# TRITICALE PRODUCTIVITY UNDER EXTREME FROST DEPENDING ON VARIETY AND NITROGEN NORM

# ПРОДУКТИВНОСТ НА ТРИТИКАЛЕ ПРИ ЕКСТРЕМАЛНО ИЗМРЪЗВАНЕ В ЗАВИСИМОСТ ОТ СОРТА И АЗОТНАТА НОРМА

**H. KIRCHEV*, T. K. TONEV**, Zh. TERZIEV*, N. SEMKOVA***

**Agricultural University, Plovdiv, Bulgaria*
***Dobroudja Agricultural Institute, Gen. Toshevo, Bulgaria*
*Corresponding author: HRISTOFOR Kirchev. E-mail hristofor@au-plovdiv.bg*

***Abstract:*** *The following evidence are based on field experiment carried out in a sample area of Dobroudja Agricultural Institute. In this experiment took place 5 triticale varieties which have been made in different selection research stations. It has been established that triticale is high sensitive plant to low temperature in the winter time in this region. It could be placed between wheat and barley in a scale of such sensitivity. As a most resistant to low temperature among the explored species were established Sadovec and Rakita. Nitrogen fertilization cannot compensate the thinning out of the crops. It even can result in secondary infestation and some additional problems for harvest.*

***Резюме***: *Настоящото изследване се основава на полски опит, проведен в опитното поле на Добруджански земеделски институт. В този експеримент участват 5 сорта тритикале, създадени в различни селекционни центъра. Установено е, че тритикале е чувствителна култура на ниски температури през зимата в този регион и заема средно положение между пшеницата и ечемика. От изследваните сортове като най-зимоустойчиви се проявяват Садовец и Ракита. При мащабно измръзване, прилагането на азотно торене не може да компенсира силното разреждане на посевите и дори може да предизвика по-значително вторично заплевеляване с допълнителни усложнения при жътвата.*

***Key words:*** *triticale varieties, cold resistance, grain yield*
***Ключови думи:*** *сортове тритикале, студоустойчивост, добив зърно*

## INTRODUCTION

Triticale (X Triticosecale *Wittmack*) is interspecific wheat (*Triticum*) x rye (*Secale*) hybrid cereal crop. It was initially developed to combine the positive traits of both parent types: the vigour and winter hardiness as well as the higher protein content of rye plus the quality gluten and baking properties of wheat (Yankov et al., 2002).

Frost-hardiness is a valuable quality of cereal crops. One of the aims of hybridization between wheat and rye is to develop more winter-resistant varieties due to rye, which is known to be the most cold-resistant of all cereal crops. The best results from developing of cold-resistant triticale are achieved when crossing highly cold- and winter-resistant maternal sides of Triticale (Tsvetkov and Tsenov, 1995).

The climate-forming factors of the plain of Dobroudja are of global and local character. From this point of view the influence of global warming is inevitable. According to Tonev and Kostadinov (2000) in the plain regions of Dobroudja a tendency to increasing air temperatures during winter, spring, and summer months is determined during the period

1953-1999, while the opposite tendency in October and November puts under risk of freezing the late autumn sowings.

## MATERIAL AND METHODS

The presented research is made on the basis of a field experiment, carried out on the experimental field of Dobroudja Agricultural Institute – General Toshevo during the period 2002-2005. Five varieties of triticale released by different selection centres were involved in this experiment: the Mexican variety AD-7291, two varieties selected by Agricultural Institute – Sadovo: Sadovec and Rojen and two varieties selected by Dobroudja Agricultural Institute: Rakita and Zaryad.

The experiment was performed after maize for grain predecessor. Four norms of nitrogen fertilization were tested on all varieties - $N_0$, $N_6$, $N_{12}$ and $N_{18}$ kg.da$^{-1}$ (background $P_{10}K_5$). The sowing is planned during the optimum for the region agricultural time. A method of 4 repetitions on plots of 10 m² was used to determine the productivity of triticale. Two-factor dispersive analysis was used to determine the quantitative authenticity between the tested factors.

