



# BASAL STERILITY OF WHEAT EARS - INDEX OF SENSITIVITY TO DELAYED SPRING FROZEN AND ITS RELATIONSHIP WITH YIELD AND PRODUCTIVITY ELEMENTS, IN THE CLIMATIC CONDITIONS OF 2020 YEAR AT ARDS CARACAL

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## INTRODUCTION

The basal sterility of the wheat ear is a common phenomenon in the years when delayed spring frosts are present. The increase in grain number per spike contributes considerably to improve wheat grain yield potential.

The grain number and grain weight in wheat are influenced by both genetic and environmental factors (Li Y. et al, 2016).

Grain yield is under big influence of ear properties, and interdependence and correlation between spike length and spikelet number per spike (Martincic et al., 1996).

The genotype - environment interaction presence complicate selection of superior genotypes. Understanding of environmental and genotypic causes of significant genotype - environment interaction is important in all stages of plant breeding (Dhungana et al., 2007).

Wheat is occasionally exposed to freezing temperatures during ear emergence and can suffer severe frost damage. Few studies have attempted to understand the characteristics of freezing and frost damage to wheat during late development stages. It was clearly shown that wheat appears to have an inherent frost resistance to temperatures down to  $-5^{\circ}\text{C}$  but is extensively damaged below this temperature (Fuller et al., 2007).

Frost damage in cereals is a significant annual production constraint for the Australian grain industry and can result in considerable yield losses (Zheng et al., 2015).

Low temperatures in spring generally occur between the end of March and beginning of April, during which time wheat ears are in a critical period of meiosis and tetrad formation and are, therefore, highly sensitive to temperature stress. If exposed to low temperature at this time, the entire wheat spike or parts of the spikelet will fail to set after tassel formation, decreasing yield by 30–50% (Zhang et al., 2011).

## MATERIAL AND METHODS

The pedoclimatic conditions available at SCDA Caracal are favorable for the cultivation of hail cereals, as they possess a soil of baticalcric cambic chernozem type with a high potential for fertility and a good production capacity. In general, chernozems do not pose any particular problem in terms of cultivation with a comprehensive assortment of agricultural plants (Roșculete et al., 2019).

In the spring of 2020, in Caracal, two consecutive days (March 16 and 17) were recorded low temperatures ( $-6^{\circ}\text{C}$  and  $-6.3^{\circ}\text{C}$ , respectively). As the plants progressed in vegetation and the ears appeared, it was observed that some of them show basal sterility, the variability being from the absence of the phenomenon at basal sterility on one third of the ear.

For 200 wheat varieties of different origins (Romanian, French, Austrian, German, Swiss, mixed, hybrid wheat germplasm) the basal sterility manifested was determined at 10 ears / replication by ratio between the number of sterile spikelets per ear and the total number of spikelets / spike.

Correlations were made between the basal sterility and the other determined characters: yield, test weight (TW), thousand kernel weight (TKW), note for delayed spring frozen resistance (SFR) – only 120 varieties, days from 01.01 to heading date (DHD). The correlation coefficient and the determination coefficient resulted.

## CONCLUSIONS

Mixed germplasm (52 wheat varieties from all over Europe) had an basal sterility average rate of 11.4% - the lowest in the experiment. At the opposite pole was the German germplasm with an average percentage of 17.1%. The lowest amplitudes between the maximum and minimum values of basal sterility were recorded in hybrid wheat and Romanian germplasm (13.5-13.6%). The highest amplitude was recorded in the French germplasm – 19,1 %.

The strongly negative correlation between basal sterility and yield makes this character an index of wheat sensitivity to delayed spring frosts, having reducing yield effect.

Exceptions (high sterility-high yield) are search through the breeding plant and these are mainly represented by the Swiss germplasm in our experiment.

The interpretation of the detected correlations suggests that varieties with late heading date are more sensitive to delayed frosts but not necessarily by decreasing yield but by decreasing the test weight.

