

# The express method of oats genotypes evaluating on $\beta$ -glucans content

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# Background

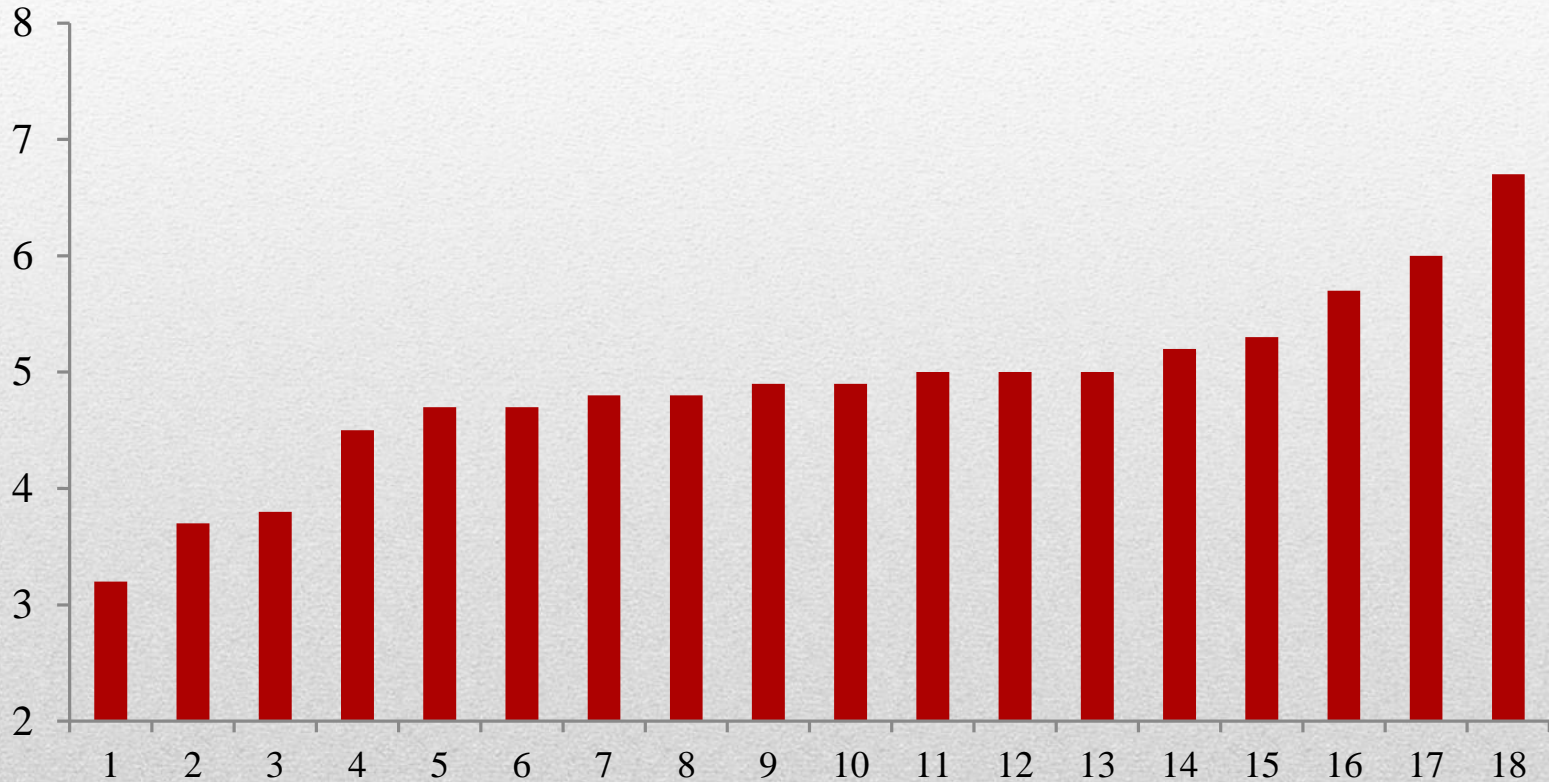
- Oat (*Avena sativa* L.) is an excellent source of mixed linkage  $\beta$ -glucans, a dietary fibre with cholesterol lowering properties. These polysaccharides are becoming recognized increasingly for their potential to lower the risk of serious diet-related conditions such as type II diabetes, cardiovascular disease, colorectal cancer, and diverticular disease.
- An increasing of  $\beta$ -glucans content in grain of oat is the most important task of breeding. Known methods of assessing oat grain quality are too time-consuming, complicated, destructive and little avail in breeding process.

