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THE IMPACT OF TECHNOLOGICAL MEASURES ON GROWTH SURVIVAL OF PLANTS OF WINTER INTERMEDIATE CROPS DURING THE WINTER PERIOD

ВПЛИВ ТЕХНОЛОГІЧНИХ ЗАХОДІВ ВИРОЩУВАННЯ НА ВИЖИВАНІСТЬ РОСЛИН ОЗИМИХ ПРОМІЖНИХ КУЛЬТУР ВПРОДОВЖ ЗИМОВОГО ПЕРІОДУ

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The results of research on the influence of elements on technology of growing of winter intermediate crops on accumulation of hydrogen-soluble carbohydrates in plants and their survival during the winter period are presented. It has been found that the most resistant varieties (AD 3/5, AD 44, Polisky 29, AD 52) accumulate as much water-soluble sugars as rye, which ensures their high competitiveness in terms of winter hardiness at all sowing dates. The maximum winter hardiness was observed for sowing 5-25,09 – 81,2-91,0%.

Key words: *triticale, winter intermediate crops, sowing period, variety, water-soluble sugars content, plant survival.*

Introduction.

An important condition for the formation of high harvest of winter crops, regardless of their purpose, is the ability of plants to resist unfavorable winter conditions, which largely depends on the development of crops until the termination of vegetation in autumn, the effect of external factors and the internal state of the plant [2].

Winter plant resistance is caused by a special organization of the plant body, adapted to quite different than in the summer of vegetation conditions: Strong dewatering of cells and sharp reduction of metabolism intensity. The biological properties of the variety and the time of sowing are important factors that influence the stability of plants. The latter, determine age, conditions of vegetation and internal biochemical-physiological processes [1].

It is proved that the frost- and winter resistance of plants significantly depend on the physiologic and biochemical condition of the plant organism, wich characterized by a complex of such indicators as the content of sugar, starch, structural and water-soluble proteins, lipoids, coloidal, osmotic-bound, free water and dry mass. However, the main energy substances to protect plants from the effects of low ambient temperatures and a number of other adverse factors of winter are carbohydrates [4].

According to the observations of Tumanov I.I. [5], the main amount of sugar in plants is accumulated during the first phase of the garnish, which takes place in the late autumn period at the average temperature of air about +5-0 °C and in optimum

lasts 2 weeks. Such thermal regime is insufficient for the intensive growth of plants and their consumption of plastic substances on growth processes, however, favorable for the process of photosynthesis, which results in accumulation of various forms of sugar, the protective mechanism of which consists in increasing stability of biookoloids against coagulation at dewatering protoplasm and increasing concentration of cellular juice. And the total amount of sugar affects the winter resistance more than their different forms.

Opinions of many researchers differ significantly on the amount of sugar accumulation by plants of different sowing dates. Some believe that the largest number of them is accumulated by late sowing times, while others are accumulated by early sowing. In this aspect, the study of triticale, especially biological reaction of its varieties to conditions and level of accumulation and nature of consumption of sugar, represents a significant interest [3].

The purpose of the research is – to determine the influence of weather conditions and elements of technology of growing winter intermediate crops on accumulation of hydrogen-soluble carbohydrates in plants and their survival during the winter period.

Research materials and methods.

Field investigations were conducted under the conditions of the "Agronomic Research Station" of the NULES of Ukraine on the black earth of typical low-humus. Object of research: wheat Poliska 90 (control), rye Kyiv fodder (control) and triticale variety (AD 3/5, AD 44, ADM 9, Poliska 29 ADM 11 AD 52), sown in 5 calendar terms: August 25, 5, 15, 25 September and 5 October. Predecessor - corn for silage [6].

Research results and their discussion.

It was found that the ability of triticale plants to accumulate carbohydrates is determined by the degree of their development, the time of termination of active vegetation and hydrothermal conditions during the hardening period. According to the obtained results, crops for sowing in the period from September 5 to October 5 are marked by the maximum amount of synthesized water-soluble carbohydrates - 17.9-21.2% of dry matter, depending on the variety (tab. 1).

Plants of August sowing, in all years of research, have accumulated the smallest quantity of spare substances – (17,2-18,6%), which can be explained by considerable consumption of carbohydrates for respiration and growth processes of growing vegetative mass [5]. Due to the intensive growth of young plants and, consequently, the increased consumption of plastic substances, low carbohydrate content was observed in plants of the October sowing period - 17.3-18.7%.

Studies have shown that, as for rye and wheat, the synthesis of sugars in triticale plants is significantly affected by moisture conditions. Dehydration of tissues is important during the transition of plants to a state of forced rest, so excessive moisture content in them complicates the preparation of plants for winter conditions. We found that in years with excessive rainfall, plants of late sowing were particularly affected, which due to early winter and unfavorable conditions for early emergence, entered the winter in the phase of seedlings without a formed knot of tillering, and therefore insufficient the amount of assimilated plastic substances - in terms of varieties at the level of 14,6-15,2%.