## RESULTS AND DISCUSSION

During the first year the experiment was performed under unfavourable weather conditions and all over freezing of autumn crops as a result of unfavourable combination of sowing conditions and the period of winter hardening of the crop (fig. 1).

The main reason for the backward preparing of the soil for ploughing and for the very sowing was the high rainfall during the last decade of September and the first half of October 2002. That is why the sowing was not performed during the favourable for the region agrotechnical period – 1st November.

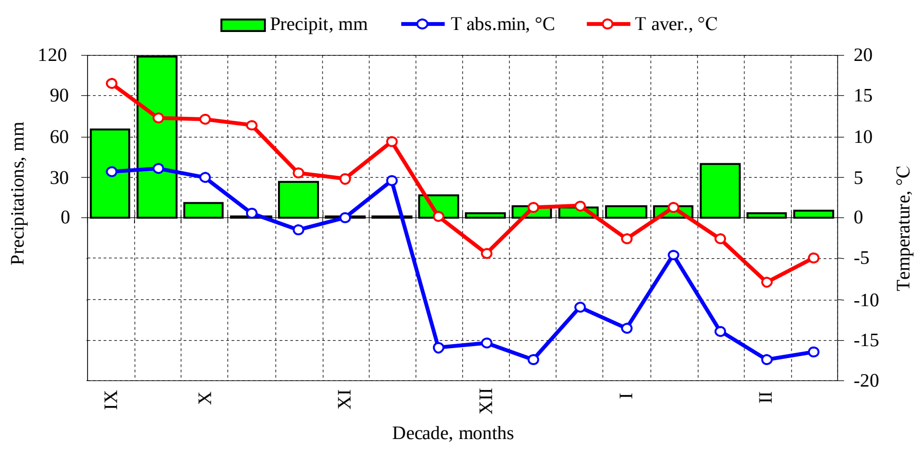


Figure 1. Agro-meteorological conditions for sowing and wintering of Triticale during the winter 2002/2003

Despite the nondurable lowering of temperature at the beginning of November, the crops were in very good condition – the third leaf phase and complete phase of hardening. On 7th December 2002 the temperature dropped drastically, combined with strong winds and lack of snowfall. Under these conditions the ground radiation temperature dropped considerably under the biological minimum for Triticale. That was the exact period of freezing of the crops. Later, during the second decade of February, the temperature too was critical for the wintering of the crops. This time, however, the snow cover was thick enough (fig. 2).

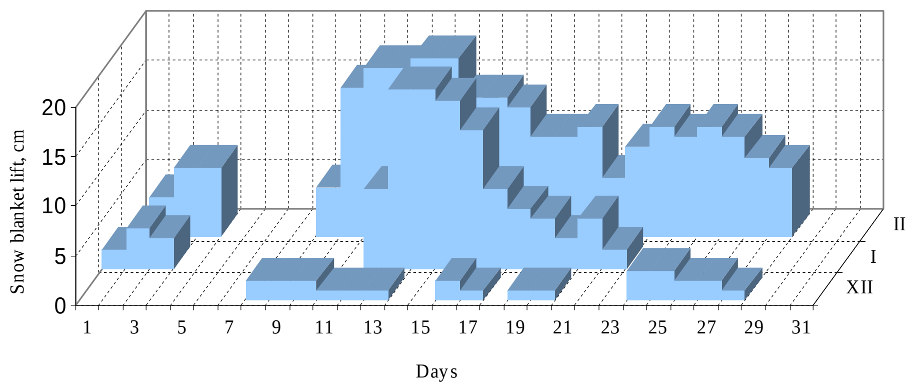


Figure 2. Snow blanket lift during the winter period 2002/2003

As a result of the unfavourable conditions for wintering of triticale in Dobroudja during the winter 2003 complete 100% freezing of the three tested varieties was observed (AD-7291, Rojen and Zaryad) ,while of the other two varieties(Sadovec and Rakita) freezing over 60% was observed (pict. 1).

