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INCREASING OF FALL RYE CORN FEEDING VALUE BY HYDROBARATHERNAL TREATMENT

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The results of production experience on hydrobarathernal treatment fall rye grain feeding are presented in the article. It is determined that ater high temperature and pressure impact on fall rye grain in aqueous media dextrinization of starch specifically amylopectin occurs to monosugar in the form of glucose, therewith, sugar content increases more than in twice in comparison with parent grain. It is revealed that replacement of milled corn grain mixture to fall rye grain hydrolyzate in rations brought sugar-protein proportion to norm which contributed to increasing of cows milk production, besides, of high quality. Using of fall rye grain hydrolyzate in cow rations for 12 months on the whole gave growth of milk yield in 484 kg per a cow with protein weight fraction content of 3,0%, that is higher on 522 kg for the same interval of time in comparison with the leading farm. Replacement of milled corn grain mixture on fall rye grain hydrolyzate in cow rations did not negatively reflect on biochemical blood composition of animals. All indexes fell within the limits of standard values. Using of fall rye grain in cow rations on account of its lower selling price, despite on extra charges during hydrobarathernal treatment, led to spending reduction of fodders on 1 centner of milk on 28,03 roubles in comparison with milled corn grain mixture. Extra income at Chalino farm in comparison with Stepanovo farm for one year composed 353188 roubles that led to milk primecost reduction on 8,44% at the given farm.

Key words: grain, fall rye, water, temperature, pressure, sugar, cows, milk, fat, protein.

Introduction. Fall rye can serve as strengthening reserve for fodder base and organization of rational and farm animals full feeding. Its high adaptive capacity to steadily give heavy grain yields on the soiles of different level fertility, its agronomic value in crop rotation and in feed conveyor, characterize fall rye as a culture of low economic risk. In Russia fall rye takes the forth place in gross grain harvest structure in other words it appears to be an important and stable grain culture [10]. As compared with other grain varieties, fall rye has complete protein enriched with lysin and rather high level of metabolizable energy. But it also has such anti-nutritional elements as phytic acid, pentosans, pectins, β-glucans, tannins, antitrypsins and chymotrypsins, β-alkyl resorcinols. Total amount of non-starch polysaccharides in rye grain achieves 17,5%, that is why its using for animals feeding is limited to 20% for ruminants, to 20% – for swines and to 5% for birds [3]. The most efficient methods for anti-nutritional elements reduction are – fall rye quality selection and also effective processing technologies: moisture-barathernal and enzymatic [2; 10; 9].

Extrusion providing biological full-value animal feed increasing appears to be an important approach allowing to raise a part of fall rye grain in farm animal feeding. Extrusion leads to cellulose content decreasing and changing of its structure, also inactivation of alimentary canal antioxidants, toxic materials neutralization, product sterilization, improvement of gustatory quality. All this contributes to better fodder eatability, digestibility and using of ration nutrient materials, quality increasing of obtained production and fodder cost cutting. The given method permits to replace other poaceous grain mixtures without risk of indigestion [4]. But extrusion treatment is metal and energy intensive. A number of scholars suggest using of barahydrothernal treatment [11].

As vatiation of barahydrothernal treatment S.Yu. Nikolaev (2009) offered hydrobarathernal treatment, it was used in experiment of A.I. Panyshev and others, but they used broken grain in their experiments [6]. Consedering, that practically equal temperature conditions are born under extrusion and hydrobarathernal treatment, then it was decided to treat directly grain of fall rye to this hydrobarathernal treatment. Thus, removal of anti-nutritional qualities and increasing of fall rye grain nutrient value by means of hydrobarathernal treatment is topical for increasing its interest in concentrate part of animals ration and volumetric gain of its production for feed goals. This will allow

to raise agronomic crops yield using correst organization of crop rotation and will reduce intension of Spring sowing campaign.

The object of research — is to reveal alterations in biochemical composition of fall rye grain after hydrobarathernal treatment and its influence on milk production of cows. Research tasks:

- to explore biochemical composition of fall rye grain before and after hydrobarathernal treatment;
- to estimate the influence of rye fed grain of hydrobarathernal treatment on production and quality of milk;
- to determine alterations of blood biochemical composition during hydrobarathernal rye grain feeding;
- to calculate economic benefit of hydrolized fall rye grain using.

