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BRESOV

Breeding for Resilient, Efficient and Sustainable Organic Vegetable production

Deliverable No. D5.2

List of crop performance measurements to be collected at all location and a questionnaire for the farmers involved

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Deliverable title	**List of crop performance measurements to be collected at all location and a questionnaire for the farmers involved**
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1 Introduction

The main activity of WP5 is to evaluate breeding lines in multiple locations on-farm, this way providing farmers with new materials to be tested alongside commercial organic varieties. The selection process of the cultivation material for these trials is described in Deliverable 5.1. In each trial location, the cultivation is carried according to the usual practices of the organic farmer hosting the trial. While the cultivation might differ between locations, the evaluation of the trials will follow a common protocol. This will allow to homogenize the results across locations and will result in a better assessment of the varieties.

In this report, we present i) the evaluation tables that were developed for each of the three crops of interest, ii) a short and simple questionnaire aimed at farmers, for their opinion on how the test material compares to the standard/usual varieties for each crop and finally, iii) a questionnaire related to the cultivation practices, the conduction of the trial and the production outcome, and the soil parameters at each location for the socio-economic study of Task 5.4. This last part serves another objective of WP5, which is to promote crop rotations.

These tables and questionnaires will be completed by each partner involved in the multi-location trials of T5.2 and their collaborating farmer.

2 Description of Activities

To fully exploit the multi-location on-farm trials and reach the objectives of this work package, 3 types of questionnaires were designed:

- Agronomic variety evaluation sheets allowing the comparison of varieties at each location: these will be completed during the cultivation and harvest of each crop (1 Excel file per crop).
- A simple farmer survey about their experience with the new material in comparison to their reference varieties.
- A table to collect the crop inputs and outputs, completed by soil analyses at each location for a socio-economic analysis of the cultivation of the three crops.

2.1 Agronomic evaluation of the varieties

The crop(s) cultivated at each location depend on the expertise of the task partner as well as on the cultures grown by the trial hosting farmer at this location. The on-farm trials are conducted under the usual local production practices. The trials are however designed in a way that makes the variety evaluation scientifically and statistically valid. Trials follow the experimental conditions described in Lindner et al., 2006, such as – depending on the crop – the minimal core plot size and the number of repetitions per variety. The experimental designs differ between location to cope with differences in field sizes, number of trialled varieties and different usual crop cultivation (such as distance between and within rows). For each of broccoli, beans and tomato, a list of relevant traits and their respective measurements was established. The basis of this list is the book of Lindner et al., 2006 as well as the Guidelines for experimental practice in organic greenhouse horticulture (Koller et al., 2016). The elaboration of the tables used also the UPOV *Brassica oleracea* L. var. *italica* Plenck descriptors (UPOV 2018) and input from the crop experts in BRESOV. Thanks to a multi-actor approach, the list of evaluation criteria could be narrowed down to these variables which were relevant to the farmers, to the breeders and to the distributers. This was done during meetings with organic farmers' advisor from the association of organic vegetable and fruits producers Terraviva – one of BRESOV stakeholders, after taking knowledge of criteria included in the data collection of sister project LIVESEED as well as marketing criteria as given by Qualiservice (Swiss regulation for the quality of vegetables). While the

list of traits finally included in the tables might seem long, these are all essential to the description of the new varieties, and the assessment of their potential to compete or replace standard varieties. The evaluation data is to be acquired by the scientific project partners during regular visits to the farm while the daily harvest can be recorded by the farmer following initial instruction from the responsible scientist. Partners report on their trial every three months when giving input to the WP leader for the quarterly project short update (a.k.a. BRESOV Pre-reads) and are advised by the WP leader whenever a question or issue arise.

2.2 Farmer's simple evaluation of the tested material

The varieties and lines cultivated in the on-farm production trials of task 5.2 include for each crop, the material commonly tested in different on-farm locations, experimental material which has received promising results in other tasks or projects, and a control reference which is either the usual variety cultivated on this farm or in this region, or any variety already established as good at this location (cf. Deliverable 5.1). In this questionnaire, the farmer is asked whether the test variety is much better, better, same, worse or much worse than the reference variety for a set of relevant criteria. The criteria were selected with the farmers' advisor from the association of organic vegetable and fruits producers Terraviva – one of BRESOV stakeholders in order to truly reflect what matters most to the producer when selecting a variety to grow.
In accordance with the ethical requirements as describes in deliverables 7.2 and 7.3 of BRESOV, the **farmers will be given a consent form (Annex 2) – translated in the national language – to sign** prior to filing the questionnaire; and **non-EU partners will fill in the confirmation of compliance with GDPR** prior to sharing the data collected with the task leader P6-FiBL.