- The aim of our work is to develop indirect method for screening  $\beta$ -glucans content in grain of oats which is nondestructive, simple and express.
  - The tasks:
    - 1. To investigate relationships between grain  $\beta$ -glucans content and physical indicators of hulled and dehulled grain;
    - 2. To divided oat cultivars into two contrasting groups, which differed significantly from each other in terms of  $\beta$ -glucans content, based on the best physical indicator of grains.
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# The object and methods

- We studied 16 hulled and 2 naked oat cultivars from VIR collection. We used hulled and dehulled (after removing external flower hulls) grains.
  - Grain  $\beta$ -glucans content was measured using standard AACC International Approved Methods of Analysis with Megazyme kit.
  - The values of grain  $\beta$ -glucans content of 18 oats cultivars were equal from 3.2 to 6.7%.
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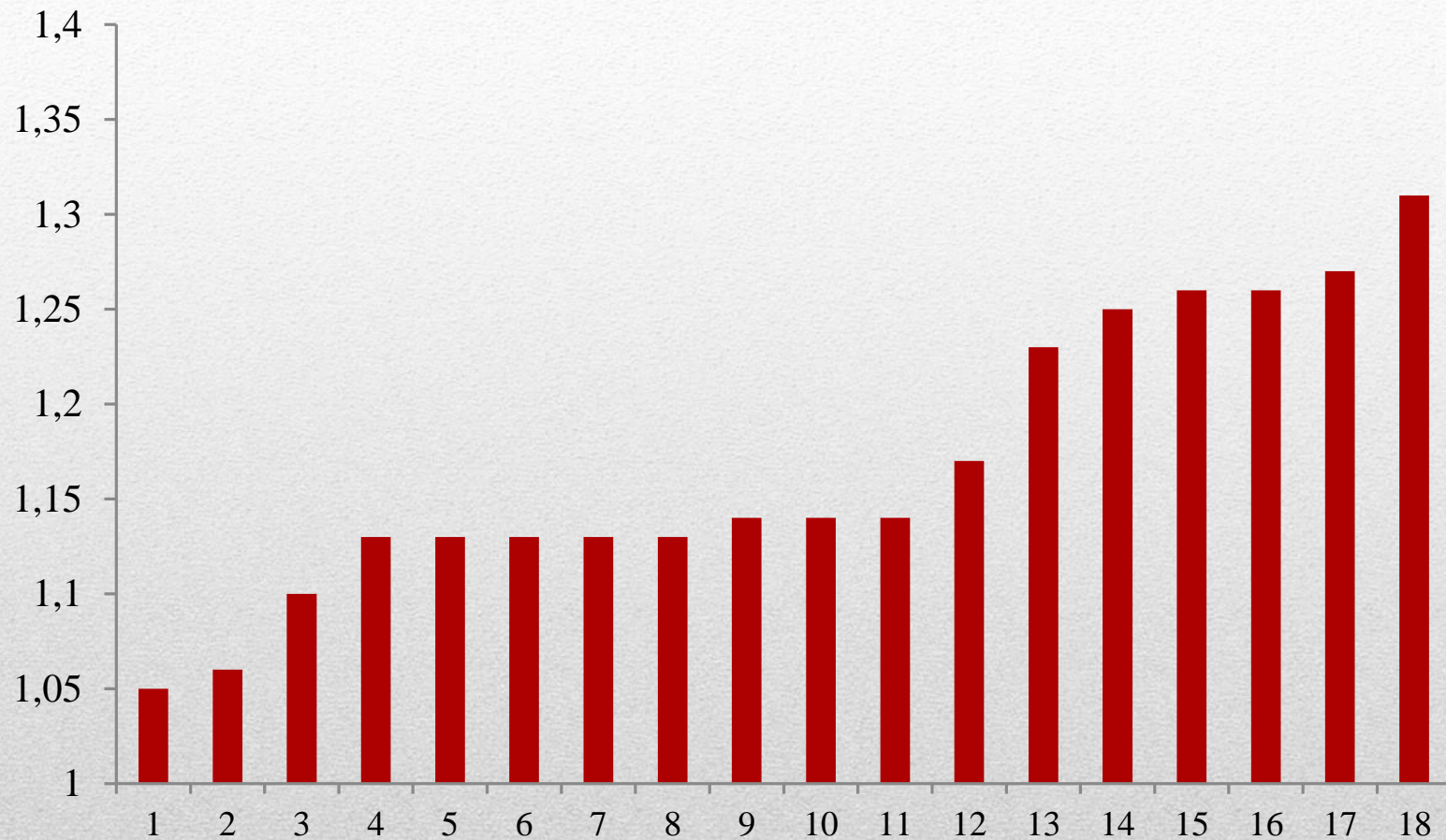
# Grain $\beta$ -glucans content of 18 varieties of oats



