Scientific Papers. Series A. Agronomy, Vol. LV-2012
ISSN Online 2285-5793; ISSN-L 2285-5785

RESEARCH ON BEHAVIOR OF THE TRITICALE GENOTYPES IN THE SANDY SOILS CONDITIONS

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Abstract

Extension of arid accents visible deserts, determine the orientation in exploitation of sandy soils to new plant species, that by results obtained to diminish the negative effects of climate change. Due to low natural fertility and climatic conditions characterized by excessive heat and insufficient rainfall, the sandy soils can be characterized as an agricultural area with handicap, farmers provide with a limited range of crops to ensure land use in terms of profitability. In this context, triticale was studied in sandy soil conditions from Dabuleni, a cereal created by hybridization between Triticum and Secale genus, plants that use more than poor soils, drought and heat. The results obtained during 2009-2011 at 12 triticale genotypes, experienced in a competition test fields, highlight productions between 3771-4604 kg/ha. There were observed by high production and good resistance to frost, disease and pest the following varieties: Negoiu, Matroz, Plai, Stil.

Key words: *triticale, genotypes, resistance, production.*

INTRODUCTION

In Romania the phenomenon of drought is a specific feature, due to settlement of our country in a temperate excessive climate, with large deviations from normal values of climatic, agro-climatic, hydrological and pedological parameters. Emphasizing this phenomenon in the last period and the specific microclimate that is created especially in the South of Oltenia, it was requiring extensive studies in Research - Development Center for Field Crops on Sandy Soils Dabuleni, which led to the promotion of plant species with a good potential to exploit the ecopedological condition by southern Oltenia, sandy soils that lie on approximately 209,400 ha. Triticale is a cereal adaptable to drought conditions with high production potential and multiple uses [5]. Due to recombination of favourable characteristics from the two parental species (wheat and rye), triticale has a number of biological and economic traits [3, 4] as:

- resistance to low temperatures, which favours the extension of vegetation until late autumn and resume growth earlier in spring;
- rich biomass plants and fast-growing;
- high-lysine content;
- nutritional value of triticale grain is superior to both the wheat and barley and those of rye.

In recent decades, due to genetic progress achieved in improving varieties, there were created more competitive than current genotypes of cereals especially for hilly area with poor soil fertility and low pH [2, 3] In 1971, it was initiated to N.A.R.D.I. Fundulea the breeding program for triticale species, created by humans and in the year 1984 it was recorded here the first variety of this species, TF2, which inaugurated the introduction of the culture in Romania, triticale species with higher production and adaptability potential, superior to other cereals [1]. Research conducted in Mexico shows that at both triticale and wheat drought is affecting most production if it occurs in the skin phase [4].

MATERIAL AND METHOD

Extension of arid accents visible deserts, determine the orientation in exploitation sandy soils to new plant species that by results obtained to diminish the negative effects of climate change. In this context it was studied in sandy soil conditions from Dabuleni culture of

triticale, a cereal created by hybridization between *Triticum* and *Secale* genus, which by plant biology make better use of poor soils, drought and heat. The research was conducted on 12 triticale genotypes, studied during 2009-2011 in a competition test fields. Experience has been placed under irrigation conditions, on a sandy soil with low natural fertility, characterized as follows: 0.66 to 0.78% humus, from 0.032 to 0.044% Nt, mobile P 28-34 ppm, available K 16-38 ppm, pH 5.4 to 6.7 (H_2O). There were made determinations on plant physiological resistance to environmental conditions (frost, pathogens, and drought) and productivity features. The results were interpreted statistically by analysis of variance method and using mathematical functions.

RESULTS AND DISCUSSIONS

Evolution of average air temperature recorded in the meteorological station of Research - Development Center for Field Crops on Sandy Soils Dabuleni trend of increased drought stresses in this area (Fig. 1). Compared to multiannual average, when during the triticale species vegetation period (October-July) were recorded in the air an average temperature of 9.59°C, in the studied period (2009-2011) the average air temperature has increased of 1.11°C. During the vegetation period triticale found in the sandy soils favourable conditions for growth and development. An increase amount of precipitation in the period under study (568.5 mm) was registered compared the multiannual average (426.1 mm). Area of sandy soils characteristic distribution of these precipitations is uneven, so that in certain periods (autumn, emergence, earring, and grain filling) is necessary to apply irrigation. Atmospheric drought and high temperatures during grain filling ears and creates a physiological imbalance in the water cycle in the plant (the transpiration exceeds absorption), which makes the grain to stop development, and to reduce weight.

