

## Development of Quinoa Based-Products Adapted to Moroccan Context

Rafik Sifeddine <sup>1</sup>, Rahmani Mohammed <sup>1</sup>, Hirich Abdelaziz <sup>2</sup> and Choukr-Allah Redouane <sup>1</sup>

<sup>1</sup> Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, Morocco

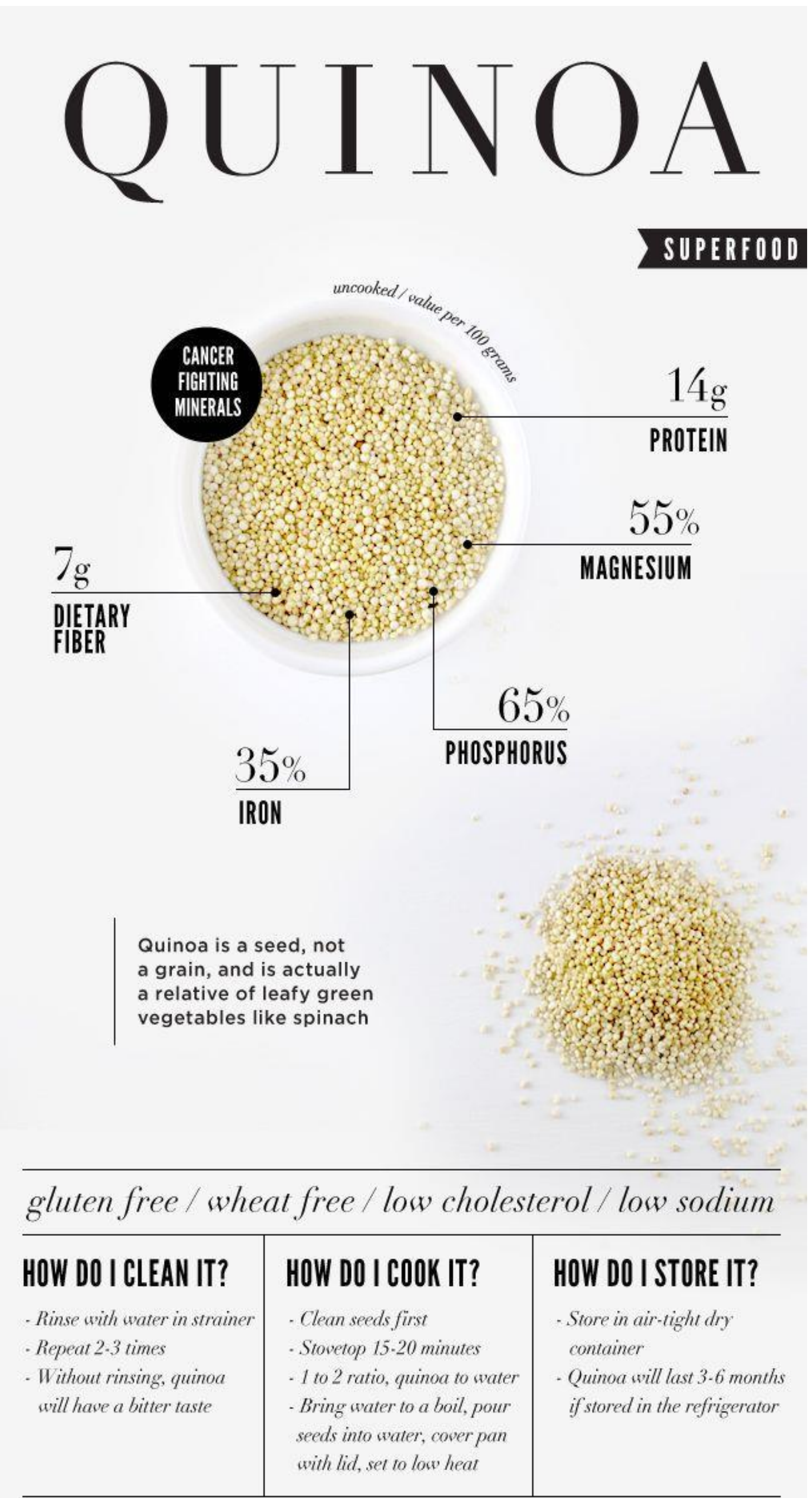
<sup>2</sup> International Center for Biosaline Agriculture, P.O. Box: 14660, Dubai, UAE

### INTRODUCTION

The quinoa crop has many outstanding intrinsic characteristics, such as :

- Its broad **genetic variability**. Its gene pool is extremely strategic for developing superior varieties (precocity, grain size and color, resistance to biotic and abiotic factors, grain yield and byproducts);
- Its **adaptability** to adverse climate and soil conditions. Crops can be produced from sea level to 4000 meters (Altiplano, salt lakes, Puno (high grasslands), valleys, and sea level) in areas where other crops can not grow;
- Its **nutritional quality**, represented by its essential amino acids composition in both quality and quantity, making it a functional and ideal food for the body;
- The diversity of **valorizations with a low cost**: traditional, non traditional and industrial innovations; and Its **low production** cost because the crop requires few inputs (irrigation, fertilizers, pesticides...etc).

