

Original article

DOI 10.48012/1817-5457_2022_3_4-11

DROUGHT TOLERANCE OF SPRING BARLEY VARIETIES IN THE PRE-KAMA CONDITIONS OF THE REPUBLIC OF TATARSTAN

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Abstract. The greatest damage to barley plants is caused by droughts. A significant suppression of all components of plant productivity occurs when extreme hydrothermal conditions affect the growth and development of plants throughout the growing season. The effect of extremely dry conditions of the interphase periods “sprouting – bushing”, “bushing – tubing”, “tubing – earing”, “earing – full ripeness” of spring barley plants on the value of elements of the crop structure was revealed. A comparative characteristic of the values of crop structure elements in acutely arid and in favorable conditions in terms of average daily temperature and moisture supply during the growing season is given. The maximum level of depression (25.6 %) is noted in the integral indicator “grain yield”. It has been revealed that one of the agronomic techniques that minimize the impact of drought conditions is the application of mineral fertilizers. The significant effects of variety, background of mineral fertilizers and their interactions on the indicator “grain yield” were established with the help of method of two-factor analysis of variance. The analysis of the share of contributions of each of the factors showed that in the extreme dry conditions of the growing season in 2021, the variety accounted for 11.3 %, the level of nutrition 61.3 % and the specific interaction 8.9 %. The varieties were found to respond differently to mineral fertilizers. The maximum gain on the background of mineral fertilizers was noted in late-ripening varieties Timerhan, Endan and Laishevsky, characterized by lower values of realization of potential productivity (80.6; 83.9; 80.4 % respectively), by higher values of specific adaptive capacity (0.42; 0.38; 0.38 respectively) and by lower values of relative stability of genotypes (33.9; 27.1; 31.6 % respectively). It was established that the yield of grain positively, reliably at the 5 % level of significance correlated with productive bushiness ($r = 0.51^*$), with the number of grains of the main ear ($r = 0.55^*$), with the weight of the main ear grain ($r = 0.53^*$). Under acutely arid conditions of the growing season in 2021 the correlation relationship between the yield of spring barley grain and the weight of 1000 grains was not established ($r = 0.05$). The analysis of variance revealed that using mineral fertilizers in varieties on average significantly increased the values of indicators: “productive bushiness”, “ear length”, “number of grains of the main ear”, “weight of 1000 grains”, “weight of the main ear”, “grain yield”.

Key words: spring barley; extreme drought; stages of organogenesis; elements of yield structure; mineral fertilizers.

For citation: Blokhin V. I., Nikiforova I. Yu., Ganieva I. S., Lanochkina M. A., Malafeeva Yu. V. Drought tolerance of spring barley varieties in the Pre-Kama conditions of the Republic of Tatarstan. The Bulletin of Izhevsk State Agricultural Academy. 2022; 3(71): 4-11. (In Russ.). https://dx.doi.org/10.48012/1817-5457_2022_3_4-11.

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Original article

DOI 10.48012/1817-5457_2022_3_12-19

POTATO VARIETY RESPONSES TO CULTIVATION IN ARTIFICIAL CONDITIONS ON AEROPONIC FACILITIES

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Abstract. To introduce the aeroponic method in obtaining improved potato planting material widely, it is necessary to develop the technology of its cultivation in Russia. For this purpose it is desirable to cultivate varieties that have a limited growth of the biomass of shoots, but at the same time capable of forming a large number of mini-tubers. The aim of the research was to study the growth, development and productivity of early and middle-early potato varieties of Russian and foreign selection. The research was conducted on aeroponic facilities in artificial conditions for the period from January to April 2021. Phenological, morphometric observations were carried out, as well as the varieties productivity assessment. The research results have shown that the period of tuber formation, depending on the variety, ranged from 38 (Irbitsky) to 43 days (Legenda, Terra, Red Scarlett), the growing period lasted 101 days. Morphometric observations carried out during the flowering period showed that the height of plants of various varieties ranged from 61.7 cm for the Legenda variety to 77.6 cm for Lux variety; root system length – from 88.5 cm (Lux) to 99.7 cm (Legenda); the length of the stolons – from 72.82 cm (Legenda) to 108.8 cm (Gala); the number of stems varied from 1.1 to 3.4 units per plant. In the group of early varieties the Legenda variety was the most productive, 108.5 minitubers were collected from one plant during the growing period. Gala variety excelled in the middle-early varieties group – 125.1 pcs per plant. The crop accounting of the potato mini-tubers was carried out by fractions: diameter up to 10 mm; 10–20 mm; 20–30 mm; 30 mm and more.

Key words: potato; original seed production; variety; productivity; aeroponic facilities; mini-tubers; stolons.