# Methods

- The next physical parameters of grains were measured:
  - 1. Weight of 1000 grains (standard method);
  - 2. Test weight by measuring the volume of a measured mass of grain in a graduated cylinder (a small scale method by Walker and Panozzo, 2011);
  - 3. Mass fraction of grain hulls (standard method);
  - 4. Density of hulled and dehulled grain. For calculating grain density the oat grain volume was measured by a sand-displacement method (Doehlert and McMullen, 2008). Fine white silica sand was used for oat grain volume measurements. Sea sand collected from a beach (The South China Sea, Vietnam).
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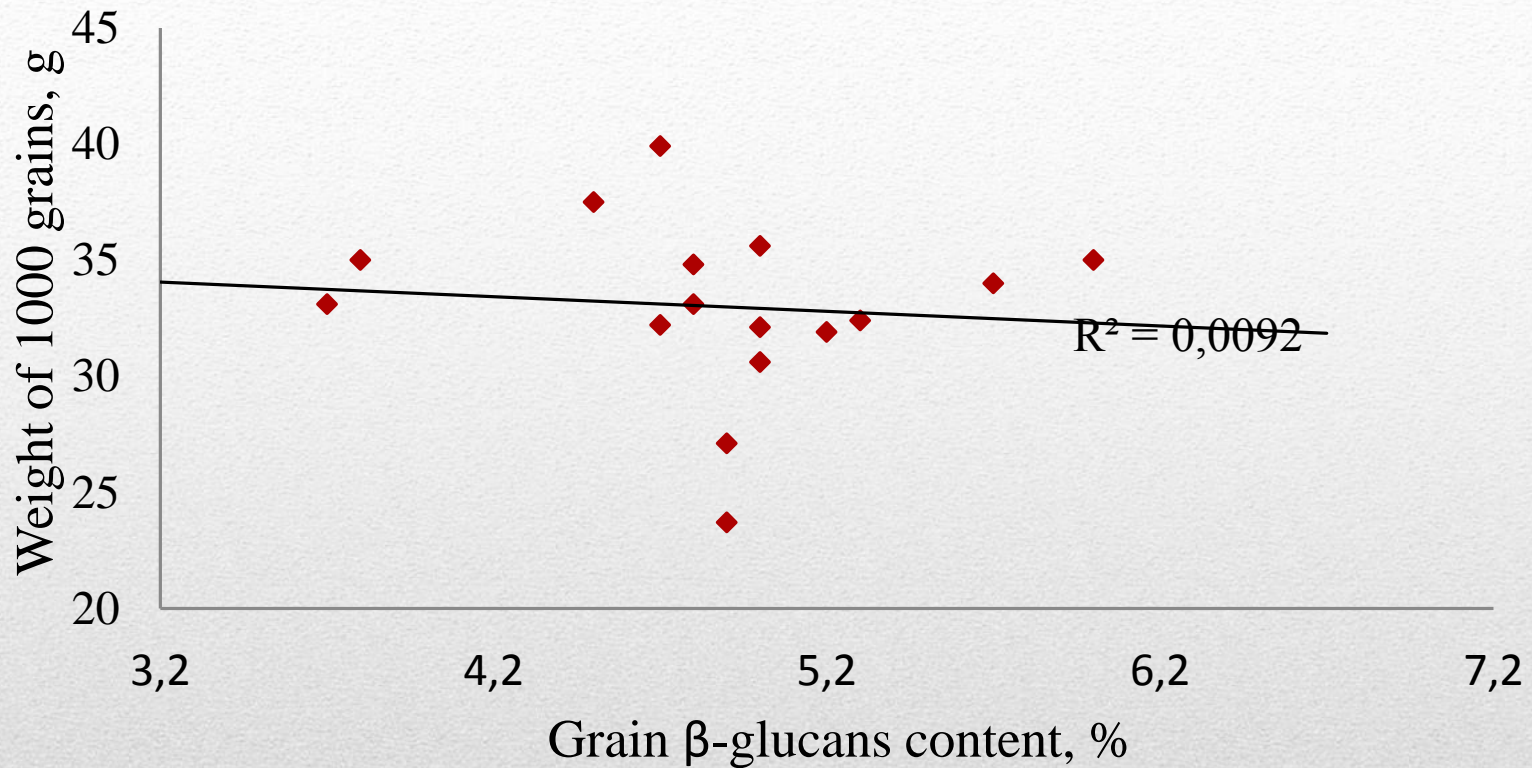
# Dehulled grain density of 18 varieties of oat



