

Boosting sustainable diversification in farming systems



the European Union

CARINA Project: Carinata & Camelina Evaluation in the EU

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CARINATA AND CAMELINA BOOSTING THE SUSTAINABLE DIVERSIFICATION IN AGRICULTURAL PRODUCTION SYSTEMS (CARINA)



What is CARINA?

- ✓It's an Innovation Action Project, funded in the framework of the Horizon Europe work programme
- ✓ It responded to the following call topic HORIZON-CL6-2022-CIRCBIO-01-04: Maximizing economic, environmental and social synergies in the provision of feedstock for bio-based sectors through diversification and increased sustainability of agricultural production systems
- ✓ It started on November 1 2022, and will last 48 M
- ✓ It includes 19 partners (+ 5 associated partners) from EU and non-EU contries (Italy, France, Spain, Poland, Greece, Bulgaria, UK, Serbia, Morocco, Tunisia, and Switzerland)
- ✓ 9 partners are from RTD and 10 represent industries, SMEs, NGOs, etc.
- ✓ It has been funded with 7.5 M€ and it will cost about 8.5 M€
- ✓ UNIBO is the coordinator (Prof. A. Monti)









The CARINA concept





The scenario in which CARINA operates



- The European bioeconomy sector generates an annual turnover of around 2 trillion euros with more than 17 M of persons employed.
- Over 15% of the current biomass feedstocks used in Europe for bioeconomy are imported from overseas, technical and sustainable strategies for year-round security supply of affordable and low-iLUC feedstocks are urgently needed to support the competitiveness of agricultural and bio-based sectors.

- To this end, innovative farming systems including resilient crops would enable farmers to produce domestic and low-ILUC feedstocks replacing fallow periods of the year or in marginal land, thus turning a rural and social problem into an opportunity.
- Several attempts have been recently undertaken in Europe for broadening the feedstock base for meeting bioeconomy demand; however, there are very few real-life examples of scaleup of innovative farming solutions.



The current EU farming system scenario



- Nowadays, most European cropping systems are highly simplified relying on only a narrow range of crop types. It should be recalled that almost 60% or total EU arable land is used for only 3 crops (wheat, barley and maize), while rapeseed and sunflower represent about 99% of total oilseed crops in Europe. It is more than obvious that concrete solutions should be urgently implemented to remedy this problem.
- ✓Crop diversification is seen as a valid strategy to improve the overall sustainability of farming systems, while reducing the use of chemical inputs.
- ✓Crop diversification could also restore and harnessing agrobiodiversity increasing the overall resilience of farming systems. As a result, yield stability and farmers' revenue can be expected to significantly increase.



The CARINA solution



In CARINA, we propose a portfolio of innovative crop diversification solutions including two promising easy-to-grow oilseed crops: carinata (*Brassica carinata* L. Brown) and camelina (*Camelina sativa* L. Crantz). Both species have proven to be suited to nearly all European pedo-climatic conditions, showing very interesting prospects in the **circular bioeconomy sector**



Why carinata and camelina?



Are carinata and camelina easy-to-fit into existing cropping systems?	Yes, they fit very well into existing crop rotations as main or intermediary crops (inter-, relay-, cash- or cover-crops) without requiring significant investments by farmers.			
Is their cultivation area limited to a restricted region?	No, previous experiences showed that both are characterized by a wide environmental suitability to European pedo-climatic conditions, but also in other agricultural contexts such as in North Africa.			
Are these crops suitable for organic farming?	Yes, both are very suitable to different farming systems including organic and regenerative farming.			
Are these crops suitable for marginal land?	Yes, both are very resilient, thus promising low-ILUC crops for marginal/degraded land (2016, Roundtable on Sustainable Biomaterials)			
Can we expect an increase of biodiversity resulting from their deployment?	Yes, there is clear evidence that both crops are beneficial in term of biodiversity, particularly pollinators and soil microbiome. They also provide significant ecosystem services (soil and water preservation, nutrient recycling, etc.) consistently with the EU biodiversity strategies: 'Bringing nature back to agricultural land', 'Win-win solutions for energy generation', and 'Reducing pollution'.			
Can we expect positive reactions by farmers towards these new crops?	Yes, both species have very high similarities to the widespread oilseed rape in term of vegetative habitus and crop management. We may expect that farmers will favorably accept to introduce these crops as long as they will be economically convenient.			
Are carinata and camelina multiuse crops in order to help deploy the circular economy model?	Yes, they produce oil, protein-rich meal, and several other cascading by-products such as mucilage and secondary metabolites for the production of bio-pesticides, bio-herbicides and biostimulants that could be also applied to camelina or carinata thus closing the loop.			



CARINA = carinata + camelina

CAMELINA is a mature crop for the European farming systems. It is currently grown in more than 500 farms in Spain and over 100 farms in France, and to a lesser extent in other European countries (e.g. Baltic region and Balkan area). The availability of winter and spring varieties makes camelina easily adaptable to nearly all European countries. CARINA will focus on winter types for intercropping or as a cover crop in double cropping systems (preceding main summer crops) in continental and Balkan Europe. The spring types will be investigated in southern and Mediterranean countries as a cover crop or for intercropping. Winter and spring types will be also investigated main crop in marginal land with high desertification and/or erosion risks.



CARINATA is a likely valid alternative to oilseed rape in the regions characterized by water scarcity. So far, it has been very little investigated in Europe mostly due to a lack of appropriate genetic material. Thanks to an extended and targeted breeding program by NUSEED (CARINA partner), carinata can now considered a reliable candidate crop to be developed on a large scale in drought environments. Carinata has already proved its suitability as a cover crops or for intercropping systems with pulses and other crops. The considerable shoot vigor makes carinata a promising option also for marginal/idle land with high desertification and erosion risks.





The CARINA cropping systems

			REFERENCE SYSTEM		
			Summer fallow		
Winter food crop			FALLOW	Winter food crop	
autumn	winter	spring	summer	autumn	winter
			Winter fallow		
FALLOW			Spring/summer food crop		FALLOW
autumn	winter	spring	summer	autumn	winter
		CA	RINA cash cover cropping		
Winter food crop			Carinata/camelina as summer cover crop	Winter food crop	
autumn	winter	spring	summer	autumn	winter
Camelina as a winter cover crop		cover crop	Summer food crop		Winter food crop
autumn	winter	spring	summer	autumn	winter

Fig. 5. Example of CARINA cash-cover cropping systems in comparison with the reference systems.













Thank you

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