

*Materials of the Conference***AMINOACID COMPOSITION
AND BIOLOGICAL VALUE OF SPRING
WHEAT GRAINS IN SOUTH-EAST
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Wheat takes leading position in human and farm animal's energetic and nutritious balance. However, FAO data about food supply has risen the question about necessity of cereals quality improvement which supposes protein increase in grain and its essential aminoacid enrichment [6].

Aminoacid composition is one of the most important protein characteristics. When analyzing quantity composition of aminoacid in wheat protein two main aspect appear – aminoacid composition as biochemical criteria of biological value of fodder and food (according to essential aminoacid composition) and as structure basis of protein molecule, fulfilling specific functions in a cell [2]. The nutritious value of grain and its derived products can be improved if we learn to change the aminoacid composition of protein [3].

Influenced by external conditions not only content of total protein in grain is changed but its fraction composition as well. The difference in grain protein fractions according to aminoacid content leads to that the change of protein balance leads to the change of aminoacid quantity in grain total protein [5, 4].

Thus the aminoacid content, characterizing by stability of quality composition of protein, has enough

wide variability according to quality depending on sort peculiarities and environment factors, providing the accumulation dynamic of separate forms and fractions of nitrogenous matters.

The research objective was to learn aminoacid composition of spring wheat grains, its variability influenced by sort peculiarities and environment conditions of growing and to estimate grain according to essential aminoacid composition.

Material and research method

The subject of research is examples of grain of eight sorts of spring hard and soft wheat of different groups of ripeness, growing in forest-steppe and steppe natural-climatic zones of South- East of Western Siberia, crops 2000- 2002. The analyzed grain is of sort of middle early ripeness group Iren, Obskaya 14, Novosibirskaya 15 and Novosibirskaya 29, mid-ripening- Aleshina and Omskaya 29, middle- late Omskaya 24, hard – Altaiskaya amber. The aminoacid composition analysis was carried out by IR-spectroscopy at infrared.

Math processing of the obtained data was carried out by analysis of variance and correlation analysis [1] with the help of modern PC IBM-type with processor Pentium- type and higher, operating system Microsoft Windows 2000 and electronic tables Excel.

Research results

Independent on sort peculiarities and growing conditions wheat grain is characterized by relatively high content of glutamic acid, proline and leucine, low – histidine, tyrosine (table 1). Relatively low quantity of methionine, alanine, lysine, serine, threonine and valine is detected.

Table 1. Aminoacid composition of wheat grain, 2000- 2002

Aminoacids	Weight percentage %		
	variation	average	Variation coefficient, %
asparaginic	0,52 – 0,62	0,58	16,1
threonine	0,42 – 0,52	0,48	19,2
serine	0,47 – 0,48	0,47	2,1
glutamic	2,32 – 3,01	2,75	22,9
proline	1,02 – 1,20	1,13	15,0
glycine	0,50 – 0,53	0,52	5,7
alanine	0,43 – 0,44	0,44	2,3
valine	0,47 – 0,49	0,48	4,1
methionine	0,37 – 0,42	0,40	11,9
isoleucine	0,62 – 0,63	0,63	1,6
leucine	1,06 – 1,16	1,12	8,6
tyrosine	0,06 – 0,52	0,37	88,5
phenylalanine	0,69 – 0,71	0,70	2,8
histidine	0,22 – 0,33	0,30	33,3
lysine	0,44 – 0,46	0,45	2,2
arginine	0,59 – 0,65	0,63	9,2
total	10,82 – 11,81	11,42	8,4

Aminoacids tyrosine, histidine, glutamic, threonine, asparaginic, methionine are characterized as the most variable influenced by sort peculiarities and conditions of growing. More stable characteristic of aminoacid composition of grain is content of phenylalanine, isoleucine, alanine, valine, serine, lysine and glycine.

Total content of aminoacids dominated in steppe zone grain (10,90 – 11,68%) in comparison to forest-steppe (10,82 – 11,19%). Content correlation of separate aminoacids doesn't give clear advantage of this or that natural-climatic zone of grain cultivation. The difference in grain among zones is most significant according glutamic acid, in steppe- 24,6%, in forest-steppe - 23,6. There's slightly difference in asparaginic, serine, methionine, isoleucine, leucine, tyrosine, phenylalanine, arginine with small domination in grain growing in forest-steppe zone, and glutamic, histidine, lysine – in steppe zone.

Total content of aminoacids in different sorts ranges from 10,99 to 11,80% (V = 6,9%), and the average is 11,42%.

