J. of Soil Sciences and Agricultural Engineering, Vol.1 (3): 299 - 309, 2010

SOME PHYSICAL AND MECHANICAL PROPERTIES OF WHEAT GRAIN

El - Sheikha, M. A. [*]; H. E. El - Morsy [*] and M. A. I. Al- Rajhi [**]
[*] Dept. of Agric. Eng., Faculty of Agric., Mansoura University.
[**] Agric. Eng. Res. Institute, ARC.

ABSTRACT

Physical properties often required for developing the machines for cleaning of grain. Physical properties of wheat varieties (Sakha93) were determined and compared for moisture content 9, 11, 13 and 15% w.b. The average length, width and thickness were 7.46, 3.37 and 2.66 mm at a moisture content of 9% w.b., respectively. Studies on wheat grain showed that the thousand-kernel mass increased from 4٨.٥96 to 55.206g when the moisture content increased from 9 to 15%. The geometric, equivalent and arithmetic mean diameter at a moisture content of 9% were 4.06, 4.08 and 4.5mm. The average mass of one grain, volume and surface area were 0.048g, 35.49 mm^3 and 43.87 mm^2. Area of flat and transverse surface was 19.74 and 7.04 mm^2. Sphericity and index-k were 54.41% and 2.49. Bulk density decreased from 660 to 589.8 kg m^{-3}, when increasing the moisture content from 9 to 15% .True density decreased from 1244.6 to 1210.8 kg m^{-3}, when increasing the moisture content from 9 to 15%.Angle of repose varied from 16.8 to 21.6° when the moisture content increased from 9 to 15% .The static friction coefficient of wheat increased linearly against surfaces of four structural materials, namely, wood (0.379 – 0.399), galvanized iron (0.345 – 0.364), formica (0.306 – 0.344) and glass (0.299 – 0.335) as the moisture content increased from 9 to 15%.

INTRODUCTION

The total wheat area harvested in Egypt equal to 2.420 million feddan; wheat grain yield in Egypt equal to 2,7315 Mg/fed.; and wheat grain production is about 8.127 Tg (Ministry of Agric. 2009). In the design of machines, structures, processing and controls to be used in productions, handling, and processing of food and agricultural products, certain physical characteristics and engineering properties of the materials should constitute important and essential engineering data (Mohsenin 1986). The physical properties of wheat at different moisture contents must be known to design a machine for handling, cleaning, conveying, storing and milling, (Tabatabaeefar, 2003).The knowledge of some important physical properties such as shape, size, volume, surface area, thousand grain mass, density, porosity, angle of repose, of different grains is necessary for the design of various separating, handling, storing and drying systems (Sahay and Singh, 1994). (Dutta *et al.*, 1988) determined the various properties of the chickpea including shape, Thousand Kernel mass, sphericity, roundness, size, volume, surface area, bulk density, true density, porosity, static coefficient of friction and angle of repose. Principal axial dimensions of rough rice grains are useful in selecting sieve separators and in calculating power during the seed milling process. They can also be used to calculate surface area and volume of kernels which are important during modeling of grain drying, aeration, heating and cooling (Ghasemi Varnamkhasti *et al.*, 2007). The effects of size and surface area on drying rates of particulate materials can also be