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EFFECT OF PREVIOUSCROPS (LEGUMES, FALLOW, WHEAT) ON YIELD COMPONENTS OF DURUM WHEAT (*Triticum durum. Desf*)VARIETY WAHA UNDER DIRECT SEEDING IN SEMI ARID REGION OF SETIF

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Abstract

The objective of this study was part of the experimental station of the ITGC of Setif (Algeria) during the campaign (2008/2009), is to determine the best previous crop among legumes, fallow, wheat for a culture durum (WAHA) driving under direct seeding in semi arid to obtain appreciable yields in quantity and quality.

The results of statistical analyzes of variance at the 5%, showed significant differences between these precedents on wheat yield components such as: "Number of ears / m, grain yield, 1000 kernel weight, fertility cob and stalk height at maturity. " This allowed the establishment of a comparison of the means of Newman-Keuls this threshold where the previous "lens" has recorded the best yield of grain was 27.4 quintals / ha the previous wheat gave a maximum value for the parameters: "1000 kernel weight, fertility, and corn stalk height at maturity." The previous fallow him, gave the maximum for the variable "Number of ears / m". These results allow us to conclude and confirm the effectiveness of previous "legumes and fallow" to 62.5% from the previous wheat despite the good results that he gave during the campaign, it remains to check on them several other campaigns in order to rule.

In conclusion we can argue that crop rotation is always a best management practice and in the absence of tillage, it may take even more important, increasing yield, the rate of organic matter in soil and the availability of nitrogen if it includes nitrogen fixing legumes. In addition, the rotation in no-till systems presents some challenges to overcome-especially-weeds.

Keywords: *previous crop, direct seeding, rotation and semi arid.*

Introduction

Cereals and their derivatives occupy the largest share in the Algerian food system (AMARA, 2006). However, BENFERHA and MEDERBAL (2009) note that the device Algeria cereal production is very low productivity. Over long periods, we find that average yields are very low (17 million quintals compared to estimated needs at 63.5 million cwt for 2008). Indeed, the annual production volumes are subject to strong variations due to weather, but also according BELLIDO- LOPEZ (1992), there has been a continuing degradation of natural resources mainly due to misuse and inappropriate farming techniques.

Thus, intensive tillage leads to a deterioration of soil quality that threatens the long-term agricultural production in the Mediterranean basin (BELLIDO - LOPEZ, 1992). Zaghouan et al (2006) also believe that conventional tillage adopted and implemented in several passages, induces an increase of erosion by wind and water, the destruction of organic matter and soil structure ; Add to that the high cost of production (ESCRIBANO, 2006).

Works such as those of RAGUIN (2008) in Morocco, show incontrovertibly that improving and stabilizing crop yields in semi-arid areas can only be achieved through long-term and replacement work conventional soil tillage or non-tillage (BOUZZA 1990; Kacemi 1992; MRABET 1997; MRABET, 2000).

Simplified cultivation techniques and direct seeding vegetation appear as alternatives to even correct the negative impact of production systems adopted by farmers. They arrive at better controlling erosion, organic matter stoker, improve water efficiency and restructure the soil under the effect of improved biological activity (KRIBAA et al, 2001).

However, the practice of direct seeding leads to problems of invasion by weeds whose solution is to use an appropriate rotation grass / broadleaf (DERKSEN et al, 2002). .

Indeed BELLANGER et al. (2007) advocate cropping systems based on crop rotation, which are recognized as beneficial to maintain soil productivity and quality of production. Also Oueld SAID et al (2002) report that the rotations cereals / legumes are probably the most interesting in the agronomic driving conditions in the dry semi-arid regions; legumes enrich the soil fertility nitrogen , but this type of rotation contributes to the reduction of fallow is currently a topic of discussion.

Therefore we tried by the present work, to show the importance of rotation in production systems, under direct seeding to maintain significant levels of performance and to avoid the disadvantages of monoculture (weed , diseases .... etc..) compared to conventional tillage and cultivation techniques simplified, and eventually, to determine the best precedent for a durum wheat crop from: legumes, wheat and fallow in order to have good performance in terms of quantity and quality.

