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YIELD COMPONENTS AND GRAIN YIELD OF TEN GENOTYPES OF WINTER WHEAT (*Triticum aestivum* L.) CULTIVATED UNDER CONDITIONS OF A.R.D.S. SECUIENI

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Abstract

Straw cereals, especially wheat (Triticum aestivum L.), are the most widely cultivated plant in the world, grown in over 100 countries, and are a prime commercial source. In this respect, the study was carried out in the growing season 2021-2022, in the agro technology conditions of Secuieni area, Neamț County, Romania, where 10 genotypes of winter wheat (Triticum aestivum L.) were studied, including 9 wheat varieties cultivars (Trublion, Centurion, Katarina, Glosa, Aspekt, Izvor, Avenue, Solehio, Alcantara) and 1 wheat hybrids variety (Hyxperia). We have used a sowing density of 500 germinable grains /sm, 360 germinable grains/sm and 250 germinable grains /sm. In this paper are presented data concerning grain yield related to the unit area (kg/ha) and yield components represented by the plant density after emergence (plants/ sm), plant density in spring (main shoots and tillers/ sm), head plant density at the harvest time (ears/ sm), the weight of the grains in the spikes (g/ ear), as well as main physical indices related to the quality, i.e. thousand kernels weight (TGW) and hectolitre mass (HLM).

Key words: *grains yields, HLM, sowing rate, TGW, wheat varieties.*

INTRODUCTION

World food production remains dominated by cereals, the demand for increasing global food security is one of the main objectives of breeding programs aimed at increasing yields associated with heterosis (hybrid vigor) in wheat (Whitford et al., 2013; Longin et al., 2012).
For high yield potential of wheat cultivars varieties, the number of harvestable ears should be between 600 and 700/sm, which can be accomplished by sowing 500-550 seeds/sm (Cvetkovic et al., 2016; Hristov et al., 2012; Cociu, 2014). Winter wheat (*Triticum aestivum*) is a rustic and drought-tolerance plant, with very good adaptability to different climatic and soil conditions, from south to north areas.
In Romania, the areas cultivated with wheat have undergone minor changes in recent decades. Thus, in 1938, 2.5 million ha of wheat were cultivated with wheat, and the areas were gradually reduced to 2.1 million ha during 1979-1981. In recent years, surface oscillations can be reported, around this value (2.1-2.2 million ha) (Roman et al., 2012).
The three main groups of grain classification according to protein content are: feed wheat (below 12.5%), baking wheat (12.5-14.5%) and durum wheat or premium wheat (>14.5%) (Tabără et al., 2008).
Wheat cultivation offers the following advantages:
- kernels has a high content of carbohydrates and proteins, corresponding to the requirements of the human body;
- kernels has a good shelf life over long periods of time;
- the grains are easily transported over long distances;
- wheat grains have different alternatives for capitalization;
- wheat grains are an important source of trade on the world market;
- wheat can be grown in different soil and climatic conditions, ensuring satisfactory yields wherever it is grown;
- cultivation technology is completely mechanized and well developed, without special problems;
- wheat is a very good precrop for most crops;

- according to the early wheat varieties, successive crops can be sown, especially if the varieties are irrigated (Ion, 2010).

The vegetation period of winter wheat lasts, in the conditions of our country, about 9 months (270-290 days). During this period, from germination to maturity, wheat plants go through certain phenological phases (stages), which are recognized by changes in the external appearance of plants and which are accompanied by internal changes in plant biology. Usually, it is difficult to strictly delimit these phases, because they partially overlap, or run in parallel (Roman et al., 2011).

It is generally accepted to divide the vegetation period of wheat plants into the following phenological phases: germination (emergence); rooting; twinning; straw formation (elongation); sprouting - flowering - fertilization; grain formation and ripening.

In turn, the presented phases are grouped in the vegetative stage (period), characterized by the development of the vegetative organs of plants (from germination to twinning) and the generative (reproductive) stage, characterized by the development of inflorescence, flowers and berry formation (from beginning of straw elongation and until full ripening) (Axinte et al., 2006). Practically, choosing the good agricultural practices, especially related to the soil management, is a key factor in granting food, clean water, feed, energy, safe climate, diverse ecosystem services and biodiversity for future generations (Mușat et al., 2021).