2.3 Cultivation data for the socio-economic study

The trials of task 5.2 are conducted under different pedo-climatic conditions and different cultivation parameters. The crops are cultivated in farms that already produce this specific crop (e.g. open field determinate tomato for P11-VRDS and P12-CREA instead of greenhouse tomato, broccoli only for P4-UTAD and P9-UNILIV, bean only for P16-SERIDA), and in the season which is favourable for its cultivation. Only the trial of P5-VURV produces Broccoli despite it not being a common crop in the region, due to the partner's involvement in all other broccoli activities in BRESOV. Broccoli, tomato and beans are usually cultivated within a rotation in organic production, but rotation schemes differ between locations. Crop rotation schemes were collected at the beginning of the project, but are continually adapted as most farmers decide before each season and according to the current conditions what to plant next. P1-UNICT collects the actual detailed crop rotations in a common format from each partner during the trial periods. P1-UNICT established a list of Indicators and parameters with the aim to analyse the farm inputs and outputs regarding the crops of interest at each location and produce a Life Cycle Assessment (LCA) of the crop production. The soil being one of the cultivation parameters, it is sampled and analysed at each location and at several time points during the two years of T5.2 (usually before the beginning of a crop cultivation, and at the end). A sampling protocol – distributed to Task 5.2 partners – is attached in Annex 1 and allows for quality sampling. Samples are then sent to laboratories specialized in soil analyses while some analyses are carried by the scientific staff at partner's institution following their usual protocol or the soil extraction protocol used by P6-FiBL and made available upon request. We decided against performing all soil analysis in one laboratory. While this would lead to results of same quality, shipping may deteriorate the samples making the analysis less reliable.

For this study, 4 phases are carried-out according to the available literature on similar analysis and in particular Falcone *et al.* 2019:

1. Identification of the Functional Unit (FU) or unit of measure to which all input and output data are related. 1 hectare of land is usually chosen as FU. Here, we will collect the data of a smaller experimental particle and then report them in proportion to the reference hectare.
2. The level of detailing of the protocol was defined according to the system boundary approach "farm from cradle to gate". The scheme of the cultivation cycle at each location is collected to define the aspects of input/output collection and economic and financial data (cf. Falcone et al. 2019, particularly in figure 1).
3. Data on processes such as seeds, fuels, fertilizers, herbicides and water consumption must be collected directly from field tests. Case studies will be collected in each region, when available, to provide the typical average values (i.e. inputs and outputs) of production per type of crop such as the Proficost in Switzerland (which gives the calculation of the complete costs and the brutto margins for vegetable cultures and where standard values can be adapted to the operation processes of a specific production) – or through experts and producers organisations in each country.
4. The Life Cycle Assessment. Data on basic processes such as fuel, fertilizers and pesticide production steps will be collected from existing databases, such as the Ecoinvent database linked to SimaPro, the trials will be geolocalized and an analysis of the production at each location will be carried using the Life Cycle Assessment software SimaPro (PRÉ CONSULTANTS B.V).

3 Results

3.1 Agronomic evaluation of the varieties

In the following sections, prints of the tables developed for the evaluation of the three crops are presented. Partners involved in task 5.2 and supervising each trial receive the forms as Excel files. The evaluation forms for each crops are divided in several Excel sheets, covering mainly pre-harvest /crop growth evaluation/field observations, observations at harvest, and harvest/production data. Documents listing the most common diseases for each crop along with pictures of their symptoms are uploaded on the project's collaborative space "Project Angel" to facilitate the disease evaluation of the crops.

3.1.1 Broccoli

Field observations

Broccol Trials 2020

FIELD OBSERVATIONS AT PLANTING AND BEFORE HARVEST

Farm/Organisation:	Type of soil
Responsible person	Previous crop
Site	Fertilisation
	Irrigation

			Before planting *(can be reported per variety instead of plot)*				General aspects of plants		Diseases (upon emergence) **please see list of diseases*			
Plot number	Variety	Replicate (rep 1, 2, 3 or rep 4)	Number of seeds seeded	Number of seedlings germinated	Remarks on seeds	Number of plants planted	Vigor/ vegetative development *(1-3 vigorous 1= very bad, 3=bad, 5= normal, 7= good, 9=very*	Leaf shape *(1erected to 9 spreadi-; see picture Ad.3 Leaf below*	Description	Average % of leaf surface affected on 10 random plants/plot	Description	Average % of leaf surface affected on 10 random plants/plot
	RASMUS	rep1										
	CN-BRO-09	rep1										
	Ref [name]	rep1										
		rep2										
		rep2										
		rep2										
		rep3										
		rep 3										
		rep 3										
		rep 4										
		rep 4										
		rep 4										