Materials and Methods

The experiment was conducted during the crop year 2008/2009 and carried out on the lands of the Middle Agricultural Technical Institute (ITMA) of Setif working in collaboration with the Technical Institute of Crop (ITGC) of Setif. This station is located partly in the small valley of the river of Oued Bousselam which is situated in the center of Setif and it belongs to the semi-arid zone (KRIBAA et al, 2001)

According to the Table 1, we find that the the growing season 2008/2009 is devided into two major periods: wet and dry periods. The wet season lasts approximately seven (07) months (from September 2008 to April 2009), but the dry period lasts only three months, which are: August 2008, May and June 2009). It can be seen that June is the driest month (4.7mm) and the hottest of the campain 2008/2009 (22.13 °C). While the coldest period of the campain, which coincides with the life slowed vegetation, corresponds to the months of December, January and February (5.27 °C, 5.54 °C and 5.41 °C). This indicates that there is an inter-monthly variation during the experimentation reflecting great irregularity at both levels, temperatures and rainfall which annual quantity (386.1mm) shows that the crop was just rainy.

During this campaign, we recorded 62 days of frost spanning from November 2008 to May 2009, including 19 days (March, April and May) corresponding to the high sensitivity of the plants.

Plant material

The durum wheat variety that was used in the test is Waha. this is obtained from CIMMYT (1979) and introduced in Algeria at the ITGC Setif in 1986 through the center of ICARDA in Syria. Table 2 below, shows the agronomic characteristics of this variety.

Table 1: Rainfall, temperature and other climatic factors characterizing (the season 2008-2009)

Parameters	Rainfall in mm	Temperatures in ° C			Others		
	2008/2009	Min	Max	Avg.	Gelée (days)	Snow (days)	Siroco (days)
September	44.90	14.14	26.54	20.34	---	---	---
October	55.40	10.11	20.63	15.37	---	---	---
November	22.80	3.53	12.94	8.24	05	---	---
December	38.10	1.22	9.52	5.27	14	04	---
January	66.30	1.60	9.50	5.54	10	05	---
February	38.20	1.0	9.83	5.41	14	03	---
March	31.50	2.44	14.38	8.41	12	03	---
April	79.10	3.36	14.76	9.09	06	02	---
May	5.10	9.34	24.88	17.09	01	---	---
June	4.70	13.06	31.20	22.13	---	---	---
Total	386.1	59.80	174.18	116.99	62	17	---

Table 2 : Characteristics of the variety Waha

Agronomic parameters	Characteristics
-ear	-Half-loose to compact, clear amber to red
-Plant height at maturity	-80- 90 cm
-Vegetative cycle	-Early
-Tillering	-Medium to high
-Resistance to cold: -Lodging: -The drought:	-Tolérante -Résistante -Sensible
-Conduct against diseases.	-Resistant to: powdery mildew, eyespot -Moderately resistant: fusarium, septoria. -Tolerant to: yellow, brown and black. Rusts -Sensitive: take-all.
-Weight of 1000 grains	-Medium.
-Technological characteristics	-Semolina Quality: good enough. -Resistant to: mitadinage, fly and ginning.
-Characteristics cultivation	-Sowing time: November-December. -Dose seed: 100-120 kg / ha

Source BOUFNAR-ZAGHOUANE *et al* (2006).

Previous cropping and Crop management:

The Factor studied focuses on five different cropping history of the culture of the current season (2008-2009) of durum wheat variety Waha (Tables 3) and Table 4 summarizes all the cultivation techniques practiced during the campaign.

Table 3. The previous cropping and their abbreviation

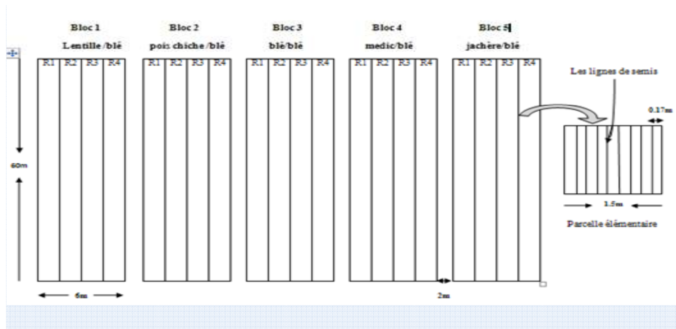
Block	1	2	3	4	5
Precedent	Lens/Wheat	Chickpea/Wheat	Wheat/Wheat	Medic/Wheat	Fallow/Wheat
Abreviation	Len/blé	Pc/blé	blé/blé	Med/blé	J/blé

Table 4. Crop management

Cultivation techniques	Dates and Particularities
Sowing	November 23rd 2008 using a specialized drill brand Semeato 4 meters, with a density of 300 seeds/m2.
Fertilization	-Fertilizers background as TSP (Tri-super phosphate) 100Kg incorporated with the seed. (Localized fertilization) -Fertilizers coverage Sulfazote 120Kg/ha at early tillering.
Weeding	-Weeding post-sowing with a total herbicide: Glyphosate total (or 480g /l Glyphosate isopropylamine salt) at a rate of 2.5 l / ha further of an acidifying Lawer7 acid in an amount of 90 ml in 300 l of water /ha -Post-emergence weed control with Granstar due to 15g/ha
Harvest	The grain harvest was carried out on 27/06/2009 using a combine harvester type HEGE80 with 1.19 m in width a surface area of 71.4/m² per plot.

