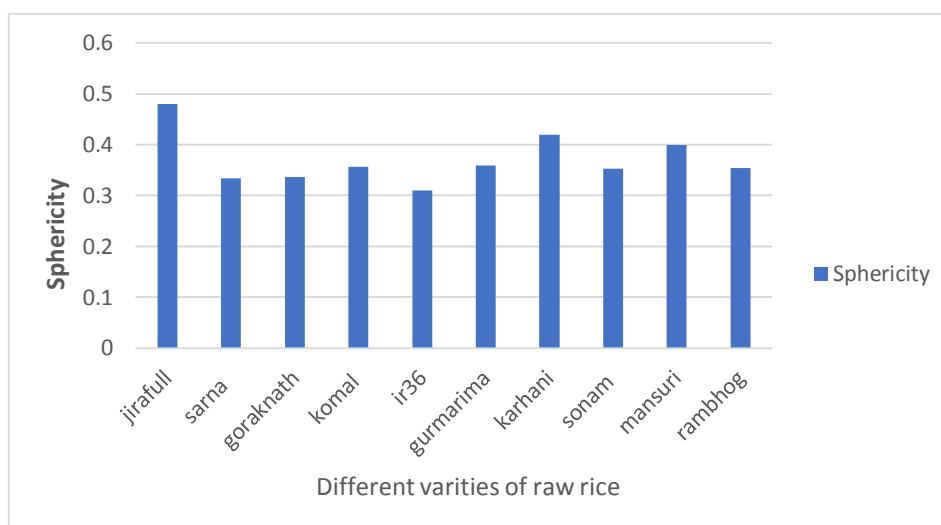
(0.67), Mansuri (0.61), Komal (0.60), Goraknath (0.59), Sonam (0.54), Rambhog (0.53), Saran (0.52), IR36 (0.45). For raw rice roundness is highest for Jirafull and lowest for IR36.

Graphical representation Roundness ratio of raw rice and:-



Among the selected varieties of rice, the roundness ratio of raw rice in descending order is Jirafull (0.55), Kerhani (0.54), Sonam (0.47), Komal (0.44), IR36 (0.43), Gurmarima (0.42), Mansuri (0.41), Goraknath (0.41), Sarna (0.36), Rambhog (0.34). For raw rice roundness ratio is highest for Jirafull and lowest for Rambhog.

Graphical representation Sphericity of raw rice and:-





Sphericity indicates the circularity of the grain. Among the selected varieties of raw rice, the Sphericity of raw rice in descending order is Jirafull (0.48), Karhani (0.42), Mansuri (0.40), Gurmarima (0.359), Komal (0.357), Rambhog (0.354), Sonam (0.353), Guraknath (0.336) Sarna (0.334), IR36 (0.31),). For raw rice Sphericity is highest for Jirafull and lowest for IR36.

SUMMARY AND CONCLUSION

Summary

Based on the results obtained from this study, selected varieties of raw rice and cooked rice was observed to have values of Roundness, Roundness Ratio and sphericity, thus the study of this literature it can be useful for designing of important equipment or determining the behaviour of the products for its handling

Various types of cleaning, grading and separation equipment are designed on the basis of physical properties of seeds such as shape, roundness, roundness ratio, and sphericity etc.

Conclusion

1. Maximum roundness for raw rice is Jirafull (0.71), and minimum roundness is IR36 (0.45).
2. Maximum roundness ratio for raw rice is Jirafull (0.55), and minimum roundness ratio is Rambhog(0.34).
3. Maximum Sphericity for raw rice is is Jirafull (0.48), and minimum Sphericity is IR36 (0.31).

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