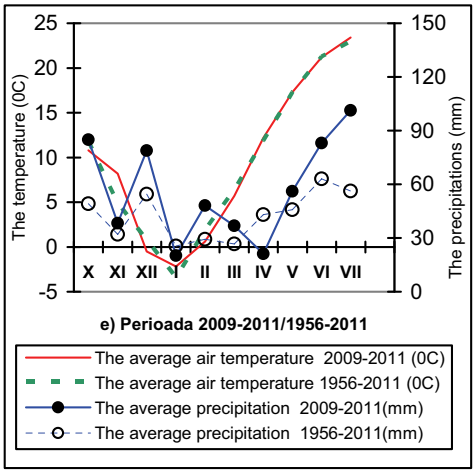

Fig. 1. Air temperature and precipitation recorded at weather station of CCDCPN Dabuleni

Photo 1. Triticale on sandy soils

Results on the variability of plant physiological traits of triticale highlight good adaptability of the triticale species under sandy soil conditions (Table 1).

On average the 12 triticale genotypes have registered 1.9 tillers/plant in autumn, good resistance to winter (grade-1, 2), a good physiological resistance to major pathogens (*Erysiphe graminis*, *Puccinia graminis*, *Tilletia tritici*, *Ustilago nuda*), which cause damage grain straw (grades 1-2).

Table 1. Variability of physiological characters triticale tested on sandy soils (2009-2011)

Genotypes	Number of tillers / plant	Resistnce to winter (grades 1-9)	Resistance to pathogens (grades 1-9)			
			Erysiphe sp.	*Puccinia*	*Tiletia*	*Ustilago*
Plai	1.7	1.3	1	1	1.00	2.00
Titan	1.8	1.1	1.3	1	1.00	2.00
Stil	1.9	1.3	1	1	1.00	2.00
Gorun	2.2	1	1.3	1.3	1.00	2.00
Haiduc	1.9	1.3	1	1	1.00	2.00
Cascador	2.1	1	2.1	1	1.00	2.00
Migrator	2	1.1	1.3	1	1.00	2.00
Matroz	2.1	1.3	1.3	1	1.00	2.00
Negoiu	2.1	1.3	1.3	1	1.00	2.00
Nera	1.7	1.3	1.6	1.3	1.00	2.00
Nedeea	1.7	1.1	1.8	1	1.00	2.00
TF 2	2.2	1.3	1.3	1	1.00	2.00
Average	1.9	1.2	1.4	1.03	1.00	2.00

In the conditions of sandy soils, the vegetation period of triticale genotypes is between 225 to 228.5 days with an average of 227.1 days (Fig. 2). The Matroz triticale variety showed the shortest amount of vegetation and Nedeea variety of the largest growing season.

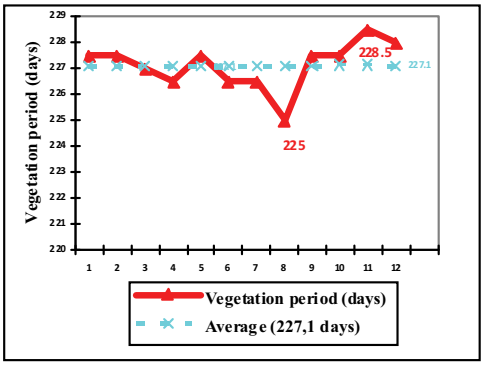

Fig. 2. Vegetation period of triticale genotypes tested on sandy soils (2009-2011)

Microclimate created on sandy soils in southern Oltenia offers favourable conditions for growth and development of the triticale culture. Determinations of biometrics on plant size, number of spikes/m^2 at harvest, spike length and number of grains/spike emphasizes a dependent variability by analyzed varieties (Table 2). Under the aspect of plant size, deviations of the 12 genotypes were recorded between -6.3 cm and 13 cm, from the average (93 cm). The elements of productivity highlight the variety Matroz who recorded at harvest spikes/m^2 527.3, 11.8 cm spike length and 40.7 grain in the spike.