Experimental Protocol:

The experimental device is adopted en bloc complete random distribution. The main plot is divided into five blocks, each measuring 6 m wide by 60 m long, each block is divided itself into four elementary plots (replicates) of 1.5 m wide each, the blocks are spaced apart by 2 m (Graph 1)



Graph 1: Experimental protocol

The measured parameters:

For reasons of convenience, these abbreviations will be used in the following paragraphs to present each parameter (Table 5)

Table 5 : Measured traits and their abbreviation

Parameters	Abbreviation
Number of emerged plants per square meter	Pt /m²
Number of herbaceous tillersper square meter	Th /m²
Number of ears per square meter	Epi /m ²
Cob (Epi) fertility	Fert
Stem height at maturity	Haut
Le poids de mille grains	Pmg
Le rendement paille	Rdtp
Le rendement en grains	Rdtg

These traits have been measured and The STATITCF software version 5.0.was used for the statistical treatment of data.

Two approaches were used for this purpose:

- The analysis of variance the effect of the five previous under direct seeding on yield components, followed by a comparison of means of Newman-Keuls to highlight the best results compared to the effect of various precedents used.
- The connection between the studied variables was evaluated by correlation matrix at the threshold of 5%.

Results and Discussion

The analysis of variance showed highly significant effects for the variables **Epi /m²**, and **Pmg Rdtg** ($p<0.00$) and a significant effect for **Fert.** and **Haut.** ($p<0.01$). This is explained by the fact that these traits constitute the most important components of performance, they can give to each species its own potential. While variables **Pt/m², Th/m²** and **Rdtp** are not significant (Table 6).

This result means that the various precedents show no significant difference with regard to their effect on the lifting of the wheat crop, and that no significant difference can be attributed to the use of the same variety (Waha) with the same seeding and tracking the same route technique (date of sowing, weeding ... etc..).

In addition, according ABDELLAOUI et al. (2006), the settlement to the lifting ensure largely successful culture and has an important role in determining the population ears, which is an important component of performance.

Table 6. Results of the analysis of variance

S: significant NS: not significant

Significant (*); very significant (**) highly significant (***)

The effects of previous cropping by comparing averages of Newman and Keuls on the measured parameters gave these results:

1-Number of ears per m²:

The results of the Graph 2, give a ranking into three groups according to the test of comparison of means with J/blé at the head (group A) of all previous cropping.

The heading stage is an important step in the life cycle of the plant. At this stage, the plant architecture becomes apparent and reaches its maximum. Most often, it gives an indication of the capacity of producing differential varieties. (KIRBIY et al, 1999).

On the stand ears per m², a highly significant difference of this component was revealed by the analysis of variance at 5% (Table 5). This can be attributed to the coincidence

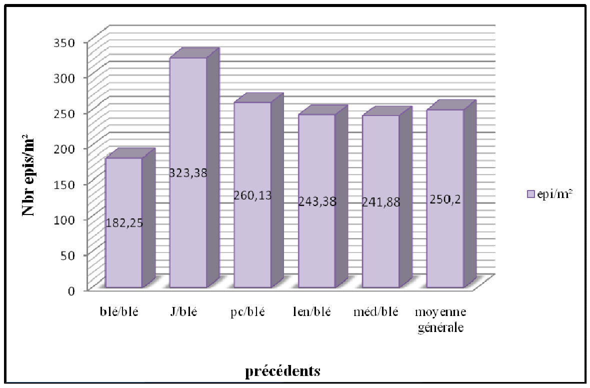
Source of variation	DDL	Pt /m²	Th/m²	Epi/m²	Pmg	Fert	Haut	Rdtp	Rdtg
Var. totales	19	584.17	3316.37	2553.41	11.62	18.90	18.92	83.06	25.29
Var. précédents	4	150.38	3973.30	10186.17	45.27	69.72	32.91	127.72	104.39
Var. résiduelles	12	174.14	1232.10	510.65	2.25	4.99	8.70	65.74	3.89
Ecart type (E.T)	---	13.20	35.10	22.6	1.5	2.23	2.95	8.11	1.97
Coefde variation(%	---	5.1	8.8	9	5.4	7.6	4.6	27.9	9.6
Test FISHER	---	0.86	3.22	19.95***	20.15***	13.96**	3.78*	1.94	26.85***
Signification statist.	---	NS	NS	S	S	S	S	NS	S

of this phase with the drought (May: 5.10 mm, June: 4.70 mm according to Graph 1), causing the plants to draw their water from the ground, and according to the potential of each of these cultures:

- Fallow has a larger pool compared to other precedents;
- Chickpea consuming plenty of water (taproot system exhausting water in the soil);
- The lens develops a lot of dry matter (then higher water requirements);

- Same goes for the medic except that it is infested with weeds;
- Not to mention the effect of monoculture wheat / wheat.