The most difference according to aminoacid content of grain of different ripeness groups is in quantity of tyrosine (V = 44,2%), histidine (V = 15,2%), glutamic acid (V = 14,0%), threonine (V = 10,0%) and asparaginic acid (V = 8,4%); the least isoleucine (V = 1,6%), valine (V = 2,0%), serine (V = 2,1%), alanine (V = 2,3%) and phenylalanine (V = 2,8%).

According to total content of aminoacids middle-late sorts dominate and trail early ripe. Thus, vege-

tation period prolongation helps in favorable conditions to accumulation and more aminoacids.

Content of aminoacids alanine, serine and isoleucine in grain is enough stable as according to sorts and according to natural- climatic zones.

Sort peculiarities are mostly appear in accumulation of such aminoacids as tyrosine, histidine, glutamic acid, threonine and methionine(relatively $r = 0,99, 0,79, 0,73, 0,64$ и $0,61$).

There was detected medial dependence of total content of aminoacids from sort peculiarities, slight – from growing conditions and enough apparent from their mutual influence (relatively $r = 0,51, 0,32$ и $0,70$).

It was detected strong but not high co-relation ($r = 0,76$) between total content of aminoacids and protein mass fraction. It can be explained by that not all aminoacids, synthesized in the process of active vegetation, go to corn seed protein biosynthesis. One of the reasons can be unfavorable conditions during earing period – yellowing and after-ripening.

Grain proteins even of the best wheat sorts are incomplete according to content of essential aminoacids. The most critical essential aminoacids are lysine and methionine, the balance of wheat grain protein is not more than 50 – 60% [7].

Total content of essential aminoacids in grain protein of the concerned sorts of spring wheat is average 4,58%. The difference according to natural-climatic zones is insignificant (0,2%). From total quantity of aminoacids essential make in steppe zone 39,8%, and in forest- steppe 40,4.

Table 2. Content of protein, limited essential aminoacids in grain and protein of spring soft wheat, 2000 – 2002

Sort	Protein mass fraction in grain, %	Mass fraction in essential aminoacids %					
		in grain			in protein		
		lysine	threonine	methionine	lysine	threonine	methionine
Novosibirskaya 15	17,3 *	0,45	0,47	0,38	2,60	2,72	2,20
	15,9	0,44	0,42	0,42	2,77	2,64	2,64
Novosibirskaya 29	17,0	0,44	0,48	0,39	2,59	2,82	2,29
	13,8	0,45	0,43	0,42	3,26	3,12	3,04
Iren	15,1	0,44	0,45	0,41	2,91	2,98	2,72
	15,9	0,45	0,49	0,40	2,83	3,08	2,52
Omskaya 29	15,1	0,45	0,47	0,40	2,98	3,11	2,65
	14,2	0,44	0,49	0,40	3,10	3,45	2,82
Average to sorts	16,1	0,45	0,47	0,40	2,77	2,92	2,48
	15,0	0,45	0,46	0,41	2,99	3,07	2,73
Norm (according to WHO)	–	–	–	–	5,5	4,0	3,5

* – In numerator – stepe zone, in denominator – forest-steppe zone.

Content of lysine and threonine in proteins of the concerned sorts is lower than required by WHO-relatively 5,5 and 4,0 %. In the researched examples of grain the quantity of lysine ranged according to sorts and natural-climatic zones from 0,44 to 0,46% (V = 4,3%), in conversion to protein average is 2,88%, threonine- relatively from 0,42 to 0,58% (V = 27,6%) in grain and 3,0% in protein (table. 2).

Content of methionine in grain ranges from 0,37 to 0,41%, which corresponds to 2,2 – 2,82% of it in protein (V = 11,9%). According to WHO the content of sulfur containing aminoacids in complete protein should be no less than 3,5%. Quantity of valine, leucine and phenylalanine correspond to complete protein.

To a greater degree total content of essential aminoacids ranges according to sorts (V в in steppe zone = 9,8 in forest-steppe - 5,1%) and less according to natural-climatic zones (range V = 1,2 – 4,9%). Range according to natural-climatic zones is methionine 9,0, lysine 7,4, threonine 4,9%.

The range between sorts according to quantity of essential aminoacids in protein within average is lysine 20,6, threonine 23,5, methionine 27,6%. Thus, quantity of methionine ranges the most. Natural-climatic zone range is methionine 9,0%, lysine 7,4, threonine - 4,9.

Conclusion

Mass fraction of aminoacid is in greater degree changes influenced by sort peculiarities and less- ecological conditions. Content of tyrosine, glutamic acid, proline and histidine is characterized by high variability; serine, alanine, glycine, valine, isoleucine, phenylalanine and lysine- low.

Content of essential aminoacid in grain protein from norms for complete protein (according to WHO) is for lysine- 48,8, , threonine 67,0, methionine - 69,1%.

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