THE PIGMENT FOUND OF WINTER TRITICALE PLANTS DEPENDING ON THE FORERUNNERS

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Abstract

The article presents the results of the studies on the content and accumulation of plastid pigments in various plant organisms of Ingen 93 variety of triticale cultivated after different forerunners in 2014. It is noted that after the following forerunners: grain peas and oats + vetch in stem elongation stage chlorophyll a and b in leaves are much higher than in later phase – ear emergence, which is 15.12 mg/g of absolute dry matter and 9.28 in cereal peas and 13.02 mg / g of absolute dry matter and 8.71 mg / g of substance absolute dry matter after cloves + oats. The organisms of winter triticale accumulate different amounts of chlorophyll - the leaves 44.3-45.9%, the stems - 41.6-43.3% and 12.4% of the quantity represented throughout the plant. Higher level of chlorophyll in winter triticale plants grown after peas has contributed to the formation and higher production growth of 597 kg /ha compared to the forerunner vetch+oat.

Key words: carotenoids, chlorophyll, forerunner, photosynthesis, triticale

Winter triticale is a relatively new species created by man. In the group of cereal crops, it still occupies a modest place in the production sector. However, interest in this crop grows every year, thanks to the unique combination of high ecological plasticity of winter rye and yield and quality of winter wheat. In Moldova, a number of high-yielding varieties of winter triticale with good grain qualities were bred. The development of elements of the technology of cultivation of this crop in a multi-factorial experience is held by the Department of Crop Sciences of The State Agrarian University of Moldova.

MATERIAL AND METHOD

The research was conducted in 2014 on the fields of the Training and Experimental Station "Chetrosu" of the State Agrarian University located in the Central Agroclimatic Zone of Moldova.

The object of research was the variety of winter triticale Ingen 93, developed at the Institute of Genetics, Plant Physiology and Protection of the ASM.

The sowing of winter triticale was carried out on October 9, after two forerunners, peas for grain and vetch + oats with a seeding rate of 5.0 million seeds per hectare.

The content of plastid pigments in winter triticale plants was determined in the phases of booting and earing in all green organs of plant by the method of Holm, Wetstein.

The harvest of grain was done by every plot. Yields were calculated for 100% purity and 14% moisture. Statistical processing of yield data was carried out by the method of analysis by B.A. Dospekhov. (1985). The soil of the experimental site is carbonate cernozem, weakly humified on loess-like loam. The humus content in the arable layer is 2.5-3.0%, total nitrogen 0.17-0.20%, phosphorus 0.14-0.16% and potassium 1.4-1.6%.

The mechanical composition of the soil is medium loam; the reaction of the soil solution is pH 7.0-7.2 neutral to slightly alkaline. The effervescence of carbonates from 10% HCl begins from the surface and intensifies with the deepening.

Climatic conditions of 2013-2014 agricultural year were in fact favorable for the growth and development of winter triticale plants. The average air temperature over the seasons exceeded the norm by 1.3-3.2 ° C, and in general for the year by 1.7 ° C. The average daily air temperature was 11.7 ° C, versus 9.9 ° C, for the average multi-year.

The amount of precipitation for the current year was 430.2 mm, which is 61.8 mm or 12.6% less than the average multi-year period. During the fall period, the amount of precipitation was 100.4 mm, which was at the level of average quantity. During the spring and summer periods, the total precipitation was 10.7 mm below the average. However, the observed precipitation deficit of precipitation did not have a significant effect on the formation of the grain yield of winter triticale plants.

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RESULTS AND DISCUSSIONS

Pigments that absorb quantum color in the process of photosynthesis are chlorophyll a and chlorophyll b magnesium compounds of porphyrin nature and carotenoids, compounds of polyazopren nature (Бриттон, Г., 1986; Дэвис, Д., Джованелли, Т., 1966). The content of photosynthetic pigments, as well as their ratios, are indicators of hereditary characteristics of plants. These indicators experience certain changes in the growth process, depending on the strength of the exogenous factors.