# Results

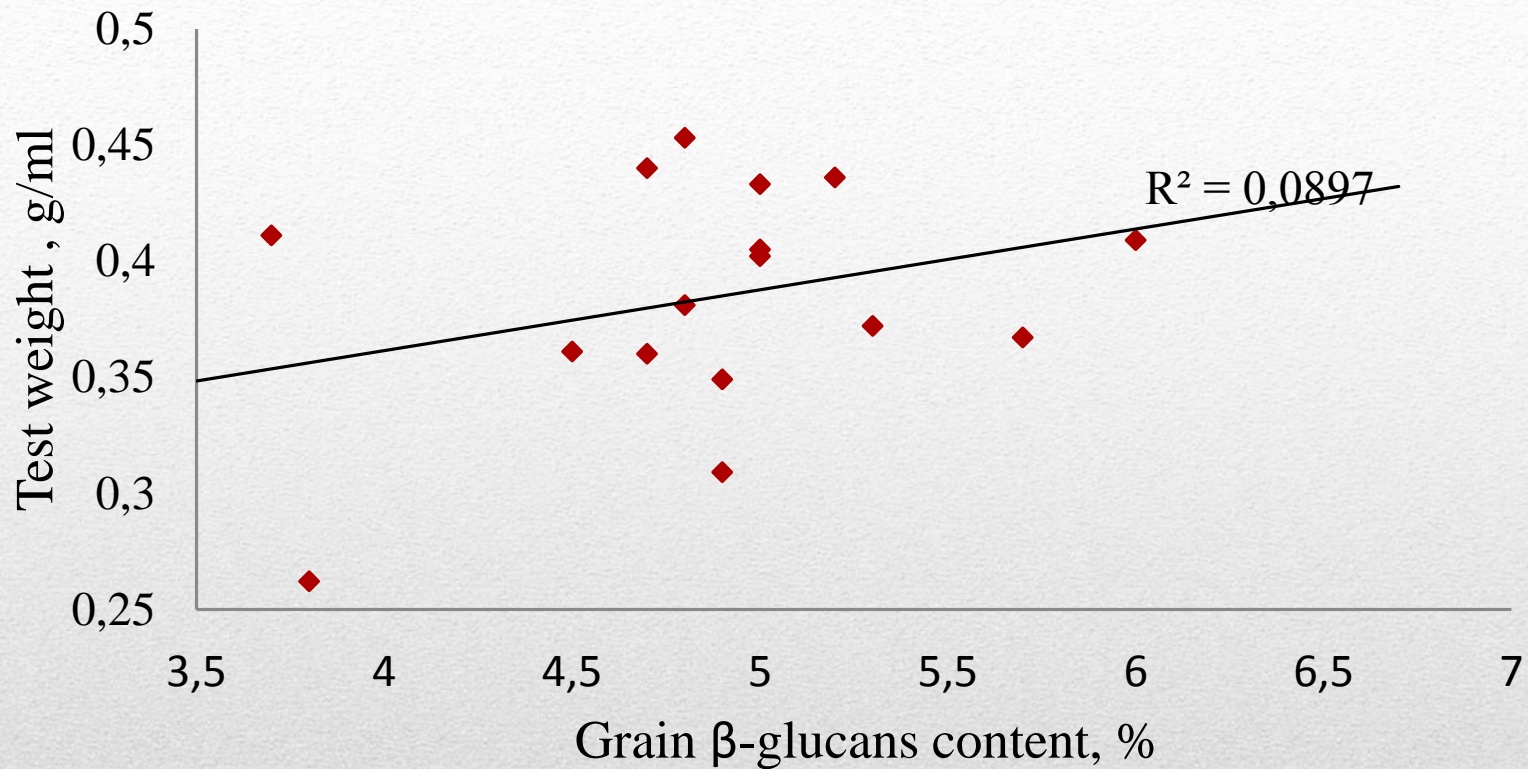
- The strong positive relation between the density of dehulled grains and  $\beta$ -glucans content was experimentally shown ( $r = 0.818$ ). It was found the low positive correlation between test weight and  $\beta$ -glucans content; but the middle positive correlation between density of