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STEM DENSITY OF WINTER INTERMEDIATE CROPS DEPENDING ON WEATHER CONDITIONS AND TECHNOLOGICAL TECHNIQUES OF GROWING IN THE AUTUMN PERIOD

ЩІЛЬНІСТЬ СТЕБЛОСТОЮ ОЗИМИХ ПРОМІЖНИХ КУЛЬТУР ЗАЛЕЖНО ВІД ПОГОДНИХ УМОВ ТА ТЕХНОЛОГІЧНИХ ПРИЙОМІВ ВИРОЩУВАННЯ В ОСІННІЙ ПЕРІОД

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Annotation. *This article presents the results of research on the study of the influence of technological methods of cultivation and hydrothermal resources on the formation of stem density of winter cereals intermediate crops. It is established that the most appropriate is sowing of culture in the period from 5 to 15 September.*

Key words: *triticale, rye, wheat, sowing period, variety, hydro-rothermic resources, tillering, stem density.*

Introduction. The use of winter triticale in the spring link of the green conveyor allows to provide animals with high-quality green fodder in the period between the mowing of winter rye and the first mowing of perennial grasses. The culture is actively increasing the green mass, primarily due to good foliage and high photosynthetic potential. It is also valuable that triticale plants retain their green color longer during the growing season, and therefore, depending on the variety, the animals eat them well for 12-20 days. Today there is a sufficient set of varieties of triticale, different in intensity of green mass formation, which allows to exclude from the use of winter wheat crops for green fodder and even free part of the area of crops of perennial grasses of the first mowing for hay for the winter stall. Today, it is also important to determine the role of agronomic measures in weakening the negative impact of climate change in recent decades on plant productivity [2].

One of the most important conditions that determines the productivity of crops, regardless of their purpose, is the optimal density of plants. Liquefied stems exclude the possibility of high yields, has bad influence on overwintering of winter plants; too dense - increases the risk of plant diseases and pests. Stem density is determined by field germination, productive cultivation of plants, preservation of their cultivated vegetations and is one of several assessments of the state of winter crops at the time of completion of the first cycle of development [1, 3].

The purpose of the research is to establish the influence of weather conditions and technological measures of cultivation on the stem density of winter intermediate

crops before the cessation of autumn vegetation in the Forest-Steppe conditions of the right-bank Ukraine.

Materials and methods of research. Field experiments were conducted at the Agronomic Research Station of the National University of Life and Environmental Sciences of Ukraine on chernozems of typical low-humus medium loam.

Object of research: wheat Polesskaya 90 (control), rye Kyiv fodder (control) and varieties of triticale (AD 3/5, AD 44, ADM 9, Polisky 29, ADM 11, AD 52), sown in five calendar terms: August 25, September 5, 15, 25 and October 5. Predecessor - corn in silage.

Research results and their discussion. According to a number of authors the optimal development of plants in the autumn and their resistance to adverse winter conditions is provided when from sowing to the transition of the average daily temperature through 5 °C is 50-70 days. During this period, the plants accumulate the sum of effective temperatures (≥ 50 °C) about 450-580 °C, during the period of germination-termination of autumn vegetation - 400-500 °C, which causes, with sufficient moisture, the formation of the optimal number of shoots (2-4). However, there is no consensus on the optimal parameters of plant development at the end of the growing season, which is due to the zonal growing conditions and varietal characteristics of the culture [3].

In the experimental field, the range of these abiotic factors was formed during sowing on September 15. At the same time, the period of sowing-termination of autumn vegetation averaged 53,3 days, during which crops accumulated 452 °C effective temperatures, which is 2,2 times more than during this time accumulate October crops and 1,7 times less than in August (table 1).

1. Hydrothermal supply of winter triticale crops for the period sowing-termination of autumn vegetation depending on the sowing date

Indicator	Sowing period				
	25.08.	5.09.	15.09.	25.09.	05.10.
Average daily air temperature, ^{0}C	10,9	9,6	9,0	7,8	6,9
The sum of average daily temperatures, ^{0}C	810	609	483	343	234
The sum of temperatures ≥5 ^{0}C	779	578	452	312	203
/ number, days	64,7	53,7	43,7	33,7	23,7
The sum of temperatures ≥10 ^{0}C	579	378	275	148	71
/ number, days	40,0	29,0	21,7	12,3	7,0
The amount of precipitation, mm	95,0	93,3	69,2	46,1	27,6

In general, depending on the sowing period, the period from sowing to the termination of autumn vegetation was 33,3-74,3 days, from germination to the cessation of autumn vegetation – 10,7-64,0 days with significant variation over the years of research.

It is noted that the average daily temperature of the period of germination-termination of autumn vegetation for the same sowing dates in different years of research almost didn't change. The difference in sowing dates was also insignificant according to this parameter – 9,7-5,8 °C. More significant is the difference in the sum of temperatures. On average, during the period of germination-termination of autumn vegetation, August sowing, compared to October, were 5,8 times more provided with

the amounts of average daily, 6,6 times effective and 12,5 times - active temperatures. A similar pattern was observed for rye and wheat.