The yields obtained, by applying organic system, show that differentiated results can be obtained, the choice of the working variant in relation to the crop plant being decisive (Guș et al., 2004).

In last years, organic system of winter wheat has gained more and more ground. Organic wheat is one of the best listed and most sought-after organic products on the world market.

For organic system, wheat varieties grown in conventional agriculture are also used.

Beneficial effects of organic farming at farm level:

- Restoring the natural balance of water and nutrients and infesting weeds, diseases, insects and other pests.
- The restoration of natural balances is achieved, both by using classical technological measures (fertilization, soil work, etc.) and by using ecological measures (rotation, associated and intercropping crops, agroforestry curtains, hedges, grassy strips, etc.), soil improvement measures (green manure, mulching, conservation work, etc.) and plant protection (preventive, biological, biotechnical methods, etc.).
- Sustainable growth of soil has the healthiest methods and means of restoring and preserving soil fertility by stimulating the activity of soil microorganisms and the use of compost, green manure and long rotations with perennials and annuals with rich and / or deep root system.
- Decreasing soil erosion. The reduction of soil erosion is achieved as a result of soil improvement (increasing the organic matter content and improving the structure) and its better coverage (mulching, protection crops, etc.).
- Better water conservation in the soil. High soil organic matter content leads to better water retention and conservation in the soil, which has the effect of reducing irrigation needs (Roman et al., 2011).
- Respecting the intrinsic needs of animals regarding food, shelter, movement (http://madr.ro/docs/dezvoltare-rurala/rndr/buletine-tematice/PT4.pdf-page 11).

In the case of *organic system* soil fertility must be maintained as follows:

- cultivation or tillage practices maintain or increase soil organic matter, improve soil stability and biodiversity, and prevent soil compaction and erosion;
- practicing multiannual crop rotation, including legume crops and green manures;
- the application of fertilizers of animal origin or organic matter, both preferably composted, from organic production;
- use of biodynamic preparations.

The sources of organic agriculture are represented by the three currents that have emerged in Europe. The first is the one that appeared in Germany in 1924 under the impetus of Rudolf Steiner, with the name of biodynamic agriculture. The second current, published in Britain in 1940, was based on the theory developed by Sir Albert Howard and Lady Eve Balfour under the name of organic agriculture. Last but not least, the third current, called organ-biological agriculture, was developed in Switzerland by Hans Peter Rush and H. Müller.

In the 1940s, in Switzerland, Hans Peter Rush and Müller H. emphasized the autarky of producers and the interest of short market circuits. These ideas have resulted in a method that the authors have called organic farming that focuses on renewable resources to ensure food security for the population. Organic farming is defined as a productive system that avoids the use of synthetic fertilizers, pesticides, plant growth regulators, feed additives in animal husbandry. Technological elements are allowed and practiced various sowing processes, use of plant resources after harvest, manure, legumes, green manure, mechanical cultivation, use of rock dust - a mineral source for maintaining high fertility, biological and physical control pests, diseases and weeds. The fundamental aims of this model of organic farming are: - long-term maintenance of soil fertility, - avoidance of all forms of pollution that can be caused by agricultural techniques, - production of sufficient quantities of food of high nutritional quality, - minimization of use fossil energy - non-recoverable energy in agricultural practice, (Toncea et al., 2012).

It has begun to take on a clearer outlook since the last decade in our country as well. Agriculture has been "ecological" since its inception, but in recent years the application of systematic vision and modern technologies to agriculture has been sought. *Organic farming* promotes the cultivation of the land through those means that ensure a balance between agroecosystems and the environment (generating "specific agro climaxes") (Puia & Soran, 1981).

It is based on the use of those means and six methods offered by society, by the scientific and technical achievements that ensure the obtaining of large, constant and high-quality productions, in the conditions of environmental protection. *Organic farming* is in fact becoming synonymous with the agriculture of the coming years, which ensures the integrity of the biosphere, maximizing the production capacity of agroecosystems and obtaining good quality products (Ionescu et al., 1978).