hulled grains and  $\beta$ -glucans content. It was shown low negative correlation between weight of 1000 grains, mass fraction of grain hulls and  $\beta$ -glucans content.
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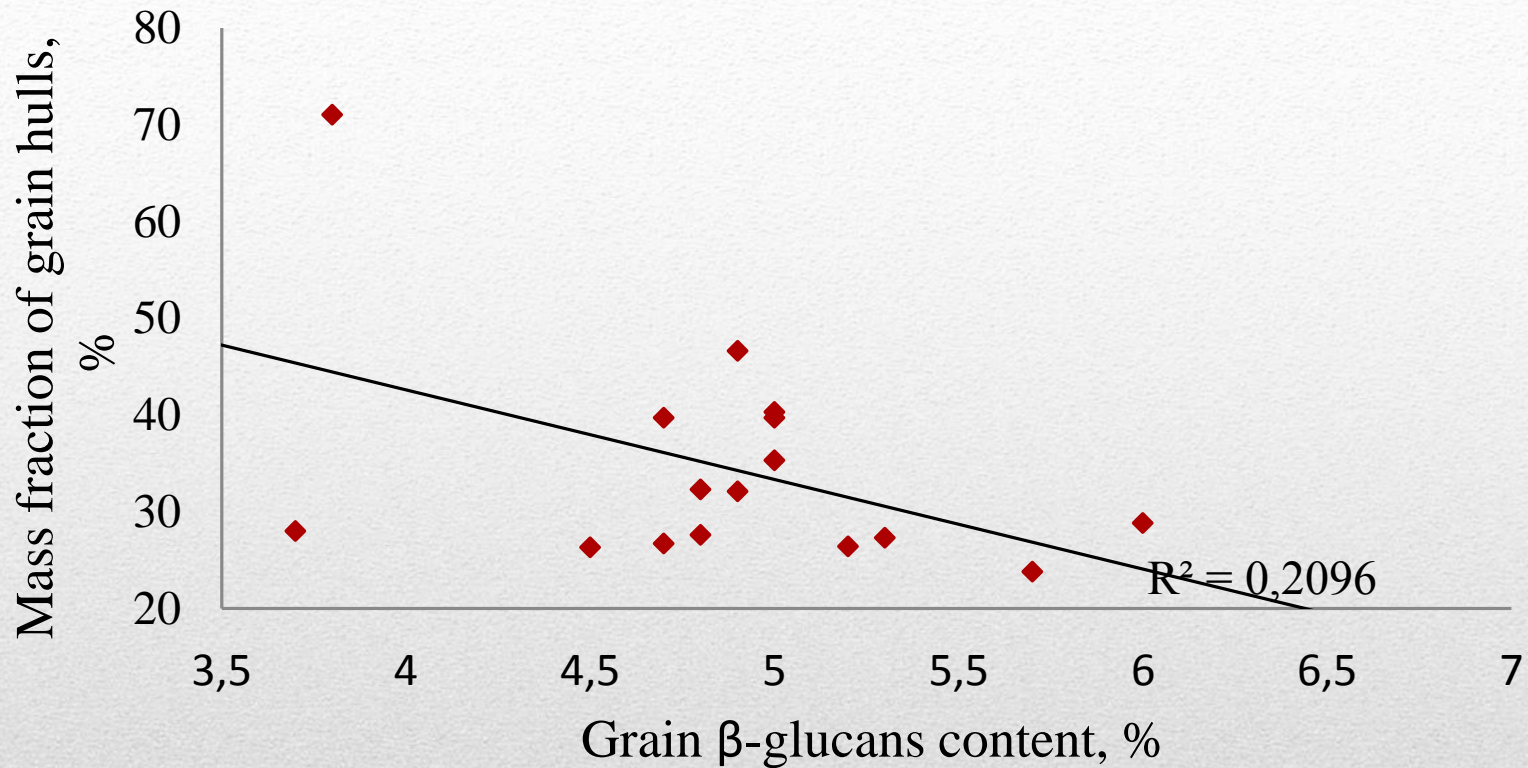
**Weight of 1000 grains dependence on the content of  $\beta$ -glucans**