Material and research technique. The flock of black-and-white breed cattle of Holstein type in APC "Russia"of Permian region in 2014 serve for research material. Research methodology provides:

- realization of scientific and production experience according to scheme (tabl. 1);

Table 1

The scheme of experience

Farm	Livestock cows, heads	Medium live weight, кг	Milk yield of a cow on the average for preceding years, kg	Feeding conditions
Chalino	187	600	5530	B.R. + hydrolyzate of rye
Stepanovo	168	600	6293	B.R. + bran of grain mixture

Notice: B.R. – basic ration consists of hay, silage

- fodder sample collection, used in animals feeding and their analysis in the testing laboratory FSBU "SCAS "Permian" by the procedure of Ye.A. Perukhova and others., [8];
- ration correction for lactating cows with milk yield of 10; 12; 14; 16 kg, 18 and 20 kg responding to standarts of feeding [6];
- recording of milk production, by means of control milking once a month with determination of quantity and quality of milk (weight fraction of fat and protein, dry nonfat remnant of milk, lactose, density, acidity of milk) on the device "Laktan-1";
- taking a blood sample from jugular vein in the morning before feeding and analysis of it on biochemical composition using practical standards in the testing laboratory SBUVR "Permian veterinarian diagnostic centre" [1];
- calculation of hydrolized fall rye grain economic using efficiency judging by expenses of actual fatness on a centner of milk in MJ and in monetary calculation.

Cow population of Stepanovo MTF where from 2011 to 2013 was received the highest milk production among APC "Russia" served as a control group. Chalino farm relinquished Stepanovo farm in milk yield from 500 to 900 kg, but for 3 years at an average retard reached 694kg.

Results of the research. The results of biochemical analysis of concentrated fodders used in APC "Russia" in the course of experiment are represented in the table 2, considering that final products contained different quantity of water then all indexes are represented with a view to absolutely dry substance.

Table 2

Biochemical composition of concentrated fodders

Type of culture	Gen. energy., MJ	Crude protein, %	Crude fat, %	Crude cellulose, %	Sugar, g	Ca, g	P, g
Rye grain	12,54	10,29	1,55	1,33	43,7	0,85	3,71
Rye hydrolyzate	12,30	9,90	1,43	1,32	90,7	0,99	3,80
Milled corn of grain mixture (wheat, barley, oat)	12,82	10,41	2,48	3,59	64,0	2,44	3,53

As we can see from the table, after hydrobarathermal treatment alterations of biochemical composition expressed in sugar content increasing to 90,7 g occurred in the grain of fall rye. The given sugar increasing connects with starch conversion through stages of dextrinization under the influence of high temperature and pressure in aqueous media. It is important to mention that under the long-term influence of high temperature and pressure in the grain not only starch conversion occurs but also distruction of protein or more correct to say free amino acids that expressed in amount of 0,39%. After hydrobarathermal treatment fat content reduction occurred in hydrolyzate on 0,12%, cellulose – 0,01% in comparison with rye parent grain that led to exchange energy concentration reduction on 0,24 MJ in 1 kg of dry substance of hydrolyzate.

As a positive fact, mineral constituent increased in hydrolyzate of fall rye grain in connection with water hardness used for conversion. The given results are coordinated with conclusions made in the course of earlier conducted researches [7]. On the farms APC "Russia" dispensation of fodders is realized from the feed alley. On the MTF Chalino dispensation of fodders is performed with a help of mixer. Thereby, hydrolized grain on this farm was loaded to the mixer where it was combined with bulk food (silage, hay) and an advanced norm on the cow milked litre was obtained through manual delivery. On the farm Stepanovo concentrates were fed in the form of milled corn grain mixture, preliminary scattered on silage. Watering was realized from drinking cups with rocker gear. The basic ration consisted of 6 kg of hay, 25 kg of silage, protein-vitamin-mineral concentrate 0,5 kg, monocalcium phosphate 30 g. The same separate concentrate feeding continued in summer period, the general ration food-value was maintained.

In control farm ration using of milled corn grain mixture 5 kg; energy concentration in 1 kg of dry substance compiled 9,4 MJ, digest protein content 86,7 g, crude cellulose 220,7 g, sugar 52 g. About 91,8 g of digest protein, crude cellulose – 234 g, sugar –55 g, calcium – 9,58 g, phosphorus – 3,79 g fall per 1 EFU. Sugarprotein proportion compiled 0,6: 1 (under the minimum standard 0,8: 1) [6; 3]. What concerns MTF Chalino then on this farm due to using of fall rye hydrolyzate in quantity of 7kg that was identical on dry substance to 5kg of milled corn , 1 kg of ration dry substance contained 9,32 MJ, 81,78 g of digest protein, 220 g of crude cellulose, 64,46 g of sugar under the sugarprotein proportion 0,8: 1. Thus, including of fall rye grain hydrolyzate to feeding ration of Chalino MTF led to carbohydrate full-value increasing of their rations.

