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Research Article

Determination Testing of Seed Hardness of Staple Breeding Wheat Seed in Gansu Province of China

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Abstract: Seed hardness is one of the important indexes of grain classification. It has close relationship with grain powder, flour quality, seed storage and processing, resist insect pest and so on. In this study, which applied based on the grain hardness indentation loading curve method and chose 3 kind of staple breeding wheat seed to determine the seed hardness in Gansu province. The experimental results showed that the average hardness value of staple breeding wheat seed was 22.42 MPa~57.85 MPa and the dispersion of the hardness value was small, which also between 3~12%. The seed hardness of breeding wheat of Western drought-resistant No.1 was maximum (52.36~61.36MPa) and the seed hardness of breeding wheat of Western drought-resistant No.3 between two parties of the other breeding wheat, which was 42.12~50.20MPa. The seed hardness of breeding wheat of Western drought-resistant No.2 was minimum, which were 58.10~62.91% and 47.91~54.66% lower than the rest of the two breeding wheat seed hardness respectively. The findings will provide theoretical basis for seed production and processing and the stimulation analysis by EDEM.

Keywords: Agricultural material properties, plant mechanics, plot breeding wheat, seed hardness

INTRODUCTION

Quality of material soft and hard of cereal grains was an important indicator to evaluate grain processing quality and food quality. Which were also closely related to the grain breeding and flour trade prices (Anjum and Walker, 1991; Miu and Kutzbach, 2007; Zhang *et al*., 2010; Dai *et al*., 2013a). The size of breeding wheat seed hardness was one of the key factors, which was directly determines grains dominant damage forms in the threshing process produce and was more concerned with scientific breeding research and food production and processing of the material characteristic parameters (Liu, 2008). When the hardness of breeding wheat seed was different, the selection of threshing parts type and material were also different.

Therefore, the hardness of staple breeding wheat seed to determine in Gansu province, which would provide theoretical basis and reference value for subsequent breeding, selection of threshing device, seed processing and the stimulation analysis by EDEM.

MATERIALS AND METHODS

Test materials: The test equipment used for the CMT2502 type of microcomputer control electronic universal testing machine (Zhao *et al*., 2010; Dai *et al*., 2013b). As shown in Fig. 1, the test materials were chosen Western drought-resistant No.1, No.2 and No.3 varieties, which were cultivated by school of agronomy, Gansu agricultural university. The parameter of the relevant materials as follows, the Western drought-resistant No.1 with the kernels per spike was 24 and the thousand seed weight was 44.5 g, the Western drought-resistant No.2 with the kernels per spike was 24 and the thousand seed weight was 44.5 g and the Western

(a): Western drought-resistant No.1

(b): Western drought-resistant No.2

(c): Western drought-resistant No.3

Fig. 1: Test material of breeding wheat seed

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(a): Under test surface (From left to right in the order: Western drought-resistant No.1 and Western drought-resistant No.2 and Western drought-resistant No.3)

(b): Seating plane (From left to right in the order: Western drought-resistant No.1 and Western drought-resistant No.2 and Western drought-resistant No.3)

Fig. 2: Test samples of wheat seed

drought-resistant No.3 with the kernels per spike was 31 and the thousand seed weight was 44.3 g.

Specimen preparation: With the specimen preparation, in order to ensure the accuracy of the breeding of wheat grain hardness determination value and strengthen the sample placed in the next fixture on stability, the ventral groove of wheat grain was burnished for seating plane and the endosperm parts of the reverse side of wheat grain was burnished for under test surface. As shown in Fig. 2, the under test sample of wheat grain hardness.

Test determination: As shown in Fig. 3, it used the testing of grain hardness based on indentation loading curve and the microcomputer control electronic universal testing machine, which inserted the specimens internal under the action of pressure head (Zhang *et al*., 2010). When got a load-indentation depth curve, by calculating the load curve slope and measuring the hardness of breeding wheat grain. The load-indentation depth curve and curve slope were reflected the indentation depth test process and changes of the applied load comprehensively.

RESULTS AND DISCUSSION

Test results and analysis: The determination testing of wheat seed hardness of staple breeding wheat in Gansu province, which collected the total 5 group of test data and repeated 3 times in each group to take the average value (Zhao *et al*., 2010; Dai *et al*., 2013a). The breeding wheat grain hardness of determination value of the test as shown in Table 1, the different varieties of hardness measurement of the corresponding curve as shown in Fig. 4a (1 to 5), b (1 to 5) and c (1 to 5).

