

Testing varieties for resistance to diseases and pests at GEVES: a way to improve genetic progress and to reduce the use of pesticides Cadot V.¹, Grimault V.², Perrot S.²

COMITÉ TECHNIQUE PERMANENT DE LA SÉLECTION

des plantes cultivées

Use of disease and pest resistance tests: for what aims ?

• For DUS tests: concerns all the species, but mainly vegetables, either for registration (for CTPS) or for Plant Breeder's Rights (for INOV and CPVO).

- Mainly of lab tests, carried out by GEVES-SNES
- Some tests carried out by INRA
- Some tests carried out by seed companies (blind tests)
- For VCUS tests: concerns field crops for registration.
 - Majority of field tests, performed by CTPS network and managed by GEVES-SEV
 - Lab tests carried out by GEVES SNES
 - Some tests carried out by INRA
- For seed companies, phytosanitary companies...
- With the aim of improving genetic progress and reducing the use of pesticides, in the frame of Grenelle Environment

How to get reliable and reproducible criteria of assessment?

 GEVES manages international research projects in order to harmonize disease and pest resistance tests, with CPVO and EU counterparts.



- GEVES takes part in working groups within ISF and APS for the codification of pathogens and the definition of differentials.
- GEVES manages reference material collection: controls and differentials varieties and 250 pathogens and pests, administrated with a database. ⇒ mainly available in the MATREF network, coordinated by GEVES



Resistance test managed by GEVES in lab and in field

field



• Evaluation of varieties resistance to viruses, bacteria, fungi, nematodes.

• Activities in progress and diversification, due to

Disease resistance evaluation

Principle:

Behavior comparison of a candidate variety to resistant,





the integration of new resistances in DUS and VCUS criteria, evolution of pathogens, and transfer of tests from INRA

▶ In Lab:

2003			2008			2011		
Species	Pathogens	Races	Species	Pathogens	Races	Species	Pathogens	Races
Beet	Heterodera		Beet	Heterodera		Beet	Heterodera	
Crucifers	Heterodera		Crucifers	Heterodera		1	Aphanomyces	
Strawberry	Colletotrichum	2 races	Strawberry	Colletotrichum	2 races	Crucifers	Heterodera	
Bean	BCMNV		Bean	BCMNV		Strawberry	Colletotrichum	2 races
	Colletotrichum			Colletotrichum		Bean	BCMNV	
	Pseudomonas		1	Pseudomonas		1	Colletotrichum	
Lettuce	Bremia	15 races	Lettuce	Bremia	15 races	1	Pseudomonas	
	LMV		1	LMV		Lettuce	Bremia	15 races
Alfalfa	Ditylenchus		Alfalfa	Ditylenchus		1	LMV	2 races
	Verticillium			Verticillium		Alfalfa	Ditylenchus	
Melon	Fusarium	2 races	Corn salad	Peronospora	2 races	1	Verticillium	
Pea	Ascochyta		Melon	Fusarium	2 races		Colletotrichum	
	Fusarium		Pepper	PVY	3 races	Corn salad	Peronospora	2 races
	BYMV		1	TMV		Melon	Fusarium	3 races
	Globodera rost.		1	PMMV	3 races	1	Golovinomyces	1 race
Potato	Globodera pal.		1	TSWV		1	Podosphaera	4 races
Rye-grass	Xanthomonas		Pea	Ascochyta		1	MNSV	
Tomato	Cladosporium		1	Fusarium		1	CMV	
	Fusarium	2 races	1	BYMV		1	ZYMV	
	FORL		Potato	Globodera rost.		1	MWMV	
	Stemphylium		Rye-grass Tomato	Globodera pal.		Pepper	PVY	3 races
	TMV			Xanthomonas			TMV	
	Verticillium			Cladosporium			PMMV	3 races
	Plasmopara	4 races		Fusarium	3 races		TSWV	
 85 hosts race/pests and diseases combinations at pathology lab of GEVES-SNES 				FORL		Pea Potato	Ascochvta	
				Stemphylium			Fusarium	
				TMV			BYMV	
				Verticillium			Globodera rost.	
				TSWV			Globodera pal.	
			Sunflower	Plasmopara	9 races	-	Test miniaturisé	
			Cereals	Yellow rust	3-4 races	Rve-grass	Xanthomonas	
 8287 tests performed, mainly for vegetables 				Brown rust	4-5 races	Tomato	Cladosporium	2 races
				Coronated rust			Fusarium	3 races
				Eve spot			FORL	
				Fusarium	2 species	1	Stemphylium	
				Septoria		1	TMV	
			L			1	Verticillium	
							TSWV	
							Pseudomonas	
						Sunflower	Plasmopara	9 races
						Cereals	Yellow rust	3-4 races
							Brown rust	4-5 races
							Coronated rust	
							Eve snot	
							Fusarium	2 snecies
							WSSMV	
Dicarco	and noct roo	rictance	lab tosta				SBCMV	
Diseuse und pest resistance iad tests at GEVES-SINES							Sentoria	
							Jocptona	1

intermediate resistant, and susceptible reference controls.

• Classification of cultivars based on phenotype and not on genotype.



Pea : Fusarium oxysporum f.sp. pisi

Main important steps:

1- Choice of the strains:

In accordance to aggressiveness and prevailing isolates, representative of the field occurence in France and also to toxigenocity (mycotoxin DON on wheat). GEVES is in relationship with INRA, for characterization of strains and evolution of pathotypes.



Evolution of yellow rust pathotypes in France

2- Inoculum production:

GEVES-SNES is in charge of the inoculum production for CTPS, CPVO, INOV studies but also for external customers.

On seeds

Eye spot inoculum on barley seeds



Fusarium graminearum





Wheat/yellow rust

▶ In the field:



Illustration of inoculated trials for field crops

45 combinations host/pathogens in specific trials in the field, of which 32 are inoculated.



3-Inoculation:

Artificial inoculation is performed either in laboratory or in the field.



In field test

Lettuce /Bremia



4- Scoring:

Resistance to diseases is evaluated either with a qualitative scale quantitative scale. For or a quantitative scales, training programs have been developed in cereals for yellow rust, brown rust and Septoria tritici, and in rapeseed for Phoma.





Development of resistance tests in the frame of the VCUS with special designs

For VCUS studies, testing varieties for resistance to diseases in the field are performed in special designs :

either by natural contamination with no fungicides (for cereals and field bean), or low level (for beet)

or by artificial contamination in order to ensure a good and uniform level of infection



About one hundred diseases and pests listed in the CTPS technical rules or in VCUS protocols, able to be scored.

Conclusion The resistance evaluation of cultivars enables a genetic progress in order to have cultivars adapted to the conditions of culture, in a context of decreasing pesticides

- GEVES : Glossary Variety and Seed Study and Control Group
 - Technical Committee for Plant Breeding CTPS :
 - **Community Plant Variety Office** CPVO :
 - National Office for plant breeder's rights INOV :
 - Reference material network MATREF :

- DUS: Distinctness, Uniformity and Stability VCUS : Value for Cultivation, Use and Sustainability International Seed Federation ISF :
- APS : American Phytopathological Society

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1 - GEVES-SEV : Variety Testing Department | 2 - GEVES-SNES : National Seed Testing Station