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Effect of agricultural practices on weeds seedbank in Nord Algeria

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ABSTRACT/RESUME

Abstract: *The aim of the experiment is to study the development of the weeds of the Vitron variety of durum wheat, conducted according to three technical itineraries, conventional work, minimum labor and direct seeding by analyzing the effects of each technique on the seedbank of weeds.*
The seedbank of weeds was estimated in the 0-15 cm and 15-30 cm horizons, on the other hand an assessment of the weeds of the surface was carried out.
The results obtained through this study showed that; Conventional labor increases the deep stock in the long term and regularly, as opposed to the minimum work that concentrates it in the first centimeters of the soil while the direct seeding leaves it on the surface. On the other hand, the plowing made it possible to destroy all the weeds present on the plot worked with the plow, which made it possible to obtain a biomass at the low heading stage at the level of the TC with 73.7 g / m² versus 93.73 g / m² for the MT and 185.27 g / m² for the SD.

I.Introduction

soil preparation is the main practice that ensure plant production. Recently, conservation agriculture is considered more adopted by farmer worldwide [13], due to economic effects [12] [7]. Also, conservation agriculture increases soil fertility [18] [17], preserve soil by reducing erosion phenomena [13], restore soil porosity [17], reduce gas emission [14], and limit weed development. Direct seeding as one of the conservation agriculture systems can modify biological functions of soil [15] and affect seedbank distribution in fields [23]. According to [3] [19], seedbank distribution is reduced in conventional system. However, in direct seeding and simplified technics weeds seedbank are localized in soil surface [22] [17]. So, many species floras are abundant and need the use of herbicides.
Some weeds produce a lot of seeds, which causes a reduction in the yield of the current crop, with an effect subsequently on subsequent crops because of the stock of seeds in the soil which determines a potential high density of weeds. The viability of these seeds can be reduced by the presence of predators (removal of seeds) and damage by microorganisms [3].
Indeed, the objective of our work consists in the evaluation of the density of surface weeds compared to the viable seed stock in the soil under the effect of three techniques of establishment of cereals: conventional work with turning of the soil, minimum work with toothed tools, and direct seeding with total elimination of any mechanical intervention on the soil.
In other hands, it is a question of identifying the cultivation technique among these three which favors the concentration of the seed stock on the superficial and deep part of the soil. And also to study the probable consequences on the cultivation of durum wheat (variety: vitron).

II.Matériel et méthodes

II.1. Experimental protocol

To study the effect agricultural technics on weed development and seedbank concentration, a field experiment was conducted at the experiment farm of national school of agronomy “*ENSA, El Harrach*”, during 2016/2017 crops season. The agricultural technics studied are: conventional technique (CH1), simplified technique (CH2) and direct seeding (CH3). The rainfall recorded during the experimentation period is 424 mm, against an average for the region of 749 mm, which is exceptional, and an average temperature of 16 ° C (Fig.01).

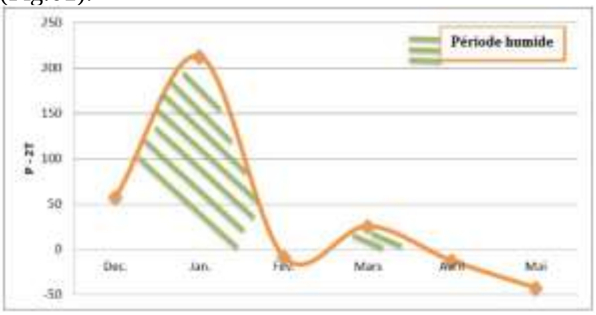

Figure 01. Climatogram of the 2016/2017 crop campaign
With:

P: mensual rainfall (mm)
T: Average temperature (°C)

The experiment was carried out on silty clay soil according to the USDA classification, with a clay content of 36%, 23% fine silt and 2.2% coarse silt, as for sand. It is of the order of 16% and 26.08% between fine sand and coarse sand, with an average pH of 7.54

Taking into account the geometry and topography of the plots and the objectives of our experiment, the block factorial device was chosen as the device. We have respectively:

- **CH1**: conventional technique
- **CH2**: simplified technique
- **CH3**: direct seeding

The speculation set up is durum wheat with Vitron variety. The seed rate recommended by the ITGC for the study region is 120 kg / ha corresponding to a number of seeds / m² of 300.

II.2. Measured parameters

II.2.1. Assessment of weed seedbank

The soil samples were taken on 12/19/2016 from each micro-plot at the rate of 06 samples of two depths, 0-15 and 15-30 cm. The dimensions of each sample are 20 × 20 × 15 cm. The samples are washed through three sieves with a mesh of 3.25mm, 0.5mm and 0.20mm. The refusal of the second sieve is spread in 18 × 10 cm terrines, filled with sterilized soil according to the following protocol (Fig.2):

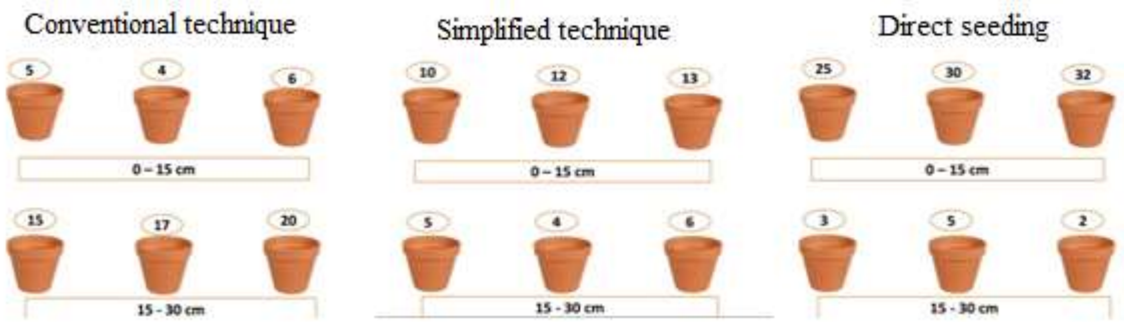

Figure 02. *Seedbank protocol*

During eight weeks, the germinated seedlings are identified and counted. For the grains which did not germinate, due to their dormancy, we installed them for a month in the dark, at 4 ° C to break dormancy, then they are put back in the culture chamber for eight weeks, the germinated seedlings are identified and counted. Irrigation of the terrines is carried out regularly to keep the substrate moist.