For citation: Latypova A. L., Tsema L. G. Potato variety responses to cultivation in artificial conditions on aeroponic facilities. *The Bulletin of Izhevsk State Agricultural Academy*. 2022; 3(71): 12-19. (In Russ.). https://dx.doi.org/10.48012/1817-5457_2022_3_12-19.

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Original article

DOI 10.48012/1817-5457_2022_3_20-28

THE EFFECT OF PLANT GROWTH STIMULANTS ON YIELD, NECK ROT INFESTATION AND QUALITY OF ONION

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Abstract. One of the techniques in the onion cultivation technology is the usage of plant growth stimulants, they increase the stress resistance of plants, the size and conformity to a standard of the yield, accelerate the ripening period of products. A special place among stimulants is held by trace elements and immunomodulators. Based on this, the aim of the research was to identify the effect of plant growth stimulants on the yield, quality and disease incidence of onion F1 Hercules. Tasks involved the study of the effect of growth stimulants on the yield and disease infestation of onions; the determination of the biochemical parameters depending on the pre-planting treatment of onion with growth stimulants. Zircon (complex of hydroxycinnamic acids), Epin-Extra (24-epibrassinolide), Siliplant (silicon-containing fertilizer), Cytovite (a mixture of trace elements in chelated form) were studied. Studies on the effect of plant growth stimulants on disease incidence and onion yield in the conditions of the Udmurt Republic were conducted in 2020–2021. The use of Epin-Extra growth regulator and Siliplant micro-fertilizer in the form of pre-planting treatment of onion sets contributed to an increase in onion yield by increasing the weight of bulbs. The infestation of bulbs with grey neck rot decreased after the use of all studied drugs except Epin-Extra. The use of Zircon contributed to an increase in dry matter and soluble solids, Epin-Extra – an increase in soluble solids, Cytovite – an increase in ascorbic acid in the bulbs. It has been revealed that when the bulbs are affected by a fungus that causes neck rot, the biochemical parameters deteriorate. There was a decrease in the content of dry matter, soluble solids, ascorbic acid. The nitrate concentration increases.

Key words: onion; plant growth regulators; Epin-Extra; Zircon; Cytovite; Siliplant; yield; neck rot; quality.

For citation: Korobejnikova O. V., Strot T. A. The effect of plant growth stimulants on yield, neck rot infestation and quality of onion. The Bulletin of Izhevsk State Agricultural Academy. 2022; 3(71): 20-28. (In Russ.). https://dx.doi.org/10.48012/1817-5457_2022_3_20-28.

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Original article

DOI 10.48012/1817-5457_2022_3_28-34

PHYSICAL AND CHEMICAL PARAMETERS OF HONEY WHEN USING PROTEIN-CONTAINING ANTIOXIDANT AS FEEDING FOR BEE COLONIES

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Abstract. In recent decades the situation in beekeeping in various countries of the world has become quite tense due to diseases of bees of various etiologies. The frequent use of chemicals leads to a deterioration in the immunity of honey bees, a decrease in their resistance to infectious diseases, and the residual components of chemicals can remain in bee products. The main task of beekeeping is to obtain environmentally friendly honey products. To accomplish this task, beekeepers need to use preventive and therapeutic solutions based on natural ingredients. These drugs include the superoxide dismutase – a strong high-molecular antioxidant of natural origin. Studies of the effect of superoxide dismutase as a prophylactic agent affecting the immune status of honey bees were carried out at the stationary apiary of “Rossiya” of Mozhginskiy district of the Udmurt Republic in 2021. To conduct an experimental study three experimental groups were selected using the method of pairs-analogues, 10 bee colonies in each group. In the spring, after the exposure of bees from the winter hut, the control group received carbohydrate feeding, experimental groups № 1 and № 2 received a biologically active additive as part of the feeding 450 mg and 600 mg of a drug, respectively. In bee colonies that received an antioxidant drug of microbial origin, the difference in the amount of marketable honey was 7.28 kg in favor of the experimental group № 2. Assessing the quality of honey it was found that all indicators met the requirements of standards.

Key words: honey; honey productivity; stimulating feeding; honey bee.

For citation: Fedorova A S., Vorobieva S. L., Vasilyeva M. I. Physical and chemical parameters of honey when using protein-containing antioxidant as feeding for bee colonies. The Bulletin of Izhevsk State Agricultural Academy. 2022; 3(71): 28-34. (In Russ.). https://dx.doi.org/10.48012/1817-5457_2022_3_28-34.