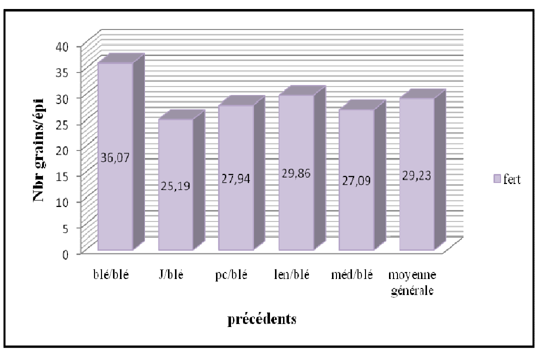
All these features water, will essentially explain these results



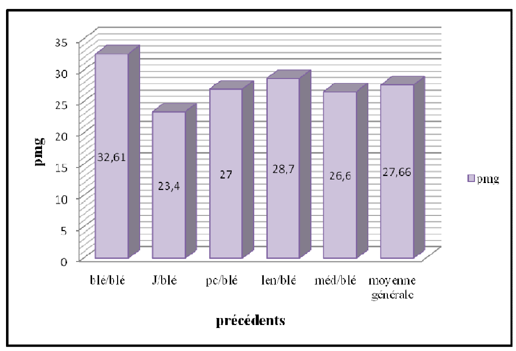
Graph 2: Number of ears/m²

2-The weight of a thousand grains:

According to the Graph 3, the highly significant effect of this variable has a ranking of three homogeneous groups. It appears that the thousand grain weight of blé/blé precedent, is ranked first (group A) because of the low density recorded in the population épis per square meter during the heading stage .GATE (1995) notes that the thousand grain weight decreases significantly under the effect of high temperature or water deficit which coincides with grain filling;fertilization and weed density can also reduce the size of the grain, as well the filling stage in our case, coincides with a period of low rainfall in May (5.10 mm on Table 1)



Graph 4: Cob fertility



Graph 3: Thousand grains weight.

3-Cob fertility (the number of grains per ear):

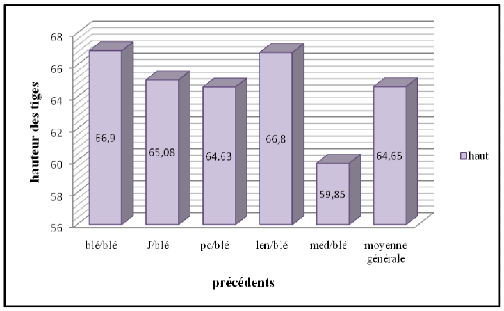
SOLTNER (2005), noted that the number of grains per ear varies between 21 and 40 grains/ear,which corroborates with our results as the overall average is 29.23 (Graph 4)

The significant difference between the previous crop for this variable was used to classify them into two groups, the second set includes all legumes which reflects the absence of statistically significant difference between them compared to monoculture. This result can be attributed to the fact that the number of grains is influenced by the quality of the soil water reserves, as well as nutrition nutrients such as nitrogen and phosphorus (SOLTNER 1978; Kolev, 1979).The trade-off between yield components may also occur. The filling phase which takes place under high water and thermal stresses, gives very low yields, even if the state of the plant at the heading stage promises a good yield, following growth conditions of the post -heading (ABBASSENNE et al, 1998). This component is critical and is considered as an essential component of the final yield and it decreases gradually as the number of ears per m² population increases (in case of water deficit in grain filling stage),

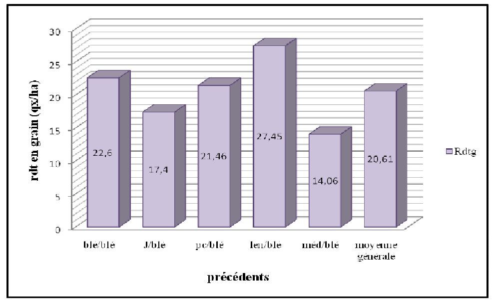
4-The stem height at maturity:

Stem height at maturity is varying between 60 and 70 cm (Graph 5), which approximates the results of BENNASSEUR (2004) indicating a broader range (60 - 110 cm).

