

# AGRONOMY, FORESTRY AND WATER MANAGEMENT

## General Farming and Crop Production

UDK 633.15:631.81.095.337(470.64)

### **Productivity of corn hybrids depending on microfertilizer complexes in the foothill zone of Kabardino-Balkaria**

**Yuri M. Shogenov**

**Abstract.** This article discusses the results of a field study to determine the effect of foliar treatment of corn hybrids Agata SV and Diana MV with microfertilizer complexes on the structural elements and yield of corn grain in the foothill zone of Kabardino-Balkaria. Field experiments were conducted in 2021–2023. in the educational and production complex of the Kabardino-Balkarian State Agrarian University named after V.M. Kokov. The experiments were carried out on leached chernozem. The purpose of the study was to determine the effect of foliar treatment of corn hybrids Agata SV and Diana MV with microfertilizer complexes on the structural elements and yield of corn grain. In favorable conditions of the foothill zone of Kabardino-Balkaria, for the formation of high indicators of elements of productivity of corn hybrids Agata SV and Diana MV were observed on the Plantafol 20:20:20 variant against the background of  $N_{60}P_{60}K_{40}$ . Thus, the Agata SV hybrid had the highest weight of 1000 grains – 252.0 g, the difference with the control was 39.7 g or 18.7%. The Diana MV hybrid has 287.7 g, 45.5 g or 18.8%, respectively. The use of microfertilizer complexes made it possible to increase the grain yield of the hybrid Agata SV in the variants Fon+ZHUSS-2, Fon+Polyfid, Fon+Plantafol within the range of 6.47-6.79 t/ha, where the difference with the control is 1,84-2,16 t/ha or 39,7-46,7%. For the hybrid Diana MV in these variants, the grain yield was in the range of 7.55-7.96 t/ha, where the difference with the control was 1,78-2,03 t/ha or 30,9-35,2%.

**Keywords:** corn hybrid, Agata SV, Diana MV, cob length, number of cobs per 100 plants, rows of grains on the cob, weight of 1000 grains, yield, microfertilizer complexes

UDK 633.15:631.82(470.64)

### **The influence of organomineral and water-soluble complex fertilizers on the yield of Berta corn hybrid in the foothill zone of Kabardino-Balkaria**

**Yuri M. Shogenov**

**Abstract.** The article examines the influence of foliar treatment of crops of early maturing Bertha corn hybrid with organomineral fertilizers with microelements and water-soluble complex fertilizers with microelements in chelated form on morphobiometric indicators and grain yield. The purpose of the study was to study the peculiarities of the formation of corn yield under the influence of organomineral and complex water-soluble fertilizers in the conditions of Kabardino-Balkaria. The influence of foliar treatment of Berta corn hybrid crops with organomineral fertilizers – Ecofus (2.5 l/ha), Gumostim (0.3 l/ha), Gumat+7 (0.5 l/ha) and water-soluble complex fertilizers with microelements in chelate was determined. form – Green Go (1.5 kg/ha),

Siliplant universal (1.0 l/ha), Cytovit (0.5 l/ha) and applying options with doses of mineral fertilizers: control (water treatment),  $N_0P_0K_0$ ,  $N_{90}P_{90}K_{60}$ ,  $N_{120}P_{120}K_{60}$ . The field experiment was conducted in 2021-2023. in the educational and production complex of the Kabardino-Balkarian State Agrarian University named after V.M. Kokov. The experiments were carried out on leached chernozem. It was shown that on leached heavy loamy chernozem, the studied preparations stimulated the linear growth of plants and the formation of corn cobs. Treatment with Cytovit, Gumat +7 and Ecofus significantly increased the morphobiometric parameters of corn: plant height to 26.9-30.3%, height of cob attachment to 29.7-45.1%, number of cobs per 100 plants to 31.0-35.0% and the weight of one plant up to 49.9-54.6%. As well as treatment with Cytovit, Gumate +7 and Ecofus, as shown by a three-year experiment in the conditions of the foothill zone of Kabardino-Balkaria, it gave a stable increase of 0.88-2.80 t/ha, 0.57-2.73 t/ha and 0.57-2.56 t/ha or 17.0-54.6%; 11.1-53.1% and 11.1-49.9%.

