



Main Objective(s)

- Despite the importance of food legumes and the history of their recent breeding, the progress achieved in the Mediterranean region remains modest and their cultivation is decreasing. This is translated to the high rates of consumed legumes observed in all Mediterranean countries.
- TRUE CS23 performed by Solintagro SL aims to promote grain legume cultivation in Mediterranean rain fed low-input farming systems, by evaluating currently and previously grown grain legume cultivars and landraces well adapted to local conditions, prioritizing the best combination of increased yield and resistance to stresses and integrated crop management.
- Six crop species (with a total of 69 legumes accessions) were tested in collaboration with local farmers during 2 growing seasons (2017/18 and 2018/19) in a multi-location trial essays.
- Cero or low input farming system conditions were maintained.

Progress of the work during the second reporting period

Multi-location field trials (seasons 2017/18 and 2018/19).

Dataset completed including the following information:

- Pedo-climatic characterization of sites (Nov2017- June2018- Nov2018- June2019)
- Phenological assessments: days to plant emergence, to tendrils formation, to 50% flowering, to 50% well formed pods, to 50% mature pods, to full ripening.
- Agronomic assessments: % of plant germination; plant height (cm); plant lodging; color and number of flowers; dry biomass production (t ha⁻¹), dry seeds yield (t ha⁻¹), seed weight (gr).
- Response to fungal diseases: disease severity (%), AUDPC and IT
- Quality Seed analyses: morpho-physiological traits, nutrient and protein content (synergy with WP3).

Anti-nutritional factors analyses: Tannins, saponins, canavanine and/or alcaloids contents (undergoing study in collaboration with UCP)

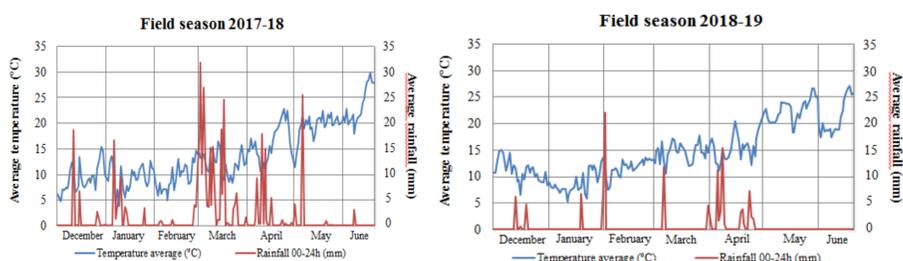


Figure 1. Climatic data recorded during field seasons 2017-18 and 2018-19 (Córdoba, Spain).

Season 2018-2019 was warmer (+1,2 °C) and drier (-285 mm) than season 2017-2018.

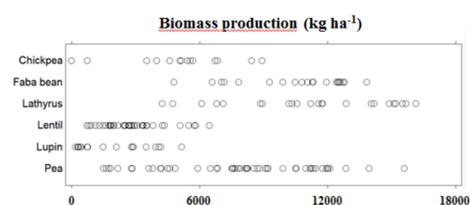


Figure 2. Differences in biomass production (kg ha⁻¹) recorded during season 2017-18 for accessions belonging to the different legume species used in TRUE field essays.

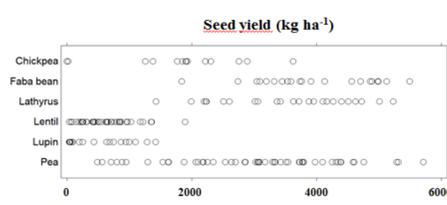


Figure 3. Differences in yield production (kg ha⁻¹) achieved for different legume accessions during season 2017-18 for accessions belonging to the different legume species used in TRUE field essays.

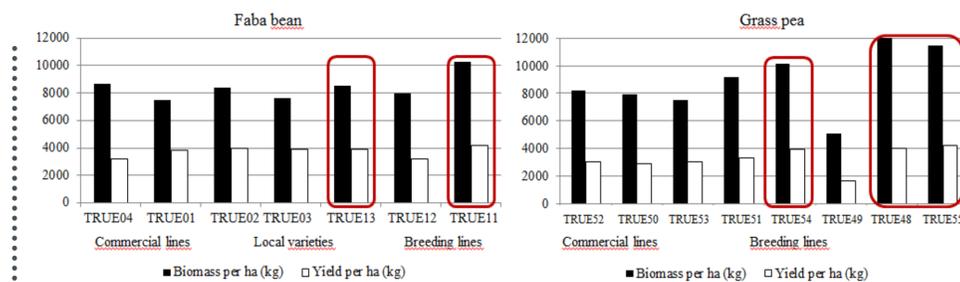


Figure 4. Examples of faba bean and grass pea breeding lines with higher biomass and yield productions (kg/ha) (circled in red) compared with the commercial lines tested.

