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Study of the Varietal Behavior of Eight Durum Wheat Genotypes Under Conditions in Haut Chéllif (Ain Defla, Algeria)

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ABSTRACT

This study was conducted on five varieties of durum wheat of which 03 are native to the region of Ain Defla (Waha, Vitron, and Siméto), and 05 others introduced were studied during this test (NV25, NV26, NV27, NV28, NV29), to study their varietal behavior under natural climatic conditions in the semi-arid zone of Ain Defla, during the 2008/2009 campaign. The chosen experimental device is complete random blocks with 04 repetitions. The study focused on the phenological characteristics of the plant, such as plant height at maturity (cm), the number of tillers.m-^{2}, the length of cob, the length of the pedoncule cob, as well as the development of the yield (biological and actual yield) and their components (number of fertile tillers plant-1, number of grains cob-1, 1000-grain weight (g), grain yield m-^{2}). With phenological characteristics, the results show that some introduced varieties have a clear superiority compared to local varieties. Regarding the yield components, the results show that they are influenced by the variety factors and pedoclimatic adaptation conditions of the new varieties compared with the control varieties. Additionally, a difference between the biological and real yields was recorded to estimate the yield around 5% to 28% in the form of loss.

Key words : *Local varieties, Introduced varieties, Durum wheat, Morphological characteristics, Yield components*

Introduction

In Algeria, cereal production, including fallow land, occupies about 80% of the country's useful agricultural area (SAU). The annual area sown to cereals is between 3 and 3.5 million ha (Djermone, 2009).

Currently, in 2021, the Algeria Press Service (APS), said that the overall area reserved for the cultivation of cereals is estimated at 2.9 million hectares with an annual production of about 3.5 million tons, including 3.3 million tons of wheat.

The evolution of the production and surface remains in stagnation since the year 2009 until 2021 for causes related to climatic and ecological variations, and varietal and parasitic attacks.

The study was carried out during the 2008/2009 season with the objective of studying the varietal behavior of five introduced varieties compared to the local ones through the identification of the different phenological characteristics, the yield, and its components and to determine their production potential.

Materials and Methods

Study location

The plain of the high Chéliff in which is located the station of the ITGC (Technical Institute of large crops), of khemis-Miliana is located at 40Km as the crow flies from the sea with an altitude of 289 m and an area of 39 000ha (Fig. 1).

Soil characteristics

According to Boulaine (1957), the nature of the soils of the Haut Chellif region varies with the relief, which allows us to distinguish three main types of soil;

-The sandy alluvial soils of a moderate terrace.

-The silty alluvial soils of a recent terrace.

-The soils of an old terrace.

Physical characteristics of the soil

The results of granulometry analysis show that the soil of the institute has a silty clay texture, which is favorable for the development of wheat because it has a good retention capacity in water and fertilizing elements (Table 1).

Climatic conditions

Annual Precipitation (Period 1986-2007)

The climatic conditions of the campaign are characterized by a regular distribution of rainfall because of the annual accumulation that was recorded in the course of the year 2007 with 571.8 mm, which allows us to conclude that the past three years (Fig. 2).

Monthly precipitation for the season (2008-2009).

The climatic conditions of the campaign were characterized by a very cold winter and an irregular distribution of rainfall, of which more than 62% of the total accumulation was recorded during the months of December, March, and April (Fg. 3). The spring