**Keywords:** Bertha corn hybrid, mineral fertilizers, organomineral fertilizers, complex water-soluble fertilizers, microelements, biometric indicators, yield

## CONSTRUCTION AND ARCHITECTURE

### Hydraulic engineering, hydraulics and engineering hydrology

UDK 626.823.45(470.63)

#### Effective technical solutions for the construction of an additional settling pond for the water supply of the Zavetnensky group water supply system in the Stavropol Territory

Saligadzhi O. Kurbanov, Mukhamed N. Kokoev, Indira R. Mikitaeva

**Abstract.** In the design and reconstruction of existing water supply systems, settling ponds for primary water treatment, play a huge role. The efficiency of the whole system of water treatment and purification depends on the efficiency of the settling pond. The article offers effective technical solutions for the design and construction of a new type of settling pond. Constructive and technological solutions for the layout of the reservoir structures and the scheme of the sedimentation chamber washing are developed. At the end of the settling pond chamber, a new technological scheme consisting of a system of sediment trays, flushing flumes and a pipeline is provided for washing the settled sediment. On the basis of the analytical studies carried out, the parameters of the settling pond and suspended sediment deposition are calculated. According to the results of the calculation, the adopted dimensions and marks of the settling pond and the tubular spillway ensure the normal operation of the entire structure for the primary treatment of suspended fine sediments in turbid water. At the base of the reservoir, laid and attached geotextile fabrics in two layers over the entire area of the bottom provide a normal mode of filling and emptying of the reservoir without significant filtration losses of water through its bottom. Technical solutions adopted for cleaning and flushing the chamber of the settling pond with the help of the system of sedimentation of collecting and conveying trays, and flushing pipeline, provide an effective mode of operation of the whole settling pond with treatment facilities.

**Keywords:** settling pond, group water supply, daily water consumption, horizontal settling pond, useful volume, dead volume, tubular spillway, suspended sediments, flushing scheme, flush flumes, slow filters

## **ANIMAL SCIENCE AND VETERINARY MEDICINE**

### **Private Animal Husbandry, Feeding, Feed Preparation and Livestock Production Technologies**

UDK 636.084./085

#### **The effect of different doses of antioxidant on the digestibility and assimilation of nutrients in a diet with a tolerant level of ochratoxin A**

**Zarina I. Gabaraeva, Fatima N. Tsogoeva,  
Rustem B. Temiraev, Valentina S. Gappoeva**

**Abstract.** To eliminate the negative impact of ochratoxin A on digestive metabolic processes, antioxidants are successfully used in feed for meat poultry. The purpose of the study is to find out the effect of adding different doses of the antioxidant santoquin (santokhin) feed preparation in the composition of feed based on corn grain and soybean cake with a tolerant level of ochratoxin A on the level of digestion and absorption of dietary nutrients. It was found that the best level of impact on the hydrolysis of organic polymers in a diet with a tolerant level of ochratoxin A was provided by the addition of the tested drug Santoquin in an amount of 150 g/t of feed. Thanks to this, meat poultry that received SA + the antioxidant Santoquin at a dose of 150 g/t of feed compared to analogues that received standard feed based on corn grain and soybean cake with a tolerant level of ochratoxin A had higher coefficients of crude protein digestion – by 3.14% ( $P > 0.95$ ), raw fiber – by 3.22% ( $P > 0.95$ ) and BEV – by 3.34% ( $P > 0.95$ ), which also provided a better level of digestion of organic and dry matter of the diet. With an almost similar volume of consumption of poultry feed by chickens of the compared groups, in broilers, due to the addition of the drug Santoquin in the amount of 150 g/t of feed to standard feed, an average of 2.13 g of nitrogen was deposited in the body per day, which is 9.23% more ( $P > 0.95$ ) compared to broilers that received standard mixed feed based on corn grain and soybean cake with a tolerant level of ochratoxin A. The use of the antioxidant Santoquin at a dose of 150 g/t of feed as part of corn-soybean compound feed with a tolerant level of ochratoxin A ensured in broilers the highest level of digestibility of calcium and phosphorus in the diet compared to groups of broilers receiving other doses of the antioxidant.