Ad. 3: Leaf: attitude (at beginning of head formation)

3 semi-erect | 5 horizontal | 7 semi pendulous

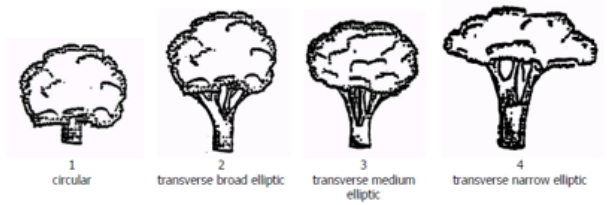
Overview of harvest timeline:

			General aspects of harvest				
Plot number	**Variety**	**Replicate** *(rep 1 , 2, 3 or 4)*	**Beginning of harvest** *[date]*	**Spread in days of main harvesting period of harvest** *[(when 80% are harvested, in nb. of days)*	**End of harvest** *[date]*	**Nb of harvests**	**Representative pictures** *(recommended at 50% of harvest)*

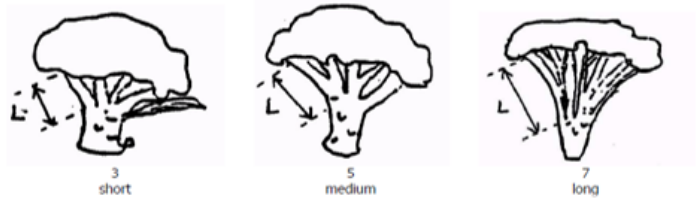
Individual observations at main of each variety: these observations are carried on 10 random plants with marketable heads per plot at the main harvest date of each variety (where ≥ 50% of the plants are harvested, once per plot)

				Head (principal)						Only for sprouting variety (brocolo nero @ VRDS)			
Plant number	**Plot number**	**Variety**	**Replicate** *(rep 1, 2, 3 or 4)*	**Colour** *(light, middle, dark green, with shade of blue or grey)*	**Shape** *(1 to 4 , refer to pic. Ad 17 below)*	**Regularity** *(1 irregular, like 10 ping pong balls to 9 very regular, like one balloon)*	**Length of branching** *(1 short to 9 very long; see picture Ad. 15 below)*	**Buds** *(1 very small to 9 very big)*	**Weight** [g]	**Number of secondary sprouts**	**Average weight/ sprout** [g]	**Pictures** *(plant and head)*	**Homogeneity of heads** *(1-9 homogeneous; 1 answer per plot)*
1	2A	Rasmus	1										
2	2A	Rasmus	1										
3	2A	Rasmus	1										
4	2A	Rasmus	1										
5	2A	Rasmus	1										
6	2A	Rasmus	1										
7	2A	Rasmus	1										
8	2A	Rasmus	1										
9	2A	Rasmus	1										
10	2A	Rasmus	1										
1	1C	[Ref. name]	3										
2	1C	[Ref. name]	3										
...	...	...	...										

Ad. 17: Head: shape in longitudinal section



Ad. 15: Head: length of branching at base (excluding stem)



Harvest data: collected at every date of harvest. Harvests are usually 2-3 days apart. Heads at harvest are normally between 8 and 18 cm high (including stem)

Plot number	Name	Replicate (rep 1, 2, 3 or 4)	Date	Number of heads harvested	Total Weight of heads harvested (g)	Number of marketable heads (1st choice*)	Weight of marketable heads (1st choice*) (g)	Number of marketable heads (2nd choice*)	Weight of marketable heads (2nd choice*) (g)	Number of non-marketable heads	Weight of non-marketable heads (g)	Reason for rejection [Number of heads]										
												Colour (yellowish)	caveous stem	Rot (on head)	Not compact	Head too flat	Buds too big	Sprouting (buds growing out of head)	Scarring (scarified from pests)	Weird/uncommon shape	Too small	Too large

*1st choice = Supermarket criteria in trial location, 2nd choice = acceptable at direct marketing in trial location)

3.1.2 Tomato

Pre-harvest observations:

FIELD OBSERVATIONS DURING GROWTH AND BEFORE HARVEST

Farm/Organisation:	Type of soil
Responsible person	Previous crop
Site	Fertilisation
	Irrigation