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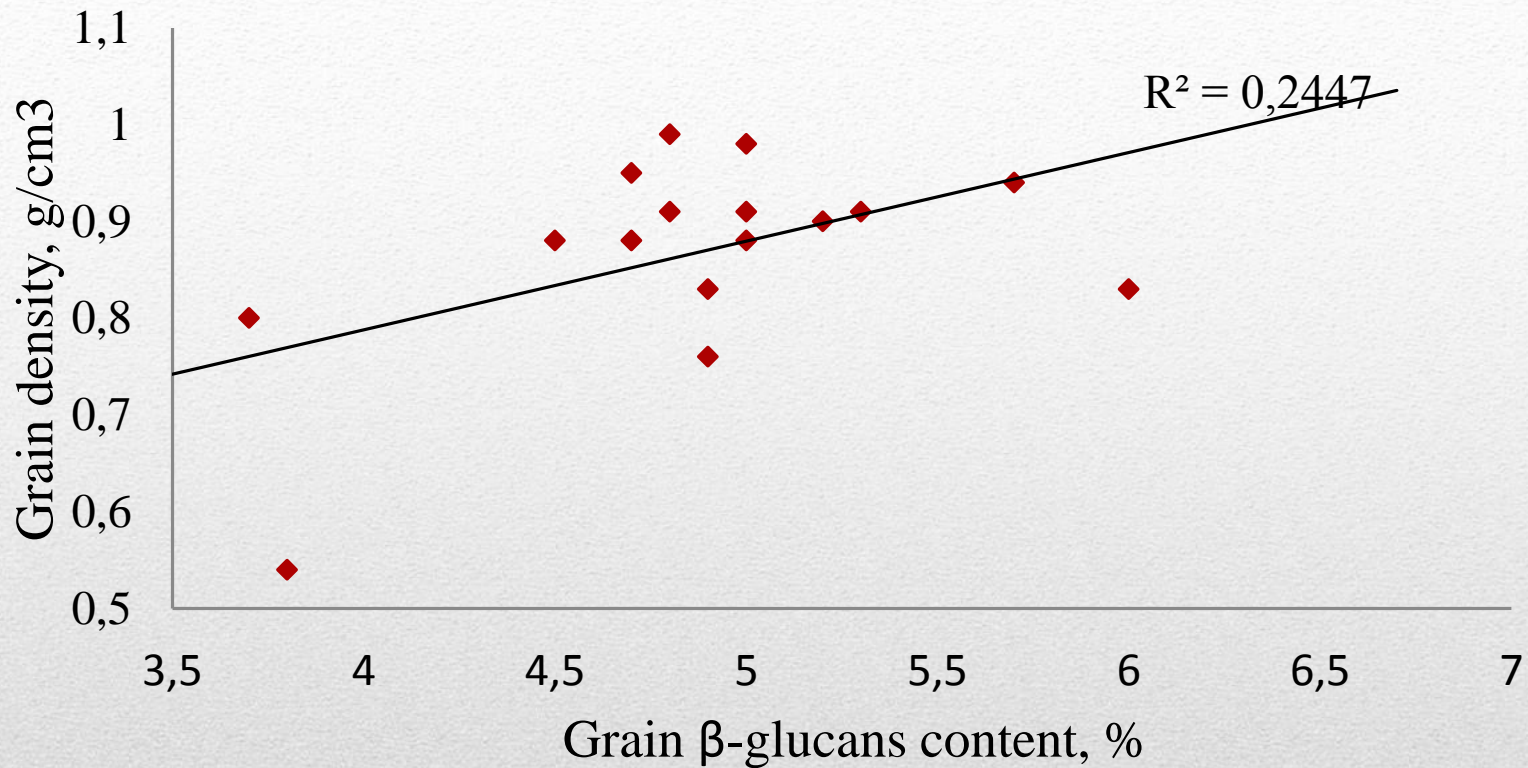
## Test weight dependence on the content of $\beta$ -glucans