**Keywords:** broilers, mixed feed, ochratoxin A, antioxidant, digestibility coefficients, nutrient digestibility

UDK 636.033:636.2

#### **The influence of adsorbent and antioxidant on meat productivity and nutritional value of bull meat**

**Dina A. Kastueva, Victoria V. Tedtova,  
Zarina T. Baeva, Larisa A. Bobyleva**

**Abstract.** On the territory of the Republic of North Ossetia-Alania, soil samples for forage plots are characterized by an extremely high level of contamination with heavy metal salts. In recent years, in the practice of feeding meat animals, adsorbents and antioxidants have been successfully used as detoxifiers. The purpose of the research is to establish the feasibility of including the Trilon B adsorbent and the Santoflex antioxidant in the diets of fattened bulls with a high content

of heavy metal salts as a detoxicant to increase meat productivity, increase the nutritional value and environmental safety of the beef produced. During the experiment, it was established that with an increased content of heavy metal salts, in order to increase the efficiency of detoxification of these toxic compounds, the Trilon B adsorbent in the amount of 1 g/100 kg and the Santoflex antioxidant in the amount of 500 g/100 kg of mixed feed should be included in the diets of fattened bulls, which helps to increase their meat productivity, nutritional and biological value of meat and is expressed in an increase in the mass fraction of dry matter by 1.29%, protein – by 1.02% and the value of the protein quality indicator – by 10.27%, and also a decrease in the mass fraction of zinc by 3.10 times, lead by 2.97 and cadmium by 3.97 times compared to animals receiving a diet with an excess of Pb, Cd, Zn. Moreover, in the composition of beef samples from animals that received the Trilon B adsorbent in the amount of 1 g/100 kg and the Santoflex antioxidant in the amount of 500 g/t of feed, the presence of salts of these elements in all cases did not exceed the maximum permissible concentrations.

**Keywords:** fattened bulls, heavy metals, antioxidant, adsorbent, slaughter indices, meat, nutritional and biological value, environmental safety

UDK 637.12.04/.07:636.084

## **The influence of antioxidant preparations on the physicochemical and technological properties of cow's milk during denitrification**

**Marina G. Kokaeva, Zalina K. Plieva, Rustem B. Temiraev,  
Diana A. Marzoeva**

**Abstract.** In the practice of feeding dairy cattle over the past ten or fifteen years, antioxidant preparations have begun to be used as effective denitrifying feed additives, which, along with antioxidant properties, also have detoxifying properties. The purpose of the research is to study the effectiveness of using the antioxidants Multiox and Eritox in the diets of lactating cows with a subtoxic dose of nitrates as denitrifying feed additives to improve the physicochemical and technological properties of their milk. It has been established that in order to optimize the physicochemical and technological properties of milk, it is advisable to introduce jointly the antioxidants Multiox at a dose of 50 g/t and Erytox at a dose of 125 g/t of compound feed into the diets of lactating cows with a subtoxic dose of nitrates. At the same time, in milk samples from cows that received the antioxidant Multiox at a dose of 50 g/t of compound feed and the antioxidant Eritox at a dose of 125 g/t of compound feed as part of the main diet, compared with analogues that received the main diet with a subtoxic dose of nitrates, a significant ( $P>0.95$ ) increase in the mass fraction of dry matter by 0.61%, fat – by 0.23%, protein – by 0.20%, casein concentration – by 0.34%, vitamin A – by 50.6% and vitamin C – by 65.5% with a decrease in nitrates – by 51.35% and nitrites – by 66.67%. With the combined addition of antioxidants to diets in samples of Ossetian cheese from the milk of animals that received the antioxidant Multiox at a dose of 50 g/t of feed and the antioxidant Eritox at a dose of 125 g/t of feed as part of the main diet, there was a decrease in nitrates by 70.47% and nitrites – by 76.92%. Moreover, in samples of cheese from animal products that received the antioxidant Multiox at a dose of 50 g/t of feed and the antioxidant Erytox at a dose of 125 g/t of feed as part of the main diet, the presence of nitrates and nitrites did not exceed the maximum permissible concentrations.

**Keywords:** lactating cows, nitrates, nitrites, antioxidants, milk, physicochemical properties, technological qualities, environmental safety