Quinoa was introduced in Morocco in the 2000s, however its valorization is still limited compared with other countries such as Latin America and Europe.



There is a need to develop and upgrade the quinoa value chain in Morocco due to the following factors:

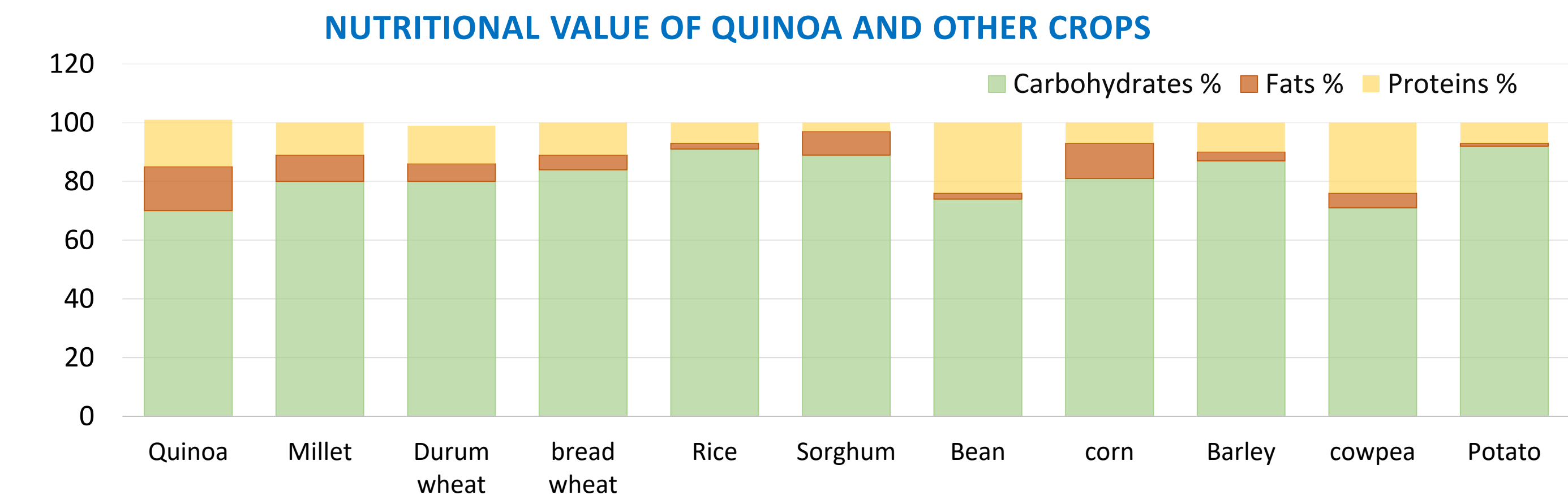
- ✓ A quinoa agriculture upstream (Field production) less developed, farmers require technical assistance and introduction of best cropping practices and tools (machines);
- ✓ A lack of knowledge of the rural women who are involved in the valorization and transformation of quinoa;
- ✓ The consumer behavior towards quinoa; still viewed as a luxurious product;
- ✓ Moroccan diet habits are progressing toward new and healthier foods;
- ✓ The rural farmers don't have enough confidence for cultivation of quinoa, as an alternative crop, due to less developed market for quinoa seeds.

### MAIN GOALS OF THE RESEARCH STUDY

The **main objective** of this research study is to develop quinoa based products, including food and by-products taking into consideration the Moroccan food habits.

The research study will be subdivided into **five mains** components:

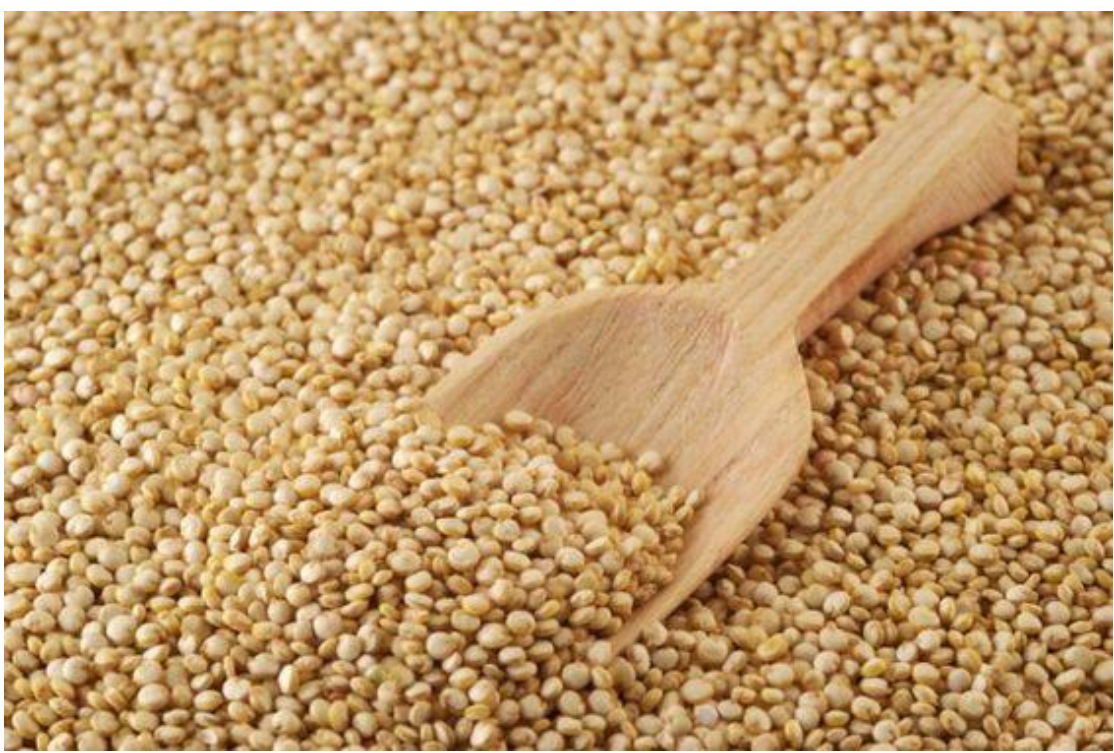
1. **Identification of the current ways of cereal valorization in Morocco**, and appropriate ways to enhance the proteinic content by incorporation quinoa;
2. **Characterization of Quinoa varieties**: The specific aim of this component is to characterize the nutritional properties for the most efficient quinoa varieties in the Rehamna province.
3. **Developing & Innovating New Moroccan Quinoa Products** : The specific main of this part of the research study is to valorize the quinoa crop, to innovate new Moroccan quinoa products and create an added value for the quinoa value chain.
4. **Valorizing & Innovating Quinoa By-products**: Developing some innovative and efficient methods to **eliminate saponins**, which will be incorporated into cosmetic formulations.
5. **Investigations about the technico-economical feasibility** of quinoa valorization in Morocco, both for the local and international markets.



### MATERIAL AND METHODS

The achievement of the objectives outlined for this thesis will require a set of work tools, including:

- Bibliographic research that will provide access to the documentation centers of organizations active in quinoa cultivation and processing;
- Mathematical methods and statistical processing tools (Excel spreadsheet, STATBOX, etc.) to process and compile the results obtained;



- Research tools for the production processes of quinoa-based products and technical methods for optimization (reduction of production costs);
- Statistical tools for establishing the sampling plan, determining the optimal variables and interpreting the results of the organoleptic tests.



### BIBLIOGRAPHIC RESEARCH

The bibliographic research will cover many aspects pertaining to the valorization and uses of quinoa products and by-products.

### PHYSICAL AND CHEMICAL ANALYSIS

We will analyze several quinoa varieties grown in the Rehamna province, according to referenced methods. The parameters to be analyzed include the following:

- ✓ Physicochemical parameters (pH, acidity, Brix value, water content, ash content, water activity, etc.);
- ✓ Organoleptic characteristics (color, texture, taste, etc.);
- ✓ Nutritional components of quinoa seeds and derived products (proteins, fats, carbohydrates, minerals, vitamins, etc.). The obtained results we will compared to those reported in the literature.

### IDENTIFICATION OF THE DIFFERENT FORMS OF CEREAL VALORIZATION IN MOROCCO

All forms of cereal valorization in Morocco will be identified, with the purpose to investigate possibilities of substitution of some ingredients by quinoa, in order to enhance the proteinic content.

### ELIMINATION OF SAPONINS

Saponins are undesirable because they confer a bitter taste to derived products. An appropriate method will be developed to remove completely these by-products.

### DEVELOPPING & INNOVATIVE QUINOA PRODUCTS

This work will include the valorization of quinoa seed to develop processed food products for different niches (babies, pregnant women, gluten intolerants, athletes, etc.). This fundamental part of the research will go through many steps, namely :

- ✓ Define the crucial parameters that should be respected for the storage of quinoa seeds in order to preserve their sanitary and organoleptic quality for a long storage period ;
- ✓ Develop agri-food products adapted to the Moroccan context (couscous, zemmita, Berkoukch, quinoa flour, quinoa semolina, etc.), besides some mixed products;
- ✓ Analyze residual content of saponins, physico-chemical and organoleptic characteristics, as well as the nutritional value of quinoa seeds and derived products.



### EXPECTED RESULTS



This research work will develop and upgrade the quinoa value chain in Morocco throughout promoting best practices for quinoa production and transformation and generating demand by conducting awareness, training, marketing studies, fairs, field days...etc.

This work will enable the development of quinoa value chain towards food processing that meets the requirements of Moroccan consumers by developing a Moroccan range of traditional agri-food products. This agri-food innovations will be have a considerable advantage in market positioning nation wide. On the other hand, it will provide an added value and a crucial support for marketing strategy of quinoa value chain in Morocco. Our study will focus on all aspects of quinoa valorization as the following:

- Developing new Agri-food products based on quinoa that meet the needs of Moroccan consumers ;
- Controlling the quality of the product from the upstream to the downstream of the quinoa value chain ;
- Generating value out of quinoa by-products, such as saponin, and introducing it to cosmetic products.