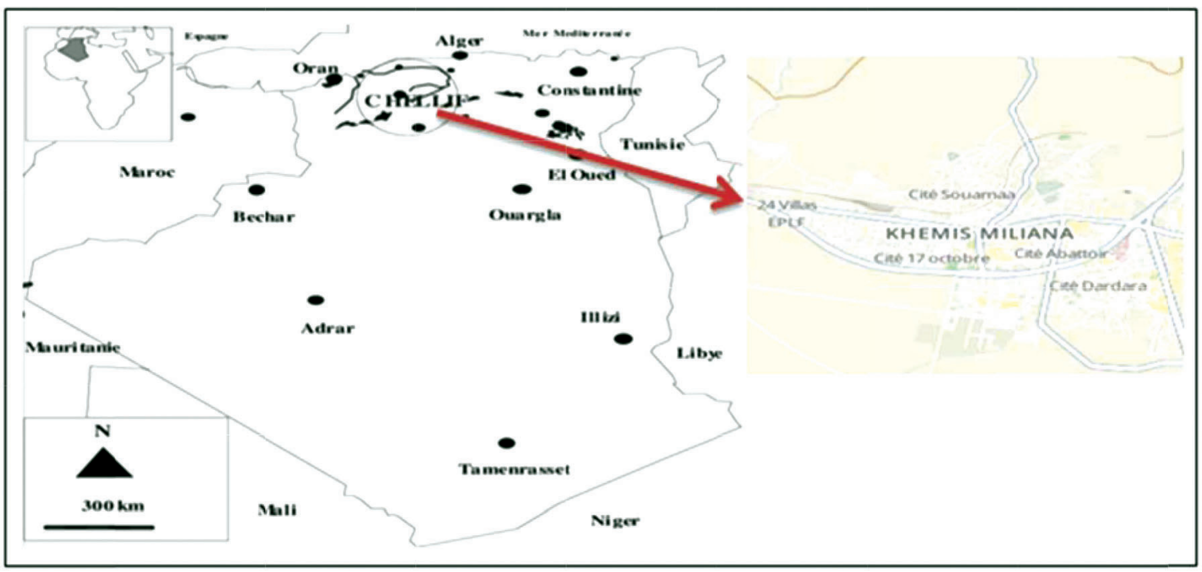

Fig. 1. The geographical location of the perimeter (Haut Chéliff).

Table 1. Physical analysis of soil

Depth (cm)	Granulométrie					Texture
	Clay	Fine loam	Coarse loam	Fine sand	Coarse sand	
0-40	32	30	19.6	10.7	7.7	Loamy-clay
40-70	40	15	17.3	19.1	8.6	Clayey
70-100	50	10	12	17.1	14.3	Clayey
100	50	10	04	13.6	17.2	Clayey

(ITGC, 2008).

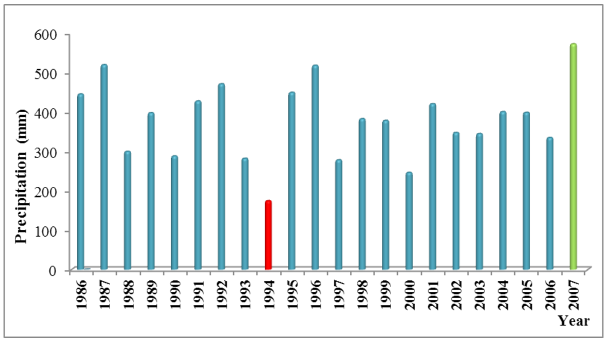

Fig. 2. Annual Precipitation (Period 1986-2007).

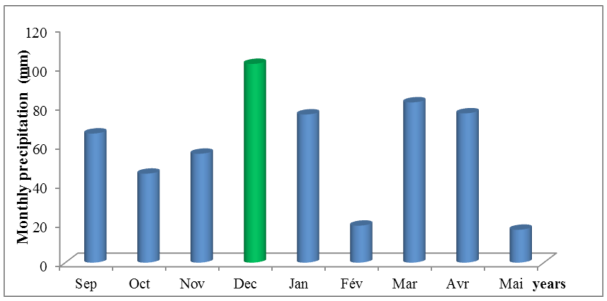

Fig. 3. Monthly precipitation for the campaign (2008-2009).

was relatively rainy, which favored a good development of vegetation. On the other hand, the months of February and May recorded the lowest amount of rainfall of less than 7% of the total accumulation.

Thermal regime

The hottest month is September with 23.33°C and May with 22.7°C. Of which the total accumulation of temperature during the cycle of our culture is more than 62.74°C (Fig. 4).

Experimental device

The set-up of our experiment is a complete-randomized block with four blocks (repetitions). Each block includes eight (08) lines, randomly distributed. According to the climatic conditions and the state of the ground, the sowing of these lines was carried out a little late, manually, on January 19, 2009, at a rate of 250 grains per micro plot (42 grains per linear meter, that is to say, 6 lines).

Results and Discussion

Morphological parameters

Indeed, water stress in February (tillering stage), causes a reduction in the growth of emitted tillers (El-hafid *et al.*, 1998). Severe water stress reduces the length and volume of seminal roots, mainly in the deep layers of the soil, thus reducing the water resource available later for wheat (Adda *et al.*, 2005).