It will require more conscientious and imaginative work and will ensure an abundance of food while reducing fossil energy consumption, maintaining or increasing the natural fertility of soils, improving man's living environment and protecting the environment as a whole. Organic farming, agriculture that is being born now for the future, is and must be thought of on an ever-widening, efficient and generous scale, ensuring the prosperity of society and nature on all the meridians of the globe. The structure of the new curricula and analytical programs in higher agronomic education must respond to the guidelines on the development of agriculture on ecological principles and in our country. For this reason, agricultural scientific research in our country must act on a systemic basis, both in the field of creating varieties (hybrids) of plants and animal breeds, and in improving the technologies of plant cultivation and animal husbandry, non-polluting, the protection of flora and fauna, the preservation of ecological balances and the protection of the environment (Toncea et al., 2012).

The characteristics to be followed in the choice of a wheat variety are its adaptability to the pedoclimatic conditions of the area, the increased tolerance to the specific pathogenic pressure and the efficient use of nitrogen, in order to maximize yields (Roman et al., 2009).

Taking in consideration these aspects, the objective of the present paper is to put into evidence the effects of different winter wheat sowed in different sowing rate in location A.R.D.S. Secuieni, from Romania.

MATERIALS AND METHODS

The experimental results were obtained in the pedo-climatic conditions from A.R.D.S. Secuieni, Neamț County, Romania in the 2021-2022 growing season.

The study focused on observations and comparative determinations on some genotypes of winter wheat, local and foreign origin (cultivars and hybrids), as follows: 9 wheat varieties cultivars (Trublion, Centurion, Katarina, Glosa, Aspekt, Izvor, Avenue, Solehio, Alcantara) and 1 wheat hybrids variety (Hyxperia). The experimental variants were placed according to the randomized block method, in three replications. The harvest surface of each plot was 10 m^2. Sowing was done at the optimum time, using a sowing density of 500 germinating seeds/sm, 360

germinating seeds/sm and 250 germinating grains/sm, at a distance between rows of 12.5 cm and the sowing depth of 4-5 cm. The agrotechnical management performed in the field was in organic farming condition used bio products. Results was based on variance analysis, according to the poly-factorial method of field setting (Săulescu & Săulescu 1967).
The main purpose of the research was to find out the influence of genotypes on grain yield related to the unit area (kg/ha) and yield components, such as the plant density after emergence (plants/sm), plant density in spring (main shoots and tillers/sm), plant density at the harvest time (ears/sm), the weight of the grains in the spikes (grams/ear), as well as the main physical index, i.e. thousand grains weight (TGW) and hectoliter mass (HML).
Researches were carried out in field experiments at the Agricultural and Development Research Station Secuieni (ADRS Secuieni) located in North Romania (Neamț County) in the years 2021-2022 under organic farming conditions (Figure 1).
The researches were performed on a soil of cambic chernozem type.
The soil has a medium nitrogen supply (20.7 ppm $N\text{-}NO_3$); well supplied with phosphorus (74.8 ppm, P_{AL}); poor potassium supply (142.6 ppm, K_2O); well supplied with calcium and magnesium (1.6 meq/100 g soil); humus - 2.44% and pH (in water) = 5.55.

Experimental design

The experiment was based on the method of subdivided plots into 3 replications, with the following factors:

- Factor A - variety, with 10 graduations:
  - a_1 = Trublion;
  - a_2 = Centurion;
  - a_3 = Katarina;
  - a_4 = Glosa;
  - a_5 = Aspekt;
  - a_6 = Izvor;
  - a_7 = Avenue;
  - a_8 = Solehio;
  - a_9 = Alcantara;
  - a_{10} = Hyxperia.
- Factor B - plant density, with 3 graduations:
  - b_1 = 250 germinable kernels/sm;
  - b_2 = 360 germinable kernels/sm;
  - b_3 = 500 germinable kernels/sm.
- Factor C - locations, with 1 graduation:
  - c_1 = Secuieni.