## **Features of protein metabolism in the body of young cattle during two- or three-breed crossing**

**Elena A. Nikonova, Vladimir I. Kosilov,  
Yusupzhan A. Yuldashbaev, Vyacheslav G. Borulko**

**Abstract.** The article presents data on the study of nitrogen metabolism in the body of purebred and crossbred young cattle obtained by crossing dairy cows with bulls of different genotypes. The object of the study were bulls, steers-castrates and heifers of the following genotypes: group I – black-and-white breed, group II –  $\frac{1}{2}$  Holstein  $\times$   $\frac{1}{2}$  x black-and-white, group III –  $\frac{1}{2}$  Simmental  $\times$   $\frac{1}{4}$  Holstein  $\times$   $\frac{1}{4}$  black-and-white, group IV –  $\frac{1}{2}$  limousine  $\times$   $\frac{1}{4}$  holstein. The goals and objectives of the study included the study of the characteristics of protein metabolism in the body of purebred and crossbred animals in terms of nitrogen metabolism in the body. At the same time, the amount of nitrogen received with feed, excreted with feces and urine, digested nitrogen, the amount deposited in the body (production) and nitrogen utilization factors were determined. It was found that the crossbred young stock had a higher nitrogen utilization rate compared to the adopted and overcooked. Purebred animals were inferior to two-breed hybrid animals of the Holstein breed in terms of the value of the first indicator by 0.19-0.99%, the second – by 0.12-0.71%, purebred bull-calves were inferior to three-breed Simmental crossbreeds by 1.37-1.51% and 0.97-1.37%, respectively, to three-breed hybrids of the Limousin breed, respectively – by 0.27-1.19 and 0.22-0.97%. At the same time, three-breed crossbreeds with Simmentals were characterized by the highest efficiency of nitrogen use. The effect of sex on the nitrogen balance in the body of experimental animals was established. So it was found that bulls were superior to heifers and bulls-castrates in terms of nitrogen intake with feed into the body by 8.7-12.7% and 3.3-5.6%, digested nitrogen - 10.5-17.5% and 2.7-6.7%, by the amount of deposited nitrogen in the body (products) – by 29.6-35.2% and 10.2-17.4%. At the same time, heifers were inferior to calves-castrates in terms of the value of the analyzed indicator. As a result of the studies, it was found that the efficiency of protein metabolism is significantly influenced by the genetic factor.

**Keywords:** cattle breeding, black-and-white breed, crossbreeding, crossbreeds with Holsteins, Simmentals, Limousins, nitrogen balance, protein metabolism

## **Loss of feed energy during digestion in cattle in different conditions of feeding**

**Muaed A. Shalov, Murat N. Tuganov, Galina N. Glotova**

**Abstract.** In the proventriculus of ruminants, as a result of the action of enzyme systems of microorganisms, the breakdown of feed carbohydrates occurs with the formation of acetic, propionic, butyric and other fatty acids. Along with fatty acids, as a result of the fermentation of carbohydrates in the forestomach, a significant amount of gases is formed. Some of the gaseous products – methane and hydrogen – contain energy. The formation of methane means a loss of energy from digestible nutrients. Cows produce 350-450 liters per day. methane, and in young cattle the formation of methane gradually increases, which is associated with the formation of pregastric digestion. The purpose of the study was to determine the energy losses of diets of various structures during fermentation in cows and young cattle by the ratio of volatile fatty acids (VFA) – and by the amount and ratio of rumen gases collected by the mask method and in

the respiration chamber. It has been established that in bull calves fed timothy hay or oat and pea silage, or barley straw as the only feed, the loss of feed energy during fermentation reaches 22-23.5%, and when using balanced diets it is 25% of the energy of digestible nutrients. dietary substances.

**Keywords:** cattle, diet structure, feed fermentation, volatile fatty acids, rumen gases, chamber, feed energy loss

## **Breeding, Selection, Genetics and Biotechnology of Animals**

UDK 636.2:636.082

### **The influence of the type of selection on the milk productivity and morphology of the udder of cows of the breeding core**

**Zaurbek M. Aisanov, Timur T. Tarchokov, Ayes Kh. Pilov,  
Madina G. Tleynsheva, Magomed R. Tangiev**

**Abstract.** The article presents the results of studies conducted in 2019-2022 in the breeding reproducer of Holstein black-and-white cattle of Agro-Soyuz LLC (Kabardino-Balkarian Republic) based on a retrospective analysis of data from breeding and zootechnical accounting. The aim of the study is to study the influence of three different types of breeding selection of breeding bulls to the breeding stock (homogeneous selection, moderately heterogeneous selection, heterogeneous selection) on the indicators of milk productivity and the morphology of the udder of their daughters who entered the breeding core of the herd. As a result of the conducted studies, it was found that the highest milk yield was characterized by animals of the moderately heterogeneous selection group, in which this indicator was 2,8-5,3% higher (first lactation), 3,6-8,9% (second lactation) and 3,7-8,3% (third lactation) than in animals of the homogeneous and heterogeneous selection groups. A similar trend was observed in the amount of milk fat and protein produced during the first three lactation, when the superiority of cows of the moderately heterogeneous selection group over cows of other experimental groups was, respectively, 4,2-10,8 and 3,4-9,3%. Besides, in the group of breeding core cows obtained on the basis of moderately heterogeneous selection, the proportion of animals with a desirable cup-shaped udder was higher than in other experimental groups, in the first lactation by 2,5-3,7 abs.%, in the third lactation – by 2,6-5,4 abs.%.

