Available online at
http://journals.usamvcluj.ro/index.php/promediu

ProEnvironment

ProEnvironment 9 (2016) 387 - 391

Original Article

The Speed of Germination, Plants' Density and Yield in Wheat, under Different Phytosanitary Treatments

OROIAN Camelia Firuţa[1], Antonia ODAGIU[2]*, Ioan BRAŞOVEAN[2], Cristian MĂLINAŞ[2], Bianca BORDEANU[2]

[1]University of Agricultural Sciences and Veterinary Medicine, Faculty of Horticulture, 3-5 Calea Mănăştur Street, 400372, Cluj-Napoca, Romania
[2]University of Agricultural Sciences and Veterinary Medicine, Faculty of Agriculture, 3-5 Calea Mănăştur Street, 400372, Cluj-Napoca, Romania

Received 12 October 2016; received and revised form 1 November2016; accepted 4 December 2016
Available online 30 December 2016

Abstract

Our trial that aimed to identify the wheat speed of germination, wheat plants' density, and yield of "Izvor" wheat variety, infested with *Fusarium sp.* and treated with five phytosanitary products (Vitavax 200 FF, Vitavax 2000, Divident Star, Kinto Duo, Lamardor), in a presence of an untreated control. The trial was developed within experimental conditions of Research – Development Station for Agriculture Jucu, Cluj – Napoca, during 2013 – 2014. The phytosanitary treatments inhibit wheat plants germination and wheat plants' density, while the phytosanitary treatment with Vitavax 200 FF stimulates wheat yield, treated plants producing the biggest yield of the experiment, of 3,532.60 kg/ha, respectively. In control variant (V6 untreated) resulted the strongest simple correlation (R = 0.458) between wheat yield and wheat plants' densities, while in experimental conditions characterized by phytosanitary treatment with Vitavax 2000 (V2), resulted the strongest correlation (R = 0.674) between the wheat yield, and speed of wheat plants' germination.

Keywords: best experimental practices, *Fusarium*, simple correlation, statistics.

1. Introduction

Wheat (*Triticum aestivum* L.) is the oldest and remains the most spread crow worldwide.

It is a cereal that represents the dominant crop worldwide, covering about 25% of the cultivated areas, on the globe, being the basis of the human food [7].

One of the most important challenges of the wheat cultivation is the problem of pathogens attacks [4].

One of the most important challenges of the wheat cultivation is the problem of pathogens attacks [4]. Among wheat pathogens, of great importance is Fusarium. Being considered a harmful pathogen of cereals, generally speaking, *Fusarium* may cause a series of diseases as *Fusarium* foot and root [1], *Fusarium* head blight [2], *Fusarium* crown rot [3], Fusarium Leaf Blotch [6], etc. their harmful effecst are also taken into consideration because they may produce intermediary metabolism substances, mycotoxins, which besides their effects on reducing wheat yields and quality, may produce harmful effects on human health. The aim of this research was to identify the speed of germination, wheat plants' density, and yield of Izvor wheat variety, infested

* Corresponding author.
Tel: +40-264-596384
Fax: ++40-264-593792
e-mail: aodagiu@gmail.com

with *Fusarium sp.* and treated with different phytosanitary products.

2. Material and Method

The biological material is represented by the autumn wheat variety ”Izvor” created by INCDA Fundulea. It is a precocious variety with good resistance at falling and winter. The variety has the plant bush half prone, within twining phase, size among 90 - 105 cm, white arista spikelet, semi lax, of pyramidal shape, grain of moderate size, and red color. The biological material was used for late sowing, in order to study the influence of the phytosanitary products on the speed of germination, and plants' density, as well as on the disease occurrence, at density of 450 wheat grains/m^2. Wheat seed, in amount of 205 kg/ha, was used. The wheat seed has a germination capacity of 94%, purity of 99.9%, and 36.9 MMB. The experimental protocol foresees the wheat infestation with *Fusarium spp.* Different phytosanitary treatments were applied in order to fight against the above mentioned pathogen.