Crop management

The previous crop was peas.
Seed treatment was with Bordeaux mixture in a concentration of 5%, spring fertilizer with manure. All studied variants were sown on 28th of October.
For disease and insect control were apply two times the product Ortimag - 100 ml/100 l water, insecto-fungicide homologated for organic agriculture (fist application on 10 April and second application on 25 May) .
The productivity elements were evaluated at 10 plants chosen at random from each experimental variant.
The calculation and interpretation of the results was done based on the analysis of variance (Săulescu & Săulescu, 1967).
The percentage of protein contain in the wheat seeds was determined with the device Nir Noise Instruments Quick Analyzer, Agri Check Plus model.

RESULTS AND DISCUSSIONS

From a climatic point of view (Table 1), in the winter months, the evolution of the thermal factor was favorable for winter crops. Although temperatures below the freezing point were set early (in October).

Figure 1. General view of research field in A.R.D.S. Secuieni

Table 1. Climatic conditions at Secuieni, Neamț County during the 2021-2022 growing season

Month	Temperature (^{0}C)		Rainfall (mm)	
	Average for 2021-2022	*Average**	*Average for 2021-2022*	*Average**
October	8.1	7.2	10.8	46.0
November	5.6	3.5	39.0	56.6
December	0.0	-1.5	5.4	40.6
January	-0.1	-3.9	4.6	18.2
February	2.7	-2.1	0.8	15.7
March	2.5	2.6	38.4	64.5
April	9.5	8.4	20.8	29.3
May	16.9	15.6	40.1	85.0
June	20.8	18.9	56.6	85.0
Average (Oct-Jun)	7.3	5.4	24.1	49.0

*average for 15 years

The monthly average temperatures of the 2021-2022 growing season were higher than the normal average in the area, according to the climatological norm. High temperatures were registered starting with October (0.9ºC) and continuing with November (2.1ºC), January (3.8ºC) and February (4.8ºC). The coldest month of the year was January, when it was -0.1ºC, with 3.8ºC higher than the normal average. Thus, we can say that wheat crops benefited from a mild winter from a thermal point of view. Starting from March, the monthly average temperatures were higher or at the same level with the normal average, in March (+0.1ºC), April (+1.1 ºC), May (+1.3ºC) and June (+1.9ºC). May had an unfavorable influence on crop growth, given to the temperature and rainfall influence.

The rainfall amount during the vegetation period (1 October 2021 - 30 June 2022) was 179.4 mm, i.e. 176.7 mm, under the normal amount in the area (356.1 mm). Lower rainfall was recorded in the months of October (10.8 mm of rainfall, 35.2 mm less than the normal amount in the area), December (5.4 mm, 35.2 mm less than normal amount in the area), January (4.6 mm, 13.6 mm less than normal amount in the area), March (38.4 mm, 26.1 mm less compared to the normal amount in the area) and June (56.6.0 mm, 28.4 mm less compared to the normal amount in the area). Concerning the climatic conditions, in the 2021-2022 growing season, was not favorable for cereals crops due to the lack of water from (practically from late October to June we had drought conditions.

The sowing densities has complied the technological norms for each genotype (varieties and hybrid). Thus, the obtained cultivars densities after emergence were considered very well. It ranged from 128 plants/sm at Avenue variety, in sowing rate 250 germinable seeds to 355 plants/sm at Izvor variety, in sowing rate 500 germinable seeds/sm (Table 2).

Concerning the determination of the density, (number of plants includes the main shoots and tillers/mp), they were performed when the vegetation resumed. This, for the cultivars obtained by breeding, the average densities were between 232 main shoots and tillers/sm for Aspekt variety in sowing rate This, for the cultivars obtained by breeding, the average densities were between 232 main shoots and tillers/sm for Aspekt variety in sowing rate 250 seeds/sm) and 646 main shoots and tillers/sm for the Trublion variety (in sowing rate 250 seeds/sm).