II.2.2. Weed estimation

- **Weed density**

Using a 0.25 m² frame placed randomly in three places of the micro plots, we will count the number of weeds to estimate the cover area at specific time intervals.

- **Aerial biomass (g/m²)**

Inside a frame of 0.25 m² we will take weed plants, the aerial parts of these weeds were put in an oven at 90 ° C for 24 hours, once out of the oven. we will weigh their dry weights.

II.2.3. Parameters measured for durum wheat

- **Measurement of the germination rate of wheat seed**

The germination rate was determined according to the following protocol:

- Place a layer of blotting paper with 5 streaks at the bottom of seven Petri dishes
- Moisten with a spray bottle so as not to soak the paper
- Place three seeds to be tested on each streak, evenly on the paper.
- Place the container in a warm, humid environment with a transparent cover to retain humidity and create a microclimate (greenhouse effect).
- Moisturize the absorbent paper approximately every two days (when the paper begins to dry out), taking care not to soak it.
- Count the seedlings that have emerged, every 3-4 days depending on the progress of germination.

The test ended after 2 weeks. The germination rate was calculated using following formula:

$$\text{Taux de germination en \%} = \frac{\text{Nombre de semences germées} \times 100}{\text{Nombre de semence testées}}$$

- **Measurement of yield and its compounds**

✓ ***Number of ears per m²***

This measurement was made using a 1m² square thrown randomly into the micro plot. The number of ears contained in the square is counted directly. Three samples were taken from each micro plot.

✓ ***Number of grains per ear***

For the measurement of this parameter, we collected 10 ears of each one of the three samples per micro plot, the samples were taken at random, then the ears were threshed manually and the number of grain recovered was counted.

✓ ***Thousand grain weight (PMG)***

We took the average of three counts per technique, these samples were weighed by a precision electronic balance.

✓ ***Estimated yield***

Estimated yield was calculated using following formula:

$$\text{Rendement estimé} \left(\frac{Qx}{ha}\right) = \text{nombre de grains par } m^2 * \frac{PMG}{10000}$$

Statistical analyses

For the processing of the results, we used XLSTAT software, and some tests:

• Conover and Iman test (1999): close to Dunn's method, this method uses a Student distribution. It corresponds to a Student test carried out on the rows

• Test of NEWMAN and KEULS (1952), cited by Michel Vilain (2003): This method is based on the comparison of the amplitudes observed for groups of two, three,…., P averages, with the maximum amplitude expected at one level of significance given.

These tests lead to the creation of homogeneous groups (of modalities), groups which may or may not have modalities in common.

Finally, we statistically analyzed the relationships between different parameters studied by correlation analysis and multiple linear regression.

III. Results and discussion

III.1. Identification of weed present in studied plot

Eleven (11) families in total were observed in the seed subsoil of the entire trial, the majority of which are common to the three experimental plots (TC, TM, SD). Monocotyledonous present in the seedbank by the Poaceae family, in parallel, dicotyledonous present by ten (10) families (table 01).

Table 01. *Monocotyledonous and dicotyledonous weed present in the seed stock of the test*

Classe	Famille
Monocotylédone	Poacées
Dicotylédone	Astéracées
	Primulacées
	Chénopodiacées
	Cypéracées
	Euphorbiacées
	Convolvulacées
	Fabacéees
	Portulacacées
	Brassicacées
	Solanacées

III.2. The distribution of the seedbank in the two horizons according to the cultural techniques adopted

For the total number of weeds present in the seedbank, the analysis of variance indicates a very highly significant difference between the three plots for the effect of cultivation technique, and very highly significant for the combined effect of cultivation work with the ground horizon.

Table 02. *Results of variance analysis and weed grain density under the effect of cultural technique compared to soil horizons*

		Moyenne (grains/m²)	Moyenne générale (grains/m²)	CV %	Probabilité	
Travail conventionnel	H1	166,67	383,33	56%	Technique culturale F1	0,04389***
	H2	500,00				
Travail minimum	H1	388,89			Horizon F2	0,40589 N.S
	H2	166,67				
Semis direct	H1	966,67			l'interaction F1 * F2	0,00168***
	H2	111,11				

*** : High significant, N.S : non-significant, H1 : Horizon 1(0 à 15 cm), H2 : Horizon 2 (15 à 30 cm)

The comparison between the average values gave us five homogeneous groups including three distinct groups and two overlapping groups, the general average is 383.33 grains / m². The lowest seedbank is marked in the second horizon of the plot conducted in direct seeding with 111.11 grains / m² and 966.67 grains / m² for the first horizon of the direct seeding plot, of which the highest density (Fig.3).

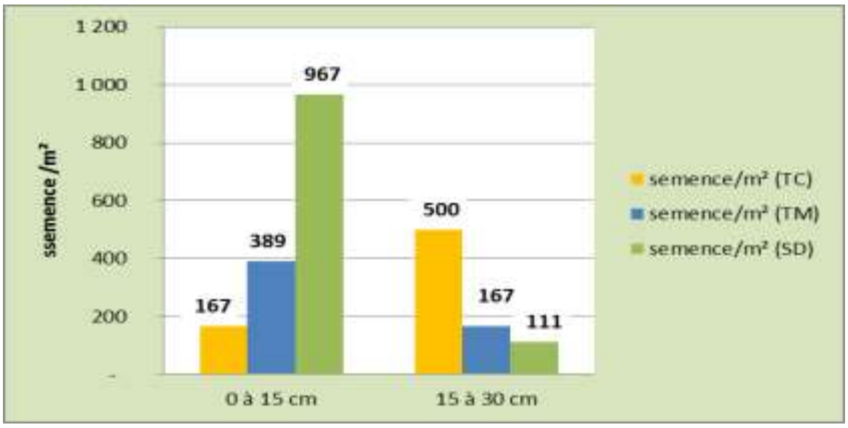

Figure 03. *Comparison of the seedbank in the two horizons of studied soil*

The results show that cultivation techniques have an impact on the vertical distribution of weed seeds in the soil profile. After plowing, a preferential localization of the seeds is observed between 10 and 15 cm deep.

As regards direct seeding, the location of the seeds becomes more and more superficial with time, in particular if the weeding is imperfect. Most seeds are found between 0 and 15 cm with 967 seeds / m².