Function of the phytosanitary treatments, and also taking into account the control variant, six experimental variants were used (V1 – V6), as follows: V1 – phytosanitary treatment with Vitavax 200 FF (Carboxin 200 g/L, Tiram 200 g/L)) from Chemtura, V2 – phytosanitary treatment with Vitavax 2000 from Chemtura, V3 – phytosanitary treatment with Divident Star (Difenoconazol 30g/L, Ciproconazol 6.25 g/L), from Syngenta, V4 – phytosanitary treatment with Kinto Duo for seeds treatment (Procloraz 60 g/L, Triticonazol 20 g/L), from BASF, V5 – phytosanitary treatment with Lamardor (protioconazol 250 g/L, tebuconazol 150 g/L), from Bayer, and V6 – no phytosanitary treatment (control).

The research was conducted within the experimental field belonging to the Research – Development Station for Agriculture Jucu, Cluj – Napoca, during 2013 – 2014.

In order to determine the speed of germination, aimed as one of the objectives of the present study, the methodology foresees the numbering of the germinated plants on an area of 1 m^2, at 14 days from sowing. In order to determine the density of germination we used a metric frame, in 5 control points; this operation was performed at time interval of 10 days from the determination of the speed of germination. The wheat yield was determined by harvesting crop by all six variants, separately, after wheat full vegetation cycle, and a mean moisture of 14%, followed by weighing and reported to 1 ha.

The experimental results were processed using STATISTICA v.8.0 for windows, according to methodology specified by literature [5].

3. Results and Discussions

Analyzing the speed of germination (Fig. 1) in all studied variants, we find that in variant who received no sanitary treatments (V6) have the biggest speed of germination, with a germination percent of 64.68%, while the variant V5, treated with Lamardor recorded the lowest speed of germination (25.54%), and this shows us that the germination of the wheat plants is inhibited by the phytosanitary treatments.