The final element of the plant density expression of the 10 winter wheat varieties is the number of ears they formed per unit area (sm). The fertile tillers capacity is specific to each genotype studied, led to a mean number of harvestable ears between 408 ears/sm in Avenue variety (in sowing rate 360 seeds/sm) to 768 ears/sm in Hyxperia hybrid wheat (in sowing rate 360 seeds/sm) the rainfall for all the vegetation period

Table 2. Influence of the genotype on the evolution plant density from emergence to the harvest

No.	Wheat varieties	Sowing rate (density g.k./sm)	Sprouting density (plants/sm)	%	Main shoots and tillers (sm)	%	Harvestable ears (sm)	%
1	Trublion	250	175	107	646	155	464	89
		360	209	96	377	77	664	112
		500	303	103	303	103	632	103
2	Centurion	250	181	111	399	96	501	96
		360	237	109	498	101	472	80
		500	272	93	272	93	592	97
3	Katarina	250	159	97	460	113	440	84
		360	249	114	549	113	552	93
		500	315	107	315	107	608	100
4	Glosa	250	179	109	375	90	628	120
		360	207	95	331	67	708	120
		500	320	109	320	109	680	111
5	Aspekt	250	133	81	253	61	612	117
		360	176	81	352	72	608	103
		500	232	79	232	79	648	106
6	Izvor	250	183	112	292	70	544	104
		360	265	122	637	130	648	109
		500	355	121	355	121	636	104
7	Avenue	250	128	78	422	101	508	97
		360	203	93	507	103	408	69
		500	261	89	261	89	536	88
8	Solehio	250	155	95	340	82	548	105
		360	227	104	612	124	584	99
		500	304	104	304	104	544	89
9	Alcantara	250	181	111	598	144	528	101
		360	205	94	575	117	508	86
		500	303	103	303	103	608	100
10	Hyxperia	250	164	100	377	91	448	86
		360	200	92	480	98	768	130
		500	269	92	269	92	624	102
Averages		**Varieties average (250 g.k./sm)**	163.8	100	416.2	100	522.1	100
		Varieties average (360 g.k./sm)	217.8	100	491.8	100	592	100
		Varieties average (500 g.k./sm)	293.4	100	293.4	100	610.8	100

This one variety formed the largest number of fertile tillers per plant.

Tillering capacity is another favorable factor that influences the grain yield. The genotypes tested in the experiment, highlight the special value of the cultivars tested, but also the clear superiority of the data obtained in the winter wheat hybrids, in terms of tillering capacity (Table 3).

The final element of the plant density expression of the 10 winter wheat varieties is the number of ears they formed per unit area. The fertile tillers capacity is specific to each genotype studied, led to a mean number of harvestable ears, fertile tillers plants between 1.2 ears/sm for Glosa variety, in sowing rate 360 g.k./sm and Aspekt variety in sowing rate 500 g.k./sm to 3.2 fertile tiller/sm in Alcantara variety, in sowing rate 250 g.k./sm. This one variety formed the largest number of fertile tillers/plant.

Tillering capacity is another favorable factor that influences the grain yield. The genotypes tested in the experiment, highlight the special value of the cultivars tested, in terms of tillering capacity and in grains weight of ears/sm. The higher quantity in terms of grains ear it was for Centurion variety, 1.7 grams/ear in sowing rate 250 g.k./sm.

Table 3. Influence of the genotype on tillering capacity and the grain weight ear