**Keywords:** Holstein breed, cow, breeding core, type of selection, milk productivity, udder shape

UDK 636.2:636.082

### **Genotyping as a factor in improving breeding and productive qualities of cattle**

**Orest A. Basonov, Ruben V. Ginoyan,  
Alice S. Kozminskaya, Artem A. Asadchy**

**Abstract.** In order to increase the number of beef cattle and further improve their breed qualities, breeding based on reliable information about the origin of animals and the most significant genes-markers of productive and reproductive qualities is necessary. The article provides an

overview of the literature data on the achievements of modern genetics, which are used to determine the genomic status and origin of animals, as well as to identify polymorphism of significant genes-markers of meat productivity. This study is relevant and is aimed at developing new breeding forms of animals that combine high meat productivity using modern breeding and genetic methods and morphological assessment of product quality. The use of genetic markers in the full genomic breeding of beef cattle breeding, in combination with basic zootechnical methods and methods of morphological control, will significantly accelerate the process of creating herds with a high genetic potential of productivity. The main task for creating highly productive herds of Hereford cattle with the help of genotyping is to determine the genetic characteristics of animals in order to choose the best parents for breeding. In future, this makes it possible to build their own lines and regional breed type.

**Keywords:** Genotyping, Hereford breed, genomic selection, markers of meat productivity, DNA chips, polymorphism, breeding of beef cattle

## **AGROENGINEERING AND FOOD TECHNOLOGIES**

### **Technologies, Machines and Equipment for the Agro-industrial Complex**

UDK 620.178

#### **Investigation of the processes of friction and wear of structural materials for agricultural purposes**

**Vladimir Z. Alov, Zaira M. Zhirikova, Kantemir V. Alov**

**Abstract.** Due to the widespread use of polymers as structural materials, the problem of increasing the reliability and durability of the structure is relevant. This problem can be solved by using polymer composites filled with short carbon fibers. Filling polymers with hard fibers ensures stable operation of friction units. Structural features of frictional wear of carbon fiber-based phenylene filled carbon fiber are investigated. It is shown that the tribological characteristics of phenylon/carbon fiber polymer composites, namely the coefficient of friction and friction wear, are completely determined by three factors: tribological characteristics of the matrix polymer (phenylon), its structure and test mode. It is noted that the structure of the amorphous state of the matrix polymer is a region of local order (clusters) consisting of several collinear densely packed segments of different macromolecules. The relationship of the cluster structure of the amorphous state of polymers with the temperature in the friction zone, an increase in which will lead to their partial decay, and as a consequence, an increase in the relative proportion of the loosely packed matrix, is found. Correlations between the coefficient of friction, linear wear and the relative fraction of the loosely packed matrix are obtained. The results obtained allow us to propose a methodology for predicting the parameters of friction and wear processes, as well as the choice of material for use in friction units of agricultural machines. The proposed forecasting technique makes it possible to change purposefully the tribological characteristics of the polymer composites under consideration.

**Keywords:** composites, ultimate strength, ultrahigh molecular weight polyethylene, degree of extraction, interfacial strength, Leidner-Woodhams equation, microplasticity

UDK 631.311:004.94

## **Mathematical modeling of the process of soil cultivation using tillage working bodies**

**Rasul A. Apazhev**

**Abstract.** Tillage is the most important link in the technology of cultivating agricultural crops. Currently, soil cultivation accounts for on average 35-40% of the energy costs of the total volume of field work and up to 20% of the energy consumed in agriculture. Soil cultivation allows you to regulate the water-air regime, the intensity of biological processes and maintain the necessary phytosanitary condition of the soil and crops. The energy intensity and quality of tillage depend on the degree of sophistication of technical means. Mathematical modeling of the process of soil cultivation with various soil-cultivating working bodies is an urgent task, since it allows the development of more advanced energy-efficient technical means. The analysis of the work process was carried out using the analytical foundations of agricultural mechanics and the theoretical foundations of elastic-visco-plastic destruction of the soil environment, taking into account its stress-strain state, simulation and physical modeling methods. The obtained data was processed by methods of mathematical analysis and probabilistic-statistical methods. As a result of cyclic vibrations of the console with which the tip is equipped, due to the propagation of deformation waves, a compressed soil zone is formed in front. The mathematical model describing the process of soil destruction by a tip with a cantilever combines static destruction of the soil and destruction based on the propagation of deformation waves by the cantilever. It has been established that the overall resistance to loosening increases in direct proportion to the depth of loosening, according to a parabolic dependence with increasing tip width, which decreases rapidly as the thickness of the cantilever decreases, and acquires its smallest value when the length of the cantilever becomes equal to the width of the tip. Thus, when designing tillage machines to reduce the energy intensity of the soil cutting process: it is necessary to take into account the positive qualities of combined soil cutting; equip the teeth of the working bodies with cantilever plates, installing them on the frontal surface.