Tab. 1 - The content of water-soluble carbohydrates (amount of sugars) in winter triticale plants, depending on the time of sowing and variety, %

Culture, variety	Sowing period				
	25.08.	5.09.	15.09.	25.09.	05.10.
During the termination of the autumn vegetation					
Rye (control)	18,4	19,3	21,1	20,6	18,7
Wheat (control)	16,7	17,5	19,1	18,4	16,6
AD 3/5	18,6	19,3	21,2	20,7	18,7
AD 44	18,4	19,1	20,9	20,4	18,7
ADM 9	17,4	18,0	19,8	19,3	17,5
Polisky 29	18,2	18,7	20,5	20,4	18,5
ADM 11	17,2	17,9	19,6	19,2	17,3
AD 52	17,8	18,4	20,6	20,3	18,4
During the restoration of spring vegetation					
Rye (control)	7,9	8,6	11,1	10,7	9,6
Wheat (control)	8,4	9,1	11,2	10,5	9,2
AD 3/5	7,9	8,8	11,1	10,8	9,7
AD 44	7,9	8,7	11,1	10,7	9,6
ADM 9	7,2	8,1	10,2	9,7	8,6
Polisky 29	7,8	8,5	10,9	10,4	9,5
ADM 11	7,4	8,2	10,5	9,9	8,8
AD 52	7,7	8,5	10,8	10,3	9,4

In the conditions of late termination of vegetation, gradual decrease in soil moisture and a long period of light in plants, the processes of photosynthesis were more active, as a result of which a significant amount of sugars accumulated.

On average, over the years of research, the highest intensity of sugar accumulation was characterized by grades AD 3/5, AD 44, Polisky 29 and AD 52.

However, the high content of sugars in plants at the beginning of winter does not always provide high winter resistance of crops - more important is the nature and economy of carbohydrate consumption during the winter and the content of these substances during spring regeneration [5].

At the end of winter, the highest content of carbohydrates is characteristic of plants obtained for sowing in the period from September 15 to October 5 – 8,6-11,1% of dry matter. Early-sowing plants contained significantly less sugar, which is associated with increased respiration of overgrown plants, the intensity of which increased during the winter thaw, which was especially characteristic of years with frequent thaws and, consequently, periodic restoration of plant vegetation.

Among the cultivars studied, significant losses of sugars during the winter period are characteristic of the cultivars ADM 9 and ADM 11, which may be due to the intensive development of their aboveground mass in the autumn. Sugar grades AD 3/5 and AD 44 were used most economically during the winter.

Resistance to adverse winter conditions is a genetic trait, the level of winter hardiness is largely determined by weather conditions during winter, preparedness of

the plant body to a state of forced rest and stressful winter conditions, which confirms the results of annual surveys of plant density after overwintering (tab. 2).

Tab 2 - Survival of winter triticale plants during the winter period depending on the sowing period and variety, %

Culture, variety	Sowing period				
	25.08.	5.09.	15.09.	25.09.	05.10.
Rye (control)	84,5	88,4	90,3	85,6	81,7
Wheat (control)	61,5	66,1	65,9	64,2	59,8
AD 3/5	83,9	89,2	91,0	86,4	81,2
AD 44	83,9	88,4	90,6	85,8	80,8
ADM 9	79,3	84,0	85,6	81,2	75,4
Polisky 29	82,1	87,0	88,2	84,3	79,6
ADM 11	79,2	84,4	85,5	81,6	75,3
AD 52	82,3	86,9	88,8	84,0	78,9

According to our observations, depending on the variation of the depth of the bush and the accumulation and intensity of carbohydrate consumption, plant density and stem density changed significantly – one of the main elements of crop productivity regardless of their purpose: grain or green fodder.

On average, over the years of observations, the most resistant to the complex of adverse conditions of the winter period were plants for sowing in the period from 5 to 25 September – the number of preserved plants of winter triticale was at the level of 81,2-91,0%. Significant liquefaction was observed in August crops - the survival rate for the winter did not exceed 79,2-83,9%. Moreover, in years with extreme weather conditions of the autumn-winter period in terms of winter hardiness triticale crops were at the level of rye or even exceeded it. Studies have also shown that depending on the weather conditions of autumn vegetation and winter, the optimal winter hardiness sowing dates may be shifted.

Among the studied varieties, high winter resistance was noted varieties AD 3/5, AD 44, Polisky 29 and AD 52, low - ADM 11 and ADM 9. The latter is characterized by a rapid reaction to temperature increase during the winter period, which considerably reduces its resistance, especially in the case of sharp cold.

Conclusions.

It is noted that the most stable winter resistance (AD 3/5, AD 44, Polisky 29, AD 52) accumulate water-soluble sugar as much as rye, as they provide their high competitiveness in terms of winter stability in all the terms of sowing. The maximum stability was marked by the sowing of 5,0-25,09 – 81,2-91,0%.

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Викладені результати досліджень щодо вивчення впливу технологічних прийомів вирощування озимих проміжних культур на ріст і розвиток рослин в осінній період. Встановлено, що зі зростанням тривалості осінньої вегетації зростали висота рослин, кількість вузлових коренів та маса сирої надземної маси. За сівби 5 жовтня рослини всіх культур та сортів тритикале значно відставали як у стадійному розвитку, так і за параметрами фітометричних показників. Найбільш доцільною є сівба озимих культур у період з 5 до 15 вересня.

Ключові слова: *тритикале, жито, пшениця, строк сівби, сорт, висота рослин, вузлові корені, маса рослин.*

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