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Submissions cover a wide range of issues, primarily the problem of improving management, sustainable economic development and introduction of innovative technologies, improved training and enhancement of the development of "human capital", interaction between the individual and society, psychological and pedagogical foundations of innovative education.

Materials addressed to all those interested in the actual problems of management, economy and ecology, social sciences and humanities.

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населения о проблемах и путях ее решения, контроль за осуществлением различных мер.

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09. Selection of Perspective Varieties of Triticale Grain, Zoned in the Republic of Kazakhstan, for Beer Malt Production

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Nowadays, beer is one of the most popular alcoholic beverages in the world. That is why brewing in Kazakhstan is quite a promising branch, which is expanding every year due to the introduction of new technologies, modern equipment, and original recipes [1].

Barley malt has traditionally been the grain of choice in the brewing industry. Malt from barley is preferred because, it has great potential for extract development with respect to yeast growth and fermentation due to its

enzyme activity, especially amylases [2]. However, it is not always economically viable to brew with 100% malted barley, and today's breweries are forced to minimize their costs without changing the quality or the character of their beer [3]. In this context, the use of cereal-based brewing adjuncts to partially substitute malt in the grist is becoming a standard procedure [4]. It is estimated that the current share of mixed grists of malt and adjuncts reaches 90% [5].

Triticale (X Triticosecale Wittmack) is the first man-made cereal, an amphiploid hybrid from crosses between wheat (Triticum) and rye (Secale). The name of the grain combines the scientific names of the two genera involved and was formed by Tschermak in 1935. The first deliberate hybrid between wheat and rye was described by Scottish botanist A.S Wilson in 1875. However, the history of cultivation of triticale started in 1888 by the German breeder W. Rimpau [6].

Present tense, triticale is commonly used for animal feed, owing to favorable amino acid composition, bioethanol production when compared with wheat and rye, to a lesser extent, for the baking industry due to its low gluten content. In malting and brewing, triticale performs well due to its high-level α – amylase activity.

Microscopy explores (Figs 1-2) showed that arrangement and size of the pericarp, aleurone layers and endosperm structure of the triticale are similar to those of wheat and rye. Grain of triticale has, in general, a wrinkled appearance, the level of which ranges from insignificant to severe. When the wrinkling is severe, the cereal has a papery and shrivelled pericarp as well as depressions in the endosperm. In Fig. 1, it is possible to observe that the amount of endosperm cell mass produced is not sufficient to fill the sink cavity of the grain and, therefore, pericarp, seed coat, and aleurone cells collapse into the empty spaces in the endosperm [7]. Two types of starch granules are present, as in wheat: lenticular/lens-shaped granules and small, spherical granules (Fig. 2).

Triticale has slightly higher levels of most of the nutritious compounds, compared with wheat. However, the levels of all constituents are exceedingly variable, reflecting triticale’s mixed parentage and its modernity as a crop.

The starch of triticale is similar to that of wheat and rye in terms of morphology (both granular and lenticular forms are present) (Fig. 3), granule size [8], amylase content, iodine affinities, gelatinization temperature and solubility during pasting [9].

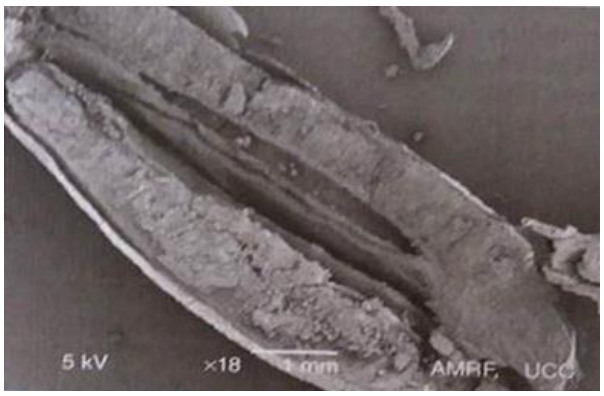

Fig 1. Scanning electron microscope (SEM) micrograph photographs showing longitudinal cross-section of the triticale grain.

Fig 2. SEM micrograph showing papery and shriveled pericarp of triticale grain

Fig 3. SEM micrograph of triticale starch

Starch high in amylose is preferred for human and ruminant consumption due to slower digestion and absorption. In triticale, the apparent amylose content was judged to be highly variable, ranging from 12.8 to 35.1 g /100 g of total starch (based on maize standards), in particular when compared to that of wheat which ranges 26.9 to 42.8 g/100 g [10].

Recently studies about modern triticale varieties show the total content of DF (dietary fibre) between 13-16%, depending on the variety. The main components of DF, on average, comprise 6.8% of arabinoxylan, 2.3% of fructan, 2.1% of cellulose, 1.6% of Klason lignin and 0.7% of β-glucan [11].

The majority importance of triticale lies in its protein content, the second most abundant component in the grain. Triticale contains around 14-15% of protein, compared with 14% or less for wheat and other cereals.

The majority of the scientists have characterized the proteins of triticale using the Osborne solubility fractionation technique, separating albumins, globulins, prolamins, and glutelins from the endosperm. Another solvents or producers are very seldom used. If classic Osborne fractions are investigated it can be mainly stated that triticale has an average place between wheat and rye [12].

In a study by Zeringue and Feuge (1980), the total lipid content of whole triticale flour varied between 1.1 and 2.4 (% on dry basis). The fatty acid compositions of the lipids from the triticale whole grain were the same

as those of its parents, wheat, and rye. The largest deflections found were the relatively high content of palmitic acid and the low content of oleic acid in triticale lipids [13]. Furthermore, triticale grain contained more phospholipids in bound form than wheat.