The main photosynthesizing plant pigments are chlorophyll a, which carries out oxygenic photosynthesis (with the release of oxygen). In various organs of green plants, chlorophyll b, amounting to 36-68% of the amount of chlorophyll a.

This is an additional resource that extends the absorption spectrum of solar radiation (Бриттон, Г., 1986; Георгиев, Н.А., Дерендовская А.И., Андрейцов, В., 1986.).

Plastic pigments in higher plants are represented by two groups of substances - chlorophylls a and b and carotenoids that form part of the light-absorbing complexes of photosystems I and II participating in the absorption of light quanta.

The process of photosynthesis underlies the formation of the organic mass and productivity of plants. Optimization of environmental factors causes an increase in the photosynthetic surface of plants-the area of leaves and photosynthetic pigments. In plants of winter triticale variety Ingen 93 growing after peas as a forerunner, in the phase of stem elongation, the greatest accumulation of chlorophyll "a" is noted in the leaves, amounting to 11.06 mg/g of dry matter (Table 1). Stems in this stage contain a much smaller amount of it - 1.57 mg/g of absolutely dry matter or 7 times less than in leaves.

Table 1

The content of plastid pigments in the organs of winter triticale plants variety Ingen 93 after forerunner peas for grain, mg/g of absolute dry matter

Pigments	growth stages				
	stem elongation		ear emergence		
	leaves	stems	leaves	stems	ears
chlorophyll a	11.6	1.57	6.18	1.73	1.43
chlorophyll b	4.06	0.99	3.10	0.96	0.80
a + b	15.12	2.56	9.28	2.69	2.23
carotenoids	2.86	0.50	1.68	0.46	0.56
a / b	2.72/1.0	1.59/1.0	1.99/1.0	1.80/1.0	1.79/1.0
chlorophyll / carotenoid	5.29/1.0	5.12/1.0	5.52/1.0	5.85/1.0	3.98/1.0
%, chlorophyll b / chlorophyll a	36.7	63.1	50.2	55.5	55.9

The concentration of chlorophyll b in the leaves in this stage was 4.0 mg/g of absolute dry matter or 36.7% of the amount of chlorophyll a.

In stems, the concentration of chlorophyll b is 0.99 mg/g absolute dry matter, which is 4 times less than in leaves. In stems, the chlorophyll a content of chlorophyll b is much higher than in leaves and is 63.1%.

The total content of chlorophylls a and b in leaves is 15.12 mg/g of absolute dry matter and in stems only 2.56 mg/g of absolute dry matter, which is 5.9 times less than in the leaves.

The content of yellow pigments in the stage of stem elongation, in the leaves is 2.86 mg/g of absolute dry matter and 0.50 mg/g of absolute dry matter in the stems, which is 5.7 times less than in the leaves.

The ratio of chlorophyll a to b in leaves is 2.72: 1, which is the highest in the experiment. Significantly lower the ratio of chlorophylls occurs when they are determined in stems 1.59: 1.0.

The ratio of green pigments to yellow in both organs of the plant is approximately the same and is 5.25: 1.0 in leaves and 5.12: 1.0 in stems.

In the next stage - the ear emergence, the highest amount of chlorophyll a is noted in the leaves - 6.18 mg/g of absolute dry matter, which significantly exceeds its concentration in other organs of plants of winter triticale in stems (1.73 mg/g absolute dry matter) and ears (1.43 mg/g absolute dry matter). The concentration of chlorophyll b is greatest in leaves of 3.10 mg/g. absolute dry matter tending to a sharp decrease in stems (0,96 mg/g of absolute dry matter) and ears (0.80 mg/g absolute dry matter). In all organs of plants, the amount of chlorophyll b is 50% or more relative to the chlorophyll a. The content of chlorophyll a and b in the ear emergence is less and is 44.1% and 25.9%, respectively, leaves and stems, with respect to the stage of stem elongation.