AD-7291 Rojen Sadovec Rakita Zaryad

Picture 1. State of the crops during the ear formation phase after complete freezing (16.06.2003)

Comparing these results with data from comparative tests carried in the Institute – Gen. Toshevo, it can be concluded that regarding winter hardiness the frozen varieties reveal the reactions of most varieties of rye, whereas the partially wintered varieties reveal the reaction of most wheat varieties. (Tonev et al., 2003; Kasimov and Tonev, 2004; Petrova and Atanasova, 2004).

The yield of the two partially wintered varieties is shown in table 1, using as a control partially wintered wheat variety Pryaspa, cultivated after the same predecessor and under the same norms of fertilizations.

*Table 1*

Grain yield, $kg.da^{-1}$ with dispersion analysis of the yield

A. Grain yield, kg/da

| kg $N.da^{-1}$ | Pryaspa (wheat) | Sadovec (triticale) | | Rakita (triticale) | | Factor B |
|---|---|---|---|---|---|---|
| | | kg/da | % to $N_0$ | kg/da | % to $N_0$ | |
| $N_0$ | 195 | 174 | 100,0 | 196 | 100,0 | 188 |
| $N_6$ | 186 | 131 | 75,3 | 186 | 94,9 | 168 |
| $N_{12}$ | 183 | 115 | 66,1 | 154 | 78,6 | 151 |
| $N_{18}$ | 172 | 111 | 63,8 | 160 | 81,6 | 148 |
| Factor A | 184 | 133 | | 174 | | |

B. Two- factors dispersion analyze

| Factor | A (variety) | B (N - norm) | A x B |
|---|---|---|---|
| MS | 646.31 | 4607.41 | 4047.79 |
| F criteria | 9.76 | 69.65 | 61.58 |
| GD 5% | 5.87 | 6.77 | |
| 1% | 7.91 | 9.13 | |
| 0.1% | 10.50 | 12.12 | |
| df | 2/33 | 3/33 | 6/33 |

Excluding nitrogen fertilization factor the lowest is the average grain yield of triticale Sadovec -133kg.da$^{-1}$ or 72.3% in comparison to the grain yield of the control variety Pryaspa. This difference is proved on level P = 0.1%, while the average yield of triticale Rakita in comparison to Pryaspa is 96.6% with proved level of P = 1%.

The determine results from the same year should not be considered as indicative, regarding the productive potential of the studied triticale varieties. It should be noticed the effect of nitrogen fertilization which is not typically negative.

All varieties showed decreasing yield under increasing norms of nitrogen fertilization. The highest is the average yield of the not fertilized variety – 188 kg.da$^{-1}$, excluding the genotype factor.

The yield decreased under applying of nitrogen fertilization. It is the lowest when the highest nitrogen norm was applied – 78.7%. In relation to the preceding it is less significantly expressed. Thus, $N_6$ fertilization decreased the yield of grain by 12% in relation to $N_0$, $N_{12}$ which decreased the yield by 11%, compared with $N_6$ and under $N_{18}$ fertilization it is 2% lower in relation to $N_{12}$.

These results can be explained with the secondary infestation of the crops. Although at the end of the tillering phase the weeds were treated, because of the thin crops during the phase of shooting up a strong secondary infestation was observed.

From the estimations by sight it can be concluded that the infestation was move significant on the plots under nitrogen fertilization, which resulted in the lower grain yield.

Partially wintered crops do not possess the requited productive potential to be industrially cultivated, thus nitrogen fertilization of such crops is not economically efficient.

Because of the thin crops the risk of secondary infestation is high which not only has negative effect on the grain yield but also prevents from direct harvest.

From all these results, it can be concluded that frozen and partially wintered crops should be ploughed up on time and the fields should be re- planted with spring cultivations.

## CONCLUSION

It has been established that triticale is highly sensitive plant to low temperature in the winter time in this region. It could be placed between wheat and barley in a scale of such sensitivity. From the studied varieties, Sadovec and Rakita proved to be the most winter resistant.

Nitrogen fertilization cannot compensate the thinning out of the crops. It even can result in secondary infestation and some additional problems for harvest. That is way preliminary and precise estimation of percentage of freezing is recommended as well as re-sowing with spring cultivations.

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