

How sustainability is taken in account in French official trials for variety registration

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CTPS
COMITÉ TECHNIQUE
PERMANENT
DE LA SÉLECTION
DES PLANTES CULTIVÉES

Introduction

In France, variety registration depends on the CTPS (technical committee for plant breeding) which joins together all the professionals concerned (breeders, beet growers, sugar industry, technical institute) and government representatives. In 2009, a common reflection started to decide how the

registration assessment could better take in account sustainability, especially the reduction of pesticides, which was mentioned as a main target at the national level with the "Grenelle de l'environnement" (reduction of 50 % of the pesticides in 2018 if possible), and the control of nitrogen fertilization with the European regulation on water. The common reflection led to 2 main axes:

- ✓ On the one hand, considering the international context, sugar beet production should be as competitive as possible: this still involves aiming for a high yield.
- ✓ On the other hand, the new varieties registered must be tested according to the best practices recommended for the farmers, applying the same decision rules, and not in trials with no input limitation.

Experimental design

Since 2010, the experimental layout now includes **2 monitoring modules** (figure 1):

- ✓ A module that includes special plots for **foliar diseases monitoring and the release of fungicide treatments**: a weekly assessment is done in July and August on 100 leaves on 3 control varieties, chosen for their low susceptibility to the 4 main foliar diseases in France. The treatments are applied only if the threshold is reached for one disease. With this protocol, the fungicide treatments are delayed and the most susceptible varieties in the trials should be more affected: a particular stress has been put on this point in order to improve the average resistance level of the varieties tested.
- ✓ A module for **nitrogen fertilization control**, with 3 rates of fertilization (0, recommended rate, recommended rate + 40); the aim is to have a control of the fertilization and to characterize afterwards with a biological indicator, the nitrogen status of the field (under-fertilized, correctly fertilized, over-fertilized).

Foliar diseases	Control variety	1 st treatment	2 nd treatment	3 rd treatment*
Powdery mildew	Eleonora KWS	15	30	30
Cercospora	Skipper	5	20	25
Leaf rust	Danube	15	30	40
Ramularia	Eleonora KWS	5	20	25

Table 1 - Thresholds for the release of fungicide treatments (number of leaves /100)

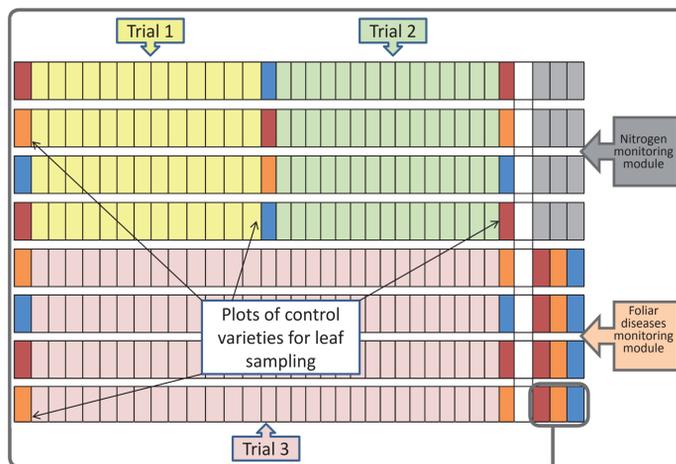


Figure 1 - General design

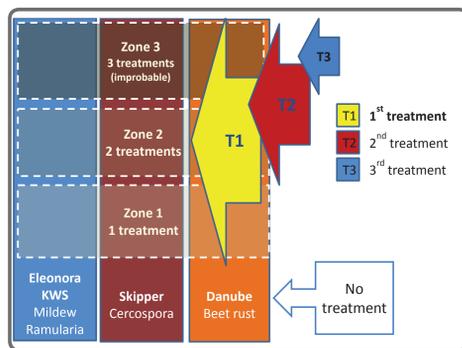


Figure 2 - Foliar diseases monitoring module

Module for foliar diseases monitoring and the release of fungicide treatments.

This module includes 3 control varieties, chosen considering their low susceptibility to the 4 more common foliage diseases in France:

- *Cercospora beticola* : Skipper
- *Erysiphe communis* and *Ramularia beticola* : Eleonora KWS
- *Uromyces betae* : Danube

- ✓ On the side of the experimental layout (figure 2), the module includes special plots receiving different levels of fungicide treatments (no treatment, 1 treatment, 2 treatments, 3 treatments).
- ✓ Plots for leaf sampling are split around the different trials (figure 1) to be more representative. A weekly assessment is done in July and August on 100 leaves of each of the 3 control varieties. Fungicide treatments are applied only if the threshold is reached for a disease (table 1).

No fungicide can be applied 45 days before harvesting.

As the control varieties are less susceptible, the threshold for the disease concerned is reached later than for another variety. Consequently, we accept to have some plots showing diseases symptoms (figure 3) in our trials. These diseases are scored if they are present; a comparison can also be done with the untreated plots of the module.