							Physiological damage		Pest/animal damage		Diseases		Viruses	
Date	Genotype	Repetition	Growth strength *(1-9; Indication on the speed of growth. Before reaching the tension wire, the growth strength is assessed. 1= very low 3 = low 5 = medium, 7 = strong, 9 = very strong)*	Uniformity of stock *(1-9; Before reaching the tension wire, the uniformity of stock is assessed. 1= very low 3 - low 5 = medium, 7 = strong, 9= very strong)*	Aerated or compact architecture (indicates susceptiblity to fungal diseases)	Tendency to produce double heads *(1 to 9; 9 = all plants do it)*	Description *(leaf rolling, nutrient defficiency etc..)*	Severity *(average % leaf area affected estimated on 10 random plants)*	Description	Severity *(average % leaf area affected estimated on 10 random plants or nb of plants in case of nematods, mammifer)*	Description	Severity *(average % leaf area affected estimated on 10 random plants)*	Description	Severity *(average % leaf area affected estimated on 10 random plants)*

Observations at harvest:

The following assessments are carried out one to three times maximum per plot on a crate of fruit during the main harvesting time. Make sure, that you observe the harvest of all the repetitions.

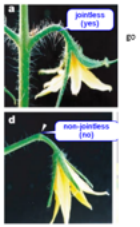
									Only open field tomatoes *see figures*			
Date	Genotype	Plot	Fruit shape *(1-9: 1= very flat-round, 2 = flat-round, 3 = round, 4 = high round, 5 = oval, 6 = pear-shaped, 9 = thin and long; see*	Homogeneity of Fruit shape *(1-9: 1= very low 3 = low 5 = medium, 7= high, 9 = very high)*	Homogeneity of fruit colour *(1-9: 1= very low 3 = low 5 = medium, 7= high, 9 = very high)*	Homogeneity of fruit size *(1-9: 1= very low 3 = low 5 = medium, 7= high, 9= very high*	Colour *(light pink; pink; dark pink; light red; red; dark red; orange)*	Color inside [Optional]	Colour intensity *(1-9 or chronometer: average over 4 readings)*	Jointless Pedicel [yes/no][1]	Core size *(Average of the measurement[2] of 5 fruits that are representative of the variety in the first harvest)*	high soluble solid contend (refractometer[3] : average over 4 readings)

Fruit shape

1= very flat-round, 2 = flat-round, 3 = round, 4 = high round, 5 = oval, 6 = pear-shaped

[1]Jointless pedicel: yes/no trait

In jointless pedicels there is no abscission layer and the calyx remains attached to the plant. In the non-jointless the calyx and a part of the pedicel with the fruit and they have to be removed manually and if they go in the final produce they reduce the quality when processing for paste, etc.



go

[2]Core size

Measurement the central part of the fruit with the locules. Small cores means more flesh and fruits less susceptible to manipulation during processing. Average of the measurement of 5 fruits that are representative of the variety in the first harvest (see black line on the figure below)

Figure modified from Mao, L., Begum, D., Chuang, H. W., Budiman, M. A., Szymkowiak, E. J., Irish, E. E., & Wing, R. A. (2000). JOINTLESS is a MADS-box gene controlling tomato flower abscissionzone development. Nature, 406(6798), 910-913.

[3]High soluble solid content

Measured with a manual refractometer. A drop of juice is required and has to be observed visually. Should be at least performed by one partner working on OF Tomato. Example of models here: https://www.atago.net/product/?l=en&f=products-master-top.php

Observations at main harvest:

For each variety in the trial, the following measurements are made **once** per plot during the variety's main harvest, on 20 data points per trait and plot.

Date	Genotype	Repetition	Fruit	Fruit diameter (heigth in mm)	Fruit diameter (width in mm)	Fruit weight (g)	Nr. of fruit chambers	Estimated % of fruits in 5kg that fall in the right size category according to calibre (height & width) /plot
			Fruit 1					
			Fruit 2					
			Fruit 3					
			Fruit 4					
			Fruit 5					
			Fruit 6					
			Fruit 7					
			Fruit 8					
			Fruit 9					
			Fruit 10					
			Fruit 11					
			Fruit 12					
			Fruit 13					
			Fruit 14					
			Fruit 15					
			Fruit 16					
			Fruit 17					
			Fruit 18					
			Fruit 19					
			Fruit 20					
			Fruit 1					
			Fruit 2					

Harvest data:

One row per harvest date and plot

Plot number	Repetition	Genotype	Harvesting date	Nb. harvested plants per plot *(count at first harvest & correct in case of plant losses)*	Marketable yield [kg/per plot]	Rejected yield [Kg/plot]	Reason for rejection *(report nb. of affected fruits by category)*							
							Wrong calibre (too big or too small)	crackled skin/bursting	Tender (as if cooked inside)	Blossom End Rot	*Botrytis cinerea*	Late blight	Pest/animal damage	Other

3.1.3 Beans

Pre-harvest assessment:

Bean Trials 2020

FIELD OBSERVATIONS AT PLANTING AND BEFORE HARVEST

Farm/Organisation:	Type of soil
Responsible person	Previous crop
Site	Fertilisation
Sowing date: **Direct sowing or transplant:**	Irrigation