**Keywords:** soil, processing, cutting, working body, energy intensity, resistance, modeling

UDK 621.45.034.3

## **Comparative operational studies of changes in the parameters of diesel injectors with serial and upgraded atomizers**

**Anzor L. Bolotokov**

**Abstract.** The technical condition of the fuel system, and especially precision parts, has a significant impact on the operation of diesel engines. One of the main components in the fuel system is the injector. Low reliability and low durability are disadvantages of injectors. The resource of the injectors is 2500-3000 engine hours, which is several times lower than the resource of plunger pairs (6000-6500 engine hours). In order to improve the performance parameters of a diesel injector, it is necessary to modernize it. Modernization of the nozzle is proposed by making a helical groove in the guide part of the nozzle needle. Reliability of operation and durability of nozzles depends on the atomizer. Fuel flowing from the screw groove into the gap between the body and the nozzle needle contributes to axisymmetric pressure, which

causes the needle to rotate around its axis. The presence of fuel in the screw channel and in the gap between the body and the atomizer needle lubricates and softens the impact of the needle cone on the housing seat, instead of a direct hard impact in serial atomizers. The volume of fuel in the screw channel depends on the volume of fuel in the gap. As the gap increases, the gap resistance coefficient does not decrease below 0.4, so the volume of the screw groove will be 0.5-0.9 of the volume of the gap between the body and the injector nozzle needle. Thus, by upgrading the atomizer, you can increase the life of the nozzle by 23%.

**Keywords:** diesel, sprayer, nozzle, test, resource, modernization

UDK 631.352.2

## **Study of the process of removing vegetation on reclamation canals with a rotary cutter**

**Artur A. Shekikhachev**

**Abstract.** The operation of reclamation canals in an earthen channel shows that weeds must be removed both from horizontal and inclined areas, and from the bottom of the canal filled with water. Moreover, when mechanically removing vegetation on canals, both special reclamation mowers and various equipment can be used, including earth-moving equipment with a bucket-type working body, milling, rotary, etc., designed to remove sediment. Simultaneous removal of sediment and vegetation on canals is usually practiced during their major repairs. However, it is not recommended to remove weeds using earthmoving machines from the slopes of canal dams, because at the same time, the turf cover is disturbed, which leads to disruption of the channel profile and increased filtration of water from the channels. Therefore, on a significant part of the canals, weeds are removed using special irrigating machines – reclamation mowers. The main parameters characterizing the operation of rotary cutting devices are: area mowed per revolution of the disk; working length of the knife; overlap of knives of adjacent rotors; cutting speed. The studies were carried out under the following assumptions: the movement of the unit is linear. The angular velocity of the rotor and the forward speed of the mower are constant. As a result of the research, a relationship was obtained to determine the area mowed per rotor revolution. It has been established that when cutting a thick stem, the minimum stress and deflection of a flat segment in the vertical plane will be at a blade angle of 45°. You can increase the rigidity of a segment in various ways. For example, increasing the segment thickness to 3 mm.

**Keywords:** rotary mower, rotor, knife, area, mowing, overlapping, cutting speed

## **Food Systems**

UDK 664:641.56

### **Development of technology for specialized food products**

**Maya Yu. Tamova, Tatiana A. Dzhum, Alena A. Bylina**

**Abstract.** Taking into account the expansion of the range of specialized products intended for people suffering from lactose intolerance to cow's milk and allergy to milk casein, research has been conducted to develop formulations and technologies of fortified cereals based on milk of

vegetable raw materials for the diet of children. In the course of the research, issues related to the justification of the choice of raw materials for the formulations of the corresponding products, the assessment of various types of milk from vegetable raw materials according to organoleptics and physico-chemical properties, their combination with cereals, optimization of the component composition and determination of the nutritional value of new products were solved. In the process of developing formulations and technologies, standard, special research methods, as well as optimization methods were used. Attention was paid to the study of microbiological parameters of the developed fortified cereals to justify the extension of their shelf life. According to the study, the nutrient composition of specialized products has been enriched, the content of vitamins C, A, B1, B2, PP,  $\beta$ -carotene, as well as magnesium, potassium, calcium, phosphorus, iron has increased, which is necessary to meet the daily needs of a particularly growing organism. Technical and technological maps are designed for the developed formulations. The research was conducted at the KubSTU Testing Center.