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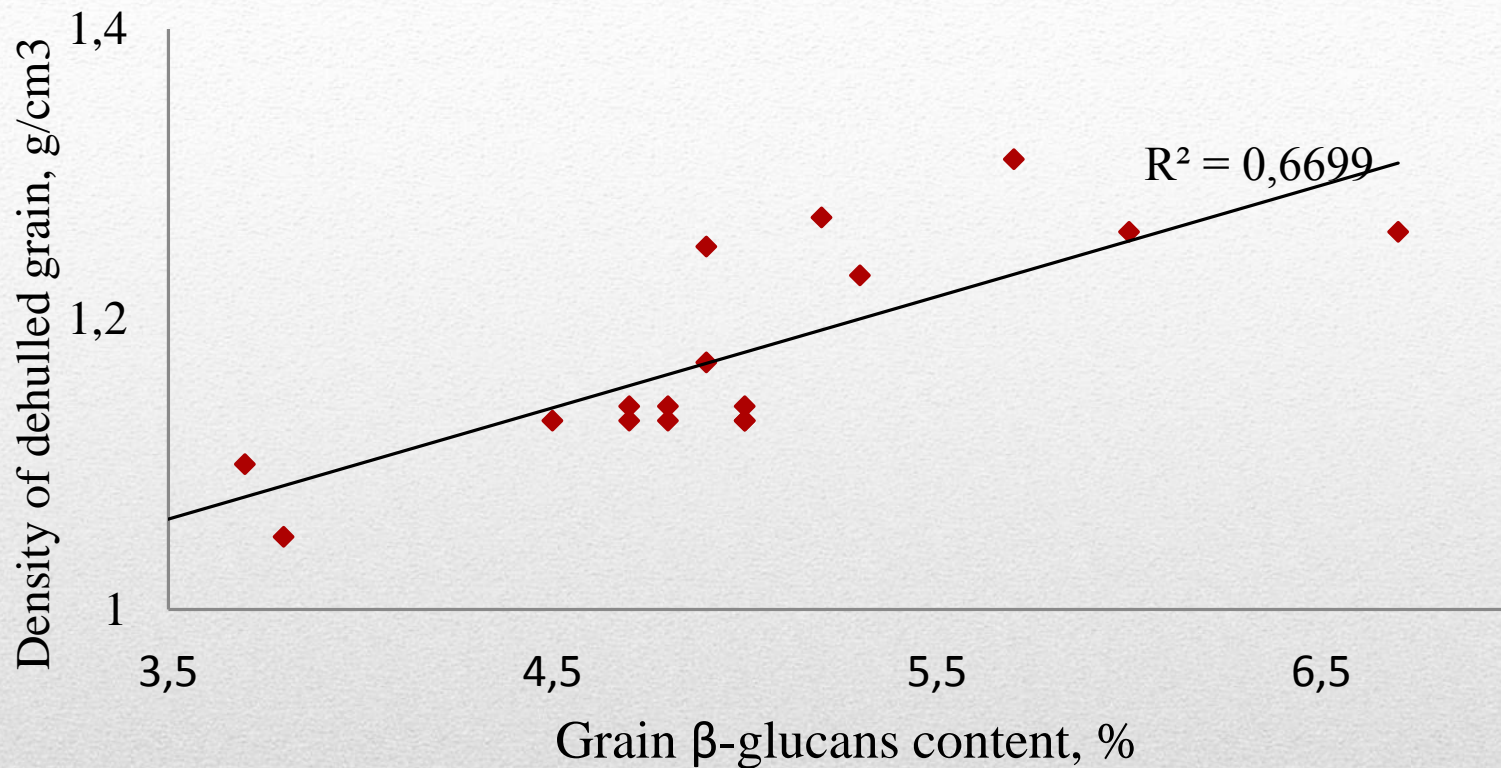