The results of the analysis of variance, show a non-significant difference between the growth parameters, except in the parameter length of the neck of the ear where the probability is ($P<0.05$), which means the significance of this parameter in the different genotypes. This result is in agreement with Grignac (1987), who found a positive and weak relationship between the yield and the length of the last internode. Also, with the ratio of the length of the last internode to the length of the stem. The pedoncule of the cob is important because it moves

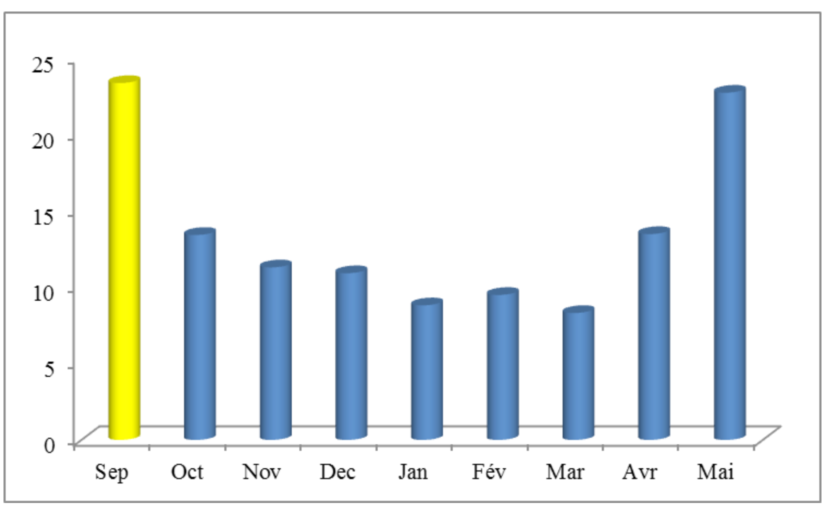

Fig. 4. The monthly average temperature of the campaign (2008-2009).

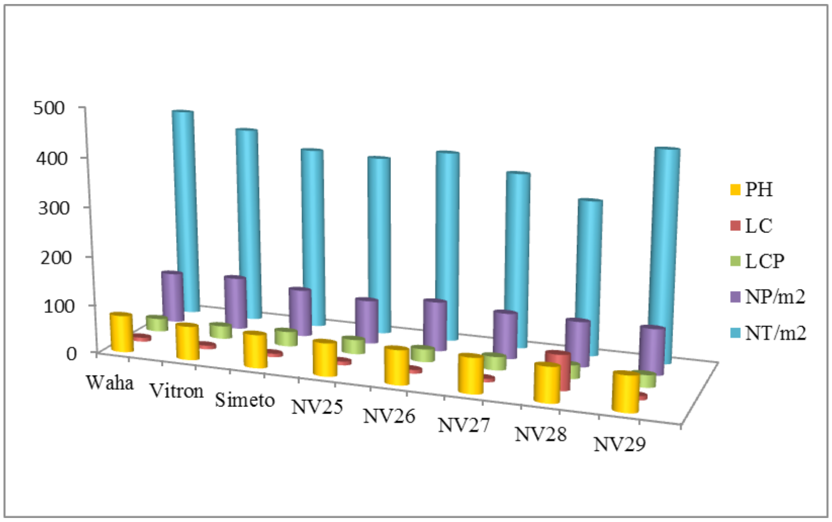

Fig. 5. Mean variations of morphological parameters of the genotypes.

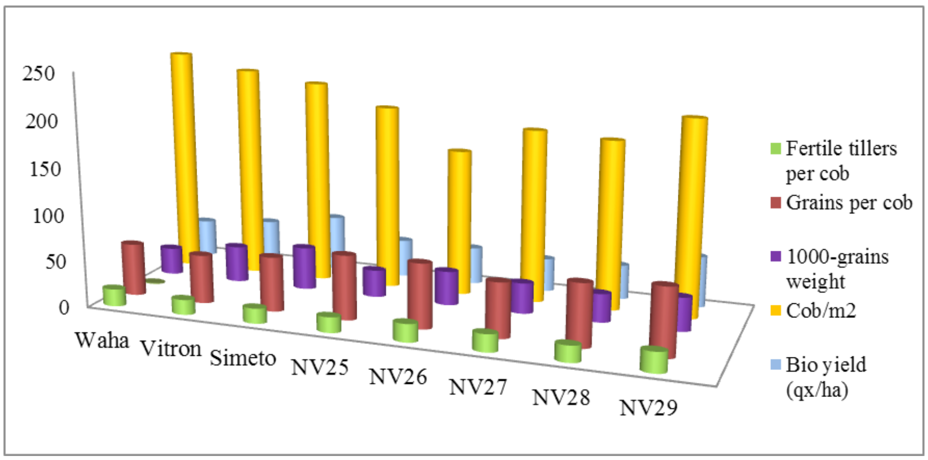

Fig. 6. Mean variations of the yield components of the genotypes.

the cob away from the foliage, thus limiting the risks of importance by possible diseases (Rapilly, 1986).