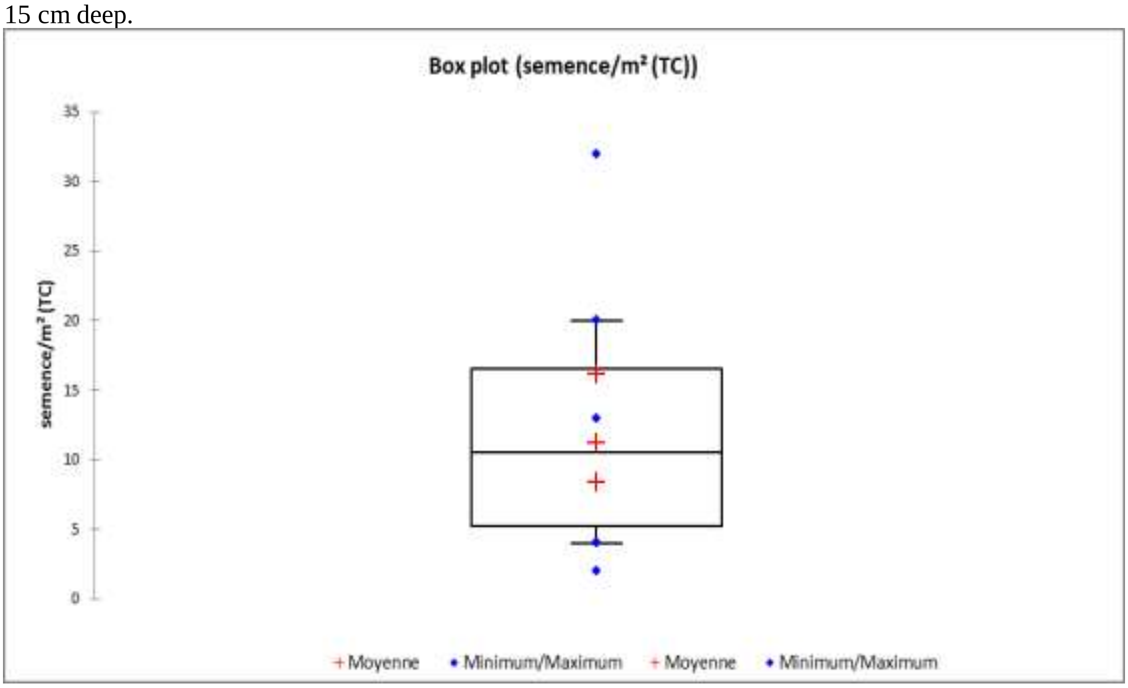

Figure 04. *Box plot represented seeds/m² in conventional technique*

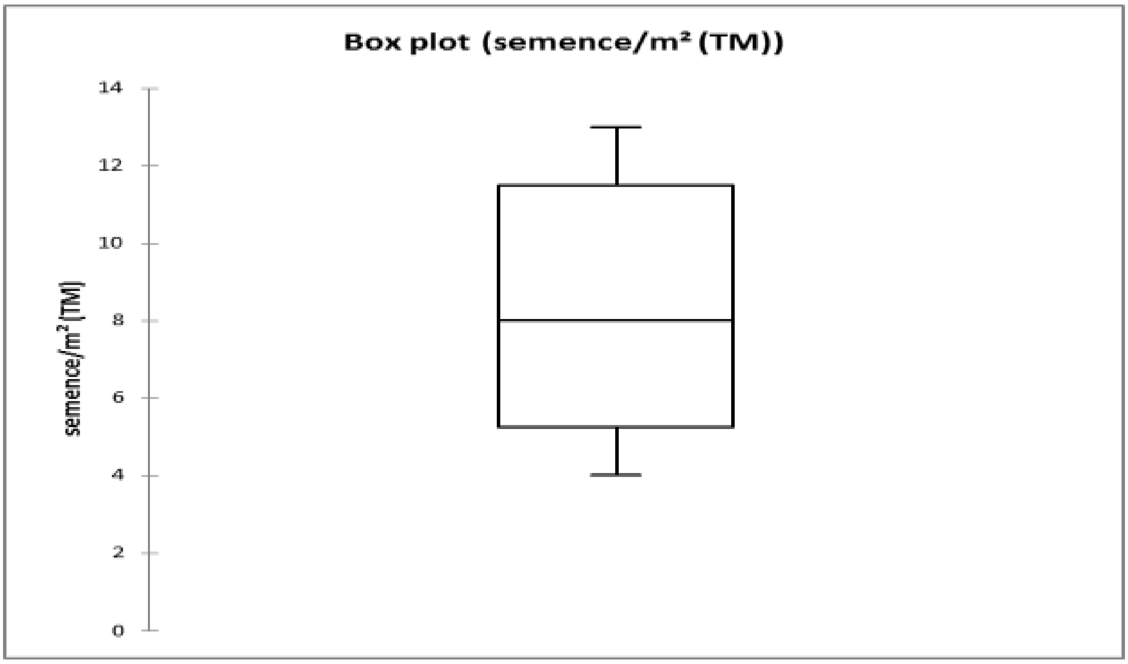

Figure 05. *Box plot represented seeds/m² in simplified technique*

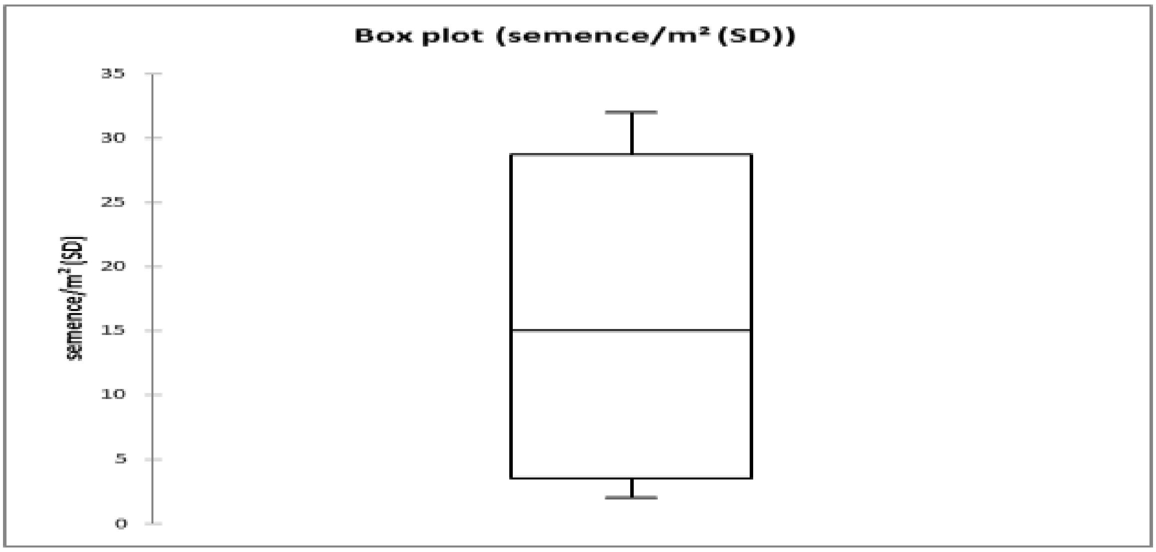

Figure 06. *Box plot represented seeds/m² in direct seeding*

So in general, direct seeding favors the rise of seeds to the surface, there is no mechanical working of the soil whereas, on the contrary, plowing by mixing the different horizons of the soil fixes the seed in depth and deprives it of germination. Except for a few species which germinate even in depth.

