

Influence of the Ratio of the Grinding Mixture of the Triticale Grain and Hemp Seeds on the Grain-Forming Ability of the Triticale-Hemp Grain Mixtures

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ANNOTATION

The results of a study on the effect of different ratios of the grinding mixture of triticale grains and hemp seeds on the grain-forming ability of intermediate grinding products are presented. Determination of the influence of different ratios of the grinding mixture of triticale grains and hemp seeds on the grain-forming ability of the intermediate products of grinding triticale-hemp flour was carried out using a laboratory mill "Nagema" with cutting rollers. According to the results of the research, it was found that the addition of 4% hemp seeds to the grinding triticale-hemp grain mixture yielded intermediate grinding products of 84.1%, incl. 9.2% triticale-hemp flour, when 6% hemp seeds were added to the grinding triticale-hemp mixture, the yield of intermediate grinding products was 85.4%, incl. 9.9% triticale-hemp flour, when 8% hemp seeds were added to the grinding triticale-hemp mixture, the yield of intermediate grinding products was 85.8%, including 8.7% triticale-hemp flour, when 10% hemp seeds were added to the grinding wheat-hemp mixture, the yield of intermediate grinding products was 89.5%, incl. 10.5% triticale-hemp flour. It was revealed that when grinding the initial control grain of triticale of the Nemchinovskaya 56 variety, the yield of intermediate grinding products was 81.1%, incl. 11.6% triticale flour. It has been established that the addition of 4% to 10% hemp seeds to the grinding triticale-hemp mixture leads to an increase in the yield of intermediate grinding products by 3.0-8.4% compared to the yield of intermediate grinding products of their control triticale grain. At the same time, after grinding on grinding systems of intermediate grinding products, the yield of wheat-hemp flour increases from 0.9% to 4.7% compared to the control sample of triticale.

Introduction

Products of processing grain crops in the form of various types and varieties of flour make up a significant share in the diet of the population of our country. However, the chemical composition of food products obtained on the basis of traditional technologies is characterized by an insufficient balance in nutritional value and

biological efficiency [1]. In this regard, it is required to develop food products with increased nutritional and nutritional value on a grain basis with the addition of oilseeds (hemp) [2-5]. Hemp seeds are of high nutritional value, while they are rich in essential fatty amino acids (EFAs), vitamins A, D, E and group B, trace elements (calcium, iron, sodium), dietary fiber [6,7]. In terms of nutritional value, only

soy can compete with hemp, while the quality of proteins in hemp seeds is much higher, they are close in composition to human blood proteins. In addition, hemp seeds are an environmentally friendly product, since no herbicides are used on hemp crops - this plant, due to its vitality, copes well with diseases and pests on its own.

A characteristic feature of hemp seeds is a high fat content from 32.5 to 51.5% with a content of polyunsaturated fatty acids (ω -3, ω -6 families) from 40 to 50% and a high protein content from 20 to 30% with a well-balanced amino acid content. composition [8,9]. The ratio of polyunsaturated Essential Fatty Acids (EFAs) ω -3 (linoleic acid), ω -6 (linolenic acid) in hemp seed oil is among the most optimal for the human body and is recommended for use by people suffering from cardiovascular diseases and disorders of the nervous system. The need to enrich triticale flour with polyunsaturated fatty acids is also justified by the fact that ω -3 and ω -6 fatty acids are not synthesized in the human body due to the lack of an enzyme system [1-3,6-9]. Hemp processed products (oil, cake, meal, flour, protein powder) are increasingly used in food production as a source of nutrients containing essential amino acids and fatty acids, incl. polyunsaturated ω 3 and ω 6 series, in sufficient quantity and ratio to meet the physiological needs of a person [1-3,6-12]. The purpose of our research is to establish the effect of different ratios of the grinding mixture of triticale grain and hemp seeds on the yield of intermediate grinding products.

Materials and Methods of Research

As an object of research, we used grain of winter triticale of the Nemchinovskaya 56 variety harvested in 2021 and hemp seeds of the Surskaya variety of the same year. Grain of triticale variety "Nemchinovskaya 56" was bred by breeders of the laboratory of selection and seed production of field crops of the Federal State Budgetary Educational Institution of Higher Education RGAU-MSHA named after K.A. Timiryazev and has good flour-grinding properties. The main physico-chemical and chemical parameters of the initial triticale grain are as follows: humidity - 11.6%, nature - 730 g / l, weight of 1000 grains - 47.9 g, ash content - 1.88%, protein content - 12.3%, gluten content - 21.8%, gluten quality - 85 units of the device, vitreousness - 32% and the falling number - 229

seconds. The processing of the triticale-hemp grinding mixture of various ratios and the control grain of triticale to determine the coarse-forming ability of the intermediate grinding products was carried out at the Nagema laboratory grinding mill with cut rollers.