The coefficient of determination show that the variability of basal sterility is associated with 3.7% of the variability of yield

## RESULTS AND DISCUSSIONS

The grouping of the assortment tested by provenance showed differences between averages and between minimum and maximum at basal sterility (Table 1).

**Table 1**

**Basal sterility at groups of tested germoplasm in 2020 on the chernozem from Caracal**

Germoplasm provenance	Average %	Amplitude %
Romanian germoplasm (25 varieties)	14,0	7,1-20,7
Austrian germoplasm (22 varieties)	15,2	7,9-23,6
Swiss germoplasm (25 varieties)	15,9	7,8-26,5
French germoplasm (36 varieties)	14,3	4,8-23,9
German germoplasm (25 varieties)	17,1	7,4-24,9
Wheat hybrids (20 hybrids)	13,9	6,4-19,9
Mixed germoplasm (52 varieties from all over Europe)	11,40	3,8-20,9

Mixed germplasm (52 wheat varieties from all over Europe) had an basal sterility average rate of 11.4% - the lowest in the experiment. At the opposite pole was the German germplasm with an average percentage of 17.1%. The lowest amplitudes between the maximum and minimum values of basal sterility were recorded in hybrid wheat and Romanian germplasm (13.5-13.6%). The highest amplitude was recorded in the French germplasm – 19,1 %.

The correlations performed highlighted the distinctly significant negative relationship between the basal sterility and the yield obtained; the significant positive relationship between yield and the note reflecting frost resistance; the significant negative relationship between the test weight and the days from 01.01 to heading date (table 2).

The strongly negative correlation between basal sterility and yield makes this character an index of wheat sensitivity to delayed spring frosts, having reducing yield effect.

Among the correlations made were also highlighted: the distinctly significant negative correlation between yield and test weight; significantly positive correlation between thousand kernel weight and test weight; the significantly negative correlation between test weight and note for delayed spring frozen resistance and the significantly positive correlation between note for delayed spring frozen resistance and days from 01.01 to heading date.

**Table 2**

**The correlations between the characters determined in 2020 in Caracal**

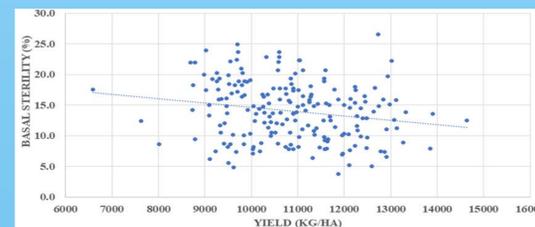
	Yield	TKW	TW	SFR	DHD
Basal sterility	-0,193 <sup>oo</sup>	0,085	0,044	0,137	0,133
Yield	1	0,065	-0,204 <sup>oo</sup>	0,188*	-0,077
TKW	-	1	0,174*	-0,094	-0,047
TW	-	-	1	-0,225 <sup>oo</sup>	-0,275 <sup>oo</sup>
SFR	-	-	-	1	0,155*
DHD	-	-	-	-	1

(P5% = 0,140; P1% = 0,180 for 200 cases studied; P5% = 0,180; P1% = 0,230 for 120 cases studied according to the annex showing the correlation coefficients that can be considered significantly different from 0 at the level of 5% and 1% - Săulescu and Săulescu, 1967).

The interpretation of the detected correlations suggests that varieties with late heading date are more sensitive to delayed frosts but not necessarily by decreasing yield but by decreasing the test weight.

The coefficients of determination show that the variability of basal sterility is associated with 3.7% of the variability of yield; yield variability is associated with 3.5% of the variability of the notes reflecting delayed spring frozen resistance and with 4.1% of the variability of the test weight.

From the graphical representation of the 200 varieties tested, important are those that are placed in the quadrature with high basal sterility values but also with high yields. Of these, the varieties that obtained: 12726 kg / ha with 26.5% basal sterility; 13027 kg / ha with 22.2% basal sterility and 12942 kg / ha with 19.7% basal sterility. All three of these exceptions are part of the Swiss germplasm (Figure 1).



**Figure 1. The relationship between yield and basal sterility in 2020 on the Caracal chernozem**

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