According to several researchers, the plow sole and despite its recognized drawback, has only one advantage, which is to deprive all the weeds located below it from germinating.

III.3. The distribution of seeds in the horizons for the three cultural techniques

The number of species present varies depending on the cultural technique. After seed development, the total number of seeds was found to be 667 grains / m² in the conventional working plot, of which 13% were monocots (Poaceae) and 87% were dicot, including 51% from the Asteraceae family, 11 % for the Primulaceae family, 08% for the Portulaceae family and 17% for the rest of the families (figure 28). We note the absence of Solanaceae (Fig.7).

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The simplified technique plot has a total number of 555 grains / m², 13% of monocots (Poaceae) and 87% of dicotyledons, the Asteraceae family, 07% for the Primulaceae family, 08% for the Portulaceae family and 15 % for the rest of the families. We note the absence of Solanaceae also at the level of TM plots (Fig.8).

For the direct seeding plot a total of 1078 seeds / m² were counted, of which 45% were Asteraceae, 24% Poaceae and 31% for the other families with the absence of Solanaceae as well (Fig.9).

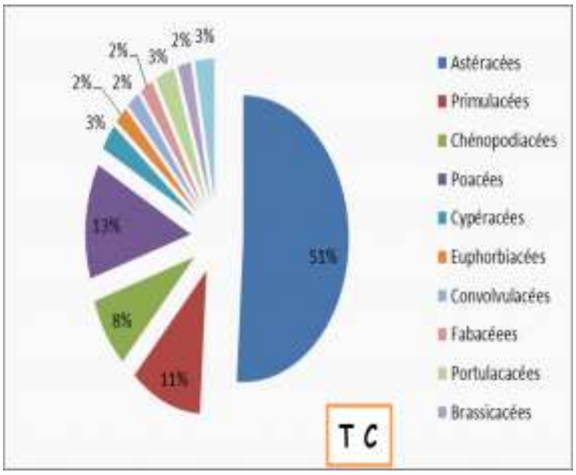

Figure 07. *Weed seedbanks in conventional technique*

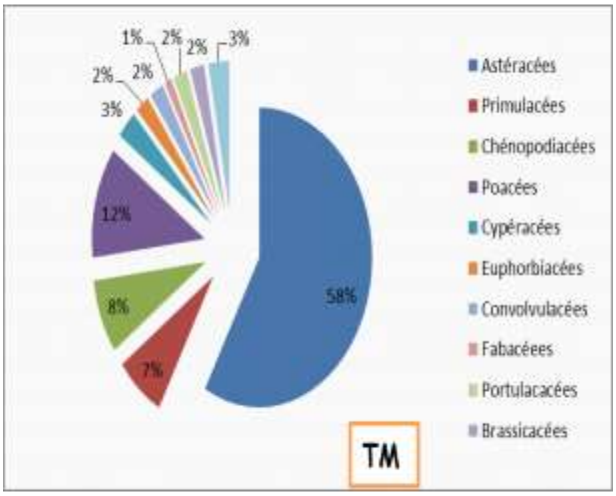

Figure 08. *Weed seedbanks in simplified technique*

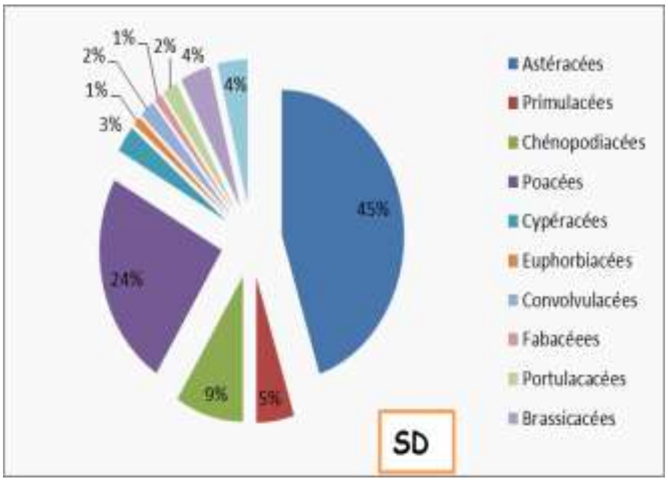

Figure 09. *Weed seedbanks in direct seeding*

III.4. Evaluation of weed flora

✓ **Identification of the main weed species**

The main weed species identified are shown in the following figure (Fig.10):

Figure 10. *Main weed species*

✓ Estimation of weed density

The measurements were at the heading stage of durum wheat.

The analysis of variance shows a very highly significant effect for the cultural technique factor on the total number of weed per square meter. The comparison of the total number of weeds gives two distinct homogeneous groups and a general average of 67.82 plants / m². The lowest density is marked in conventional work with 41.87 plants / m², 78.20 plants / m² for MT and 84.40 plants / m² for Direct Sowing, the latter being the highest.

There is a total dominance of monocot weed in the no-till plots versus a dominance of dicots in the minimum working plots with. Conventional work, on the other hand, maintains a certain balance between the two types of weed.