Table 2. Variability of biometric measurements triticale tested on sandy soils (2009-2011)

Genotypes	Plant size cm	No. spikes / m^2	Spike length (cm)	No. grains / spike
Plai	102.6	502.3	10.6	37.3
Titan	106	535.6	10.3	37.3
Stil	95	509.6	11	41.3
Gorun	86.3	533	10.5	36.7
Haiduc	94	494.3	10.6	38.6
Cascador	89.6	527.3	10.1	35.3
Migrator	92	534.3	11.5	38
Matroz	87.6	527.3	11.8	40.7
Negoiu	86.3	506	10	38
Nera	87.3	524	10	38
Nedeea	93.3	513	9.8	32.6
TF 2	96	504	10.3	36.6
Average	93	517.5	10.5	37.5

Triticale plant has a maximum sensitivity to drought in the earring phase and grain filling. As the amount of bound water is higher so that genotype is more resistant to adverse weather conditions (high temperatures, drought, soil and air humidity low). Plants grow and develop normally if there is a stable equilibrium between water absorbed and eliminated from the organism. If this balance goes awry most metabolic processes are not proceeding normally.

In unfavourable environmental conditions when plant life activity is reduced than the amount of free water decreases and the bound water increases, which causes a higher resistance of plants. In the leaves of triticale amount of free water was influenced by both the variety and climatic factors. Free water content was between 57.36% in genotype Gorun and 59.02% in Titan genotype. Free water is retained low in the ribs and therefore travels easily, both inside the cell, and from one cell to another, providing state of the cell turgor.

It is the environment in which biochemical processes take place directly participating in their conduct. Under pressure thermo-fluid concentration increases cellular juice, as a reaction to adapt the plant to these conditions by increasing the cellular osmotic forces, forces that diminish water loss through sweat. Triticale studied cellular juice concentration values recorded between 13.45 to 14.55%, which has good adaptability at good genotypes: Negoiu, Matroz, Stil and Plai (Table 3).

Table 3. Variability of physiological indices of triticale genotypes studied on sandy soils (2009-2011)

Genotypes	Free water (%)	Bound water (%)	Dry substance (%)	Concentration of the vacuole juice (%)
Plai	58.9	4.72	36.38	14.3
Titan	59.02	4.46	36.52	13.45
Stil	56.49	4.60	38.91	14.3
Gorun	57.36	4.51	38.13	14.15
Haiduc	57.52	4.54	37.94	14.25
Cascador	57.65	4.58	37.77	14.25
Migrator	57.98	4.16	37.86	14.15
Matroz	57.47	4.45	38.08	14.45
Negoiu	57.24	4.76	38.00	14.55
Nera	57.99	4.55	37.46	14.05
Nedeea	57.8	4.08	38.12	13.95
TF 2	58.48	4.34	37.18	14.1
Average	57.83	4.48	37.69	14.16

Thousand grain weight (TGW), indicating that significantly influence the production obtained in the studied genotypes, varies in limits from 34.5 to 41.7 g and hectolitre weight (HW) varied between 60 and 67 kg (Fig. 3).