Variables to evaluate **once right before the first harvest, 1 row per plot**

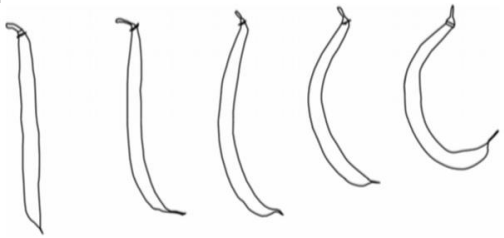
								Diseases and symptoms (upon emergence)					
Variety	Repetition	Date of when 50% have germinated	Date of recording	Germination-rate [%]	Stand density [nb. Plants/m] *Before harvest, plants are counted in one linear metre at a point typical of the density of the section, at least 50 cm from the beginning of the row.*	Steadfastness [1 to 9] *(the ability of plants to remain standing as opposed to laying down of each plot and variety is assessed: 1 = very bad 3 = bad, 5 = average 7 = good, 9= very good)*	[cm] *(Before harvesting, 10 plants are measured from soil to top without roots and the average is reported)*	Description	Average % of leaf surface affected on 10 random plants/plot	Description	Average % of leaf surface affected on 10 random plants/plot	Seed marking [1-9] *(how marked are the seeds of mature pods, 1=absent, 3=minimal, 5=medium, 7=strong, 9=very strong)*	Pods growing above foliage [yes/no] *See picture*

Pods above foliage - called Gluckentyp in German. Usually easier/faster to harvest

Observations at harvest:

The data about the harvested pods is acquired once per plot during the main harvest date of each variety. Values are recorded on 20 random pods per plot.

Variety	Repetition	Date of recording	Pods	Curvature [1- 9] *(1 = very little, 3 = little, 5 = normal, 7 = strong, 9 = very*)	Length of pod [cm]	Width of pod [mm] *(measured at the middle of a pod from seam to seam)*	weight of 100 pods (g)
			Pod 1				
			Pod 2				
			Pod 3				
			Pod 4				
			Pod 5				
			Pod 6				
			Pod 7				
			Pod 8				
			Pod 9				
			Pod 10				
			Pod 11				
			Pod 12				
			Pod 13				
			Pod 14				
			Pod 15				
			Pod 16				
			Pod 17				
			Pod 18				
			Pod 19				
			Pod 20				



Harvest Data:

One row per harvest date and plot

									Reason for rejection *(report nb. of apods or weight in g by category - please write the unit)*									
Date	Variety	Repetition	Time to harvest [minutes] *(duration of the harvest per plot- recorded only once per plot, at the main harvest of each variety)*	Nb. harvested plants per plot *(count at first harvest & correct in case of plant losses)*	Marketable yield [Kg]	Weight of 100 pods [g] *(recorded only once per plot, at the main harvest of each variety)*	Non-marketable yield [Kg]	Non-marketable yield (Kg)	Botrytis	Sclerotinia	Anthracnose *(Colletotrichum lindemuthianum)*	Fat spots *(bacterial blight of beans: Xanthomonas sp=Pseudomonas)*	Ascochyta (leaf spot of bean)	Eaten (pests)	Mosaic Vuris	Other *(please describe)*	Overall impression [1 to 9] */ Takes into account all criteria for cultivation and marketing: 1 = very bad, 3 = bad, 5 = average, 7 = good, 9= very*	Optional exc. for P6-FiBL: Ability of pods to remain longer on the plant* [Yes/No]

*in an 0.5 m of each variety, pods will not be harvested when mature but 1 week later a bite test is made on pods- if their texture feels like straw, the answer is No.

3.2 Farmer's simple evaluation of the tested material

Farm name	Location	Crop	Variety	Reference variety

Please use one table per variety test.

Please tick the box under the adjective that better fits your experience with the test variety compared to the reference variety or your standard variety, for each criterium listed below:

	Much better	Better	Same	Worse	Much Worse	Please explain how or why
Yield						
Ease /speed of harvest						
Taste (for tomato)						
Acceptance by customers *(unusual type, visual disease symptoms, appearance)*						
Problems due to pest and diseases						
Maintenance needs *(plant structure/shape can affect maintenance such as weeding, pruning, plant treatments...)*						
Yield quality						
General assessment of the variety compared to the standard						

	Yes	No	Why?
Would you cultivate this variety again?			
Would you recommend this variety?			
Do you see a market potential for these variety? *(can be also for different from your market e.g. interesting for direct marketing but not for distributers)*			

Question for the researcher	Rating
How do you rate this variety from 1 (very bad) to 9 (very good)	