In plants of winter triticale grown on after forerunner vetch + oats, in the stage of stem elongation the concentration of chlorophyll a in the leaves is 9.30 mg/g. of absolute dry matter and in the stems 1.12 mg/g. of absolute dry matter which is 15.9% and 28.7%, respectively, to organs, less than the forerunner peas for grain (Table 2). The quantitative content of chlorophyll b in the leaves is 3.72 mg/g of absolute dry matter, and in stems 0.66 mg/g. of absolute dry matter, which is 8.4% and 33.3% less than the forerunner peas for grain.

Table 2

The content of plastid pigments in the organs of winter triticale plants variety Ingen 93 after forerunner vetch + oats, mg/g of absolute dry matter

Pigments	growth stages				
	stem elongation		ear emergence		
	leaves	stems	leaves	stems	ears
chlorophyll a	9.30	1.12	5.93	1.77	1.38
chlorophyll b	3.72	0.66	2.78	0.94	0.79
a + b	13.02	1.78	8,71	2.71	2.17
carotenoids	3.09	0.30	1.58	0.55	0.58
a / b	25.0/1.0	1.70/1.0	2.13/1.0	1.88/1.0	1.75/1.0
chlorophyll / carotenoid	4.21/1.0	5.93/1.0	5.51/1.0	4.93/1.0	3.74/1.0
%, chlorophyll b / chlorophyll a	40.0	58.9	46.9	53.1	57.2

After the predecessor vetch + oats, a higher content of yellow carotenoid pigments on the leaves is observed at 8% in the stem elongation stage.

In the ear emergence stage, the content of green pigments is reduced to 8.71 mg/g. absolute dry matter, and in the stems increases to 2.71 mg/g of absolute dry matter compared with the previous stage of stem elongation.

The concentration of carotenoids in the stem elongation stage decreases twice in leaves, and in stems it increases by 1.5 times.

The dynamics of accumulation of plastid pigments in the leaves of winter triticale grown after forerunner vetch +oats have the same pattern as after forerunner peas for grain.

Calculations of the accumulation of chlorophylls in various organs of plants of winter triticale variety Ingen 93 grown after different forerunners showed that their dynamics are the same for both forerunners (Table 3).

Table 3

Accumulation of chlorophyll in plant organs of winter triticale variety Ingen 93 (mg/plant) and grain yield, kg/ha.

Forerunners	The plant's organs						The hole plant	The yield of grain, kg/ha
	leaves		stems		ears			
	mg	% to plant	mg	% to plant	mg	% to plant		
Peas for grain	12.25	45.9	11.11	41.6	3.32	12.4	26.68	5107
vetch +oats	11.58	44.3	11.31	43.3	3.24	12.4	26.13	4510
± to forerunner	-0.67		+0.20		-0.08		-0.55	-597
% to peas	-5.5		+1.8		-2.4		-2.1	-11.7
LSD $_{05}$, kg/ha								313

Leaves account for 44.3-45.3% of chlorophyll, for stems - 41.6-43.3% and for ears of 12.4%. The chlorophyll content for both forerunners was almost equal to 26.68 mg/g and 26.13 mg to vetch-oats.

CONCLUSIONS

Based on the results obtained in the studies we can draw the following conclusions:

1. The content of chlorophylls in plants of winter triticale variety Ingen 93 in the stage stem elongation is much higher in leaves than in the stage ear emergency - 15.12 mg/g. of absolute dry matter and 9.28 mg/g of absolute dry matter after

forerunner peas for grain and 13.0 mg/g of absolute dry matter and 8.71 mg/g. of absolute dry matter after the forerunner vetch + oats.

2. The concentration of chlorophylls a + b in the leaves and stems after peas for grain is higher than after vetch + oats.

3. Pigment found of plants of winter triticale variety Ingen 93 is 44.3 - 45.9% composed of leaves, 41.6-43.3% of stems and 12.4% of ears.

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