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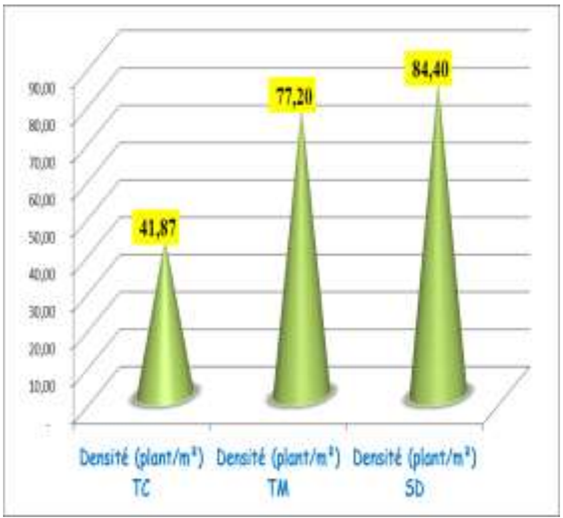

Figure 11. *Weed density on different cultural techniques*

Tableau 03. *Descriptive statistics*

Statistique	Densité SD	Densité TC	Densité T
Nb. d'observations	30	30	30
Minimum	28,000	16,000	44,000
Maximum	244,000	84,000	124,000
Moyenne	84,400	41,867	77,200
Variance (n)	4160,640	337,849	425,760
Ecart-type (n)	64,503	18,381	20,634
Coefficient de variation	0,764	0,439	0,267

Tableau 04. Comparisons by following the Conover and Iman test

Comparaisons multiples par paires suivant la procédure de Steel-Dwass-Critchlow-Fligner / Test bilatéral :

Echantillon	Effectif	p-value (bilatérale)	alpha	Groupes
Densité TC	30	< 0,0001	0,05	A
Densité SD	30			B
Densité TM	30			B

Annual grass emergence tends to increase with the simplification of tillage. The phenomenon is amplified by the practice of cereal monoculture, the development of early sowing and the widespread use of broad-spectrum dicotyledonous herbicides.
The regrowth of cereals is obviously favored by the simplified systems, in particular during early seeding. In addition, the emergence of annual dicotyledons decreases with the simplification of tillage.
The difference in composition is less clear between plowing and surface work. Nevertheless, species with large seeds, which require a slight burial, develop preferentially in plots cultivated superficially.
In general, it can be concluded that plowing has an impact on weed densities. Indeed, by reducing the densities of the weed population, plowing limits the competition of these weeds vis-à-vis the crop and allows better development of the crop.

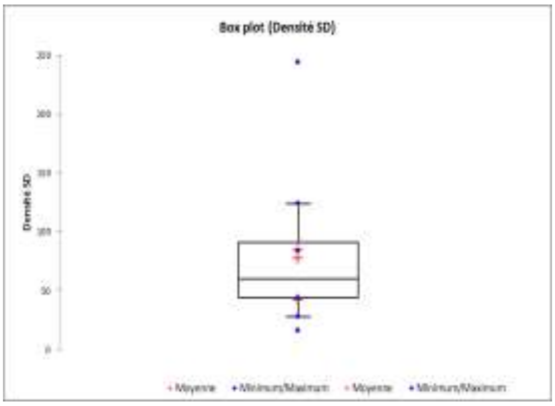

Figure 12. *Box plot represent weed density in direct seeding*

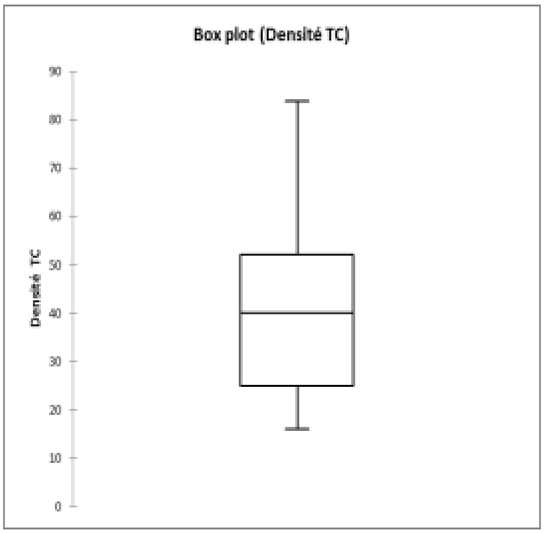

Figure 13. *Box plot represent weed density in conventional technique*

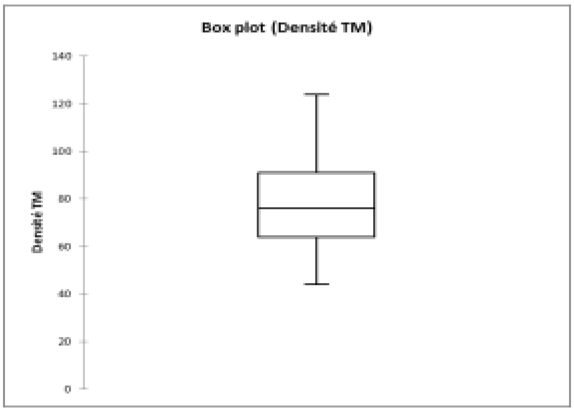

Figure 14. *Box plot represent weed density in simplified technique*

III.5. Effect of cultural techniques on weed biomass

The results of the analysis of the effect of cultivation techniques on weed biomass in the plots carried out in CTC, ST, DS are presented in the following figure:

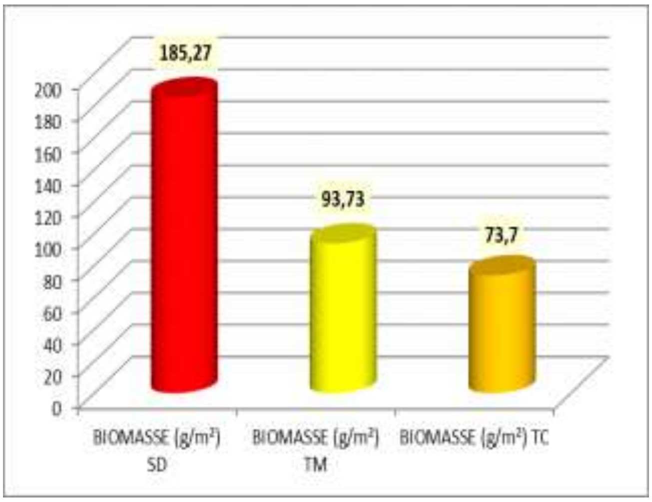

Figure 15. Comparison of weed biomasses under the effect of the three cultivation techniques

The figure above represents the estimate of the biomass of the weed flora expressed in g / m² for plots cultivated conventionally, in minimum and in direct seeding.
In view of these results, the first conclusion that can be drawn is that the plowing made it possible to destroy all the weeds present on the plot worked with the coulter plow, which made it possible to obtain a biomass at the heading stage. low at the TC level with 73.7 g / m² against 93.73 g / m² at MT and 185.27 g / m² in SD.