One of the main components of crop productivity is the density of stems before the termination of autumn vegetation, which is largely determined by the degree of tillering of plants - a parameter that significantly determines the viability of the plant and its overwintering and is, in fact, a reflection of the meteorological complex, agronomic and soil conditions during the autumn period.

It was investigated that the most favorable conditions for the formation of the optimal number of shoots were formed on average during sowing on September 15-25 (table 2).

2. Tillering of winter triticale plants before the termination of autumn vegetation depending on the sowing date and variety, pcs/plant

Culture, variety	Sowing period				
	25.08.	5.09.	15.09.	25.09.	05.10.
Rye (control)	7,3	6,3	4,5	2,6	1,5
Wheat (control)	6,1	5,1	3,5	2,0	1,3
AD 3/5	5,7	4,6	3,1	1,8	1,1
AD 44	5,8	4,9	3,3	2,0	1,2
ADM 9	7,1	5,9	4,0	2,3	1,3
Polisky 29	6,1	5,0	3,7	2,1	1,3
ADM 11	6,8	5,5	3,7	2,1	1,2
AD 52	6,7	5,5	4,0	2,3	1,4

The most favorable conditions for the formation of the optimal number of shoots were on average for sowing on September 5-25. At the same time, the degree of plant development of the same sowing dates in different vegetation years varied significantly, which was due to different hydrothermal resources during the autumn. It is noted that with the reduction of vegetation duration the shoot-forming ability of all crops decreases - in rye from 7,3 to 1,5, in wheat - from 6,0 to 1.3 shoots / plant; triticale according to this indicator, in terms of varieties, situated in an intermediate position - the coefficient of its tillering ranged from 7,1-5,7 (August 25) to 1,4-1,1 (October 5).

The optimal number – 2,8-5,5 non-overgrown shoots on triticale plants was formed when they accumulated 312.1-460.5 ^{0}C of the sum of average daily and 278,0-426,4 ^{o}C effective air temperatures. Under such thermal conditions, the active vegetation of crops from the germination phase to the termination of autumn vegetation lasted on average 39–54 days at an average daily air temperature of 8,0-8,7 ^{o}C.

The most intensive autumn tillering was marked ADM 9. Sufficient for the formation of 2,0-4,9 shoots / plants of ADM 9, is the sum of average daily temperatures at 211,9-427,2 ^{0}C, effective – 187,6-402,9 ^{0}C with the duration of the period of germination-termination of autumn vegetation 28-49 days. Higher values of the sums of positive temperatures caused the plants to overgrow.

Polisky 29 variety was characterized by the highest plasticity before sowing dates (August 25-October 5), as the formation of the optimal number of shoots – 1,9-5,2 took place over a wide range of accumulated average daily amounts (211,9-538,0^{o}C). and effective – 187,6-510,1 ^{0}C temperatures. Variety AD 52 sufficient for the formation of 2.1-5.5 shoots is the sum of average daily temperatures at the level of 211,9-460,5 ^{o}C and effective – 187,6-426,4 ^{o}C.

Among the studied cultivars, the least plastic in terms of tillering intensity was the cultivar ADM 11, which formed 1,9-5,5 shoots only under the condition of accumulation of 223,5-460,5 °C of the sum of average daily and 195,6-426,4 °C of effective air temperatures during the period of the emergence- period of autumn vegetation 36-54 days. The specified range of required temperatures characterizes the specified variety as unsuitable for sowing in the late calendar period.

Before the onset of winter, the density of stems in crops decreased from the first to the fifth sowing period, respectively from 2234-2745 to 445-544 shoots / m^2 depending on the variety (table 3).

3. Density of winter triticale stalks at the time of termination of autumn vegetation depending on the sowing date and variety, pcs / m^2

Culture, variety	Sowing period				
	25.08.	5.09.	15.09.	25.09.	5.10.
Rye	3005	2910	2110	1150	633
Wheat	2358	2200	1548	847	497
AD 3/5	2234	1976	1427	785	445
AD 44	2241	2078	1519	829	479
ADM 9	2673	2481	1799	966	513
Polisky 29	2423	2244	1708	897	539
ADM 11	2745	2493	1769	887	488
AD 52	2605	2389	1842	943	544

In terms of the studied varieties due to intensive tillering high density of stems for almost all sowing dates formed the variety ADM 9 - 2673-513 shoots / m^2, in contrast to which AD 3/5 was characterized by the least powerful stem - 2234-445 shoots / m^2 depending on the sowing date. Varieties AD 52 and Polisky 29 predominate in stem density at sowing after September 15; AD 11, on the contrary - until September 15 inclusive.

Conclusions. Thus, the density of stems is such an element of productivity, which can be regulated by agronomic measures, including sowing dates and varietal composition. The most expedient is the sowing of winter triticale from 5 to 15 September.

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Анотація. *В даній статті викладені результати досліджень щодо вивчення впливу технологічних прийомів вирощування та гідротермічних ресурсів на формування щільності стеблостою злакових озимих проміжних культур. Встановлено, що найбільш доцільним є сівба культури в період з 5 до 15 вересня.*

Ключові слова: *тритикале, жито, пшениця, строк сівби, сорт, гідротермічні ресурси, кущистість, щільність стеблостою.*

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