BRESOV

Breeding for Resilient, Efficient and Sustainable Organic Vegetable production

Validation of efficient tools to improve the quantity and quality of organic seed production in broccoli, tomato and snap bean (BRESOV EU project, 2018-2023)

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The development of organic farming in Europe is affected by different issues including the limited quantity and the poor quality of seeds available for the growers. The objectives of the **workpackage 4** of the EU H2020 BRESOV project is to develop protocols and tools to maximize yield (T4.1) and ensure high sanitary quality (T4.2) and high genetic purity (T4.3) of organic seeds of broccoli, tomato and snap bean.

T4.1

Protocols to improve organic seed yield

The 5 partners involved in this task performed trials on 3 different geographical regions accross Europe over 3 years (Figure 1). The different parameters tested to improve organic seed yield are detailed by crop in Table 1.

Figure 1. Location of trials performed to improve organic seed yield. SECL : Terre d'essais, OBS : l'Organisation Bretonne de Sélection, FiBL : Forschungsinstitut Fur Biologischen Landbau stiftung, UNICT:University of Catania.

Table 1. Parameters modulated to improve organic seed yield in each crop.

Brassica	Tomato	Snap Bean
Nutrition [OF, T]	Nutrition [OF]	
Plant density [OF, GH, T]	Plant density [OF, GH]	Plant density [OF, GH, T]
Best density x Best nutrition [OF]		
Transplantation time-points [OF]	Harvesting frequency [GH] Grafting [GH]	*Rhizobium-Phaseolus vulgaris* symbiosis [OF]

[OF] : Open Field, [T] : Tunnel, [GH] : Green House

Various factors could influence seed production and seed germination, e.g. the experimental factors tested (crop-dependent), genotypes and genotype X environment interactions.

T4.2

Protocols to control the sanitary quality of organic seed lots

Microbial consortia (MCs) and natural compounds (NCs) have been evaluated as seed dressing to improve plant sanitary quality and control seed borne pathogens. Molecular tools are being developped (e.g. qPCR-based) to control sanitary quality of seeds, for 11 major seedborne phytopathogens (Table 2). These tools are being validated on DNA extracted from pure strains, and from artificially inoculated seeds and/or from naturally infected ones.

Table 2. Seedborne pathogens and BRESOV partners involved in T4.2

	seedborne pathogen	Detection tool development*	Treatment development
Tomato	*Clavibacter michiganensis* subsp. *michiganensis*	ITAKA/UniCT (v)	ITAKA
	Pseudomonas syringae pv. tomato	ITAKA/UniCT (v)	ITAKA
	Xanthomonas spp pathogenic to tomato	UNICT (a)	UNICT
	ToMV	VEG (a)	ITAKA
	Fusarium oxysporum f.sp. *radicis lycopersici*	ITAKA (a)	ITAKA
Broccoli	*Xanthomonas campestris* pv. *campestris*	VEG (d), UNICT (v)	VEG
	Alternaria spp.	VEG (d), UniCT (a)	UNICT
	Phoma lingam (*Leptosphaeria maculans*)	ITAKA (a)	ITAKA
Snap Bean	*Colletotrichum lindemuthianum*	FiBL (a)	FiBL
	Pseudomonas savastanoi pv. *phaseolicola*	FiBL (a)	FiBL
	Fusarium solani f.sp *phaseoli*	ITAKA (a)	ITAKA

*validation (v) development (d) application (a), SECL : Terre d'essais, OBS : l'Organisation Bretonne de Sélection, FiBL : Forschungsinstitut Fur Biologischen Landbau stiftung, UNICT : University of Catania, VEG : Vegenov.

First results support the efficacy of the different treatments. Some MCs and NCs reduced the symptoms of seed borne pathogens on their respective hosts but their biocontrol activity differed according to host/pathogen combinations.

T4.3

Protocols to control the genetic quality of organic seed lots

Development of molecular tools to evaluate genetic quality of seeds lead to the evaluation of several markers for intra and inter-specific seed contamination for the three crops considered. The preferred QC tool is based on molecular markers. The objective is thus to find the optimal marker set per crop that enables the detection of intra-specific contamination (= variety mixture, concerns tomato, broccoli and snap bean) and inter-specific contamination (= presence of weed seeds, concerns essentially broccoli).

Table 1. One crop allocated by partner

Brassica	Tomato	Snap Bean
Universita degli studi di Catania	Universitat Politecnica De Valencia	Vegenov

General procedure :

1) Initial marker set (Exhaustive list of highly polymorphic markers to detect intra and inter-specific contamination, preferred marker types SSRs or SNPs)

2) Initial material set (min. 30)

3) Determination of the discriminative power of the markers – definition of the optimal marker set (generation of a marker database, calcul of the Polymorphic Information Content)

4) Assessment of the contamination detection power of the optimal marker set (Artificial range of samples containing 1 major variety and 1 or several minor varieties)

5) Validation of the optimal marker set and related QC protocol for routine use

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