Evaluation of the Value for Cultivation, Use, and Sustainability (VCUS) of new varieties for listing in the French Catalogue

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COMITÉ TECHNIQUE PERMANENT DE LA SÉLECTION DES PLANTES CULTIVÉES

Sugar beet

To be proposed for listing on *List A* of the French catalogue, a new variety must meet the following three conditions:
1. Be recognized as Distinct, Uniform and Stable. The DUS guarantees the identity of the variety and is the basis for plant variety protection and seed certification.
2. Provide an improvement in agronomic value or use, as judged in VCUS tests.
3. Be designated by an approved denomination in accordance with the applicable rules.

Variety listing is decided by the Ministry of Agriculture after consultation with the CTPS, on the basis of summaries presented by GEVES.

VCUS studies make it possible to describe the **cultivation value** of a variety in the main soil and climate conditions that it will encounter in France, as well as the **use value** of harvested products from the variety. In order to limit the negative impact of agricultural production on the **environment**, particular attention is paid to the variety's adaptation to environmental and growing conditions, its efficiency with regard to water and nitrogen, and pest resistance.

In order to be proposed for listing, the new variety must provide an improvement over current varieties: it is therefore compared to market reference controls. The variety is studied for 2 years, sometimes 3.

Listing in the French catalogue therefore allows the entire plant sector to have shared references, acquired over two seasons, as soon as the variety is launched in France.

There are several sections in the catalogue:

- varieties resistant to **rhizomania** (main category).
- varieties resistant to **rhizomania and tolerant to cyst-nematode**.
- varieties **resistant to rhizomania and to *rhizoctonia solani***.
- varieties **resistant to rhizomania and able to limit the multiplication of the cyst-nematode**.

➔ The experimental set-up for VCUS studies:

6 types of protocols are used: 5 in the field, 1 in the laboratory. Some apply to all varieties, regardless of the heading (but the controls are based on the corresponding heading); others are trials or tests specific to a heading.

2 protocols common to all headings

▪ Field trials with and without rhizomania

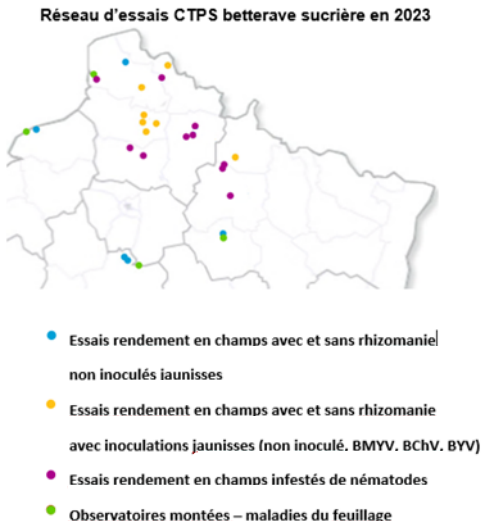
Field trials with or without rhizomania BNYVV; some trials with high rhizomania pressure, some trials under different experimental yellows conditions: without inoculation with insecticide protection, inoculated with BMYV virus, inoculated with BChV virus, inoculated with BYV virus. Except for the experimental design concerned with the yellows evaluation, these trials are carried out with control modules for fungal leaf diseases used to define the date for the fungicide treatment only if the threshold is reached for the disease on a variety chosen for its low susceptibility to this disease.

Varieties resistant to rhizomania:
16 trials/year including 8 with yellows inoculation.

Varieties resistant to rhizomania and tolerant to cyst-nematode:
16 trials/year including 8 with yellows inoculation.

From these trials, in order to realize technical analyzes (sugar content, impurity content) samples are taken.

These trials are carried out by the ITB, the breeders (UFS), the SNFS, Tereos and the CGB.



▪ Bolting observatories - leaf diseases

Trials sowed in place and not harvested. No fungicide application. Counting bolting in certain trials carried out in early sowing (Normandy, Pas de Calais). Regular rating of the foliage diseases expression.
4 trials in year 1 and 3 trials in year 2.

Specific protocols

▪ *Rhizoctonia solani* trials with artificial infection

After stabilisation of the population (thinning), inoculation with *Rhizoctonia solani*.

Uprootong and individual notation of the roots; division into 4 classes according to the intensity of the symptoms (healthy roots, with damage < 20 % of the surface, 20 to 50 %, > 50 %) and counting of dead plants.
A **disease index** integrating the above elements with a weighting according to the severity of the symptoms is calculated.