For that, precedents are distributed in three homogeneous groups ranked by comparing the average (Table 9), where previous: wheat and lens constitute the first group with nearby averages. The rest of the groups are formed by: J/blé, Pc/blé and Med /blé that not much different from the first group



Graph 5: The stem height at maturity



Graph 6: Grain yield

5-Grain yield:

For this trait (Rdtg), the results in Graph 6, provide a ranking into four groups according to the test of comparison of means (Graph 6) and show that compared to an overall average of 20.61 quintals/ha, the precedent lens/wheat with 27.45 quintals/ha (group A) is the best one among all the precedents.

BELAID (1996) notes that a wheat following to lens crop whose performance is higher than 4 quintals / ha, requires less nitrogen than wheat after hay vetch-oats.

The values of the linear correlation coefficients are used to study the links between the variables. Existing correlations are of two types (Table 7)

Table 7: Correlation matrix

	Pt /m²	**Th/m²**	**Epis /m²**	**Pmg**	**Fert**	**Haut**	**Rdtp**	**Rdtg**
Pt/m²	1.000							
Th/m²	**-0.449* (p<0.05)**	1.000						
Epis/m²	0.072	0.075	1.000					
Pmg	0.067	-0.175	**-0.817** (p<0.001)**	1.000				
Fert	0.164	0.064	**-0.708** (P<0.001)**	**0.642** (p<0.001)**	1.000			
Haut	0.431	-0.325	-0.042	0.314	0.245	1.000		
Rdtp	0.095	0.321	0.280	-0.056	-0.009	0.136	1.000	
Rdt g	0.057	-0.222	-0.321	**0.470* (P<0.05)**	**0.453* (p<0.05)**	**0.484* (P<0.05)**	-0.203	1.000

At the threshold of 5%, ddl = 18, correlation coefficient r = 0.4338

Significant negative correlations such as those between **Pt / m²** and **Th /m²** (r=-0,449), this indicates that in proportion as the number of plants raised per m² increases, the number of tillers per m² decreases ; there is also a highly significant correlation between variables **Fert** and **Epi /m²** and between **Pmg** and **Epi /m²** respectively r = -0,708 and r = -0,817, this means that a large number of ears per m² causes a decrease in fertility and therefore inthe thousand

grain weight. Significant positive correlations: **Rdtg** is moderately correlated with **Fert** (r = 0.453), **Pmg** (r = 0,470) and the **Haut** (r = 0,484) where it can be deduced a highly significant correlation between the **Fert.** ears and **Pmg** (r = 0,642).
Finally we can conclude that these yield components, in this case, have fulfilled their role.

Conclusion

At the end of this work which was initially intended to draw the importance of rotation in production systems and identify the best among previous: legume, fallow and wheat under direct seeding in semi-arid area, we can conclude that:

Various previous induced some variability in agronomic traits measured. Indeed, the analysis of variance at 5% showed that previous cropping really induces significant differences characters: ears per m², thousand grain weight, fertility ears, stem height at maturity and grain yield which gives a rate of distinction between these previous results about 63% confirmed by the study of correlations where the previous lens achieved very good results, especially for the trait grain yield.

This study enters in the ITGC station program within the introduction and extension of the system of direct seeding in the high plains area in particular, and Algeria in general, compared to Morocco (20 years of research on direct seeding) and Tunisia (5-6 years of research) where system has been tested and has reserved areas where it does not cease to grow. So whatever the cropping, crop rotation is always a best management practice. In the absence of tillage, it may take even more important; especially to interrupt the life cycle of insects, diseases and weeds that crop rotation can also increase performance, the rate of organic matter in the soil and the availability of nitrogen if it includes nitrogen-fixing legumes. However, crop rotation tillage systems present some challenges.

This system can be an effective way to ensure that conservation agriculture and ensure the sustainability and preservation of the environment. But this can be done by:

1-A more intensive program of research carried out on the direct seeding.

2-Dissemination of research findings in the producer middle and farmer participation in development program and engagement should ensure widespread adoption of the system in farms. In addition, financial support for farmers is recommended to purchase specific equipment.The beneficial effect of direct seeding on the components of the environment is not found as soon as the early years of his practice, but probably in the long term and with the rotation, the evolution of soil structure and its chemical composition positively influence productivity and soil quality. The results of this study are preliminary to better capitalize on this research topic we strongly recommend its recovery with a possible extension in time and space in this case deal with new issues such as rotation and evolution of weeds, insects and diseases conducted under direct seeding.

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