

## AGRICULTURAL SCIENCES

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### **INFLUENCE OF SOIL TILLING AND FERTILIZERS ON LIXIVIOUS CHERNOZEMS FERTILITY**

The article considers fertility indicators of the lixivious chernozem including the humus content and stock, the content of labile forms of phosphorus and potassium, and also mobility degree of phosphates and potassium when applying various methods of the basic cultivation of soil under the conditions of the southern forest-steppe of the Republic of Bashkortostan. The research findings showed that after the first crop rotation in a layer of 0-30 cm in options with the minimum soil tilling, with chisel tilling, with primary tillage on the fertilized background (N85P40K75, green fertilizer) the humus content increased by 0.24, 0.14 and 0.13% respectively in comparison with the antecedent soil. When plowing the soil in this layer there was a reduction of the humus content by 0.22%. Our researches indicated statistically that there was a reliable increase in the labile humus content when using chisel tillage, primary tillage and minimum tillage in comparison with plowing on the studied grounds. According to our data, the mineralization process of carbon-nitrogen bonds proceeds less actively at the minimum cultivation in comparison with the other studied ways of the basic cultivation of soil. The labile phosphorus content in the spring wheat field was the lowest on average for years of researches with minimum tillage in comparison with the other studied ways of the basic cultivation of soil. There were no essential distinctions between different ways of soil tillage in transformation of potassium metabolic forms and also mobility degree of potassium in the soil. Organo-mineral fertilizer application system boosted the productivity of spring wheat grain by 23-32%. The maximum efficiency of spring wheat is achieved when using chisel soil tillage due to the creation of the most optimum conditions for development of plants.

**Key words:** soil tillage; fertilizers; humus; nutrients; spring wheat; profitability.

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## **ECOLOGICAL RESPONSE OF SUMMER BARLEY VARIETIES TO ABIOTIC CONDITIONS OF THE MIDDLE CIS-URAL REGION**

The relevance of research determining comparative ecological response of summer barley varieties to abiotic conditions of the Middle Cis-Ural region is doubtless. The data of the state crop testing sites of the Udmurt Republic in 2009-2013 were used for the analysis of productivity of spring barley varieties. Weather conditions of growing seasons differed both in the temperature regime and in the amount of precipitation. The soil of state crop testing sites is derno-podzolic of diverse particle size distribution and the light-gray forest heavy clay-loam with a plowing layer of the average state of cultivation: the humus content is average to high (2.1 – 2.6 %), labile phosphorus is increased to very high (101 – 251 mg/kg), exchangeable potassium is average to very high (100 – 300 mg/kg). It was revealed that the change in grain yield by 52.4-96.0% was due to the influence of abiotic environmental conditions. The most favorable by abiotic conditions for Balezino and Mozhga state crop testing sites was 2011, for Glazov, Uva and Sarapul – 2009. Relatively worse abiotic conditions were in 2013 at Balezino, Glazov and Uva state crop testing sites. The most unfavorable for the high yield of barley was 2011 year at Sarapul and Mozhga state crop testing sites according to the index of environmental conditions. The variety Rodnik Prikamia was the most stable in grain yield at Balezino and Uva state crop testing sites, varieties of Sonet and Belgorodsky 100 – at Glazov and Mozhga state crop testing sites, Veresk and Nevan – at Sarapul state crop testing sites. These varieties had higher stress tolerance to the growing conditions. The variety Belgorodsky 100 proved to be responsive to changing environmental conditions among the tested varieties of barley at all state crop testing sites. This variety displayed the greatest correlation

between the variety genotype and environmental factors. Rodnik Prikamia was distinguished by relative flexibility and yield stability at all state crop testing sites of the Udmurt Republic.

**Key words:** barley; variety; grain yield; state crop testing site; abiotic conditions.

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## **CULTIVATION PRACTICE EFFICIENCY OF NEW VARIETIES OF FIBER FLAX IN THE SOUTHWEST OF NON-CHERNOZEM AREA OF RUSSIA**

The early ripening variety Leader had the maximum yield of flax-straw in the control stage (without fertilizer) of 2.44 t/ha; that is 0.04 and 0.23 t/ha higher than the varieties C-108 and Soyuz had. The variant N<sub>30</sub> P<sub>54</sub> K<sub>95</sub> (borofoska and ammonium nitrate) resulted in 4.98 t/ha of flax-straw of the variety Leader. In the N<sub>45</sub> P<sub>54</sub> K<sub>95</sub> variants with various types of fertilizer the variety C-108 had 4.7 and 4.67 t/ha, Union - 5.02 and 5.15 t/ha, respectively. Plant lodging of these varieties was observed with an increased supply of nitrogen (N<sub>45</sub>). The variety Leader had the best number of flax-straw (3.5) and long fiber (15.5), flexibility (42 mm), breaking load (18.2 kg), long fiber yield (0.92 t/ha) in the N<sub>30</sub> P<sub>54</sub> K<sub>95</sub> variant with ammophos +Kalimag + ammonium nitrate. With the rate of N<sub>45</sub> the parameters decreased: the yield of long fiber (0.73 t/ha), number of flax straw (2.25), long fiber output (16.1%), flexibility (34.5 mm), breaking load (15.6 kgs). Higher doses of nitrogen worsened the fiber quality. It gets rougher and has less breaking load. The variety Leader in the variant with borofoska and N<sub>15</sub> had the long fiber yield 0.89 t/ha, number of flax-