- **Variety-specific protocols for the rhizomania - nematode sections.**
  - ***Field trials with nematodes***

Yield trials in fields with *Heterodera schachtii* nematodes. Planting of a susceptible control on the border; soil tests in the susceptible control (initial and final nematode population). Comparison of the yield results of these trials with those obtained in the baseline study allow to assess variety **tolerance**.

  - ***Biotest for resistance to Heterodera schachtii***

Test carried out in the pathology laboratory of GEVES. Test in pots with 50 individuals per variety; inoculation with *H. schachtii.* Counting of cysts formed: average per variety and calculation of a multiplication index (MI). The aim of this test is to assess **the resistance** of varieties to cyst nematodes **and to ensure that the variety is significantly different from the susceptible control.** There are 3 categories:

- ***Resistant** variety*: major resistance due to the HS1pro1 gene; these varieties fall under the heading "varieties for limiting the multiplication of cyst nematode."
- **Intermediate** (partial) **resistance** varieties: Varieties in this category fall under the heading "Cyst nematode tolerant varieties" and represent a wide range of resistance.
- **Sensitive** variety: multiplication index not different from the sensitive control; these varieties are not eligible for either of the above headings.

➔ Characteristics assessed:

Yield	Technological value	Physiological characteristics	Resistance to pests
- Root yield (t/ha) - **Sugar yield (t/ha)**	- Sugar content (%) - SM/POL = molasses sugar / sugar content = industrial quality indicator	- Seedling resistance	- soil pest series - foliage diseases - yellows

➔ Judging the varieties after 2 years of study:

The decision to accept the VCUS is taken by considering all the important characteristics of the interest of the variety for the sector, it is a decision based on many criteria.

		Resistant to rhizomania	+ limiting the multiplication of the cyst-nematode	+ tolerant to cyst-nematode	+ resistant to *Rhizoctonia solani*
Determination of the value 100:		*genetic progress objective*	control	*genetic progress objective*	Control
Decision based on:		*lowered threshold value if disease bonus*	expertise with the characters (X)	*Threshold value*	*Threshold value*
Trials with and without rhizomania	*Sugar yield*	≥ 100	X	≥ 100	≥ 100
	Sugar content	≥ 97	X	≥ 97	≥ 97
	***Industrial quality** : SM/POL*	≤ 106	X	≤ 106	≤ 106
Bolting		No sign > T in 2 trials /3	X	No sign > T in 2 trials /3	No sign > T in 2 trials /3
Behaviour in relation to leaf diseases and high rhizomania pressure		Bonus if resistant*	X	X	X
Biotest resistance to *Heterodera schachtii*			Resistant profile	MI sign < sensitive control	
Percentage of plants with HS1pro1 resistance gene (PCR test)			>90%		
Field with nematodes	Productivity : sugar yield		X	≥ 100	
Specific trials *Rhizoctonia solani*	**Disease index *Rhizoctonia solani***				MI var <MI control+ppds

Variety with **good resistance to two diseases, receives a 2-point bonus for yield (threshold lowered to 98) and the SM/POL threshold is raised to 109*

*For a variety with a high level of resistance to **cercospora**, thresholds lowered to 96% for yield, 96% for sugar content, 109% for SM/POL.*
*For a variety with very good behaviour in a situation of high **rhizomania** pressure, the threshold is lowered to 99% for yield and 109% for SM/POL. There are also rules for moving to the second year, based on the same principles as for registration, but with lower threshold requirements.*

VCUS test procedures, which are set out in the technical regulations for registration, are not immutable: the study procedures and rules of admission evolve regularly and progressively according to the needs of users and consumers as well as methodological advances.

However, a variety that does not meet this threshold but has a characteristic or combination of characteristics that is not (or is only marginally) taken into account in the current regulations may be proposed for registration, and it is also possible for breeders to request the registration of a variety for an innovative characteristic or use, within the framework of a special experiment.

➔ For more information:

The references acquired during registration years of listed varieties are published on the GEVES website. This information is taken over by the ITB, which completes it with post-registration data.
For the registration rules, the only reference document is the technical examination regulations approved by ministerial order of the Ministry of Agriculture.

The registration documents can be downloaded from the GEVES website.

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