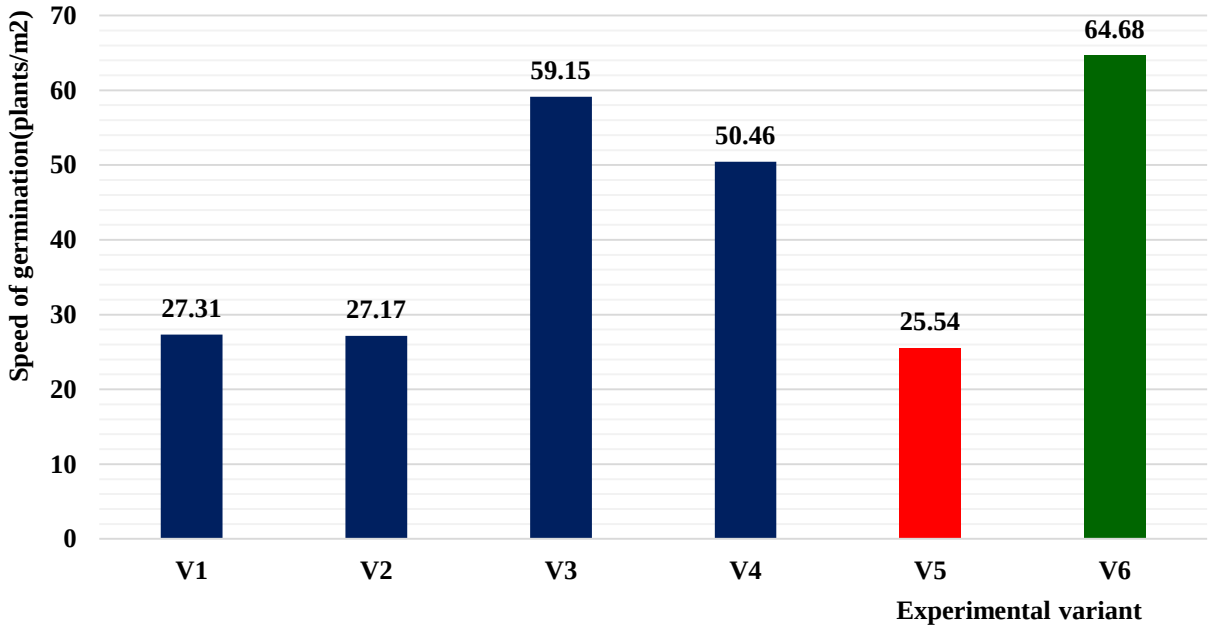

Figure 1. The evolution of plants' emergence yield (plants/m^2), in 6 experimental variants

The study of the plants' density (plants/ m^2), in studied variants, show us that the biggest density may be reported for the variant V6 – control (60 plants/m^2), while for the variant V2 (the plot treated with the phytosanitary product Vitavax 2000) is reported the smallest density, of 200.85 plants/ m^2 (Fig. 2).

Concerning production, one may find that the maximum yield was obtained in variant V1 (treated with Vitavax 200 FF), and it was of 3,532.60 kg/ha, while the lowest yield was obtained in variant V5 (phytosanitary treatment with Lamardor), where we obtained a production of 1,751.2 kg/ha (Fig. 3).

Analyzing the influence of the plants' density (plants/m^2) and speed of germination (plants/m^2) on the wheat yield obtained when the phytosanitary treatment was performed with the product Vitavax 200 FF, we found that the biggest productions (over 2,775 kg/ha) at plant densities with values between 350 – 400 plants/m^2 and speed of germination at values between 34 – 36%, as well as for a plant density between100 – 110 plants/m^2 and speed of germination between 26 – 32% (Fig. 4). The coefficient of multiple correlation between the three studied parameters, plants' density, speed of germination, and yield, respectively, is a moderate one , as shows its value, R = 0.485, representative for 23.50% of the sample (Fig. 4).

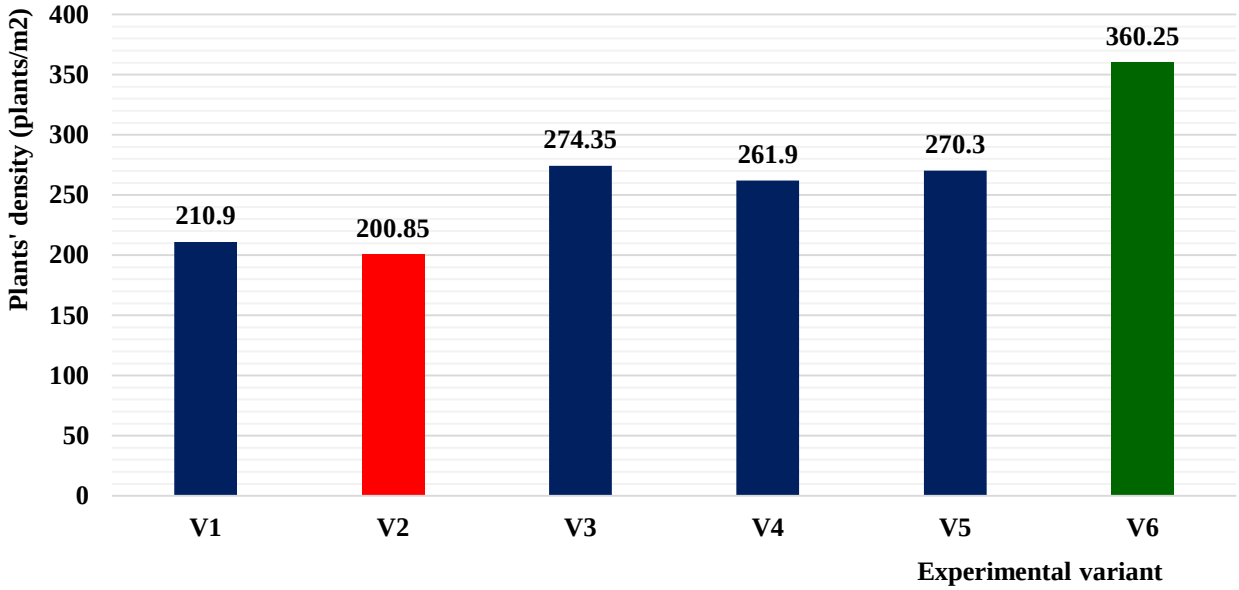

Figure 2. The evolution of plants' density (plants/m^2), in 6 experimental variants