Tableau 05. Comparisons by following the Conover and Iman test

Comparaisons multiples par paires suivant la procédure de Steel-Dwass-Critchlow-Fligner / Test bilatéral :				
Echantillon	**Effectif**	**p-value (bilatérale)**	**alpha**	**Groupes**
Biomasse g/m² TC	27	< 0,565	0,05	A
Biomasse g/m² SD	27			A
Biomasse g/m² TM	27			A

Statistical analysis does not show a significant effect of cultivation techniques on weed biomass, there are three homogeneous groups
Plowing is a tillage operation which has a very positive impact on the weed flora present, and its total elimination will reduce the pressure it exerts on the crop in place and allow it to develop correctly without competition for it. water, light and nutrients. In addition, plowing makes it possible to reduce the use of chemical control products, a source of soil and water pollution, and even to deteriorate the quality of the product sown, thus reducing the effects on the environment.

III.6. Evaluation of the surface weed density compared to the viable seedbank in the soil according to the cultivation technique adopted

It should be remembered that this evaluation was carried out by comparing weed that emerged from the soil compared to the seedbank.
Analysis of variance revealed a very highly significant difference between the three cultivation techniques with two distinct homogeneous groups.

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Tableau 06. *Analysis of variance results and averages of the surface weed density compared to the viable seedbank in the soil under the effect of tillage compared to the soil horizons*

	Moyenne (plant %)	Moyenne générale (plant %)	CV %	Probabilité
Travail conventionnel	6,28 A	9,34	20%	0,00131***
Travail minimum	13,90 B			
Semis direct	7,83 A			

*****:** High significant, **A, B, C**… : different groups

The simplified technique presented the highest values with 13.90% plants. Direct seeding and conventional technique seem have an identical average (Fig.16).

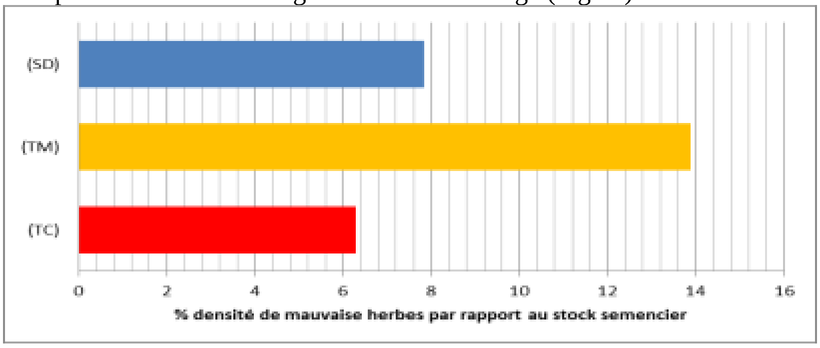

Figure 16. *Representation of the surface weed density relative to the viable seedbank in the soil*

Depending on the initial state of the seedbank (distribution, density, species ...), the continued use of surface work can lead to higher infestations than plowing, if the seed production is poorly controlled by chemical control. If the seedbank is very abundant, the reduction will however be limited in the first years by the regular renewal of seeds allowed by plowing.

III.7. Consequences of the choice of cultivation technique on the yield of durum wheat

In this last part, we will try to present and discuss all the performance results obtained.

An analysis will make it possible to identify the effects of cultivation techniques, namely plowing, simplified and direct seeding on the production parameters of the crop (yield and yield components). The examination of these effects will be based on a number of hypotheses concerning the possible consequences of not working the soil on the establishment and functioning of the crop, with reference to those made so far.

We tried to focus our work on a few parameters that seemed to us to be the most important, namely:

• The weight of a thousand grains (g),
• The number of seeds per ear,
• The number of ears per square meter,
• The estimated grain yield (Qx / ha)

III.8. The impact of cultivation techniques on the weight of a thousand grains

The figure below (Fig.17) represent the variation in the weight of a thousand seeds for the three techniques used.

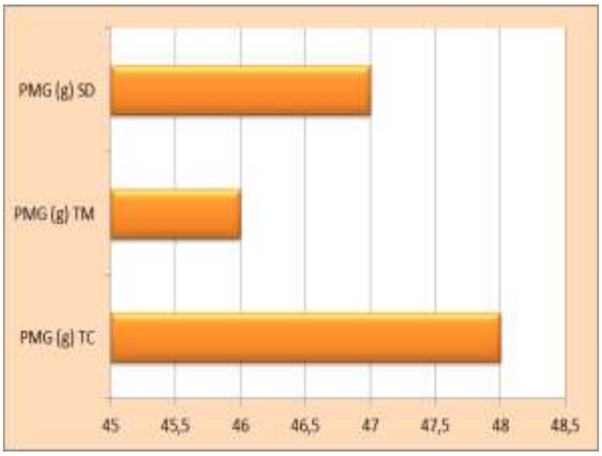

Figure 17. *The variation in the weight of a thousand grains for the three techniques used*

From the results presented above, it is clearly that the weight of a thousand grains is slightly better for the plots worked with the share plow compared to those carried out in direct seeding, the average value recorded for the CT is 48 g, while that obtained for direct seeding is 47 g, for simplified technique, a slightly lower PMG is recorded than the other two treatments with 46 g.

III.9.The impact of cultivation techniques on the number of seeds per ear

The figure below illustrates the number of seeds per m² for the three cultivation techniques:

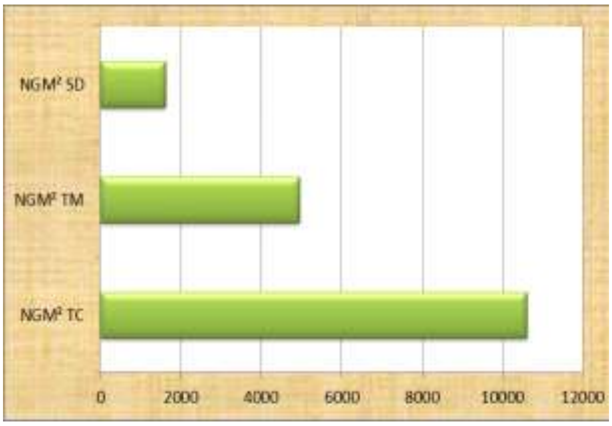

Figure 18. *The variation in the number of grains per m² for the three cultivation techniques*

According to this figure, the number of seeds / m² is clearly higher in conventional technique with more than 10,000 gr / m², while direct seeding does not exceed 2000 gr / m², it is the consequence of a bad development of the crop with a very low number of ears and a very low number of gr / ear at the level of the direct seeding plots. For simplified technique, it is between the two with 5000 gr / m².