straw - 3.0, long fiber yield - 20.3% with number 13.2. With N<sub>45</sub> the long fiber yield increased to 0.93 t/ha. The variety C-108 had the long fiber yield of 0.94 t/ha, long fiber output of 20.9%, flax-straw number of 2.5, long fiber number of 13.7 in the N<sub>30</sub> P<sub>54</sub> K<sub>95</sub> variant with ammophos +Kalimag + ammonium nitrate. In the variant with borofoska and N<sub>15</sub> there was the increased number of flax-straw (2.75), the total fiber content (31.7%), but the fiber strength was lower (12.6 kgf). In the variant with borofoska and N<sub>30</sub> and N<sub>45</sub> there was the increased long fiber yield (0.76 and 0.77 t/ha), flexibility (38.5 mm) and strength (breaking load of 15.4 and 18.0 kg), but in comparison with the N<sub>15</sub> variant the total fiber content decreased (28.2 and 29.2%), so did the long fiber output (16.5% in both variants). The varieties Prince and Lavina gained the maximum seed yield in the second sowing date (1.10-1.25 t/ha). The later sowing date reduced the harvest to 67-160%. The variety Prince of the second sowing date had 4.65 tons of flax straw, 1.40 t/ha of flax fiber and 1.25 t/ha of flax seeds. The later sowing dates caused the drop in flax fiber production to 66-152%.

**Key words:** fiber flax; mineral fertilizers; variety; sowing date; yield of straw; straw number; long fiber number; fiber flexibility; breaking load of fiber; long fiber yield.

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**A.A. Petrov, D.A. Pozdeev, D.A. Zorin, A.A. Kamasheva**  
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**THE USE OF PERIODIC YIELD OF FINAL FELLING IN FOREST DISTRICTS OF THE UDMURT REPUBLIC IN TAIGA ZONE,**

## **SOUTHERN TAIGA FOREST REGION AND CONIFEROUS-DECIDUOUS ZONE, MIXED FOREST AREA**

The article defines a concept of periodic yield of final felling and conditions which the optimal periodic yield should provide. The most complete account of the investigated problem of timber harvesting in centrally planned economy (the eighties of the twentieth century) in the Udmurt Republic and in the period of transition to market economy in the Russian Federation is given. The article contains extensive analysis of using the periodic yield of final felling in forest districts of the Udmurt Republic in the taiga zone, in the southern taiga forest area, in the coniferous-deciduous zone, and in the mixed forest area. The analysis is presented in dynamics from 2008 (the year of forest districts' foundation in the Udmurt Republic) till 2014 with the classification of forests according to the designated purpose, the average taxation factors, the percentage of forest cover in municipal areas of the Udmurt Republic. The average index of percentage of forest land for forest zones and forest regions in the Udmurt Republic is introduced. The article also considers the fulfilled sanitary-curative measures in the period under study for forest zones and forest regions in dynamics, which is of vital importance because of the dry hot summer in 2010 when mass reproduction of spruce pest - European spruce bark beetle (*Ips typographus* L.) was observed. Conclusions are drawn and recommendations for remedial actions of European spruce bark beetle damage and for the improvement of the periodic yield of final felling are presented in the article. Data of growth of the underused periodic yield of soft-wooded broadleaved species leading to the deterioration of sanitary conditions of soft-wooded broadleaved forests are given.

**Key words:** the use of periodic yield of final felling; forest region; forest area; forest cover in municipal areas; sanitary-curative measures; European spruce bark beetle.

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## **TECHNICAL SCIENCES**

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### **DESIGN AND OPERATING PRINCIPLE OF CYCLONE-SEPARATOR WITH ADJUSTABLE SCREEN**

The design of existing grain crushers does not provide smooth, precise adjustment of the size of crushed particles (grinding module). Available technical solutions for the grinding module adjustment do not permit to obtain the product fully conforming to the zootechnical requirements for feed. Therefore, the aim of this work is the efficiency upgrading of hammer grain crushers by improving the adjustment of the grinding module. The following problems are solved: to develop constructive and technological scheme of a cyclone - separator with the grinding module adjuster; to determine theoretically and experimentally the optimum parameters of a cyclone - separator with the grinding module adjuster. The basic machines for grain grinding in the feed industry and agricultural enterprises are closed-type hammer grain crushers. The major drawback of these machines is that the process of grinding and separation occurs in one chamber leading to intensive formation of dust fraction, inaccurate separation, the concaves, screens and hammers wear, as well as to the increased energy consumption. Thus, the processes of grinding and separation should be separated, and the process of separation should promote the fractionation accuracy and comfortable adjustment of the grinding module. The laboratory unit simulating the process of stock feed separation with the possibility of the grinding module adjustment was constructed. Due to the conducted research it is possible to identify the best constructive and technological parameters of a cyclone - separator with an adjustable screen.