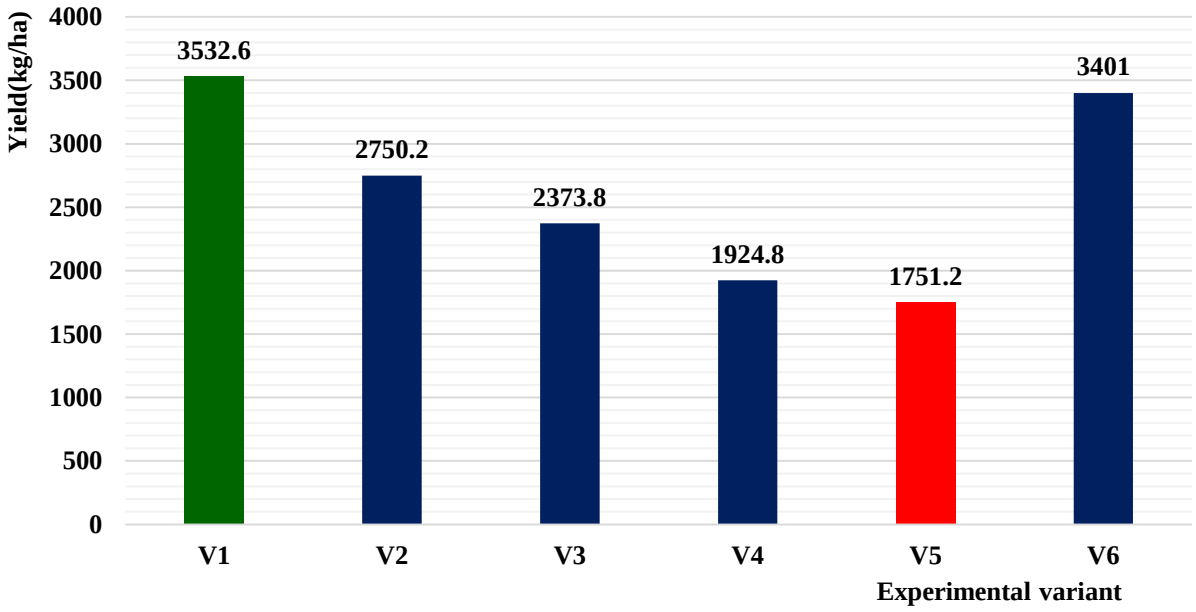

Figure 3. The evolution of plants' yield (kg/m^2), in 6 experimental variants

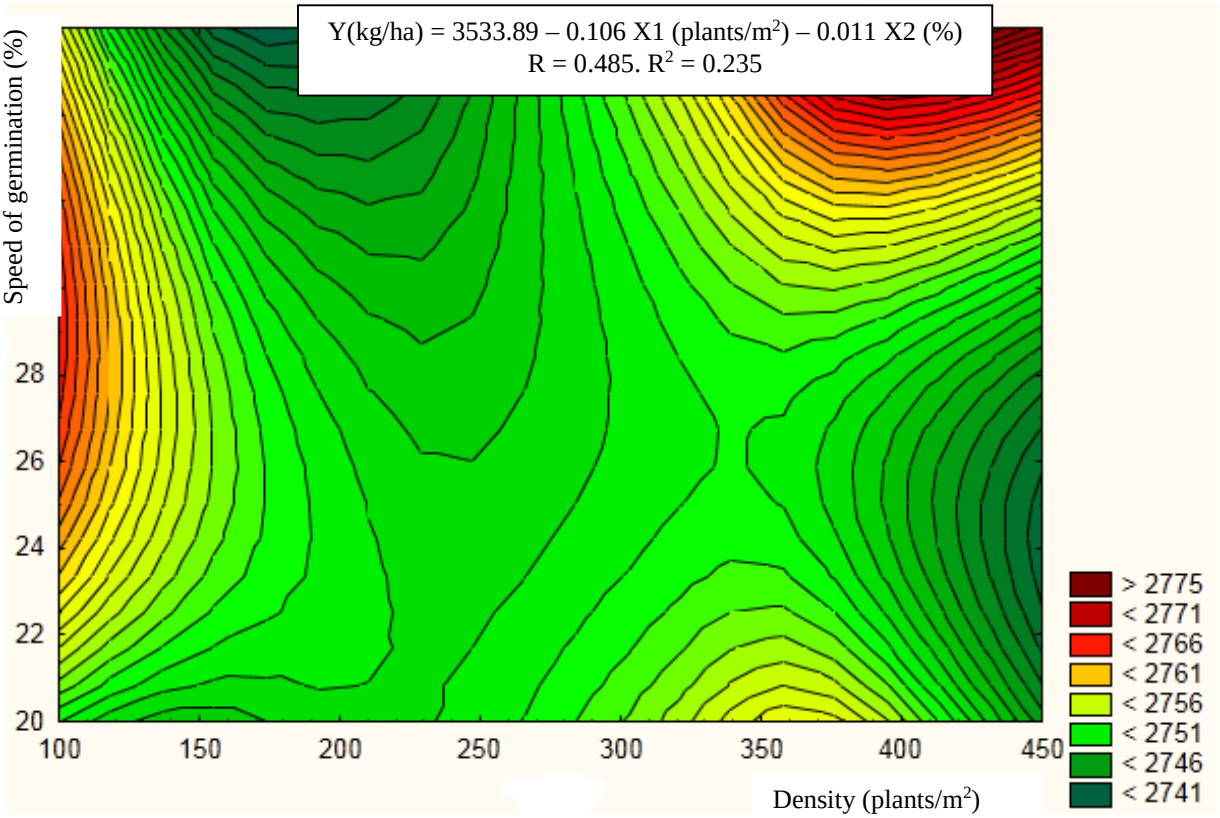

Figure 4. The influence of the plants' density (plants/m^2) and emergence yield (%) on production (kg/ha) in variant V1

One may also find that weak, weak to moderate, and moderate positive simple correlations are reported between wheat yield (kg/ha) and plants' densities (plants/m^2) in variants V1, V3, V4. The weakest simple correlation, emphasized by the value of the coefficient of correlation of R = 0.312 (representative only for a share of 9.70% of the sample) is reported in variant V4, where the wheat seeds were phytosanitary treated with Kinto Duo. Weak to moderate, and moderate positive simple correlations between wheat yield (kg/ha) and plants' density (plants/m^2) were identified in variants V2 (phytosanitary treatment with Vitavax), V5 (phytosanitary treatment with Lamardo) and V6 (control). The strongest correlation, emphasized by the value of the coefficient of simple correlation, R = 0.458 (representative in a share of 20.90%) was identified in variant V6 (Table 1).

Table 1. The correlations between yields (kg/ha) and plants' density (plants/m^2) in 6 experimental variants

Variant	R	R^2
V1	0.327	0.106
V2	0.418	0.174
V3	0.372	0.138
V4	0.312	0.097
V5	0.389	0.151
V6	0.458	0.209

Positive moderate and moderate to strong, simple correlations are emphasized between wheat yield (kg/ha) and speed of plants' germination (%) in variants V1 (phytosanitary treatment with Vitavax 200 FF) and V4 (seeds phytosanitary treatment with Kinto Duo).