The experimental results showed that the average hardness value of staple breeding wheat seed was 22.42~57.85MPa. The seed hardness of breeding wheat of Western drought-resistant No.1 was maximum (52.36~61.36MPa) and the seed hardness of breeding wheat of Western drought-resistant No.3 between two parties of the other breeding wheat, which was 42.12~50.20MPa. The seed hardness of breeding wheat of western drought-resistant No.2 was minimum (21.94~22.76MPa).

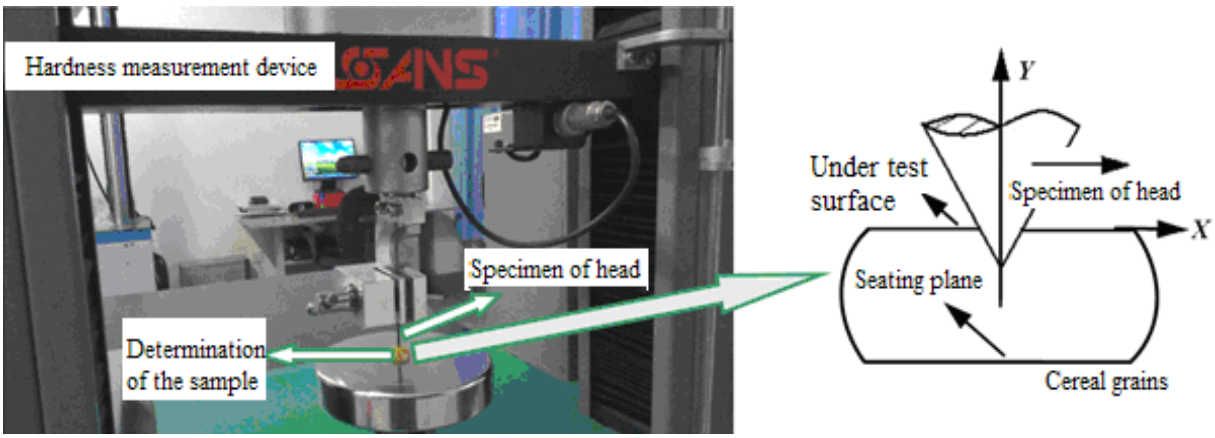
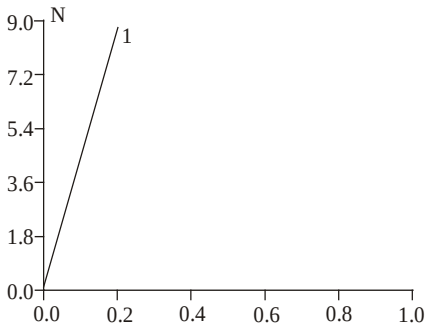


Fig. 3: Schematic diagram of testing of grain hardness based on indentation loading curve measurement

Table 1: Hardness test datas of different variety breeding wheat grains

	Hardness value/MPa							
	Group number of corresponding experiment							
Varieties	(1)	(2)	(3)	(4)	(5)	Average value/MPa	Dispersity/%	S.D.
Western drought-resistant No.1	52.36	54.24	60.12	61.16	61.36	57.85	15.56	3.78
Western drought-resistant No.2	21.94	21.96	22.36	22.56	22.76	22.42	3.57	0.32
Western drought-resistant No.3	42.12	44.12	48.40	50.20	47.66	46.50	11.91	2.95



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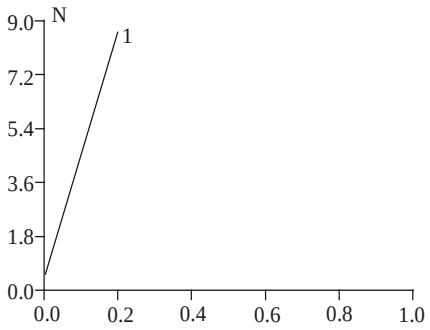

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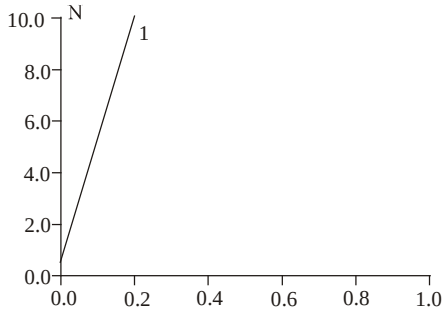

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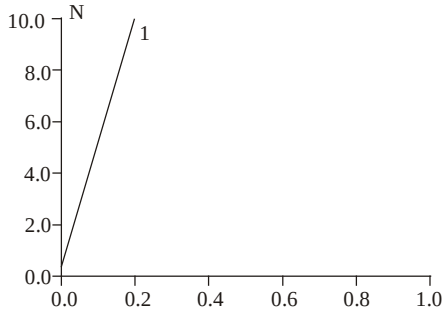