**Keywords:** vegetable milk, lactose, casein, cow's milk, rice groats, oatmeal, organoleptics, microbiological studies, nutritional value

UDK 664.64.016

## **Technological assessment of the quality of triticale grain of the "Elephant" variety and determination of the direction of use**

**Yuriy S. Triandofilidy, Natalia V. Sokol, Vladimir V. Voronin**

**Abstract.** Grain production is the basis of the entire food complex of the Russian Federation, and every year new varieties are added to the list of zoned varieties of grain crops. Taking into account the promising directions of the bakery industry development, such as the use of new raw materials, the development of functional food products from plant raw materials with specific properties compared to traditional grain crops and the optimization of the nutrition structure of the population, triticale can take a worthy place among the main grain crops of the Russian Federation. Triticale grain has an increased content of high-grade protein, minerals and is very resistant to fungal diseases. Therefore, the study of its technological quality indicators and the determination of the direction of use is of practical importance for the bakery industry. Flour from triticale grain of the "Elephant" variety and wheat of the "Thunder" variety selected by the Grain Research Center of the P.P. Lukyanenko Krasnodar Research Institute, cupcakes were used as objects of research. The method of making cupcakes on chemical baking powder is used. In this regard, the purpose of the study was a comparative study of the quality of flour from triticale grain of Elephant and wheat of the Grom variety and their properties for predicting behaviour in technological processes of cupcake production. The results characterizing the quality of experimental flour samples were obtained: the gluten content in triticale flour is 19.2%, the quality of gluten is 84 units, etc. IDK, in wheat flour the gluten content is 28.7%, the quality of gluten and 60 units, etc. IDC, the number of drops (PE) in triticale flour 123 s, in wheat flour PE 268 s, which indicates a higher activity of the enzyme  $\alpha$ -amylase in triticale flour compared to wheat flour. It has been established that triticale and wheat flour exhibit unequal ability to bind and retain water and fat, which is due to the different protein and carbohydrate composition of flour types. The water-holding capacity of triticale flour is 1.6 times higher compared to wheat flour, fat-holding capacity is 1.3. Trial laboratory baking showed that triticale flour cupcakes are not inferior in quality to wheat flour cakes and have the best nutritional value.

**Keywords:** wheat, triticale, flour, gluten, number of drops, cupcakes, quality

UDK 663.44

## **Study of the influence of protein and carbohydrate solutions on physical indicators of beer wort quality**

**Madina B. Khokonova, Amina S. Dzhaboeva**

**Abstract.** The work is devoted to determining the components of beer wort, which most increase its viscosity by studying solutions of maltose, proteins, dextrans and hemicelluloses. After adding enzyme preparations, more starch remains in the grain of poorly loosened malt than in the grain of well-loosened grain. When washing spent grains, the sugar content in the wash water decreases, and total and high-molecular nitrogen and viscosity increase. Due to insufficient enzymatic hydrolysis during malting, high molecular weight carbohydrates and proteins dissolve in the wash water and the composition of the wort deteriorates. The objects of research were laboratory brewing wort with the addition of solutions of maltose, protein substances, hemicelluloses and dextrans. To determine the effect of solutions of maltose, protein substances, dextrans and hemicelluloses on the physical characteristics of beer wort, their content in the solution varied from 1 to 13%, from 1 to 7%, from 1 to 4%, from 1 to 7%, respectively. The study was carried out at temperatures of 20°C and 70°C. It has been established that the content of a maltose solution in the wort with a concentration of 1 to 13% does not impair the quality of the product. For the production of modern types of beer, a 7% concentration of protein solutions in the wort is allowed; for classic beers, the protein concentration in the solution should be less than 1%. The maximum concentration of a solution of dextrans in beer wort at a temperature of 20°C should not exceed 2%, and hemicelluloses in malt at a temperature of 70°C should not exceed 7%.