The first man-made grain has been discussed for some time, but there is little information about triticale malting. Recent studies have shown that unmalted triticale may be available as an adjunct in brewing [14].

Most unmalted adjuncts contribute neither enzyme activity nor soluble nitrogen to the wort; however, this is not the case with triticale. Because this cereal has high levels of α-amylase activity in its non-malt form, it performs well in malting and brewing. Of this and the low gelatinization range of triticale starch (59-65^{o}C), triticale is capable of degrading its own starch content with the similar level of efficiency as barley malt [15].

However, malts prepared from triticale produces worts with extreme protein degradation and therefore, high nitrogen content, both of which promote haziness, instability and strong dark color in beer [16].

According to Zipaev D.V. and others who were developing the technology of a beer drink using malt from triticale, the high enzymatic activity of triticale malt makes it possible to use it in brewing. The average yield of beer from the triticale malt was lower than that of barley. For triticale wort is characterized by a slightly longer drain time, a darker color and a shorter starching time than starch from barley. The triticale wort is richer in nitrogenous compounds, the amount of total and formal nitrogen in triticale wort is almost two times higher than in barley. Beer from the triticale wort was darker and had higher pH values, and also contained less alcohol than barley [17].

One of the last studies of modern triticale cereals showed results of Zarknow et al., research, where the optimum malting programme was determined with 5 d germination time, 45 % degree of steeping, 15 °C steeping, and germination temperature. [18].

Triticale - a universal culture. Its grain can be used for both production and forage purposes. According to the statistics of recent years, published by FAO, the sowed area in the world in 2015 was 3.6 million hectares. The highest per capita incomes of this culture occupy - more than 1.2 million hectares, Germany - 404, France - 331 thousand ha, and from the republics of the former USSR - in Belarus - 376 thousand ha.

Triticale was sowed on a field of more than 350 thousand ha in Kazakhstan in 2015 y. The largest of its fields are zoned in the South and Central regions, as well as in the Northern and East regions [19].

New grades of triticale grain were introduced in the State Register of the Republic of Kazakhstan: Asiada, Balausa 8, Kozha, Orda, Taza [20].

To assess the suitability of triticale varieties grown in various agroclimatic zones of the Republic of Kazakhstan for the production of malt with brewing properties were analyzed the physicochemical indicators of 5 grades of the triticale grain harvested in 2015-2016. Barley variety Arna - the

most common variety grown in Kazakhstan for malt production, served as a control.

The evaluation of the quality of triticale and its suitability for malt production was carried out according to the quality indicators for brewing barley, which are presented in Table 1.

Table 1 - Qualitative indicators of various grades of grain triticale and barley zoned in the Republic of Kazakhstan

Parameters	Triticale					Barley Arna
	Aziada	Balausa 8	Kozha	Orda	Taza	
Nature, g/l (n=3)	665±0.85	717±0.46	707±0.53	716±0.45	710±0.54	725±0.94
Absolute weight of 1000 grains, g (n=3)	52±0.28	62±0.32	55±0.18	58±0.33	57±0.37	40±0.24
Moisture content of grain, % (n=3)	12±0.18	11.8±0.23	12.7±0.52	13±0.32	11.7±0.36	12.2±0.22
Protein content, % (n=3)	10.6±0.71	8.76±0.07	13.1±0.53	12.6±0.61	13.3±0.27	11.3±0.47
Starch in dry mass, % (n=3)	68.65±5.2	70.73±5.4	65.43±3.3	65.13±4.7	61.82±5.1	66.48±3.8
Amylolytic ability, u/g (n=1)	4.7	5.6	4.5	4.2	4.6	5.1
Extractivity, % (n=1)	79	81	76	75	75	80
Germination capacity, % (n=1)	97	98	96	95	92	98

As can be seen from Table 1, the Triticale Balausa 8 surpasses not only the barley grain variety Arna but also the triticale varieties Aziada, Kozha, Orda and Taza with high productivity, the high starch content of 6.3%, 3%, 8.1%, 8, 5% and 14.4%. It should be noted that the variety of Balausa 8 is distinguished by increased amylolytic activity (which exceeds the other test samples by 9.8%, 19.1%, 24.4%, 33.3% and 21.7%) and absolute weight of 1000 grains exceeding this index the grain of triticale of the Aziada is 19.2%, and the Kozha is 12.7%. All the samples under study have high germination capacity, but Balausa 8 and by this index exceeds all experimental samples by 2.5-3.5% on average.

Based on the foregoing, the greatest interest for further research, the study of the malt properties of this variety and the possibility of obtaining fermented and unfermented malts from it, is the Triticale grain variety Balausa 8, which possesses the best technological properties.

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10. Табаны бұжырлы каналдардағы бірқалыпты қозғалыс және бұжырлық коэффициентін анықтау

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Сұйықтың бірқалыпты қозғалысының келесі негізгі ерекшеліктері бар:

1) каналдың әрбір қимасындағы ұзына бойы тереңдігі, өтім қимасы, жылдамдығы және өтімі тұрақты;

2) энергия сызығы, еркін беті және каналдың табаны параллель, яғни олардың еңістіктері өзара тең.

Тәжірибелік мақсаттар үшін жылдамдық тұрақтылығының талаптарын, ағынның орташа жылдамдығы тұрақтылығын сақтау талабы ретінде келтіруге болады. Бірақ, талп мынаны білдіреді, бірқалыпты қозғалыс байқалған каналдың бүкіл ұзындығы бойында әрбір нүктесінде ағын тұрақты жылдамдықта болу керектігін көрсетеді.

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