**Mass fraction of grain hulls  
dependence on the content of  
 $\beta$ -glucans**

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## Grain density dependence on the content of β-glucans



**Dehulled grain density dependence on the content of  $\beta$ -glucans**

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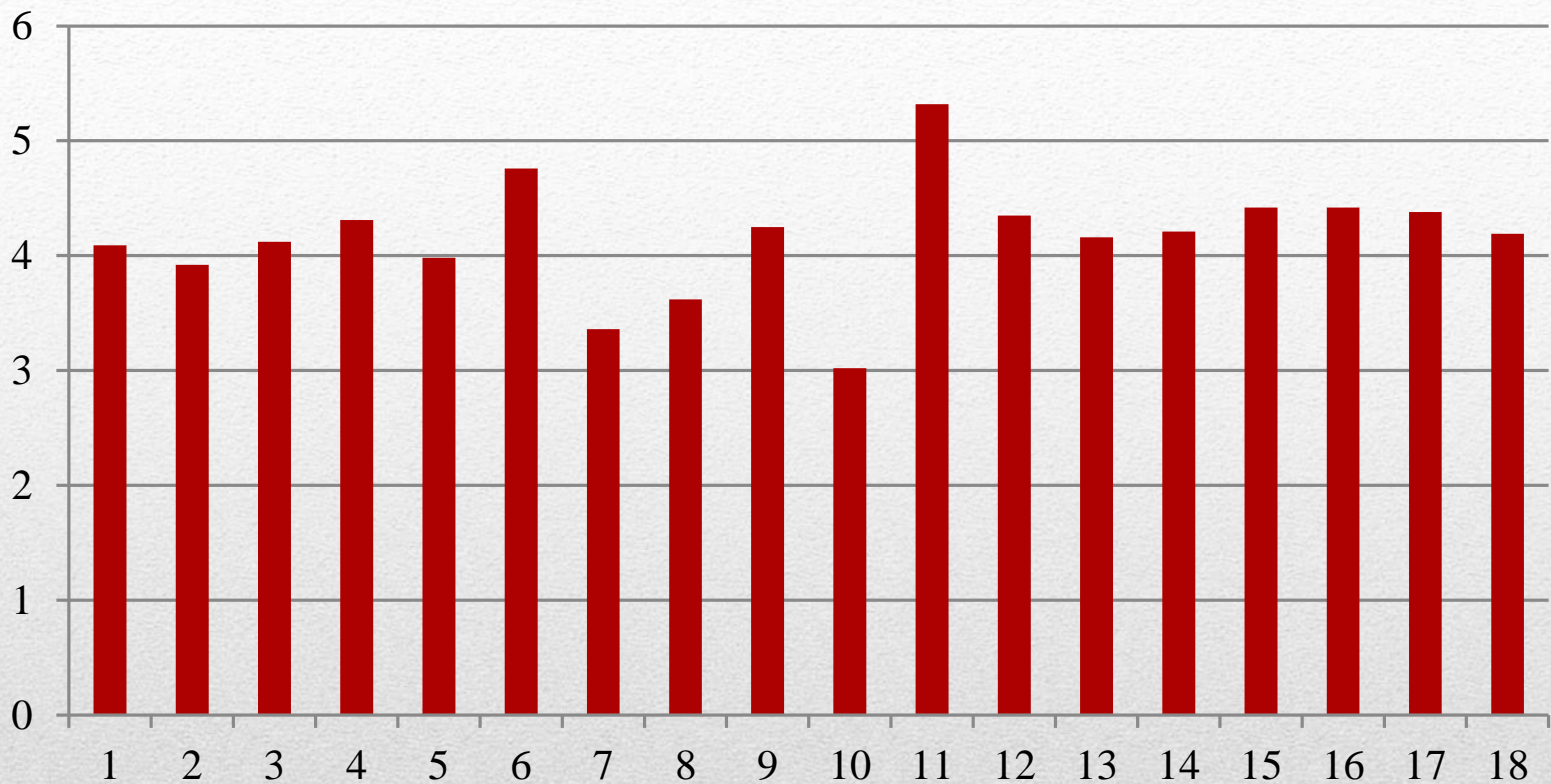
# Coefficients of correlation for physical grain traits

		Hulled grain				Dehulled grain
		Test weight, g/ml	Weight of 1000 grains, g	Density, g/cm <sup>3</sup>	Mass of grain hulls, %	Density, g/cm <sup>3</sup>
Hulled grain	Weight of 1000 grains	0.347				
	Density	0.780*	0.176			
	Mass of grain hulls	-0.477	-0.041	-0.651*		
Dehulled grain	Density	0.101	-0.239	0.278	-0.561*	
	$\beta$ -glucans content	0.299	-0.096	0.495	-0.458	0.818*

- The average value of the dimensionless ratio (the ratio of  $\beta$ -glucans content to dehulled grain density) was equal to 4.16 and varied slightly from cultivars of oat.

## **Results**

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**The ratio of  $\beta$ -glucans content to the dehulled grain density of 18 varieties of oats**

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- All samples of oats in terms of  $\beta$ -glucans content were divided into two contrasting groups, which differed significantly from each other not only in terms of  $\beta$ -glucan content, but the density of dehulled grains.

## **Results**

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# **$\beta$ -glucans content and dehulled grain density of contrasty groups of oats varieties**

<b>Group of varieties</b>	<b>Average data</b>	
	Dehulled grain density, g/cm <sup>3</sup>	Grain $\beta$ -glucans content, %
All varieties (18)	1.17 $\pm$ 0,04	4.88 $\pm$ 0,47
Three varieties with minimum $\beta$ -glucans content	1.07 $\pm$ 0,02 a	3.57 $\pm$ 0,18 a
Three varieties with maximum $\beta$ -glucans content	1.28 $\pm$ 0,02 b	6.13 $\pm$ 0,30 b

- Indirect method for assessing  $\beta$ -glucans content in oat was developed. It was proposed to use the criterion of the density of dehulled grains to assess technological qualities of oats.
- It is assumed that the use of this approach will ensure a simple, speed, and a quantitative assessment of the quality and the undamaged grain oats in respect of its  $\beta$ -glucans content. Based on the received data the contrasting groups that can be considered as promising forms for oats selection of different directions are singled out.

## **Conclusion**

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# Acknowledgements

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**Thank you for attention!**