The weakest simple correlation, as the value of the coefficient of correlation shows R = 0.578 (representative in a share of 33.50%) was emphasized in variant V1 (phytosanitary treatment with Vitavax 200 FF).

Moderate, and moderate to strong simple correlations between wheat yield (kg/ha) and speed of plants' germination (%) may be reported for the variants V2 (phytosanitary treatment with Vitavax 2000), V3 (phytosanitary treatment with Divident Star), V5 (phytosanitary treatment with Lamardor), and V6, untreated control (Table 2).

Table 2. The correlations between yields (kg/ha) and plants' emergence velocity (%) in 6 experimental variants

Variant	R	R^2
V1	0.578	0.335
V2	0.674	0.454
V3	0.652	0.425
V4	0.624	0.389
V5	0.591	0.349
V6	0.657	0.431

4. Conclusions

Our study shows that wheat plants germination is inhibited by the phytosanitary treatments, because best results, with biggest speed of germination, 64.68%, were obtained in control where no treatments were administered.

In the meantime, plant density is also favourised by lack of phytosanitary treatment, the biggest wheat plant density, of 60 plants/m^2, being reported for variant V6, control.

Not the same thing may be stated for wheat yield, in experimental conditions of our trial, which is favourised by the phytosanitary treatment with Vitavax 200 FF (experimental variant V1), when 3,532.60 kg/ha, resulted.

The strongest interaction between the wheat yield (kg/ha) and wheat plants' densities (plants/m^2), is emphasized by the value of the coefficient of simple correlation, R = 0.458 (representative in a share of 20.90%) variant V6 untreated (control), while the strongest simple correlation between the wheat yield (kg/ha) and speed of wheat plants' germination (%), equal to R = 0.674 (representative in a share of 45.40%) is reported for the variant V2, – phytosanitary treatment with Vitavax 2000.

Thus, our study shows that in specific experimental conditions of Research – Development Station for Agriculture Jucu, Cluj – Napoca, the best experimental practices of cultivating wheat infested with *Fusarium spp*., were represented by lack of phytosanitary treatment when referring to speed of germination, and wheat plants' density, and phytosanitary treatment with Vitavax 2000 from Chemtura, when referring to wheat yield.

References

[1] Chekali S., S. Gargouri , M. Rezgui, T. Paulitz, B. Nasraoui, 2016, Impacts of previous crops on Fusarium foot and root rot, and on yields of durum wheat in North West Tunisia, Phytopathologia Mediterranea, 55, 2, 253−261.

[2] Dweba C.C., S. Figlan, H.A. Shimelis, T.E. Motaung, S. Sydenham, L. Mwadzingen, T.J. Tsilo, 2017, Fusarium head blight of wheat: Pathogenesis and control strategies, Crop Protection, 71, 114 – 122.

[3] Moya-Eliyondo E.A., B.J. Jakobsen, 2016, Integrated management of Fusarium crown rot of wheat using fungicide seed treatment, cultivar resistance, and induction of systemic acquired resistance (SAR), Biological Control, 92, 153-163

[4] Oroian I., I. Covrig, A. Odagiu, 2015, Aplicative Treatise of Plant Protection, Ceres Publishing House, Bucureşti [In Romanian].

[5] Merce E., C.C. Merce, 2009, Statistică – paradigme consacrate şi paradigme întregitoare, Editura AcademicPres, Cluj-Napoca.

[6] Prescott J. M., P. A. Burnett, E. E. Saari, J. Ranson, J. Bowman, W. de Milliano, R. P. Singh, G. Bekele, 1986, Wheat Diseases and Pests: a guide for field identification, https://wheat.pw.usda.gov/ggpages/ wheatpests.html

[7] Shewry P.R., 2009, Wheat, Journal of Experimental Botany, 60(6), 1537-1553.

[8] ***, Wheat Disease Identification, 2011, https:// cropwatch.unl.edu/documents/Wheat%20Disease%20I d ent ification.pdf