The main mechanical and kinematic indicators of the Nagema mill with cut rollers are as follows: productivity - up to 150 kg / h, speed of the rapidly rotating roller 4.5 m / s, differential 1.5, location of the corrugations back to back, the number of corrugations on the 1st linear centimeter - 5 pieces, flute slope 7%. The gap between the rollers on the I torn system was 0.5 mm, on the II torn system - 0.25 mm, on the III torn system - 0.15 mm, on the IV torn system - 0.1 mm and the V torn system - 0.09 mm. As a Hydrothermal Treatment (HTT) in the preparation of triticale grains for laboratory grinding of a grinding mixture of triticale grains and hemp seeds, cold conditioning was used as the most common method and the cheapest way. At the same time, only the triticale grain was subjected to the TRP, because hemp seeds are not recommended to be moistened due to their high fat content.

Research Results

When conducting research to determine the effect of different ratios of the grinding mixture of triticale grain and hemp seeds on the goat-forming ability of intermediate grinding products, laboratory grinding of triticale-hemp grain grinding mixtures was carried out in the ratios of 92.0 / 8.0%, 94.0 / 6.0 %, 92.0/8.0% and 90.0/10.0%. Adding more than 10% of hemp seeds to the grinding mixture is not recommended due to the fact that the cut grinding rollers of the machine begin to clog, as well as polyamide sieves in the screening for sifting intermediate grinding products due to the increased fat content. During laboratory grinding, all 5 of 5 tattered, goat-forming systems were modeled. The obtained experimental data on the yield of intermediate products of grinding triticale-hemp grain grinding mixture and triticale-hemp flour in a ratio of 96%:4% are presented in Table 1. As can be seen from Table 1, when adding 4% hemp seeds to the grinding triticale-hemp grain mixture, the yield of intermediate grinding products in the form of coarse dust products was 84.1%, incl. 9.2% triticale-hemp flour.

Table 1: Yield of intermediate products of grinding triticale-hemp grain grinding mixture and flour in a ratio of 96%:4%.

Technological system, the value of the inter-roller gap, mm	Yield of intermediate products, %			
	Gathering 850 μ m	Gathering 425 μ m	Gathering 132 μ m	Pass 132 μ m
I frayed system, 0.50	73.8	14.9	6.8	4.3
II frayed system, 0.25	56.3	13.5	4.4	1.7
III frayed system, 0.15	41.8	11.0	2.9	1.4
IV frayed system, 0.10	22.8	9.9	2.3	1.2
V frayed system, 0.08	15.9	7.6	1.6	0.6
Total:	bran	56.9	18.0	9.2

Table 2 presents the obtained experimental data on the yield of intermediate grinding products and triticale-hemp flour when grinding triticale-hemp grain grinding mixture in a ratio of 96%:4%. As can be seen from Table 2, when adding 6% hemp seeds to the grinding triticale-hemp grain mixture, the yield of intermediate grinding products in the form of coarse dust products was 85.4%, incl. 9.9% triticale-hemp flour. Table 3 presents the obtained experimental data on the yield of intermediate grinding products and triticale-hemp flour when grinding triticale-hemp grain grinding mixture in a ratio of 96%:4%. As can be seen from Table

3, when adding 8% hemp seeds to the grinding triticale-hemp grain mixture, the yield of intermediate grinding products in the form of coarse dust products was 85.8%, including 8.7% triticale-hemp flour. Table 4 presents the obtained experimental data on the yield of intermediate grinding products and triticale-hemp flour when grinding triticale-hemp grain grinding mixture in a ratio of 90%:10%. As can be seen from Table 4, when adding 10% hemp seeds to the grinding triticale-hemp grain mixture, the yield of intermediate grinding products was 89.5%, incl. 10.5% triticale-hemp flour.

Table 2: The yield of intermediate products of grinding triticale-hemp grain grinding mixture and flour in a ratio of 94%:6%.