No.	Wheat varieties	Sowing rate (density g.k./sm)	Spring density (tillers plants/sm)	%	Harvest density (fertile tillers plants)	%	Grains weight ears/sm (g)	%
1	Trublion	250	3.7	145.1	2.8	123.3	1.3	95.7
		360	1.8	80.0	1.5	78.9	1.5	108.7
		500	2.0	86.6	2.0	101.5	1.1	100.9
2	Centurion	250	2.2	86.3	2.0	88.1	1.4	104.3
		360	2.1	93.3	1.7	89.5	1.7	123.7
		500	1.8	77.9	1.4	71.1	1.4	130.9
3	Katarina	250	2.9	113.7	2.5	110.1	1.4	102.9
		360	2.2	97.8	2.0	105.3	1.3	96.7
		500	2.4	103.9	2.1	106.6	1.0	89.1
4	Glosa	250	2.1	82.4	1.7	74.9	1.0	69.6
		360	1.6	71.1	1.2	63.2	1.1	84.0
		500	2.1	90.9	2.0	101.5	1.3	117.3
5	Aspekt	250	1.9	74.5	1.8	79.3	1.5	109.4
		360	2.0	88.9	1.5	78.9	1.1	81.0
		500	1.4	60.6	1.2	60.9	1.0	88.2
6	Izvor	250	1.6	62.7	1.5	66.1	1.4	102.2
		360	2.4	106.7	2.2	115.8	1.3	96.7
		500	2.2	95.2	1.8	91.4	1.2	109.1
7	Avenue	250	3.3	129.4	2.9	127.8	1.5	105.1
		360	2.5	111.1	2.1	110.5	1.4	105.7
		500	2.5	108.2	1.9	96.4	1.1	101.8
8	Solehio	250	2.2	86.3	2.1	92.5	1.7	120.3
		360	2.7	120.0	2.2	115.8	1.3	93.7
		500	2.4	103.9	1.6	81.2	1.2	108.2
9	Alcantara	250	3.3	129.4	3.1	136.6	1.3	92.8
		360	2.8	124.4	2.5	131.6	1.3	99.0
		500	3.0	129.9	2.8	142.1	1.1	100.0
10	Hyxperia	250	2.3	90.2	2.3	101.3	1.4	97.8
		360	2.4	106.7	1.9	100.0	1.5	110.9
		500	3.3	142.9	2.9	147.2	1.0	89.1
Averages		**Varieties average (250 g.k./sm)**	2.6	100.0	2.3	100.0	1.4	100.0
		Varieties average (360 g.k./sm)	2.3	100.0	1.9	100.0	1.3	100.0
		Varieties average (500 g.k./sm)	2.3	100.0	2.0	100.0	1.1	100.0

The lower weight per ear were for Katraina variety, in higher density, 500 g.k./sm, Aspekt, 500 g.k./sm and Hyxperia, also in 500 g.k./sm. (Table 3).

From the point of view of the productive potential of the 10 winter wheat genotypes studied, a great variability is observed (Table 4). This, in the case of varieties average, the grain yield was 6,746 kg/ha with values between 5,338 kg/ha for the Aspekt variety (in sowing rate 250 seeds/sm) and 7,878 kg/ha for the Izvor variety in sowing rate 500 seeds/sm.

Following the determinations concerning the main physical indicators that show the quality of wheat grains, respectively the thousand kernels weight (TGW) and the hectoliter mass (HLM) we noticed that there were no significant differences between the 10 varieties of winter wheat tested in the experiment (Table 5).

This, the TGW values in the case of cultivars were between 32.9 g of Katarina (500 seeds/sm) and 43.5 g of Centurion (360 seeds/ sm).

Table 4. Results of the grain yields (kg/ha) obtained at A.R.D.S. Secuieni

No.	Wheat varieties	Grain (density g.k./sm)	Grain yield (kg/ha)	%	Difference from CT* (kg/ha)	Significance
1	Trublion	250	6223.0	98.9	-66.8	o
		360	6675.0	98.7	-86.1	o
		500	6853.0	95.3	-334.9	oo
2	Centurion	250	6580.0	104.6	290.2	
		360	6887.0	101.9	125.9	
		500	7501.0	104.4	313.1	
3	Katarina	250	6964.0	110.7	674.2	
		360	7213.0	106.7	451.9	
		500	6960.0	96.8	-227.9	o
4	Glosa	250	6655.0	105.8	365.2	
		360	6959.0	102.9	197.9	
		500	7453.0	103.7	265.1	
5	Aspekt	250	5338.0	84.9	-951.8	ooo
		360	5600.0	82.8	-1161.1	ooo
		500	6330.0	88.1	-857.9	ooo
6	Izvor	250	6392.0	101.6	102.2	
		360	7409.0	109.6	647.9	
		500	7868.0	109.5	680.1	
7	Avenue	250	6365.0	101.2	75.2	
		360	6292.0	93.1	-469.1	oo
		500	6647.0	92.5	-540.9	oo
8	Solehio	250	5371.0	85.4	-918.8	ooo
		360	6869.0	101.6	107.9	
		500	7302.0	101.6	114.1	
9	Alcantara	250	6828.0	108.6	538.2	
		360	6714.0	99.3	-47.1	o
		500	7468.0	103.9	280.1	
10	Hyxperia	250	6182.0	98.3	-107.8	oo
		360	6993.0	103.4	231.9	
		500	7497.0	104.3	309.1	
Averages		**Varieties average (250 g.k./sm)**	6289.8	100.0		
		LSD% 5=416.5	***LSD 1%=564.69***		***LDS 0.1%=756.82***	
		Varieties average (360 g.k./sm)	6761.1	100.0		
		LSD% 5=414.02	***LSD 1%=626.95***		***LDS 0.1%=1007.17***	
		Varieties average (500 g.k./sm)	7187.9	100.0		
		LSD% 5=309.71	***LSD 1%=424.74***		***LDS 0.1%=578.12***	

