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To a Question of Growth of Cereals.

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ABSTRACT

Features of aftergrowth of grasses are considered: the scheme of placement of buds of renewal of grasses is given, types of the sprouts that are formed by these groups of buds are defined. Groups of grasses are defined basing on nature of aftergrowth: 1) aftergrowing generally by the subterranian buds at a low cut, not forming the truncated sprouts and losing all leafy surface after alienation (rhizomatous types); 2) forming truncated sprouts with long vaginas (their apical buds take place on a surface of the soil and often alienate), which partially keep an assimilatory surface after a cut and aftergrow by the remained apical buds and buds of a tillering zone (tall growing types of friable sod); 3) aftergrowing generally by apical buds, standing out for preservation of considerable part of a leafy surface after alienation (short growing pasturable grasses). The ratio of storage organs at aftergrowth is defined. Dynamics of nutrients is determined: protein, monosaccharides, disaccharides, starch. It is established that the increase of carbohydrates in storage organs takes place at the beginning due to increase of monosaccharides and disaccharides.

Keywords: *Poaceae*, grasses, aftergrowth, renewal buds, types of sprouts, storage organs.

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INTRODUCTION

Grasses (*Poaceae*) make a basis of the majority of meadows of all botanic and geographical zones thanks to high level of adaptability [18]. After bevelling or browsing, grasses aftergrow restoring the top. The growing-up grass is called aftermath, and property of plants to form it is called aftermathability. Thanks to aftermathability of plants it is possible to reuse hay harvest during summer and use pastures many times. On hay harvest and pastures the aftermath is generally formed thanks to aftergrowth of the tuncated sprouts or formation of buds of new sprouts. Plants with the truncated sprouts after bevelling or browsing still have big surface of the leaves which are near to the surface of the soil, in comparison with the plants having extended sprouts.

Features of aftergrowth of grasses aren't studied enough, exsisting publications reflect features of aftergrowth of tropical and subtropical grasses [1, 2, 5, 7, 12- 15, 20]. In this regard research of aftergrowth of the grasses is of the utmost interest, being characterized by a variety of biomorphes and making the main economic and botanical group in a crop of pastures in many areas [3, 6, 8, 10].

The aim of our researches was study of features of aftergrowth of grasses. The research problem included division of grasses into groups on nature of aftergrowth and determination of dynamics of the nutrients accompanying this process.

METHODS

For experiment fodder grasses were used as the most important in the economic relation. Route inspections, expeditions as the considerable part of our work, were carried out in the territory of the Republic of Mordovia. Stationary observations were also made over fodder and grain grasses by constant sampling and defining biometric indicators. In some experiences each 15 days the whole plants are got out (to 10−12 copies of each species), described and the information is fixed for thorough studying. We assume I. G. Serebryakov's technique as a basis (1954) [17].

Studying aftermathability of some grasses their herbage was cut in optimal period of development with the following observation of harvest formation. The specificity of aftergrowth of some sprouts was defined for every species. In a given time after alienation the plants were dug out for laboratorium inspection. The quantity of sprouts that appeared was counted up and the buds from which sprouts appeared were defined. The computation of new structures was performed for 100 ratooned sprouts in 5-6 fold frequency. The daily gain of sprouts of aftermath was defined according to some species and their development was observed. The peculiarities of treatment in the test area were defined by the research tasks.

Biochemical characteristics were studied by the common methods. Biochemical characteristics were studied in chemical laboratory according to changes in forms of nitrogen (basing on Kjeldahl), phosphorus (basing on Lowry) and saccharides (basing on Bertrand). Data on dynamics of saccharides, protein (their increase or reduction) served as the main indicator of intensity of metabolism in plants. All indicators were determined as far as the formation of different phytomers was completed (by reference to the leaves which have finished their growth) before transition of plants to a tillering phase.

MAIN PART

Despite significant species differences in formation of buds by bions, a certain regularity is traced in nature of aftergrowth of the grasses, first of all presenting in proportion of various groups of buds that take part in reproduction of their herbage as evidenced by data of our experiences in Mordovia (herbage was cut off at the height of 6-8 cm with the subsequent calculation of number of the formed sprouts at 100 ratooned ones in 5-6-fold frequency) during the summer period.