Yield Components

The ANOVA results obtained show a non-significant difference between the varietal factor and the yield components (P<0.05). On the other hand, it is very highly significant in the other parameters like No. of fertile tillers per plant, number of grains per cob, and 1000-grains weight.

In rain-fed crops, the number of cobs per square meter, the number of grains per cob, and the 1000-grans weight are the most important components in determining the final yield (Duner, 1976 ; Merouche, 2015).

Indeed, the number of ears and the number of

Table 2. Analysis of variance of morphological parameters

S.O.V	Df	Plant height (cm)		Length of the cob		Length of the cob pedoncule		No. of Plants per m²		No. of tillers per m²	
		P	Cv	P	Cv	P	Cv	P	Cv	P	Cv
Genotypes	7	0.7423	9.74	0.1061	9.68	0.0465*	8.41	0.4348	13.79	0.4917	18.73

(p<0.05) ; (Df, degré of freedom ; Cv, coefficient of variation).

Table 3. Effect of genotypes on yield components.

S.O.V	Df	No. of fertile tillers per plant		No. of cobs per m²		No. of grains per cob		1000-grains weight		Grains yield (qx/ha)	
		P	Cv	P	Cv	P	Cv	P	Cv	P	Cv
Genotypes	7	0.0001***	7.41	0.1105	20.19	0.0000***	5.82	0.000***	5.32	0.3670	24.49

(p<0.05) ; (Df, degré of freedom ; Cv, coefficient of variation).

Table 4. Effect of morphological parameters and yield components on the varietal behavior of local and introduced genotypes.

	LCP	LC	NFT/P	NC/m²	NG/C	NT/m²	1000-GW
Waha	26.550 BC	8.2625AB	18.457 BC	243.33A	56.040 CD	405.66AB	29.16 E
Vitron	26.700 BC	7.6625ABC	16.125 DB	229.16AB	52.200 D	409.41AB	35.595 BC
Siméto	30.525A	7.2500 BC	16.122 DB	219.75 AB	51.127 D	376.33AB	42.622A
NV25	29.575AB	8.3750AB	16.568 CD	197.83 BC	69.165AB	370.66AB	29.528 E
NV26	26.365 BC	7.7625ABC	19.373 B	157.32 C	69.425AB	392.08AB	36.748 B
NV27	27.500ABC	7.0875 C	18.813 B	185.91ABC	60.773 C	360.75AB	32.928 CD
NV28	27.700ABC	8.6625A	17.500BCD	176.91 BC	67.050 B	317.47 B	30.542 DE
NV29	25.225 C	7.8750ABC	21.622 A	210.33ABC	72.513A	430.50A	36.258 B

Alpha=0.05
Df :21. Mean in a column followed by the same letter are not different (P<0.05 according to Fisher's protected LSD).

grains per ear are linked to the state of the vegetation at the end of the winter (number of plants and the state of tillering). This component is influenced by the seeding rate, the characteristics of the seedbed and the climatic conditions before and after seeding, the availability of water, and by the N.P.K. nutrition (Belaid, 1996).

Aissani (1989), showed that the number of grains intervenes for nearly 29% in the realization of the yield.

Concerning the 1000-grains weight, it depends on the conditions of nutrition and settlement, it is important in Simeto variety and even in the other introduced varieties, except NV25 variety and the local variety (Waha). Therefore, the 1000-grains weight, will be low when the wheat suffers from cryptogamic diseases, or late rains associated with high heat. A sudden rise of temperature during the phase of accumulation of reserves causes scald, which gives a light grain (Grignac, 1987).

Conclusion

A rather limited number of durum wheat varieties are cultivated in Algeria, whether they come from local populations or from a rather recent introduction (Benbelkacem and Kllou, 2001). The local genotypes are characterized by a low but rather stable yield potential. On the contrary, the introduction genotype (NV29, NV26, and NV25) allows reaching a high production potential but only under favorable hydric and thermal conditions. This is why, in order to valorize this potential and stabilize the production, the irrigation of durum wheat was proposed as a complement to the varietal choice (Bouthiba *et al.,* 2008).

To make up for the production deficit, national production would have to be multiplied by 4, either by increasing the cereal acreage from 3 to 11.5 million hectares, or by raising the average yield to 27.5 q/ha, which highlights the extent of the progress to be made and underscores Algeria's long-term dependence on imports for cereals (Smadhi and Zella, 2009).

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