**CT - average of the field*

Figure 2. Centurion variety in sowing rate 250 seeds/sm

Figure 3. Centurion variety in sowing rate 500 seeds/sm

Table 5. Influence of the genotype on physical quality indices TGW and HLM

No.	Wheat varieties	Grain (density g.k./sm)	Thousand Kernel Weight (g)	%	HLM (kg/hL)	%
1	Trublion	250	35.7	92.8	77.4	95.8
		360	34.7	92.1	77.4	96.1
		500	35.7	94.5	77.8	96.6
2	Centurion	250	41.9	108.9	80.0	99.0
		360	43.5	115.4	80.2	99.6
		500	43.5	115.2	80.6	100.1
3	Katarina	250	38.1	99.0	83.1	102.8
		360	32.9	87.3	80.5	100.0
		500	32.9	87.1	80.4	99.9
4	Glosa	250	40.2	104.4	82.3	101.9
		360	39.4	104.6	82.2	102.1
		500	38.2	101.1	82.1	102.0
5	Aspekt	250	35.5	92.2	81.7	101.1
		360	34.3	91.0	81.5	101.2
		500	33	87.4	80.9	100.5
6	Izvor	250	38.2	99.2	83.5	103.3
		360	37.7	100.1	83.5	103.7
		500	38.2	101.1	83.6	103.9
7	Avenue	250	38.1	99.0	81.5	100.9
		360	38.4	101.9	81.4	101.1
		500	39.4	104.3	80.6	100.1
8	Solehio	250	38.5	100.0	80.3	99.4
		360	36.4	96.6	80.9	100.5
		500	39.2	103.8	81.5	101.2
9	Alcantara	250	38.3	99.5	80.2	99.3
		360	38.6	102.4	81.0	100.6
		500	38.7	102.5	79.8	99.1
10	Hyxperia	250	40.4	105.0	77.9	96.4
		360	40.9	108.5	78.9	98.0
		500	38.9	103.0	78.1	97.0
Averages	**Varieties average (250 g.k./sm)**		**38.49**	100.0	80.8	100.0
	Varieties average (360 g.k./sm)		**37.68**	100.0	80.5	100.0
	Varieties average (500 g.k./sm)		**37.77**	100.0	80.5	100.0

CONCLUSIONS

The correct choice of variety and cultivation technology according to the climatic conditions of the year are decisive factors in obtaining stable productions. Sowing density is an important technological sequence in increasing productivity and is determined according to the cultivation area and the phenotypic characteristics of the variety.

The morphological characters of wheat are not significantly influenced by the sowing density; they are influenced by the variety and to the greatest extent by the climatic conditions.

Productivity elements are influenced by seeding density, variety and experimental conditions.

The Katarina variety achieves high and stable yields (6964 kg/ha in lower sowing rate 250 seeds/sm), with a TGW of 38.1% and HLM 83.1 kg/hl.

The Hyxperia hybrid wheat obtained the highest yields (6,993 kg/ha in sowing rate 360 seeds/sm) regardless of the climatic conditions of the year, proving stability and ecological plasticity, with a protein content of 13.5%.

The Avenue variety is the earliest variety tested, with high production potential but lower protein content (11.3%).For the northern part of the country in the year 2021-2022, good results were obtained when 500 seeds/sm were used, at which density the reduction in productivity was compensated by the increase in the number of seeds/sm, the production obtained being 7868 kg/ha on average over the years of experimentation, with the variety Izvor.

The year 2021-2022 is relevant when, due to the climatic conditions, wheat had a very poor rainfall, in average 49 mm during all the vegetation period (October-June) with a major influence on wheat production.

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