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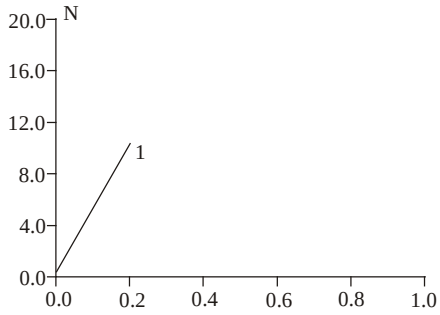
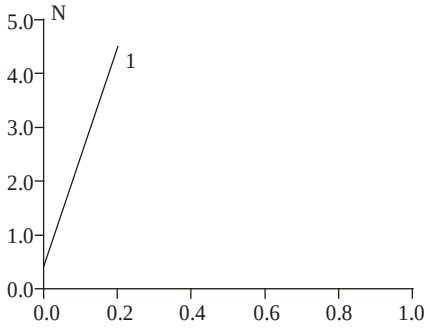


(5)

(a): Hardness test curves of Western drought-resistant No.1



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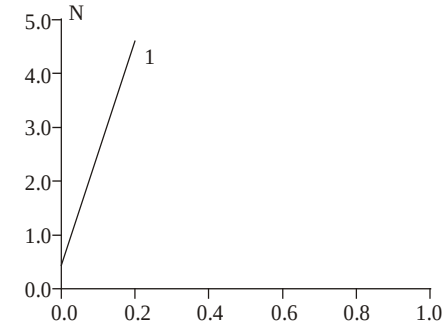

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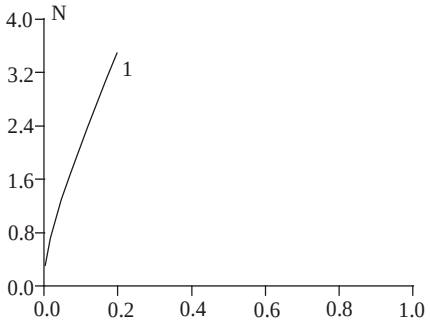

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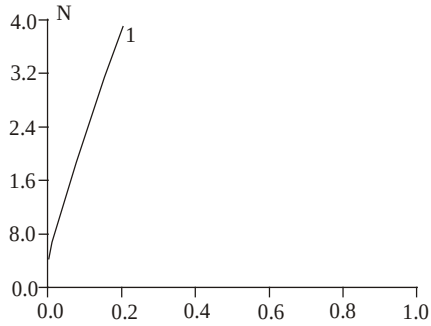

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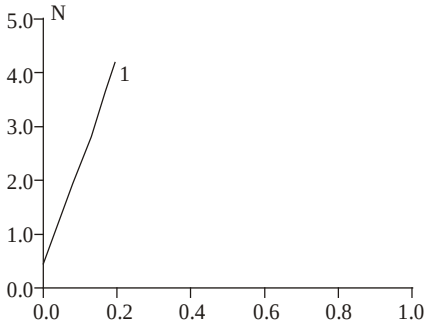
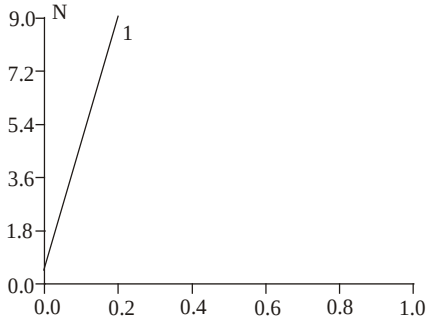


(5)

(b): Hardness test curves of Western drought-resistant No.2



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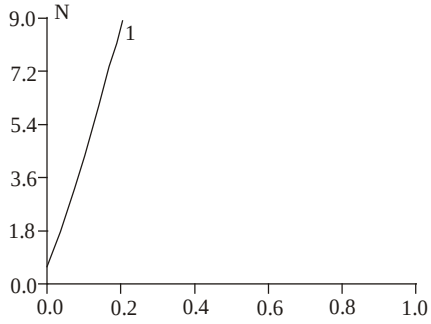

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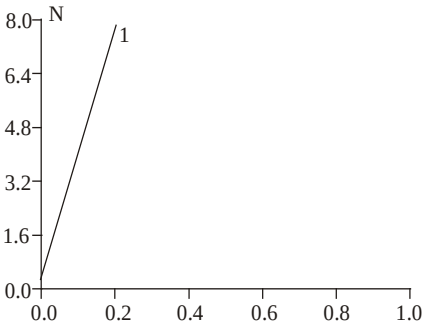