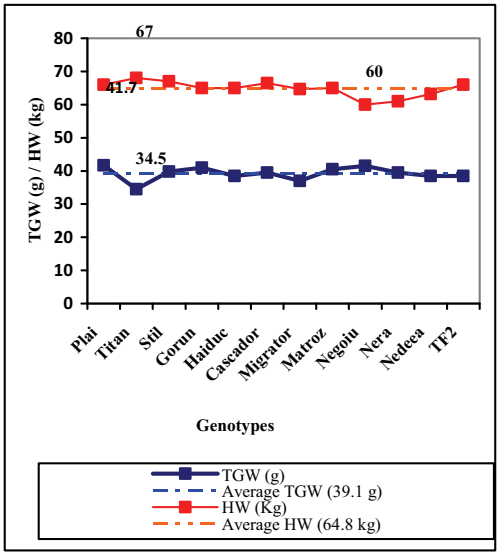

Fig. 3. TGW and HW variability of triticale genotypes tested on sandy soils (2009-2011)

Production results obtained in the 12 triticale genotypes were within 3371-4604 kg/ha, with an average deviation between – 396.5 kg/ha and 436.5 kg/ha. The highest production (4310-4604 kg/ha) were remarked by Negoiu, Matroz, Plai and Stil genotypes (Fig. 4).

Analyzing the relationship between grain production and cellular juice concentration recorded in the earring phase a finding of distinct significant positive correlation. As the concentration cellular juice increases, triticale genotypes better respond to stress in the sandy soil, through the productions obtained (Fig. 5).

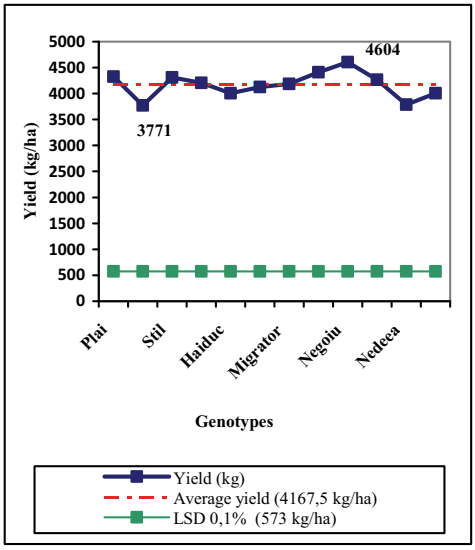

Fig. 4. Production variability obtained in some triticale genotypes

Photo 2. Negoiu triticale variety

Photo 3. Stil triticale variety

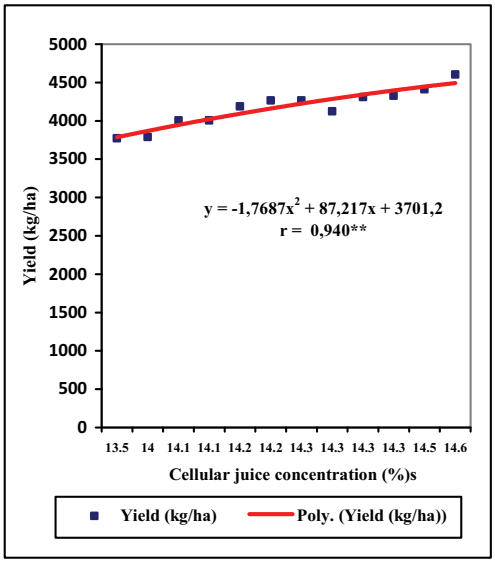

Fig. 5. The correlation between production and concentration of the cellular juice triticale

CONCLUSIONS

Microclimate created on sandy soils in southern Oltenia offers favourable conditions for growth and development of triticale culture.

The 12 triticale varieties showed a good physiological resistance (grades 1-2) to the main pathogens (*Erysiphe* sp., *Puccinia* sp., *Tilletia* sp., *Ustilago nuda*).

Thousand grain weight (TGW) at triticale genotypes grown on sandy soil varied in limits from 34.5 to 41.7 g and hectoliter weight (HW) varied between 60 and 67 kg.

Triticale genotypes: Negoiu, Matroz, Plai and Stil have obtained the biggest production (4310-4604 kg/ha) and the best physiological indices (4.45 to 4.76% - bound water and 14.3-14.55% - cellular juice concentration);

There is a distinct significant positive correlation between production and vacuolar juice concentration (r = 0.940 **).

ACKNOWLEDGEMENTS

This research work was carried out with the support of Academy of Agricultural Sciences and Forestry Bucharest and was financed from thematic research plan of Research - Development Centre for Field Crops on Sandy Soils Dabuleni.

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