

LIFE17/CCA/ES/000030 LIFE RESILIENCE

Prevention of *X. fastidiosa* in intensive olive & almond plantations applying productive green farming practices. Development of disease-resistant olive varieties.

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INTRODUCTION AND OBJECTIVES

'Life Resilience' project is focused on measures to lower the production system's water and carbon footprint, adapting to measures aimed at lowering the impact of agriculture on climate change. With regard to increasing resilience, a large part of the project will be focused on increasing the resistance of the olive plant and its surroundings to foreign pathogens and epidemics, in the most urgent case, *Xylella fastidiosa*, but also other foreseeable outbreaks in the future. Since the beginning of the outbreak produced by *Xylella fastidiosa* in the South of Italy, different levels of resistance among local olive cultivars were observed. Recent studies have corroborated this variability; cultivars such as 'Leccino' and 'Fs-17' have shown high levels of resistance, while others such as 'Ogliariola Salentina' and 'Cellina di Nardo', have shown the opposite behaviour (Figure 1). This variability has been the foundation for the first olive-breeding program to develop new cultivars resistant to *X. fastidiosa* that is currently being developed by the University of Cordoba (UCO) in the frame of this LIFE project.



Figure 1. Visit the infected area in Lecce (Italy). On the left 'Cellina di Nardo' (susceptible) and on the right 'Leccino' (resistant).

MATERIALS AND METHODS

In order to develop the new varieties resistant to *Xylella fastidiosa*, we selected the olive cultivars to be used as genitors according their resistance to *Xylella fastidiosa* (Boscia et al., 2017) and positive agronomical traits (Barranco et al., 2017). Subsequently, directed crosses between the selected genitors were carried out during the springs of 2017 and 2018 in the World Olive Germplasm Bank of Córdoba – UCO. The following protocol was applied in order to germinate the seeds and grow the seedlings (Figure 1):

1. Fruit collection and seed germination. After collecting ~6000 fruits and germinating the seeds in controlled conditions, more than 2500 seedlings (1080 and 1401 in 2017 and 2018, respectively) were obtained from the directed crosses (Table 1 and figure 2A-E).
2. Forced growth of the seedlings in controlled conditions (greenhouses, 24 hours of light) during at least 6 months (Figure 2F-H)
3. Selection of the seedlings according to their height (seedlings > 1 m height). The selected seedlings from 2017 crossings (501 genotypes) and the selected seedlings from 2018 (550) were planted in an experimental field (El Valenciano, Carmona, Seville) owned by Galpagro, to characterize their agronomical traits. The plantation followed a randomized block design, with 5 meters between rows and 2 meters between trees and the cultivars 'Picual', 'Frantoio', 'Fs-17', 'Arbequina' and 'Arbosana' as controls (Figure 2I and 3).

In parallel, an agreement between the University of Córdoba and an Italian company from Lecce (the main affected area by *X. fastidiosa* (CoDIRO) in Italy) was signed. This company own several olive orchards severely affected by the disease (Figure 1) and agreed to establish an experimental field to carry out the evaluation of the selected genotypes in natural infection conditions.