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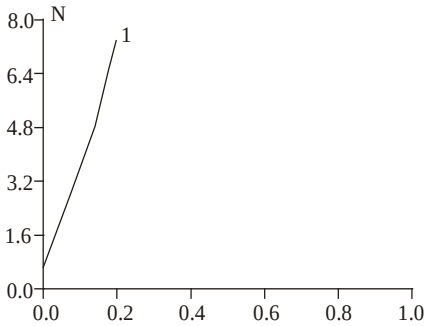

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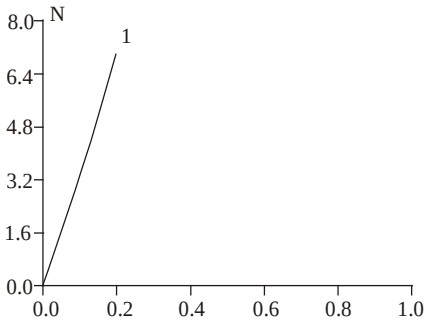
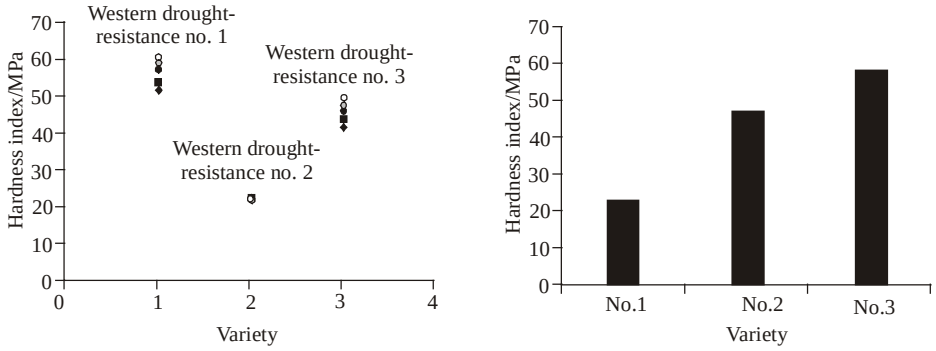


(5)

(c): Hardness test curves of Western drought-resistant No.3

Fig. 4: Hardness test curves of different variety wheat grains



(a) (b)

Fig. 5: (a): Scatter plot of different varieties of breeding wheat hardness distribution; (b): Histogram of different varieties of breeding wheat hardness size distribution

As shown in Fig. 5a and b, the dispersion of the hardness value was small, which also between 3~12%. The seed hardness dispersion of breeding wheat of Western drought-resistant No.1 was maximum (15.56%) and the seed hardness dispersion of breeding wheat of Western drought-resistant No.2 was minimum (3.57%) and the seed hardness dispersion of breeding wheat of Western drought-resistant No.3 between two parties of the other breeding wheat, which was 11.91%.

By the experimental results and analysis could be seen that the hardness and its distribution of staple breeding wheat seed (Western drought-resistant No.1 and Western drought-resistant No.2 and Western drought-resistant No.3) had large differences, the breeding wheat seed of Western drought-resistant No.1 distribution was significant, which could select spike-tooth threshing device for production. The seed hardness of breeding wheat of western drought-resistant No.2 was minimum, which were (58.10~62.91%) and (47.91~54.66%) lower than the rest of the two breeding wheat grain hardness, respectively. It should choose bow-wire tooth threshing component after harvest production and processing.

CONCLUSION

It applied based on the grain hardness indentation loading curve method and chose 3 kind of staple breeding wheat grain (Western drought-resistant No.1 and Western drought-resistant No.2 and Western drought-resistant No.3) to determine the seed hardness in Gansu province. The experimental results showed that the average hardness value of staple breeding wheat seed was 22.42~57.85MPa.

The seed hardness of breeding wheat of western drought-resistant No.1 was maximum (52.36~ 61.36MPa) and the seed hardness of breeding wheat of western drought-resistant No.3 between two parties of the other breeding wheat, which was 42.12~50.20MPa. The seed hardness of breeding wheat of western drought-resistant No.2 was minimum (21.94~22.76 MPa), which were 58.10~62.91% and 47.91~54.66% lower than the rest of the two breeding wheat grain hardness respectively. The dispersion of the breeding wheat hardness value was small, which also between 3~12%.

ACKNOWLEDGMENT

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