**Key words:** hammer grain crusher; cyclone; cyclone-separator; resource; screen; adjustment.

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## **STRUCTURE AND PROPERTIES OF THE MODIFIED ANTI-FRICTION COATING ON BASIS OF METALLIC COMPOSITION**

The basic causes of degradation of plain bearing units are presented, and also principal directions regarding maintenance of their steady operation are offered. The existent methods of operating capacity increase of anti-friction coatings of plain bearings are considered. The drawbacks of these methods are indicated. The article proposes a radically new technology of higher operating capacity maintenance of plain friction bearings based on a comprehensive approach to the problem by ensuring high wear resistance of anti-friction coatings, accelerated conformability and self-lubricity of bearing units. The research methodology provides rationalization for anti-friction coatings development. The babbitt alloy B83 possessing high tribotechnical properties is accepted as the metal matrix of coating. Modification of the babbitt coating with molybdenum disulfide MoS<sub>2</sub> is offered for the increase of bearing strength of coatings. Application of laser radiation for the anti-friction coatings on the basis of babbitt 83 provides the

synthesis of finely dispersed, intermetallic phases, and also forms a porous structure due to incomplete remelt of powder material. Molybdenum disulfide is mainly produced through the porous structure that provides self-lubricity of bearing units in the conditions of oil starvation. The results of microstructural and X-ray structural analysis are presented for the structure detecting of the obtained anti-friction coating. The research findings characterize the presence of the following intermetallic phases in the structure of coating: Fe<sub>2</sub>Sn, SnSb, Cu<sub>3</sub>Sn. Dispersability of the formed phases is considerably higher than of the standard babbit coating, which is determined by high-rate of crystallization in the conditions of laser processing. The diffractograms analysis proves that distribution of intermetallic phases by the thickness of coating is uneven. Underlying layers close to the base coat are the softest and the most yielding due to  $\alpha$  – solid solution; surface layers are hard and saturated with the finely crystalline phase of Cu<sub>3</sub>Sn. The study of coating in the conditions of dry friction justifies the possibility of anti-friction coating functioning without lubrication in a bearing unit.

**Key words:** laser radiation; babbit B83; anti-friction coating; bearing; sliding; operating capacity; wear; intermetallic phases; molybdenum disulfide.

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## **ECONOMIC JUSTIFICATION OF HYPEROSMOTIC PROCESSING OF FODDER GRAIN BEFORE ITS DRYING**

Grain losses in the process of its production and storage considerably influence the industry profitability and essentially reduce the efficiency of agrarian production as a whole. This problem remains unresolved as the application of even the advanced technologies of its processing and storage does not provide safe keeping of all volume of grain weight. In this connection the development of the technologies improving economic benefit of grain production at the expense of reduction of its losses continues to be relevant. The peculiarities of a physical and chemical processing method of fodder grain and cost – benefit analysis of such processing are shown. It is offered to subject grain to processing by sodium chloride for hyperosmotic dehydration prior to the beginning of traditional drying process (or instead of it). Dehydrating properties of different structures of sodium chloride solutions under the conditions of temperature fluctuations of their influence on grain of barley, wheat, rye and oats are studied in a laboratory experiment. The calculated values of production costs of drying of identical volume of grain using the traditional technology and the developed method are used for cost - benefit analysis. The research findings determined that the physical and chemical processing method of damp grain mass by the hypertonic solutions of sodium chloride considerably improves efficiency of the following hot air drying and reduces grain losses during its preparation for storage and the subsequent usage.

**Key words:** grain losses; hyperosmotic dehydration; grain dehydration; efficiency of drying.

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## **THE DEVELOPMENT OF MANAGEMENT ACCOUNTING AND INTERNAL CONTROL OF COSTING CYCLE AND AGRICULTURAL OUTPUT CYCLE**

The issues of the development of management accounting and internal control of the costing cycle and the output cycle in agriculture are considered. Theoretical principles clarifying the essence of the concepts "production costs", "input costs" are justified. The model of integrated information system of management accounting, planning and costs control is proposed. Recommendations for the development of management cost accounting by responsibility centers and the internal control of the efficiency of agricultural production are developed.

**Key words:** biological costs; production costs; total costs; responsibility centers; the internal transfer price; the standard of internal control; operational and managerial audit.

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