After alienation grasses aftergrow differently: some types renew mainly by elevated buds, others by subterranean ones. For example, the grasses that form rhizomes (*Bromopsis inermis*, *Calamagrostis epigeios*, etc.), generally aftergrow by buds of subterranean structures, and the types that have a large number of truncated and stoloniferous sprouts in the structure of bions (*Agrostis stolonifera* L. *Phleum pratense*, etc.) aftergrow by elevated groups of buds. Apical buds are of great importance at 44% of the studied types in

Mordovia. The defining role in formation of aftermath belongs to the buds of such types as *Deschampsia cespitosa*, *Dactylis glomerata*, *Phleum pratense*, etc. in which structure the truncated sprouts prevail. The value of lateral buds of diageotropic sprouts in aftermath formation is of small account despite many types have these structures. The significant role belongs to them in aftergrowth of the stoloniferous grasses.The lateral buds of apogeotropic sprouts are of great importance in aftermath formation of many grasses. For example, the lateral buds of *Agrostis stolonifera* sprouted about 67% in Mordovia. Their role is significant in herbage restoration of the tall-growing grasses which don't form truncated sprouts (*Bromopsis inermis*, *Calamagrostis epigeio*s, etc.) is over 20%. The value of buds of a tillering zone in restoration of herbage of grasses is rather significant though the proportion of different types in aftergrowth of aftermath varies greatly. The majority of sprouts are formed by buds of a tillering zone of such types as *Dactylis glomerata*, etc. Buds of rhizomes account for 50% of formation of the aftermath of tall-growing rhizomamous grasses.

In the environment of Mordovia the proportion of buds of diageotropic sprouts in formation of aftermath of grasses was also low. This is due to more intensive taking of the adjacent areas by each bion associated with temperature increase during the summer period (to 300 and above), improvement of conditions of vegetation for grasses with C_4 - type of photosynthesis and weakening of the competition on the part of the types of midlatitudes that grew in the early spring. High temperature of summer favors to development of the heat-tolerant grasses the bions of which are capable to vegetate rather quickly due to rooting in nodes of the stoloniferous sprouts. The analysis of structure of aftermath of grasses shows that distinctions in aftergrowth of different types occur due to nature of their tillering: the more types of sprouts are in structure of bions, the more groups of buds take part in aftermath formation. The aftergrowth of some grasses after defoliation depends on a proportion of truncated and the stoloniferous sprouts, shoot buds of which are below the alienation level as a rule. The growth cessation of sprouts occurred every time when the cut was below the top node. The removal of the top part of the sprout, where the active meristem concentrates, paralyzes its growth and even leads to death. During growth of maternal sprout, many buds of a tillering zone and also of elevated phytomers are at rest and don't expand. Cutting of a top leads to transition to growth of lateral buds that were at rest. Removal of an apex of the maternal sprout also stimulates the growth of sprouts from buds of rhizomes and stolons.

Thus, on nature of aftergrowth, grasses can be divided into the following groups: 1) aftergrowing generally by the subterranian buds at a low cut, not forming the truncated sprouts and losing all leafy surface after alienation (rhizomatous types); 2) forming truncated sprouts with long vaginas (their apical buds take place on a surface of the soil and often alienate), which partially keep an assimilatory surface after a cut and aftergrow by the remained apical buds and buds of a tillering zone (tall growing types of friable sod); 3) aftergrowing generally by apical buds, standing out for preservation of considerable part of a leafy surface after alienation (short growing pasturable grasses).

The nature of growth of grasses is also defined by quantity and nutrient composition in storage organs which are used for breath and formation of new structures, what many authors [4, 19] note. The most dynamic substances are carbohydrates of stubble which are presented by assimilations and are used as an energy-yielding material for formation of new organs. Hydrolysis of carbohydrates of other organs happens a bit later. Intensity of vegetative renewal of grasses, as well as other plants, is defined by the amount of storage compound which each plant have been saved up especially at the first after defoliation [16]. Our researches of dynamics of protein, monosaccharides, disaccharides and starch after bevelling of grasses during the summer period in Mordovia visually testify to it. Right after bevelling decrease in soluble carbohydrates is observed at first in stubble, and then in the subterranean organs. In process of growth of leaves and strengthening of photosynthesis the amount of soluble carbohydrates increases. The first three days after alienation are characterized by sharp decrease in the content of carbohydrates in elevated structures of all types while in subterranean part their quantity changes a little. During this period, obviously, process of hydrolysis and use of carbohydrates for breath intensively proceed. Process of growth is mild. Only the first convoluted leaf comes from the apical buds of all types. The content of protein practically doesn't change in all structures. Fast mobilization of storage compound of stubble is obviously explained by early aftergrowth of the truncated sprouts and awakening of the remained lateral buds of the apogeotropic sprouts.