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Original article

DOI 10.48012/1817-5457_2022_3_35-42

ANALYSIS OF CATTLE FERTILITY PRESERVATION

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Abstract. Intensive dairy cattle breeding often comes with a significant decrease in the reproductive qualities of cows, which leads to a reduction in the productivity of cows on average up to 3 years, which reduces industry profitability. The purpose of the work was to evaluate the effectiveness of measures aimed at improving and preserving the reproductive properties of cattle. Comparative studies were conducted in six enterprises of the Udmurt Republic over a three-year period from 2019 to 2021. The subject of the research were cows of Black-and-White breed. A retrospective study based on the results of clinical, biochemical, and anamnestic data was used. The analysis of economic conditions, zootechnical accounting and the results of clinical and gynecological studies can be helpful for identifying and eliminating factors that retard obtaining high results in herd reproduction on each farm. The following is recommended for the studied farms: to correct the animal feed base, namely, to restore the calcium-phosphorus ratio. At the same time it is possible to use pharmacological preparations with optimal absorption of calcium. But it is necessary to determine the amount of feed per head taking into account the desired indicators in the future. Depending on the specific biochemical profile, it is recommended to introduce iodine preparations and drugs that prevent the development of ketosis and acidosis of cattle especially when increasing dairy productivity. To correct metabolic processes during the dry and the post-calving periods, it is necessary to introduce preparations of fat-soluble vitamins taking into account the live weight and productivity of livestock. Measures in livestock synchronization can be carried out only under the condition of an optimal balance of the biochemical profile and the animal clinical condition as an integral part of competent work on the herd reproduction.

Key words: cattle; reproductive system; metabolism.

For citation: Khamitova L. F., Ilyina A. N. Analysis of cattle fertility preservation. The Bulletin of Izhevsk State Agricultural Academy. 2022; 3(71): 35-42. (In Russ.). https://dx.doi.org/10.48012/1817-5457_2022_3_35-42.

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Original article

DOI 10.48012/1817-5457_2022_3_43-49

THE IMPORTANCE OF COW BEHAVIOR PATTERNS IN MILK PRODUCTION

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Abstract. The study of the features of cow behavior is primarily necessary for the development of design and technological solutions for the construction of farms for the milk production, it will preserve the health of animals and will contribute to achieving high productivity. The aim of the research was to study specific patterns of the behavior of cows with a tethered housing technology in the winter stall-feeding period. The research was carried out on the basis of «Iskra» (collective farm) of the Kez district of the Udmurt Republic in 2020–2021. The assessment of specific behavior of cows with tethered housing technology is given: the activity of cows during the day (standing, lying); the resting position (poses); attempts to get on their legs after rest. The research results have found out that cows stand for an average 13.84 hours per day and rest for only 10.16 hours. The most common resting position in cows is on the side, the head is turned aside – 96 heads (52.7 %). Cows rest in a position on their side, with their heads outstretched – 73 heads (40.1 %). There are cases when cows have an unnatural position – 13 heads (7.2 %). The observation of cows during rest period have shown that the change of positions occurs on average after 71.5 minutes, in the group it ranges from 47 to 105 minutes. The number of attempts to get on their legs after rest averaged 2.2 times, and in the group ranged from 1 to 4 times. It was found out that the stalls did not correspond to the size of the cows, so the specialists of the farm were recommended to take into account modern requirements for comfortable rest and increased productivity while housing the animals.

Key words: cow; Black-and-White breed; tethered housing technology; productivity; behavior; activity; rest; posture; pose; position; multiplicity; limb.

For citation: Kudrin M. R., Ivanov I. N. The importance of cow behavior patterns in milk production. The Bulletin of Izhevsk State Agricultural Academy. 2022; 3(71): 43-49. (In Russ.). https://dx.doi.org/10.48012/1817-5457_2022_3_43-49.

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Original article

DOI 10.48012/1817-5457_2022_3_50-58

LABORATORY JUSTIFICATION OF THE WORKING BODIES ARRANGEMENT ON THE FRAME OF A HEAVY SPRING-LOADED HARROW

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Abstract. Existing harrow models have a large gripping width within 7...27 m. However, the distribution of working bodies by width and its effect on the completeness of tillage has been little studied. The purpose of the research was the laboratory substantiation of the arrangement of working bodies on the frame of a heavy spring-loaded harrow. The objectives involved the development of a laboratory testing methodology of the effect of the working bodies arrangement on the completeness of field tilling and experimental justification for their rational placement. Research methods included specific laboratory procedures and experimental statistics. This article presents the laboratory testing procedure. The experiments were carried out on a soil box using a traction platform with working bodies placed on it. The principle of operation of the laboratory facility is shown, the operations procedure during the experiment and the rules for placing working bodies on the frame corresponding to their factory and rational installation are indicated. The coefficient of completeness of field tilling was chosen as the optimization criterion. Based on the research results, it has been found that the factory installation of spring-loaded working bodies in the harrow sections has processing limitations and flaws. It was revealed that with an increase in the speed of the machine-tractor unit from 2.22 m/s to 3.33 m/s, the value of the coefficient of completeness of tilling γ increases from 0.912 to 0.926. However, it was not possible to achieve complete tilling of the entire field surface. The recommended arrangement of working bodies in the harrow sections ensures complete tilling of the entire surface of the field, the completeness coefficient at all speeds is one.