Technological system, the value of the inter-roller gap, mm	Yield of intermediate products, %			
	Gathering 850 µm	Gathering 425 µm	Gathering 132 µm	Pass 132 µm
I frayed system, 0.50	74.1	14.9	6.6	3.8
II frayed system, 0.25	51.4	14.2	3.8	2.6
III frayed system, 0.15	34.9	11.6	2.8	1.4
IV frayed system, 0.10	26.7	9.2	3.7	1.2
V frayed system, 0.08	14.6	7.3	1.4	0.9
Total:	(bran)	57.2	18.3	9.9

Table 3: The yield of intermediate products of grinding triticale-hemp grain grinding mixture and flour in a ratio of 92%:8%.

Technological system, the value of the inter-roller gap, mm	Yield of intermediate products, %			
	Gathering 850 µm	Gathering 425 µm	Gathering 132 µm	Pass 132 µm
I frayed system, 0.50	74.3	16.2	6.5	3.0
II frayed system, 0.25	56.5	13.0	3.0	2.1
III frayed system, 0.15	33.3	13.1	4.3	1.8
IV frayed system, 0.10	20.8	9.0	2.5	1.1
V frayed system, 0.08	14.2	8.3	1.2	0.7
Total:	(bran)	59.6	17.5	8.7

Table 4: Yield of intermediate products of grinding triticale-hemp grain grinding mixture and flour in a ratio of 96%:4%.

Technological system, the value of the inter-roller gap, mm	Yield of intermediate products, %			
	Gathering 850 µm	Gathering 425 µm	Gathering 132 µm	Pass 132 µm
I frayed system, 0.50	73.2	14.1	5.4	2.5
II frayed system, 0.25	46.8	18.4	5.7	2.3
III frayed system, 0.15	38.4	9.8	2.5	3.4
IV frayed system, 0.10	23.0	9.2	2.3	0.9
V frayed system, 0.08	10.5	8.6	3.0	1.4
Total:	(bran)	60.1	18.9	10.5

Table 5 presents the obtained experimental data on the yield of intermediate grinding products and triticale flour when grinding the control grain of triticale without adding hemp seeds. As can be seen from Table 5, when grinding the initial control grain of triticale of the Nemchinovskaya 56 variety, the yield of intermediate grinding products in the form of coarse dust products and triticale-hemp

flour was 81.1%. Thus, adding from 4% to 10% of hemp seeds to the grinding triticale-hemp mixture leads to an increase in the yield of intermediate grinding products, from which wheat-hemp flour will be obtained later on grinding systems, from 0.9% to 34.7% by compared with the control sample of wheat.

Table 5: The yield of intermediate products of grinding the original triticale grains grade "Nemchinovskaya 56".

System, value of inter-roller gap, mm	Yield of intermediate products, %			
	Gathering 850 µm	Gathering 425 µm	Gathering 132 µm	Pass 132 µm
I frayed system , 0.50	76.8	12.4	8.9	2.9
II crushing system , 0.25	52.3	10.9	5.7	3.5
III crushing system , 0.15	25.2	10.4	4.9	2.9
IV crushing system , 0.10	17.2	6.5	2.6	1.6
V drilling system , 0.09	18.9 (s)	6.1	1.1	0.7
Total:		46.3	23.2	11.6

Findings

- Thus, according to the results of the studies, it was found that the addition of 4% hemp seeds to the grinding triticale-hemp grain mixture yielded intermediate grinding products of 84.1%, incl. 9.2% triticale-hemp flour, when 6% hemp seeds were added to the grinding triticale-hemp mixture, the yield of intermediate grinding products was 85.4%, incl. 9.9% triticale-hemp flour, when 8% hemp seeds were added to the grinding triticale-hemp mixture, the yield of intermediate grinding products was 85.8%, including 8.7% triticale-hemp flour, when 10% hemp seeds were added to the grinding wheat-hemp mixture, the yield of intermediate grinding products was 89.5%, incl. 10.5% triticale-hemp flour.
- When grinding the initial control grain of triticale of the Nemchinovskaya 56 variety, the yield of intermediate grinding products was 81.1%, incl. 11.6% triticale flour.
- It was found that the addition of 4% to 10% hemp seeds to the grinding triticale-hemp mixture leads to an increase in the yield of intermediate grinding products by 3.0-8.4% compared to the yield of intermediate grinding products of their control triticale grain. At the same time, after grinding on grinding systems of intermediate grinding products, the yield of wheat-hemp flour increases from 0.9% to 4.7% compared to the control sample of triticale.

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