In 6 days after bevelling during expansion of the first leaf in elevated part, the content of mono- and disaccharides of all types decreased to a minimum, and protein decreased by 2-3 times; the amount of starch considerably decreased in subterranean organs, especially in organs of *Dactylis glomerata*. Mild decrease of

mono- and disaccharides in roots, obviously occurs due to conversion strengthening. Decrease in protein is also noted. The obtained data specify that the storage compound continues to be spent as the products of photosynthesis, that is formed in young leaves, isn't obviously enough for forming new sprouts. In 9 days after a cut (expansion of the second leaf) further decrease in amount of starch is observed because of increase of consumption of plastic material for formation of new organs and dying off of the part of old roots. By 12th day new sprouts of all grasses had 2-3 expanded leaves, and *Bromopsis inermis* had 4; decrease in water-soluble saccarides and starch is observed. 15 days later after beveling, growing sprouts had the fourth and sixth leaves, and stabilization occurs in the content of carbohydrates, and some types had the increase in simple carbohydrates. The last obviously occurs due to release of saccarides from elevated organs where their formation considerably increased because of photosynthesis strengthening. Various process of change in the content of carbohydrates and their fractions by types during aftergrowth of aftermath can be fairly explained by data of ratio of storage organs of studied types. On the average 100 sprouts of *Phleum pratense* have more roots and rhizomes, than other types have formed (by weight). Therefore stabilization in the content of storage carbohydrates of these types was observed by 9-12 day after a cut. For example, *Poa pratensis* L. s. l. has only 115 g of solids of storage organs that is accounted for 100 sprouts, *Phleum pratense* has 409. Bevelling considerably influences on a ratio of storage organs. Weight indicators of the remains of stubble, tillering zones and roots are exposed to the greatest change. *Poa pratensis,* the roots of which are the most important source of storage, has decrease in the mass of active roots more than twice in half of a month after cutting; the mass of roots of *Bromopsis inermis* and *Phleum pratense* decreases less considerably that is due to continuation of vigorous activity of the roots formed by rhizomes. The high percent of the remains of stubble of *Poa pratensis* is explained by continuation of their vegetation after a cut because of formation of lateral sprouts.

SPECULATION

Aftergrowth of plants depends on their biological properties, period of bevelling (browsing), conditions of growth, degree of providing plants by storage nutrients. The analysis of dynamics of carbohydrates in storage organs of boreal grasses shows that their usage during the first period after alienation (the period of intensive breath) is higher, than of protein; carbohydrates of stubble are most actively used; coming of plants into a phase of intensive formation of new organs (in 6-9 days after a cut) is due to continuation of usage of carbohydrates and noticeable decrease in protein in stubble and subterranean organs; stabilization of carbohydrates in storage organs and their some accumulation coincide with formation of sprouts with 3-4 leaves; the increase in carbohydrates in storage organs occurs at the beginning due to increase of monosaccharides and disaccharides.

The study of reproduction peculiarities of various grasses shows that there are definite differences in speed of herbage formation between some vegetative structures of plants that are used for renewal [9].The peculiarities of formation of aftermath with the participation of various groups of buds have a practical bearing, pointing out the necessity of detailed approach to the problem of defoliation of pastures [4, 11].

CONCLUSION

Aftergrowth of grasses is defined by features of their tillering and formation of different groups of buds. Buds are divided into five groups according to the location and a role in formation of aftermath after a defoliation of herbage: apical, lateral buds of diageotropic sprouts, lateral buds of apogeotropic sprouts, buds of a tillering zone and buds of rhizomes differing with biometric and biochemical characteristics. Specific of boreal grasses is their high ability to aftergrowth by lateral buds of elevated apogeotropic sprouts. The grasses relating to the group of the rhizomal - stoloniferous and the rhizomal differ by broad participation in formation of aftermath of lateral buds of the apogeotropic sprouts (rhizomes and stoloniferous).

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