These remarks highlight the importance of plowing over direct seeding techniques. Moreover, and according to several studies, it was concluded that the number of grains is related to the cultivation technique, they recorded low values for the technique which consists of working the soil by surface only. Therefore, shallow tillage does not allow the plant to explore the depths properly.

✓ **The impact of cultivation techniques on the estimated yield**

Yield is the most important and determining parameter for understanding the influence of the factors studied on the crop. All the parameters studied so far suggest that this would be lower in direct seeding, and this is what we will see in the following histogram:

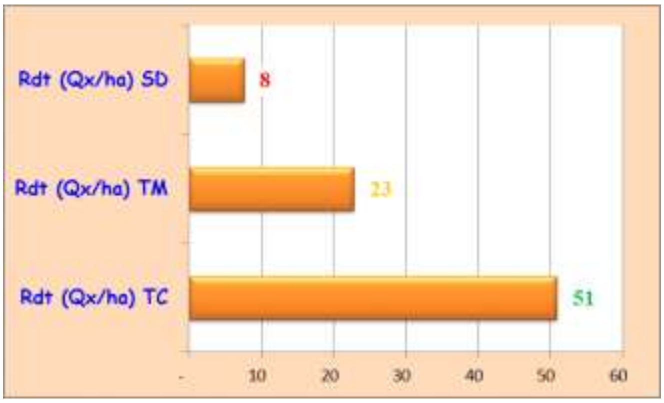

Figure 19. *The variation in yield for the three cultivation techniques*

The results show that the yield obtained in plowed soils is greater than that of simplified technique. We record 51 qx / ha in conventional technique and 23 qx / ha in simplified technique, and in direct seeding we record 08 qx / ha, with a difference of more than 43 qx / ha compared to conventional technique.

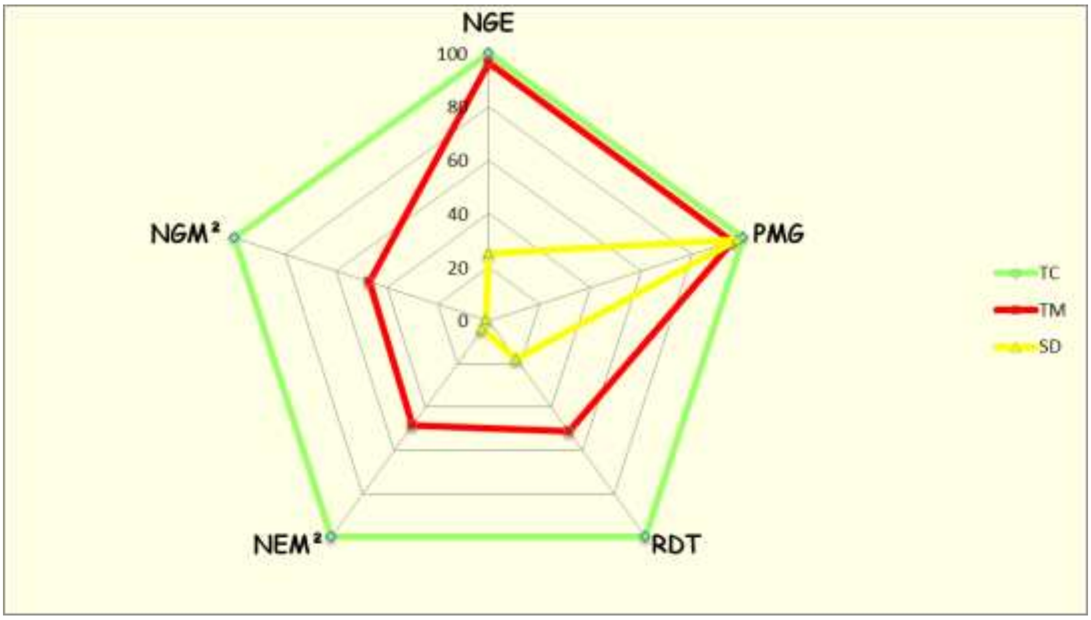

Figure 20. *Average effect, in% of the maximum value, of the three techniques for the variables measured during the campaign*

The differential response of variety behavior in contrasting cultivation techniques for thousand grain weight (PMG), and NGE. Grain Yield (RDT) assesses the good expression of the soil-grown variety in TM against SD systems. The average of the thousand kernel weight of the variety for the three modes varies around 47 g. However, from the above representation, it is clear that the conventional technique is good for all performance components, while the minimal technique has a positive effect on NGE and PMG. For direct seeding, it has a positive effect only on the PMG.

It is therefore concluded that the cultivation techniques have an effect on the yield, the best yields were obtained at the level of the plots worked, and these were the consequences of the choice of techniques to be implemented. The crop yield is largely conditioned by the presence of weed, which are influenced by cultivation techniques.

Statistical analysis of the relationships between different parameters studied

In this part, it will be a question of quantifying the effects of cultivation techniques as well as the relations between different parameters studied by a correlation and regression analysis, the effects will be illustrated by relations of the form Y = f (X, X ', X' ',…..).

III.10.Relationship between yield and other parameters studied

It is still accepted that the yield of straw cereals is the combination of several components: plant density, ear tillering, ear fertility, PMG (weight of a thousand grains). Each of these develops during a different phase of the culture cycle; they therefore interact in cascade, under the additional influence of the environment (climate, soil, crop management).

The yield is implemented throughout the production cycle through several components:

- the density of plants,

- the tilling-ear (which can be divided into herbaceous tilling and uphill-ear),

- ear fertility (number of spikelets per ear and number of seeds per spikelet),

- the weight of the grains (PMG).

For our part, we tried to highlight the relationship between the yield and the parameters linked to the dynamics of the weed flora, it is not a question of calculating the yield but a start of quantification of this parameter by making intervene other variables outside the performance components, which may influence performance in one way or another.

