DIFFERENT METHODS FOR DETERMINING KERNEL HARDNESS

Balázs P. SZABÓ, Antal VÉHA, Ernő GYIMES

SUMMARY

Kernel hardness is one of the most important characteristic. In our investigation we used two methods to measuring kernel hardness. The dinamic method was Perten Single Kernel Characterization System (SKCS) 4100 device, the static test was the Lloyd 1000 R Material Testing Machines. The aim of this research was the investigation of the kernel hardness and our aim to compare these two methods.

INTRODUCTION

The kernel hardness is a genetic factor (well inherited factor). It determines conditioning parameters, flour yield, quality, starch damage, water absorption capacity etc. Kernel hardness controlls by friabilin protein and it depends on the relation between protein matrix and starch granules. The friabilin presents in high concentration in soft grain varieties and low concentration in hard grain varieties (Békési, 2001). The flour which is made from hard winter wheat varieties are better than the flour which is made from soft winter wheat varieties. Such indicators are flour yield and flour particle size since the adhesion between the starch granules and proteins of hard varieties is so strong in the milling process that starch granules fragment rather than get released from the protein matrix as they do in soft wheat varieties.

OBJECTIVES

The aim of this research was the investigation of the kernel hardness. We use two methods (Perten SKCS 4100 and Lloyd 1000 R) and the aim is to demonstrate the relationship among these results. The aim is to demonstrate a dinamic and a static test. The endospermium structure was examined by mechanical breaking force. We used hungarian varieties of Szegedi Gabonatermesztési Kutató Kht. (Cereal Research NPC, Szeged) as samples. There were six soft grain varieties and six hard grain varieties, which were labeled with code number.

MEASUREMENT METHODS

The Perten SKCS 4100 instrument (figure 1.) can test 300 kernels in 3 minutes on the average and report the following data: kernel hardness (hardness index, %), moisture, thousand kernel weight and kernel size.

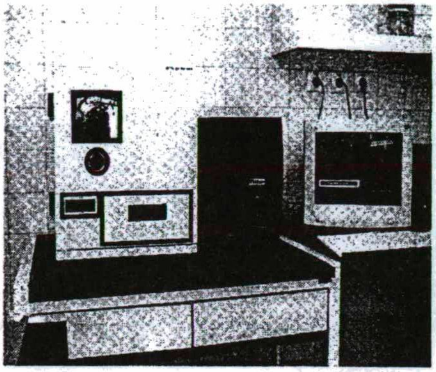

Figure 1. Perten SKCS 4100 instrument

LLOYD 1000 R Material Testing Machines (figure 2.): We scraped the grain, the surface on the side of the beard and the germ and this machine presses the kernels with the compressor head of Lloyd 1000 R testing machine of 1000 N force, and by reading the force – displacement curce (figure 3.). From this graph we read the breaking force, the incline and the break work. We examine the grain in standing position.

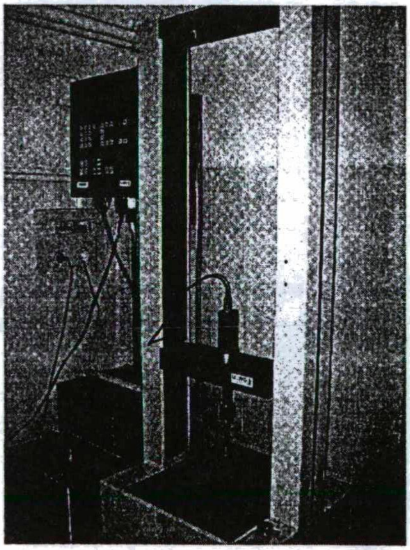

Figure 2. LLOYD 1000R Material Testing Machines

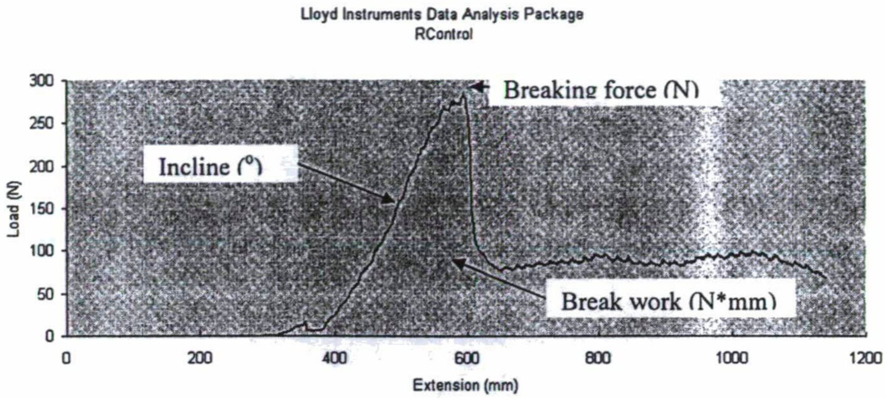

Figure 3. Load (N) – extension (mm) graph

RESULTS

The results of Perten SKCS 4100 and Lloyd 1000 R (table 1.).

***Table 1.** Test results*

Code:	Incline (°):	Breaking force (N):	Break work (N*mm):	SKCS 4100 (HI):	Hardness grade:
311	50.93	246.84	28.98	39	**S O F T**
320	56.15	288.60	33.25	40	
321	55.88	293.39	33.12	24	
322	52.70	285.85	35.65	45	
325	49.00	268.13	33.42	46	
331	47.71	246.21	29.58	38	
374	59.58	365.18	52.40	71	**H A R D**
376	60.34	407.88	61.81	72	
378	60.21	400.98	62.19	85	
379	62.24	421.97	61.91	77	
389	53.79	312.45	44.78	80	
307	61.79	394.79	61.43	91	

We use twin correlation to determine the relationship among the results. The SKCS 4100 compartmentalize the results in two groups. Under 50 is soft grain (the hardness index was between 24-46). Above 50 is hard grain (the hardness index was between 71-91). The correlation between hardness index and the static test was significant (r=0,7-0,9), for example: hardness index – breaking force r=0,829 (figure 4.); hardness index – break work r=0,902. As a result, the Lloyd 1000 R machine can sort the winter wheat in two groups (soft, hard).

BIBLIOGRAPHY

1. Békési, F (2001): A búza endospermium szerkezetének szerepe néhány minőségi búzát termelő országban. (in szerk Bedő, Z.: A jó minőségű, keményszemű búza nemesítése és termesztése, p. 25-34)
2. Gyimes, E. (2004): Összefüggés-vizsgálatok búzafajták szemtermésének agrofizikai tulajdonságai között, Doktori (PhD) értekezés Mosonmagyaróvár
3. Gyimes, E. – Neményi, M. – Véha, A (2002): Reológia és szemkeménység összefüggése őszi búzáknál In: Ötven éves az Acta Agronomica Hungarica Martonvásár, p. 117-124
4. Láng, L. – Juhász, A. – Rakszegi, M. – Bedő, Z. (2001): A búza keménységmérés ismételhetősége búzában, Növénytermelés 50, 497-503
5. Sitkei, Gy. (1981): Mezőgazdasági anyagok mechanikája, Akadémiai Kiadó, Budapest p. 11-461
6. Tanács, L. (2003): Élelmiszerek növényi eredetű nyersanyagai, SZTE-SZÉF jegyzet