3.3 Cultivation data for the socio-economic study

Information number	Guidelines	Description of the main features of the experimental trial per crop and cultivation year																
	Fact sheet: This on-farm trial is made with [CROP] in [farm address] by [Px-Partner name] under organic production conditions in [open field OR Greenhouse]. The crop rotation is as follow: [please include sowing and transplanting dates of the other plants in the rotation]. List the different varieties of this crop cultivated in the trial, the number of replicates, the plot size in m2 and the number of plants per plot. Include a picture of th.e trial																	
		Technical-agronomic characteristics																
1	Enter the worked surface of each individual field distinguished by species and variety	area m^2																
2	Type of soil (eg: clay, sandy, medium-textured etc)	soil type																
3	Indicate the prevailing slope of the individual plot, in the case of flat soil indicate 0	slope %																
		Production of seedlings																
4	Indicate in chronological order the operations carried out for the production of seedlings. In case some data is not available, it is important to know the number of trays, the type of tray and the type of soil used.	Seeding																
		Data	Type of seed	Thousand-seed weight (g)	Type of seed tray used	Type of polystyrene (for seed try)	Number of cell in a seed tray	Total number of seed trays used	Weight of seed tray (g)	Type of soil used	Total weight of soil used	Total volume of soil used	Price of seed (€/kg)	Price of seed tray (€/piece)	Price of soil (€/kg)	Total cost of seedlings production (€)		
5	Indicate in chronological order the irrigation operations carried out on the seedlings in the nursery, in case you do not have the required data it is important to know the distribution system and the total amount of water used	Irrigation of seedlings																
		Data	Distribution system	Materials of irrigation pipes	Weight of irrigation pipes	Lenght of irrigation pipes	Total amount of water (m3)	Quantity per single distribution (m3)	Price of irrigation pipes (€/meters)	Total cost of irrigation (€)								
6	Indicate in chronological order the treatments carried out on the seedlings before transplanting	Treatments for seedlings																
		Data	Type of plant protection product used	Active substance %	Distribution system	Quantity per single distribution	Price of product (€/L or €/g)	Total cost of treatments (€/application)										
7	Indicate in chronological order the operations concerning transport of seedlings from nursery to the field. where the required data are not available, indicate the distance travelled, the type of vehicle used and the total flat-rate cost of transport of plants	Transport of seedlings from nursery to greenhouse/field																
		Data	Type of used vehicle	Vehicle trade mark	Engine power of the vehicle (CV or Kw)	Year of production of the vehicle	Crossede kilometers	Quantity of fuel used (L)	Price of fuel (€)	Total cost of trasport (€/km)								

8	Indicate in chronological order all cultural operations related to production, distinguishing man-hours and machine-hours of work, type of machine used, tractor power (Kw),tractor's year of manufacture, surface worked and its consumption and the costs of individual operations.	**Cultural operations for production**														
		Data	Operation	Manual work (hoursMen = nb. of hours x nb. persons)	Work with machines (h)	Tools used for coltural operations (model and name)	Type of tractor	Tractor trade mark	Engine power of the tractor (CV or Kw)	Year of production of the tractor	Crossing kilometres of prepared surface	Quantity of fuel used (L)	Price of manual work (€/h)	Price of work with machines (€/h)	Price of fuel (€)	Total cost of operation (€)
			Field preparation													
			Transplanting													
			Supporting with reeds													
			Weed control													
			Fertilisation													
			Irrigation													
			Plant protection													
			Harvest													
9	Indicate fertilisation operations in chronological order of administration, the fertilisers used for the individual plot of the test and their costs	**Fertilisation detail**														
		Data	Type of fertiliser used	nitrogen content (%)	P2O5 content (%)	K2O content (%)	Other elements content (%)	Other elements content (%)	Other elements content (%)	Distribution system	Quantity per single distributiion	Price of product (€/L or €/g)	Total cost of operation (€)			
10	Indicate in chronological order of administration the pesticide treatments and report the products used for the individual test plot and the related costs	**Treatments details**														
		Data	Type of plant protection product used	Active substance %	Distribution system	Quantity per single distribution	Price of product (€/L or €/g)	Total cost of operation (€)								
11	Indicate in chronological order all irrigation operations. Where it is not possible to have all required data it is important to indicate the irrigation system, the number of irrigations, the total amount of water used and the total number of hours of irrigation	**Irrigation details**														
		Data	Distribution system	Materials of irrigation pipes	Weight of irrigation pipes	Lenght of irrigation pipes	Total amount of water (m3)	Quantity per single distribution (m3)	Total cost of operation (€)	Power of irrigation pumpo (Kw)	Energy consumption of irrigation pump (€/kWh)	Total cost of operation (€)				

