

PHYSICAL PROPERTIES OF SOYBEAN (A RESEARCH REPORT COMMUNICATION)

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ABSTRACT

Physical properties of linear dimensions, sphericity and solid density of four different varieties of dry mature soybean were determined in this study. For the varieties - TGX1768-6F, TGX-1681-3F, TGX-536-02D, and TGX-1740-3F, the mean sphericity are 0.745, 0.857, 0.830, and 0.829 respectively. It is shown from the statistical analysis that there is significant difference between the sphericity of TGX-1768-6F and the other three varieties at a probability level of 0.05. The solid densities of all the varieties are very close and range from 1079.5 to 1170kg/m³.

1. INTRODUCTION

Soybean, which has been reported to contain about 40% protein and 20% cholesterol free oil, is gaining popularity as one of the major source of food protein in Nigeria. Many Nigerian families and households depend entirely on soybean protein for achieving nutritional balance in their daily diet. The recent introduction of soybean and its wide application (food value) gave the inspiration to look into the various physical properties of this grain. The results of this study will serve as a guide to the soybean processing industries as well as designers of machinery and equipment for handling, aeration and storing of soybean. Several investigators have measured various physical properties of soybean at various levels of moisture content (Deshpande et al, 1993; Siwasamy, 1971; and Sreenarayan, 1985). Such investigations are not available in Nigeria. The objective of this work is to determine the physical properties of soybean.

2. MATERIALS AND METHODS

Dry mature soybean (Glycine Max CV) were used for all the experiments in this study. Folur varieties of soybean namely, TGXI681-3F, TGX 1740-3F, TGXI768-6F, and TGX536-02D were grown and harvested from the experimental farm of the University of Nigeria, Nsukka. The physical properties of the soybean determined were sphericity,

linear dimensions and solid density

2.1 Sphericity:

Five replicate samples were randomly chosen from each variety giving a total of twenty (20) grains which were taken for measurements. The experimental design used is randomized complete block design (RCBD). The three linear dimensions namely length (L), width (W), and thickness (T) were measured with a micrometer, reading to 0.01mm. With the mean dimensions the geometric mean diameter and sphericity of each variety were determined using the relationship shown below and the results statistically analysed. The degree of sphericity ϕ can be expressed as follows: (Mohsemin, 1970).

$$\phi = \left[\frac{\text{volume of solid}}{\text{volume of circumscribed sphere}} \right]^{1/3}$$

$$\phi = \left[\frac{[(\pi/6)LWT]^{1/3}}{\text{major diameter}} \right]$$

$$\phi = \frac{(LWT)^{1/3}}{L}$$

Where L = Length (mm);

W = Width (mm)

T = Thickness (mm)

2.2 Solid density:

In the determination of the solid density, thirty grain samples of each variety were taken in a random manner. The mass of the

samples was obtained using electronic balance (which read up to 0.001g). Measurement of the volume of the samples was made with a graduated cylinder using fluid displacement method. The fluid used was distilled water. The solid density was determined by the ratio of mass to volume of the samples.

Density

$$= \frac{\text{mass of 30 grains (kg)}}{\text{equivalent volume of the water displaced (m}^3\text{)}}$$

Three replicates were made

3. RESULTS AND CONCLUSIONS

The results of the determinations of length, width, thickness, sphericity, and solid density for the four varieties of soybean are shown in Table 1.

Table 1: Physical properties of soybean

Variety	Length (mm)	Width (mm)	Thickness (mm)	Sphericity	Density kg/m ³
TGX1768-6F	7.94	5.63	4.62	0.745	1170.0
TGX1681-3F	6.36	5.45	4.67	0.857	1079.5
TGX 536-020	7.22	5.85	4.92	0.830	1092.1
TGX 1740-3F	7.25	6.18	4.86	0.829	1122.5

From the analysis of variance performed, for the sphericity of soybean, it was shown that there is significant effect of variety on sphericity. The F-LSD test presented in Table 2 shows that there is very significant difference between the variety mean sphericity of TGX-1681-3F and TGX-1768-6F. The other two varieties - TGX536-02D and TGX1740-3F are also significantly different from the variety TGX1768-6F. There is no significant difference between the mean

sphericity of the other three varieties.

Table 2: Mean sphericity of four varieties of soybean

Variety	Sphericity
TGX1768-6F	0.745
TGX1740-3F	0.829
TGX536-0.2D	0.830
TGX1681-3F	0.857
F-LSD _{0.05}	0.03204

The sphericity obtained by Deshpande et al (1993) ranges from 0.806 to 0.816. Siwasamy (1971) and Sreenarayan (1985) have reported the values for sphericity of soybean as 0.83 and 0.82 respectively. These results are similar to the determination of this study. The results of the solid density of the soybean also are close to that reported by Deshpande et al (1993).

REFERENCES

- Deshpande, S.D., S. Bal, and T. P. Ojha (1993). Physical properties of soybean, *J. of Agric: Engineering Res.* 56:89-98.
- Mohsenin, N.N. (1970). *Physical properties of plant and animal materials.* Gordon and Breach Science Publishers, New York.
- Siwasamy, S. (1971). *Terminal Velocity of solids.* M. Tech. Thesis, G. B. Pant University of Agric. And Tech., Pantnaga, India
- Sreenarayan, V.V. (1985). Physical and Thermal properties of soybean. *Proceedings of Indian society of Agric. Engineers*, 3: 161 -169.