About 88,2 g of digest protein, 238 g of crude cellulose, 69,52 g of sugar, 9,88 g of calcium and 4, 03 g of phosphorus fall to 1 EFU of ration. The used rations had to guarantee milk yield no less than 18 kg per 24 hours. At Chalino farm where rye hydrolyzate is fed, for 12 months was milked on 484 kg more in comparison with 2013 and on 522 kg more in comparison with Stepanovo farm (table 3). During the whole period under observation protein weight fraction content at Chalino MTF exceeded the same indexes at Stepanovo farm by 0,1-0,2%, as for fat weight fraction then significant differences were not determined. We suppose that fat weight fraction content to a

large extent depends on and correlates with the volume of daily milk yield, the more milk yield the lower fat weight fraction.

Table 3

Production indexes in section of the farms (in average per head)

Farm	Milk yield per cow , kg	Quality factor			
		Quantity of milk fat, kg	difference with control farm, kg	quantity of milk protein, kg	difference with control farm, kg
Chalino	6092	215,65	+18,47	182,76	+19,56
Stepanovo	5570	197,18	0	163,20	0

MTF Chalino and Stepanovo were at the same level in matter of fat weight fraction, but on account of higher milk yield of Chalino farm output of milk fat was on 8,56% more. Protein weight fraction at an average for 7 months at Stepanovo farm compiled 2,93%, at Chalino farm - 3,0% under specification of 2,9%. There was on 0,1% lactose more in dry nonfat remnant of cow milk of MTF Chalino. Thus, cow milk of Chalino farm differed its higher quality of protein and lactose weight fraction content.

Except milk production indexes one can judge about full-value feeding by blood biochemical composition. Rye hydrolyzate feeding at MTF Chalino led to improvent of 5^{th} indexes, besides, such index as sugar in the blood of MTF Chalino cows was on 0,47 mmol higher in comparison with MTF Stepanovo cows, ferment SGPT content was also higher, but within normal limits. Calculation of economic benefit adjusted reduction of fodder expenses on account of lower price for 1 kg of rye, for 1 centner of narural fat milk in money terms at Chalino farm on 28,03 roubles for an overall amount of 172920 roubles. Using of fall rye grain hydrolyzate in cows feeding led to reduction of fodder expenses per 1 centner of milk per 1,37 EFU, or it was expressed in 8451,71 EFU for the whole observation period. Primecost of milk production at MTF Chalino in comparison with Stepanovo farm by using of fall rye grain of hydrobarahernal treatment reduced on 8,44%.

Conclusion. In the result of fall rye grain hydrobarahernal treatment, content of monosugar increased in two times by means of complex carbohydrates conversion, therewith, in consequence of high temperature and pressure the whole sterilization from all kinds of pathogenic and opportunistic microflora, molds takes place, that permited to improve in the experiment animals physiological state expressed in indexes of biochemical composition of blood responding to norms of healthy animals.

Hydrobarathernal treatment of concentrates destroys fall rye grain anti-nutritional factors, antioxidants of digestive enzymes, sterilizes weed seeds, ensures receiving of dung from animals which does not pollute the environment with weed seeds. Including of fall rye hydrolized grain into milk-cows ration composition allowed not only to maintain daily milk yield on a level in comparison with the animals which were fed with concentrates prepared with a help of traditional method, but also to increase milk yield on 484 kg for 12 months. Using of hydrobarathernal treatment fall rye in cows feeding for 12 months of 2014 at Chalino farm provided output milk protein on 19,56 kg more or protein weight fraction at an average expressed in 3,0% in comparison with MTF Stepanovo.

For 12 months by means of using hydrobararhernal treatment fall rye grain instead of refined grain mixture at Chalino farm fodder expanses decreasing were obtained per 1 centner of milk actual fatness on 28,03 roubles, therewith money of the farm was saved to the amount of 172920 roubles. At an average per head at the farm where cows were fed by fall rye grain hydrolyzate a profit was made from milk realization for protein weight fraction increasing in the amount of

964 roubles, for an overall amount of 180268 roubles. Extra income at Chalino farm in comparison with Stepanovo farm compiled 353188 roubles for 12 months that led to milk primecost decreasing on 8,44%. Feeding of fall rye grain hydrolyzate approved that cows ate it with pleasure. Organoleptical estimation of taste and smell did not fix negative emotions. Lifting of restrictions from fall rye grain hydrolyzate and the following feeding will afford to increase the volume of its using in animals feeding that in the following will influence on cultivation areas enlargement and in some way will degrade intension of Spring sowing campaign.

Offers. For milk productivity enhancement we recommend to entirely replace the concentrate part of ration on hydrobarathernal treatment fall rye grain.

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