Figure 3 - Cercospora on a susceptible variety

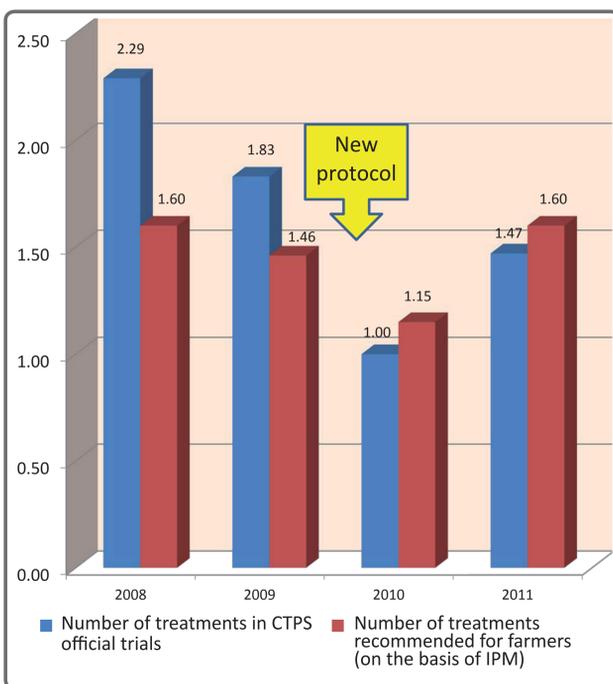


Figure 4 - Number of fungicide treatments in CTPS trials compared to average number of treatments recommended

Results

With this protocol, we have 2 objectives:

- ✓ To reduce the number of treatments in variety registration trials, which should not receive more treatments than recommended on the basis of IPM (foliar disease index) as a normal crop. This aim has been reached: since the new protocol has been applied (2010), the number of treatments has been significantly reduced and is now lower than the average number of treatments recommended (figure 4).
- ✓ To improve the average resistance level of the varieties tested, penalizing the most susceptible varieties (figure 5). This result is more difficult to establish after only 2 years with moderate disease pressure.



Figure 5 - Susceptible (left) and resistant (right) variety

Module for nitrogen monitoring

This module includes 3 fertiliser rates on one variety (Python), with 4 replications (figure 5).

- 0 N: no nitrogen fertilization (a special zone is delimited by covering or without spraying liquid nitrogen).
- R: Recommended fertiliser rate, as in the whole field: on the basis of the Azofert® software (this software determines the rate of nitrogen provided by the field, taking in account the average climate of the location, the soil characteristics, the previous crops, etc.).
- R + 40: second application with liquid nitrogen or ammonium nitrate.

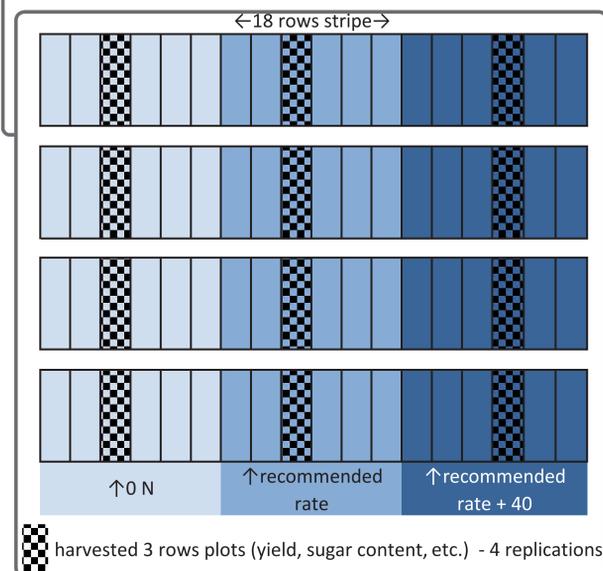


Figure 6 - Nitrogen monitoring module

Standard 3 rows plots are harvested and analyzed as any trial plot, especially for root yield, sugar content, sugar yield and alpha amino nitrogen content. These plots are included in wider plots (about 12 to 18 rows) to prevent border effects. The plots are also visually scored for leaf development and colour. At the end of the campaign, on the basis of all the data collected, a CTPS commission classifies the trial sites in 3 groups according to their nitrogen status:

- Over fertilized.
- Near to optimum.
- Under fertilized.

For this classification, the Azofert® software can also be use afterwards with the real climate of the campaign to calculate, according to the nitrogen provided by mineralisation, what would have been the recommended rate.

Results

With this protocol, we have 2 objectives:

- ✓ To control with a biological indicator the level of nitrogen fertilization in the official trials, to ensure they are carried out on the basis of recommended practices. This aim has been achieved.
- ✓ To classify the trial locations according to their nitrogen status, for a further variety characterisation (in relation with their nitrogen requirements) - see example presented in table 3. This part needs further work, but it is important to start to accumulate data.

LOCATION	RELATIVE SUGAR YIELD OF THE CONTROL PLOTS - REFERENCE : RECOMMENDED RATE		CONCLUSION
	O N	RECOMMENDED RATE + 40	
CROTTES EN PITHIVERAIS	83	115	under fertilized
GODERVILLE	81	109	under fertilized
SOMMEPY TAHURE	87	119	under fertilized
ERMENOUVILLE	90	105	under fertilized / optimum
NORRENT FONTES	81	103	under fertilized / optimum
MERY LA BATAILLE	93	98	optimum
MESNIL LA COMTESSE	83	97	optimum
ROYE	103	100	over fertilized

Table 3 - Nitrogen status of the trials: example in 2011

Conclusion

Since 2010, monitoring modules have been included among the official trials layout with 3 objectives:

- ✓ To have a better control of the fungicide treatments and the nitrogen fertilization, in order to ensure that the official trials are carried out on the basis of the practices recommended to sugar beet growers, without over fertilization or excess of fungicide treatments. This target has already been reached,

especially for fungicide treatments that have been significantly reduced since this protocol has been applied.

- ✓ To improve the general level of resistance of the varieties to the main foliar diseases, penalizing the most susceptible varieties. We need more data to assess the effect of the protocol on this point.
- ✓ To obtain a better characterization of the trial locations for

the nitrogen status of the field and foliar diseases, included in a general genotype*environment interaction analysis for the characterization of the varieties regarding the different factors. This process has to be continued and improved, in relation with the similar actions started among CTPS on other species, with the development of new analysis software and in relation with ITB post registration trials.