**Keywords:** brewing, saccharification, wort, enzymes, proteins, maltose, dextrans, hemicelluloses, viscosity

UDK 663.533

## **Identification of optimal values of the medium reaction during saccharification of starchy mashes with *Aspergillus oryzae* culture**

**Olga K. Tsagoeva, Madina B. Khokonova, Valery A. Volkov**

**Abstract.** This work is devoted to identifying the optimal values of the medium reaction during the saccharification of starchy mashes with the *Aspergillus oryzae* culture. With an increase of temperature from 30° to 50°C, the optimal pH zones of the amyolytic (AC) practically do not change, while the saccharifying (OS) and dextrinolytic (DS) zones shift to the alkaline side. The optimal values of all three indicators were achieved under the following conditions: temperature 30°C, pH 4,7; temperature 50°C, pH 5,0. At the initial moment, a decrease in pH from 6,5 to 5,0 does not significantly affect the activity of  $\alpha$ -amylase. After 72 hours at pH 5,0, AC decreases to 58% of its maximum value, and at pH 4,5 to 14%. At pH 4,5, a rather sharp inactivation of  $\alpha$ -amylase occurs. The presence in the enzymatic complex of the preparation of enzymes that break down hemicelluloses, fiber, pentosans, promotes the transition into solution of a certain amount of substances that are not fermentable by yeast and increase waste in mature mash. The data presented indicate that the stability optimum lies in a more alkaline zone than the activity optimum. Therefore, the optimal pH values for different durations of exposure to enzymes should be selected based on the appropriate combination of their activity and stability. In a saccharifier where the mash is briefly exposed to enzymes, it is advisable to make maximum use of  $\alpha$ -amylase activity and maintain the pH of the mash in the range of 5,0-5,1 at

a temperature of 50-55°C. It has been established that the conditions for saccharification of wheat mash with malt and an enzyme preparation depend on the density of the mash. The initial density of the mash during saccharification with an enzyme preparation and malt is 8,2 versus 10,8, respectively. When using *Aspergillus oryzae* and increasing the temperature from 30° to 50°C, the optimal pH zones of the AC practically do not change, and the SA and DC shift to the alkaline side. Optimal values of all three indicators were achieved under the following conditions: temperature 30°C, pH 4,7; temperature 50°C, pH 5,0.

**Keywords:** alcohol production, *Aspergillus oryzae*, saccharification, medium reaction, temperature, enzyme activity

## ECONOMY

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### **The state and prospects of modern architecture of the growth development of the agricultural complex of the KBR**

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**Abstract.** In the article, based on statistical data for the period 2010-2020, using index, correlation, matrix methods, the analysis of existing production, technological, organizational and economic relations in the agricultural complex of the Kabardino-Balkarian Republic is carried out. By splitting the complex into two subcomplexes (crop and livestock), the main connections forming the subcomplexes are identified, formalized and quantified. The heterogeneous contradictory nature of the relationship between the main resource factors (acreage) and the final results (gross output) has been established. In the conditions of growing climate and weather changes, the influence of climatic and weather factors on the dynamics of the main parameters of the crop subcomplex has been revealed and quantified. The analysis of the relationship of the final products of the latter (gross harvest of grain and leguminous crops, hay, etc.) with the main parameters (livestock, milk yield, etc.) of the livestock subcomplex is carried out. Discrepancies and contradictions have been established. The revealed dependencies allow us to assess the state of the architecture of the agricultural complex of the KBR, identify the so-called "weak points" in it and indicate reserves. The general conclusion reached by the authors is that properly structured connections, on the one hand, eliminate the influence of negative factors, and on the other, strengthen the influence of positive factors and conditions. The formation of an effective architecture of the agricultural complex is important in conditions of limiting the so-called basic factors of agriculture: land, fresh water, workers, as well as environmental degradation. It is important from the point of view of replacing deficit factors with surplus ones. For example, land and workers with capital. It is precisely these factors and conditions that agriculture faces in Kabardino-Balkaria and the regions of Russia. The latter makes the task of identifying, formalizing and quantifying the existing technological, organizational, economic and institutional links between various structures (industries, sub-sectors, sectors, segments) of the agricultural complex of the KBR relevant. Based on the calculations carried out, the main directions for improving the interrelations in the agricultural complex of the KBR are proposed, allowing it to form stable long-term trends and increase overall efficiency.

**Keywords:** agriculture, complex, subcomplexes, architecture, correlation, lensing, digitalization, gross collection