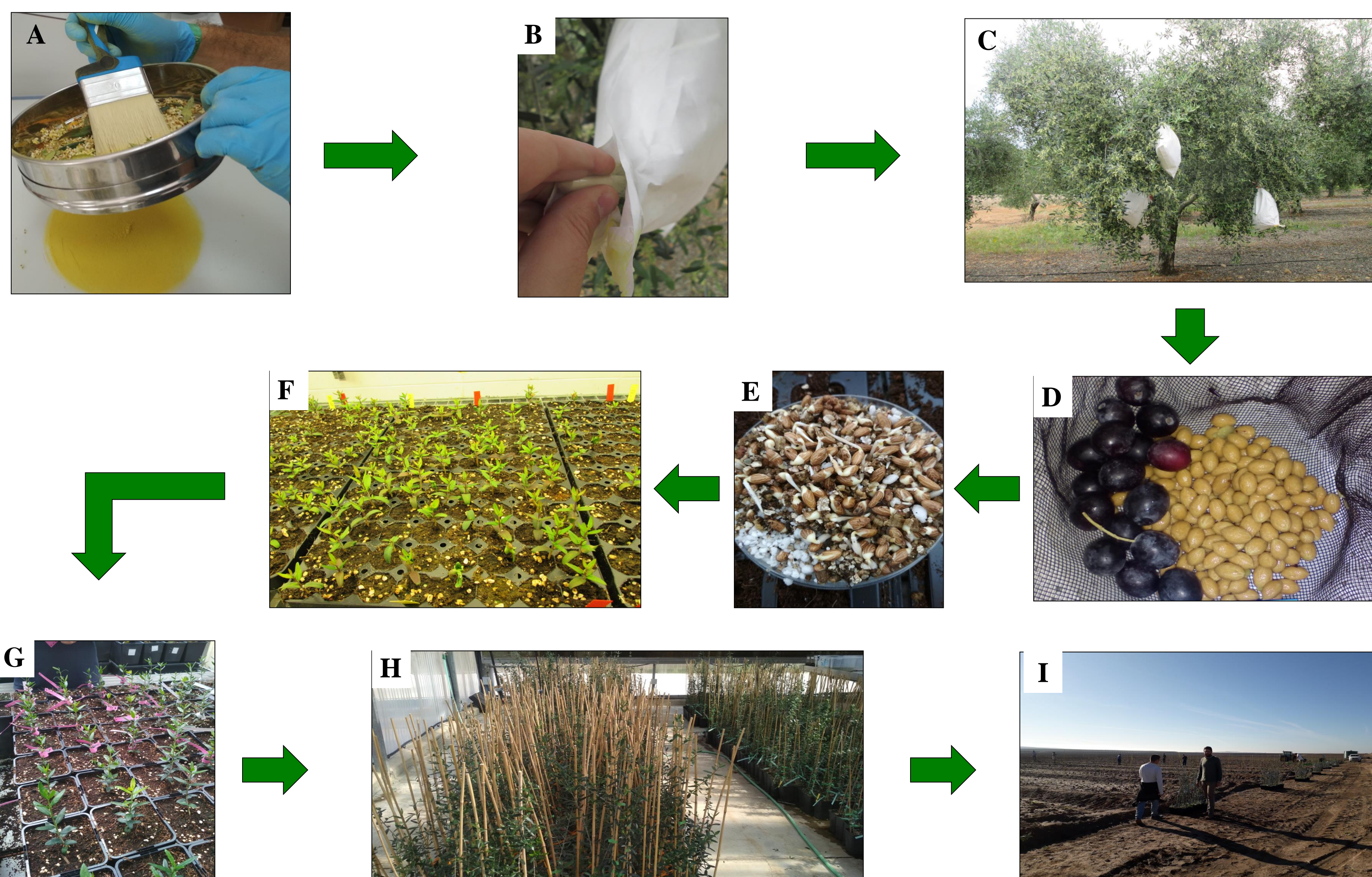


Figure 2. Protocol of breeding and plantation used in the project. A. Collection of pollen from the cultivars used as male genitors; B. Application of pollen; C. Cultivars used as female genitors with bagged branches during the directed crosses; D. Fruit harvest; E. Seedlings in the growth chamber ready to be transplanted; F, G and H. Seedlings following a forced growth protocol; I. Plantation of the selected genotypes to the field "El Valenciano" in Sevilla.

RESULTS

Currently we are evaluating the agronomic characteristic of 1051 genotypes in field conditions ('El Valenciano' orchard). The first 501 genotypes coming from the 2017 crosses were planted in December of 2018 (Figure 3). In August of 2019 we planted 550 genotypes more coming from the crosses carried out in the spring of 2018 (Table 1). All of these genotypes are currently being evaluated. The most promising genotypes will be selected, propagated and evaluated to *Xylella fastidiosa* disease in laboratory and field condition (Lecce, Italy).



Figure 3. Genotypes planted in december of 2018 in 'El Valenciano' experimental field.

Table 1. Directed crosses between the selected olive cultivars, harvested fruits, seeds and seedlings generated in 2017 and 2018.

Crossings	Harvested		Selected seedlings
	fruits	Seeds	
Crossings 2017			
'Leccino' x 'Fs-17'	500	200	94
'Leccino' Open pollination	550	220	90
'Leccino' x 'Carolea'	550	220	86
'Fs-17' Open pollination	550	220	97
'Ogliariola salentina' x 'Leccino'	175	70	41
'Leccino' x 'Picual'	375	150	93
Total	2700	1080	501
Crossings 2018			
'Leccino' x 'Arbequina'	735	294	114
'Leccino' x 'Arbosana'	1212	485	297
'Fs-17' x 'Arbequina'	960	384	168
'Fs-17' x 'Arbosana'	100	40	24
'Fs-17' x 'Picual'	495	198	38
Total	3502	1401	641
Total	6202	2481	1142

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