Contribution to the Open-Data Repository

- 2 MEFs have been provided (September 2018 and March 2020) (201809_TRUE_WP2_SOL_Y1; 202003_TRUE_SOL_Y2) detailing plant materials, field locations, experimental methods followed and use of data expected.
- 2 datasets have been provided (201809_TRUE_WP2_SOL_CS23Y1; 202003_TRUE_SOL_CS23Y2) including 3 sheets (1 per location) were phenotypic and agronomic parameters of legumes accessions are presented.
- 2 datasets have been provided (201809_Climatic data2017/18_TRUE_CS23_SOL; 202003_Climatic data2018/19_TRUE_CS23_SOL) including 3 sheets (1 per location) were climatic parameters during growing seasons are presented.
- 2 SOPs has been provided (TRUE-SOP-SOL and TRUE-SOP-006) (September 2018 and April 2020) with detailed information about plant material, soil preparation and sowing, methodology of data survey and statistical procedures.

Advice to stakeholders or practitioners: The whole dataset is under analysis to obtain the most reliable conclusions.

Barriers inhibiting greater uptake of this approach

- Lack of knowledge was detected in steps between cultivating, harvesting and processing legumes (ex.: which market could be available for less-common legumes in our region?)
- Weeds and pest management were sometimes a problem in zero or low-inputs conditions. Late emerging legumes with scarce soil coverage and/or plant susceptibility needed a higher crop handling rate and less yield production.
- Seed availability for breeding lines was a sometimes a barrier, as some of them were recently developed and scarce amount were available. To solve this problem, seed multiplication trials were recently made in collaboration with some farmers.

Innovations

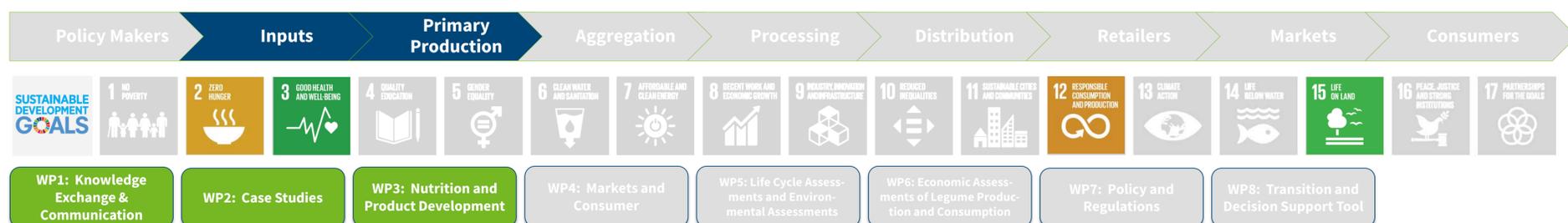
- Development of breeding lines (under or close to registration) of various legume crops that perform better than commercially available ones (better resistance to drought and fungal pathogens).
- Breeding lines with better nutrient and protein contents than commercial cvs (results under study).
- Anti-nutritional factors analyses between accessions of each legume specie; presence/contents influenced by environmental conditions (results under study).

Impact

- Better performance of legumes cultivated under local Mediterranean conditions
- Saget, S., Costa, M., Barilli, E., Vasconcelos, M., Santos, C., Styles, D. and Williams, M. Substituting wheat with chickpea flour in pasta production delivers more nutrition at a lower environmental cost. Sustainable Production and Consumption (Manuscript under evaluation).
- Two planned publications related to the agronomic and nutritional results obtained

Recommendations to realise this transition in practice

- Usually, varieties developed under temperate climatic conditions did not perform well in Mediterranean areas. To allow breeders to expand their choices, we have proposed a panel of legumes well adapted to local conditions that could help breeders to more effectively choose the lines in their crosses.
- Under zero or low-inputs farming systems, we found that drought resistance and competitiveness against weeds are target features to achieve stable yields. The end goal is to breed legumes selected for taller plants with greater above ground biomass, as well as with fast soil coverage, when challenged by weeds or sown closer together.
- **To achieve these purposes, and at the light of the interest showed by farmers involved, selected legumes accessions may also been tested in large-scale field essays with a larger panel of farmers involved with a more diverse Mediterranean environmental conditions.** We identified interesting varieties of the most common legumes locally growth by farmers (faba beans, chickpeas and peas), as well as several less-utilised legumes as lupin, lentil, lathyrus or one-flowered vetch were proposed to farmers as a possibility of alternative multipurpose crops. Its insertion in the Mediterranean cropping system rotation could contribute to their sustainability, particularly when the region is facing severe abiotic and biotic challenges. This novel outcome will also have a high socio-economic impact.
- Possibility to test selected legume accessions under several crop mixture strategies.



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