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BUCKWHEAT

Origin of Buckwheat

Buckwheat (*Fagopyrum esculentum*) is a pseudo-cereal of the Polygonaceae family. Its ancestor originates from south-western province of China. After a domestication process dated around 3000 BCE, this East Asian crop spread to Far and Middle East. Its cultivation is documented in Europe since the end of the 15th century.

Why a forgotten crop? Its limits and qualities

Suitable for low-fertile, acidic but well-drained soils, buckwheat can be grown as main, back or substitute crop, for its grain-like seeds or as a cover crop. Its itinerary requires zero input and little intervention. Thanks to its tap root system, it establishes quickly and bears shallow soil. Some varieties are appropriated for high latitudes or northern areas; all thrive in cool, moist climate, have a vigorous health and a strong weed competitiveness. Buckwheat has a short vegetative cycle - around 4 months, from June to October - but a long blooming period that confers it good melliferous qualities.



Flour and shelled seeds are the basis of a wide variety of food including crepes, pasta, cakes, porridge, beer and whisky. Beyond the absence of gluten, buckwheat is notorious for its health benefits related to protein richness - with a balanced composition of essential amino acids -, cholesterol-regulating activity, presence of fibres and micro nutrients of interest.

Buckwheat cultivation dropped sharply in the 20th century with the adoption of nitrogen fertilizer that increased the profitability of other crops. Because of its sensitive to lodging, it doesn't tolerate high nitrogen residues. It is also vulnerable to both frost at early stages and temperature variations in July and August. Yield may be random (0.5-2.5 t/ha) and the gradual ripening of grains makes harvesting rather delicate.

DIVERSIFOOD approach to this issue

By gathering farmers, millers, processors, beekeepers and researchers, national projects (e.g. "Sarrasin de pays" in France) emerged at the crossroads of several actors' preoccupations and skills: to relocate and secure the production, to manage the complex reproductive system and to benefit from melliferous capacities.

AT FIRST GLANCE

Underutilised nowadays, local and new populations of buckwheat show a great potential for developing diversified food systems with high quality products.

Embedding crop diversity and networking for local high quality food systems



A first step was to explore diversity within available populations, either marketed, local, or from genetic resources centres. This preliminary investigation includes agronomical, technological and organoleptic analyzes at various stages from seed to final product, in addition to bees counting and honey-dew following on different locations. While farmers and gardeners are involved in *in situ* dynamic conservation, two methods of selection based on the same five initial varieties are compared: (1) mixtures provided by spontaneous crossings within a “dynamic population” and (2) Cross Composite Populations (CCP), created by hand crossing the 5 different populations. Trials are managed in UK, France and Cyprus.



DIVERSIFOOD first results

These five initial populations had been characterized according to their global performance (yield and rate of flour, weight of a thousand grains, agronomic behaviour, suitability for different outlets and organoleptic properties). If organoleptic tests showed strong effect of the variety in colours, textures and flavours, several traits of final products are modified by pedoclimatic context, the modes of harvesting, drying, milling (cylinder or stone wheel), storing and transforming.

Intra-population diversity has been studied at phenotypical and genetic levels. Genetic analyzes allowed to establish different groups among the studied varieties. The studied French landraces belong to the same group in which inter-varietal diversity is relatively low. A decline of polymorphism can be associated with the migration story and the selection pressure exerted for marketing. Throughout evolutionary history, seed exchanges and cross-pollination of this allogamous and entomophilous specie underlay frequent gene flows between populations, creating country-wide metapopulation structures where interconnected subpopulations are subject to local colonization and replacements.

Two breeding strategies to increase diversity, the CCP (Cross Composite population) and the mixture, have been explored: contrasted effects on phenotypic and genetic diversity of buckwheat, and their respective interest have been considered for on-farm selection. The first data showed that the mixture based on natural open pollination within the five populations did not present an intermediate phenotype between his original parents as did the CCP, but has behaved like a new population with an intrinsic diversity of the same level as their parents.

The way forward

1 – During DIVERSIFOOD project and after, the trials will be extended in farm networks to compare both breeding strategies for diversity to answer to farmers' objectives.

2 – In parallel, diversity exploration and quality evaluation are on-going on genetic resources (about 200 new accessions evaluated in France) and then, new populations will be bred on the basis of results on breeding methods.