III.10.1.Relation Yield = f (density MH, Biomass MH, seed stock MH) in Direct Seeding

The multiple regression analysis between the dependent variable Rdt and the independent variables density (D), biomass (B) and seedbank (SSMH) gave the following results:

Table 07. *Results corresponding to the Fisher test*

Source	DDL	Somme des carrés	Moyenne des carrés	F	Pr>F
Modèle	4	31,946	7,987	150,802	0,0
Erreur	1	0,054	0,054		
Total corrigé	5	32,000			
Calculé contre le modèle Y=Moyenne(Y)					

First, the analysis of variance table, which is a result that should be analyzed carefully. It is at this level that we test whether we can consider that the selected explanatory variables (D), (B) and (SSMH) provide a significant amount of information to the model or not. In other words, it is a means of testing whether the mean of the variable to be modeled Rdt would be sufficient to describe the results obtained or not. Fisher's F test is used. Given that the probability associated with F in this case is less than 0.041, this means that we take a risk of being wrong of less than 4.1% in concluding that the explanatory variables provide a significant amount of information to the model.
Second, it is necessary to verify that there is no significant correlation between the independent variables, and this is what has been verified from the correlation matrix presented previously.
Third, we provide the details on the model, we obtained a p-value associated with Student's test for the three parameters:

Source	Pr > |t|
D	**0,04**
B	**0,034**
SSMH	**0,016**

Given that p-value is less than 0.05, we can say that the three parameters (especially the SSMH) have a strong impact on the yield.
The model equation is as follows:

Rdt(SD)= 3,28 –0,032 * **D**- 1,2 * **SSMH** – 0,0212 * **B**

The coefficient of determination R^2 = 0.71, the variables D, B and SSMH explain 71% of the variability of the yield.
So this equation illustrates the relationship between Rdt, D, B and SSMH. Note that the higher the density of weeds, the more the yield decreases, we also see that the seedbank has more effect than Density and Biomass on Yield.
Standardized coefficients allow the relative weight of variables to be compared. The higher the absolute value of a coefficient, the greater the weight of the corresponding variable. When the confidence interval around the normalized coefficients includes the value 0 (this is easily seen on the graph of normalized coefficients), the weight of a variable in the model is not significant.
In our case, the normalized coefficient of the variable SSMH is higher than that of D and B, the following figure illustrates this result:

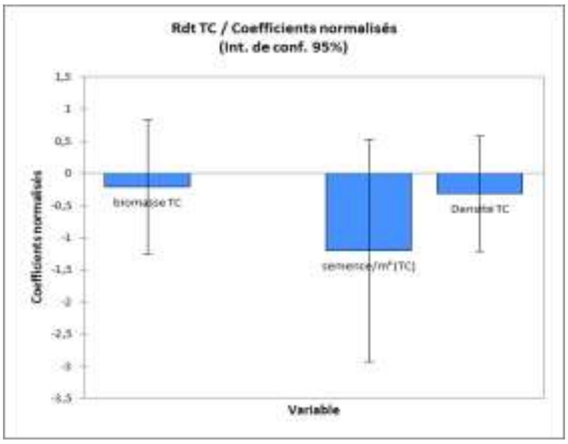

Figure 21. *Boxplot corresponding to biomass, seed and density compared to the coefficient normalized in conventional work*

III.10.2. Relation Yield = f (density MH, Biomass MH, seed stock MH) in simplified technique

Multiple regression analysis between the dependent variable Rdt and the independent variables density (D), biomass (B) and seedbank (SSMH) yielded the following regression model:

Rdt (TM)= 65,91 – 0,1 * **D** - 3,24 * **SSMH** – 0,008 * **B**

The coefficient of determination R^2 = 0.82 the variables D, B and SSMH explain 82% of the variability of the yield.
So this equation illustrates the relationship between Rdt, D, B and SSMH. Note that the higher the density of weeds, the more the yield decreases, we also see that the seed stock has more effect than Density and Biomass on Yield.

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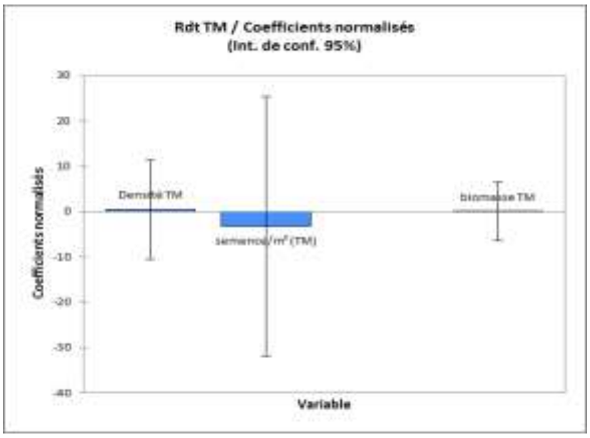

Figure 22. *Boxplot corresponding to biomass, seed and density compared to the normalized coefficient in simplified technique*

III.10.3. Relation Rdt = f (density MH, Biomass MH, seed stock MH) in conventional technique

Multiple regression analysis between the dependent variable Rdt and the independent variables density (D), biomass (B) and seed stock (SSMH) yielded the following regression model:

Rdt (TC)= 37,48 – 1,5* **D** - 0,61 * **SSMH** – 0,038 * **B**

The coefficient of determination $R^2 = 0.88$ the variables D, B and SSMH explain 88% of the variability of the yield.
So this equation illustrates the relationship between Rdt, D, B and SSMH. Note that the higher the density of the weeds, the more the yield decreases, we also see that the Density has more effect than the seed stock and Biomass on Yield.

IV. Conclusion

Weed development affect cereal cycle, consequently the yield can be decreased. That's why, the adoption of adequate agricultural technique is necessary. Through the present study, some informations are extracted. Weed seedbanks in direct seeding is higher than simplified technique and conventional technique. In fact, mechanical weeding in conventional technique increase seedbank deeply under action of plough, or plowing can reduce seedbank of foxtail grass by 85%.

In no-tillage, failed weeding can have significant consequences in the future cycle crops. In the short term, the nuisance of weeds can cause lost yield by 5 to 10%. In the longer term, heavy soiling increases the risk of herbicide-resistant of Alopecurus, perennial ryegrass and Avena fatua.

However, we must be careful with the chemical treatment, which is not 100% effective against the weed seedbank. In fact, 90% efficiency on a population of 100 weed plants leaves ten plants capable of generating many seeds, thus increasing the seed potential of the plot.

Prospects

To reduce weed seedbanks in the soil and limit the use of herbicides in direct seeding, it is imperative to plow soil in deep layer each 5 years. Especially when crop rotation is not conducted regularly during crops seasons.

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