Key words: harrow; spring-loaded working body; frame; working bodies arrangement; soil box; tilling speed; coefficient of field tilling completeness.

For citation: Ivanov A. G., Bodalev A. P., Lomaev A. A. Laboratory justification of the working bodies arrangement on the frame of a heavy spring-loaded harrow. The Bulletin of Izhevsk State Agricultural Academy. 2022; 3(71): 50-58. (In Russ.). https://dx.doi.org/10.48012/1817-5457_2022_3_50-58.

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Original article

DOI 10.48012/1817-5457_2022_3_59-63

IMPROVEMENT OF OPERATIONAL EFFICIENCY OF TURBOCHARGER BY MEANS OF BEARING INTERFACES MODIFICATION

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Abstract. The operational life, reliability and efficiency of turbochargers are largely determined by the state of bearing interfaces. High kinematic and dynamic loads lead to their premature failure, and also to degradation of performance, in particular, decrease in productivity and forming the “turbo lag” effect. The purpose of research is to study the performance of turbochargers with modified bearing interfaces by application of carbonitride compounds. Modification is achieved by applying thin anti-friction ceramic coatings by short-pulse laser processing. To analyze the performance, an installation was developed to determine the excess pressure in the compressor channel. It follows from the research results that the use of ceramic coatings significantly reduces the compressor shaft breakaway moment by reducing the friction coefficient in the bearing interface. High spin-up speed under low pressures of exhaust gas makes it possible to avoid the «turbo lag» effect and increase the effective engine power at low crankshaft speeds. Research results show an increase in effective engine power at 5000 n⁻¹ of the turbocharger by 55 %. The dynamics of power increase is observed up to 50,000 n⁻¹. A further increase in speed does not give a significant increase in power compared to a standard turbocharger. Thus, the modification of bearing interfaces makes it possible to increase the operational efficiency of turbochargers in unsteady operating modes, when failures are possible due to the «turbo lag» effect.

Key words: modification of bearing interfaces; turbocharger; operating efficiency; ceramic coatings.

For citation: Ipatov A. G., Ivanov A. G., Malinin A. V. Improvement of operational efficiency of turbocharger by means of bearing interfaces modification. The Bulletin of Izhevsk State Agricultural Academy. 2022; 3(71): 59-63. (In Russ.). https://dx.doi.org/10.48012/1817-5457_2022_3_59-63.

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DEVELOPMENT OF TECHNOLOGY OF RECYCLING PLASTIC WASTE FOR PRODUCING PAVING STONES WITH OPTIMAL MECHANICAL PROPERTIES

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Abstract. The installation of under floor heating from recycled plastic on agricultural farms is of great importance both in terms of reducing costs and improving the environmental situation. The aim of the study is to develop a technology for plastic waste recycling with the addition of sawdust to produce paving stones. To achieve this goal it was necessary to choose the optimal structure of the paving stones and conduct strength tests of the prepared samples. The materials for the research were samples of paving stones cast from a mixture of polyethylene terephthalate obtained from PET bottles and sawdust of small and large fractions in different proportions. The developed technology for the production of plastic paving stones with the addition of sawdust includes the following stages: acceptance and preparation of raw materials (plastic, sawdust), sorting, cleaning, crushing and melting of plastic, mixing of components (plastic + sawdust). A comparative analysis of compression and strength tests of the obtained samples showed that variations with fine sawdust have the best characteristics. The tensile strength of the samples with a fine sawdust fraction was 0.7086 and 0.8680 MPa, the plasticity coefficient was 2.56 and 4.10 %, and the sample with a large sawdust fraction was 0.254 MPa and 2.43 % respectively. Thus, in order to preserve the thermophysical properties and strength of the floor covering, it is better to use fine sawdust in the production of tiles. In order to preserve all the physical properties of PET plastic during the melting process, it is necessary to observe the exact melting temperature regime – 260 °C.

Key words: paving stones; polyethylene terephthalate (PET); sawdust; PET plastic bottle; cow stalls; comparative analysis of strength tests; livestock farm; recyclable materials.

For citation: Sergeev A. A., Spiridonov A. B., Porobova O. B. Development of technology of recycling plastic waste for producing paving stones with optimal mechanical properties. The Bulletin of Izhevsk State Agricultural Academy. 2022; 3(71): 64-70. (In Russ.). https://dx.doi.org/10.48012/1817-5457_2022_3_64-70.

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