12	Indicate crop total production, crop total marketable production and estimated average price over the period	**Production**											
		Data	Product type	Crop total production (kg)	Crop total marketable production (kg)	Average market price (€)							
13	Indicate in chronological order all management operations of cultural residuals, distinguishing man-hours and machine-hours of work, type of machine used, tractor power (Kw), tractor's year of manufacture, surface worked and its consumption and the costs of individual operations.	**Crop residue management**											
		Data	Operation	Manual work (hoursMen)	Work with machines (h)	Tools used for coltural operations (model and name)	Type of tractor	Tractor trade mark	Engine power of the tractor (CV or Kw)	Year of production of the tractor	Crossed kilometers	Quantity of fuel used (L)	Total cost of operation (€)
14	Indicate amount of plastic, polystyrene and crop residues and method of disposal	**Waste disposal**											
		Data	Type of waste	Operation	Manual work (hoursMen)	Work with machines (h)	Tools used for operations (model and name)	Disposal site (eg. landfil, company for the recycling of waste…)	Crossed kilometers from farm to disposal site (km)	Quantity of fuel used (L)	Total cost of operation (€)	Waste weight (kg)	
			Plastic (irrigation pipes)										
			Polystyrene (seed try)										
			crop residue										

We invite all partners of the project who would like clarification during the compilation to send an email to: fbranca@unict.it;brancafer@hotmail.com;mariar.cammarata@gmail.com

Soil Analysis	
pH	
Soil salinity- electrical conductivity (dS/m)	
Organic matter (% or g/100g)	
Macronutrient	
total nitrogen (g/kg)	
assimilable phosphorus (mg/kg)	
exchangeable potassium (mg/kg)	
exchangeable calcium (mg/kg)	
exchangeable magnesium (mg/kg)	
Micronutrient	
assimilable iron (mg/kg)	
assimilable manganese (mg/kg)	
assimilable rame (mg/kg)	
assimilable zink (mg/kg)	
soluble boron (mg/kg)	

4 Conclusions

The different evaluation sheets and questionnaires presented here will require extensive work from all partners involved. This is however a unique research opportunity and data will allow the description of the test varieties under regular organic production, the study of their real agronomic and economic potential, as well as the assessment of the interest of farmers to use them in the future. The collection of cultivation data on each farm (i.e. questionnaire for the LCA) will in addition, give some insight on the differences of processes between locations and their impact on the production and hopefully allow the identification of these differences including crop rotations, which lead to better production results. With this, we fulfil the objectives of WP5 which are: to evaluate a shortlist of breeding lines compatible with organic farming for the production of crops of enhance quality and marketing value, to provide farmers with new materials to be tested alongside commercial organic varieties on-farm and to promote crop rotations for improved performance of broccoli, snap bean and tomato.

5 References

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Beans https://www.qualiservice.ch/uploads/normen2017/fr/Haricot_nain.pdf and
Tomato https://www.qualiservice.ch/uploads/normen2017/fr/Tomate.pdf, by type
https://www.qualiservice.ch/legumes.html.

Union for the Protection of New Varieties of Plants (UPOV) - UPOV *Brassica oleracea* L. var. *italica* Plenck descriptors (UPOV 2018) https://www.upov.int/edocs/tgdocs/en/tg151.pdf

6 Annex 1: Soil sampling procedure

Because the trials of T5.2 will be done according to the usual practices in every region, the analyses of soils will be done using the regular lab or method used in each farm.

Sample A: 12 samples of 0-30cm each, pooled- can be done as early as now or any time before fertilization
This sample can be send to a laboratory to give you a full for soil analysis including: P, K, Mg, Ca, only available (not the reserve), Soil type (ex. see here in German, but easily translated with deepl.com), Humus, pH (please indicate the measurement method used), EC (electrical conductivity, soluble salts; especially needed for greenhouse cultivation). Boron and all trace elements (especially needed for Broccoli).

Samples B (ideally 2 weeks before fertilization, to have enough time to adjust the fertilization but should not be done too early):12 samples of 0-30cm each, pooled (**B1**) and 12 samples of 30-60 cm pooled (**B2**). These 2 samples will be needed to measure Nmin. Follow your standard soil extraction method (with CaCl2 or KCl) or it can be extracted and analysed by a lab. Watch out, the samples for Nmin should be stored in a cool box and extracted within 24h. Extracts can be frozen if not directly analysed.

You can either do the soil sampling twice or at once (2 weeks before fertilization): pool the different samples of 0-30cm, mix well and divide in two samples A & B1, mix all the samples from 30-60cm to obtain B2.
The standard farmer/country method should be used. Usually sample A is sent to a lab as is and samples B1 and B2 are extracted on-station (pH measured in filter suspension and EC measured in the filtrate) and the filtrate is sent to a lab for Nmin measurement.

Remark: To make the acquisition of the soil sample easier, you are advised to use a thin soil prober/drill of 2cm diameter. This makes it easier to dig and leads to enough quantity of soil (as 12 samples are mixed).

7 Annex 2: Generic Informed Consent BRESOV template (cf. BRESOV D7.2)

Project Acronym:	**BRESOV**
Project Name:	**Breeding for Resilient, Efficient and Sustainable Organic Vegetable production**
Start date of the project	**01/05/2018**
End date of the project	**30/04/2022**
Website:	www.bresov.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 774244.

1. Introduction

You have been invited to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully and ask your contact researcher (i.e. study investigator) if there is anything that is not clear or if you need more information. *At all times, we are in compliance with the European data protection laws and regulations: EU General Data Protection Regulation (GDPR) Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data.*

Data acquisition of this study will consist of [a questionnaire on farming experience with the test varieties OR a questionnaire on crop production data and farm operation OR and an interview for a short video about BRESOV].

The specific objectives of the task in which you are involved are as follows: (include here the objectives of the specific task <TASK NUMBER> considered).

2. Description of the project 'Breeding for Resilient, Efficient and Sustainable Organic Vegetable production (BRESOV)'

In BRESOV, we plan to advance the development of varieties which are well suited to organic agriculture. To do so, we exploit the genetic variation of brassica, snap bean and tomato looking for traits that enhance productivity and quality. We also develop strategies for better farming and research methods to increase the quantity and quality of organic seeds. These aims will be achieved thanks to the active involvement of farmers, advisory services, research institutes, breeding companies and food processors from diverse geographical/climatic contexts in Europe and Non-EU countries.

BRESOV involves 22 partner institutions from 10 European countries as well as China, Tunisia and South Korea, and is characterised by a multi-actor approach placing special emphasis on the input and needs of the breeding and farming sector. A full list of the project partners is available on the BRESOV website: https://www.bresov.eu/network/partners

3. Study procedures

You are asked to [fill a questionnaire about<DESCRIPTION> OR answer questions in a filmed interview]

4. Risks and benefits

No risk is foreseen. While it is likely that you will not receive any personal benefit for your participation in this study, you will informed about its results. Your participation makes a substantial contribution to understanding the potential of [alternative crop varieties OR certain farming methods OR organic farming].

7. Privacy and confidentiality

Your responses to [the questionnaires OR the interview] will be recorded.

In case of questionnaire, the information you provide – excluding personal, identifiable data such as name, email, telephone number or physical address - will be stored by members of the consortium, processed during data analysis and will be shown in project reports. Your personal data will only be stored by the contact researcher (i.e. local investigator of this study and their institution). No personal data will be shared with third party companies.

The results of this investigation may be published in scientific journals or conferences and may be used in further studies.

In the case of filmed interviews, your consent to the display of your name and profession will be sought prior to the publication of the media.

8. VOLUNTARY PARTICIPATION

Your participation in this study is voluntary. If you decide to take part in this study, you will be asked to sign this consent form. After you sign it, you are still free to withdraw from the study at any time and without reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

7. Contact persons

If you have questions at any time about this study, you may contact your local study investigator, the Leading Researcher whose contact information is <NAME SURNAME> (Name@Organisation.country) or the Project Coordinator, Prof. Ferdinando Branca (fbranca@unict.it).

8. Your consent

I have read and understood the provided information and have had the opportunity to ask questions.

I agree to participate in this study and to the use of the information I provide for [scientific OR dissemination] purposes.

I will be given a copy of this consent form.

.....	.....
Name and surname of participant	Place, date and signature of participant (electronic signature for web-survey)
.....	.....
Name and surname of study director	Place, date and signature of study director

8 Annex 3: Confirmation of compliance of non EU partners with GDPR (cf. D7.3)

Project Acronym: BRESOV
Project Name: Breeding for Resilient, Efficient and Sustainable Organic Vegetable production
Start date of the project 01/05/2018
End date of the project 30/04/2022
Website: www.bresov.eu
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 774244.

Confirmation of compliance of partners from non-EU countries or international organisations with national and EU legislation

I confirm that……(organization name, name of authorised person)…. located in …. (non-EU country) will rigorously apply the ethical standards and guidelines of Horizon 2020 and the national regulations, regardless of the country in which the research is carried out.

I confirm that……(organization name, name of authorised person) located in …. (non-EU country).. will collect scientific and personal data. If personal data are transferred from/to a non-EU country or international organisation, we will comply with national and EU legislation.

_____ _____

Date, place Signature