

CORNET: International Collective Research Network

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Subject:	<p>Amaranth grain oil as a source of Omega fatty acids: Marker-assisted bReeding and cultivar selection associated with innovative oil extraction technologies to obtain functional healthy vegetable oils (AMOR)</p>
Coordinator: Other applicant(s):	<p>Prof. Dr. Simone Graeff-Hönninger, Institute of Crop Science, University of Hohenheim (UHOH)</p> <p>Prof. Dr. Peter Nick, Botanical Institute, Karlsruhe Institute of Technology (KIT)</p> <p>Dr. Aquilino Alvarez, Centro de Investigación de Cultivos Andinos, Universidad Nacional de San Antonio Abad del Cusco (UNSAAC)</p>
Sector/Target group:	Food, nutraceutical, cosmetic, and plant breeding sectors
<p>Proposal summary</p> <p>With consumption volumes reaching 193 Million Tons in 2017, the global vegetable oil market has grown at a compound annual growth of around 4 % during 2010-2017. Europe is one of the most interesting markets for premium vegetable oils worldwide. These are special high quality oils, new exotic oils, or oils with a healthy composition, like amaranth oil targeted by this project. Especially in Western Europe, consumers are generally more open to try new flavours, invest in quality and investigate the origin of the products they purchase. Increased awareness for the problem of obesity and its association with coronary diseases and type-II diabetes is a major factor in the changing food trend among consumers. Consumers are increasingly aware that different oils have a different impact on human health. For example, there is an increasing demand for vegetable oils with specific health properties, such as high omega fatty acid content, vitamin E and antioxidant properties.</p> <p>Amaranth grain oil is characterised by high levels of unsaturated fatty acids, whose important health benefits in lowering the cholesterol and triacylglycerol concentration are very well documented. Of special nutritional interest is the omega 3-fatty acid DHA, which is produced mainly by algae and fungi, but only by few plants. DHA is essential and has to be taken up through the food chain (mainly by marine fish) to prevent, for instance, coronary disease. Therefore, amaranth oil has great potential as DHA-source, alternative to fish in frame of vegetarian or vegan diets. In addition, squalene represents a very important component of amaranth grain oil. It has been proposed that the decreased risk for various cancers associated with high oil consumption, could be due to the presence of squalene. The unique nutraceutical properties of amaranth oil, due to the high omega 3 and omega 6 content including DHA, its squalene content and antioxidants opens interesting perspectives to this crop as sources of food supplements or nutraceuticals for food and pharmaceutical industries, meeting the consumer demands in favour of more nutritious and healthy products.</p> <p>Amaranth grain is currently cultivated on a small scale in Europe, such that most of the amaranth grain intended as a functional food product comes from non-EU suppliers. Peru is one of the centres of origin for amaranth, mirrored in great genetic diversity and a strongly growing industrial sector. However, out of an available ~ 3000 amaranth accessions in Peru, only major agronomic traits, such as yield potential, growing period, or grain colour have been assessed. Information on their nutritional benefits, oil and protein content as well as fatty acid profiles are largely missing, such that farmers choose their seed material mainly based on the overall yield potential. To exploit the potential of amaranth as plant source for Omega 3/Omega 6 fatty acids and especially DHA, novel cultivars have to be developed and adapted to cultivation. Research studies</p>	

need also to evaluate amaranth grain quality characteristics relevant to shelf life such as phenolic content, antioxidant activity and others. Likewise, parameters related to the oil processing which can affect oil stability need to be taken into consideration and explored. Sensory evaluation and consumer acceptance tests of the amaranth grain oil would validate the research further.

The aim of the project is to define the relevant agronomic and technological parameters to obtain amaranth grain oil of high quality regarding their omega fatty acid content. The research idea comprises four major topics: First, the screening of a given range of accessions regarding their omega fatty-acid content, accompanied by mapping with highly resolving molecular markers in preparation for subsequent marker-assisted breeding. Second, the cultivation of selected amaranth cultivars with favourable fatty acid profiles and the investigation of agronomic impacts on the final grain and oil quality. Third, the set-up of an innovative, high quality oriented oil extraction processes. And fourth, the combination of the oil formulation with the stabilising of amaranth grain oil with other edible oils in order to obtain a long shelf life product.

Advantages for trade and industry

This project investigates high value bioactive ingredients of plant origin that are used in functional foods, which currently have a growing market. Bioactives, along with functional foods and nutraceuticals, have been of rapidly gaining importance in the food industry during the past two decades. Sales in Germany alone have increased tenfold in the last decade to around EUR 5 billion with still rising tendency. The main basis for a high quality amaranth grain oil is a higher Omega-3 and Omega-6 fatty acid content. As the project intends to identify and optimise competitive amaranth accessions, it assures the differentiation of high quality amaranth grains, which can offer opportunities for smallholder farmers in supplying selected varieties of grains that conform to specific industrial requirements. The identification and tailoring of a specific molecular marker, that identifies omega fatty acid components could inspire similar technologies to be applied to other Andean grains e.g. quinoa, cañihua. The knowledge gained on extraction of amaranth grains and stabilisation processing techniques will benefit Peruvian and German companies seeking business opportunities of innovative quality products. Based on the project results, a processing protocol for amaranth oil will be provided.

This project will improve the image of amaranth grains as high value ingredients and contribute to expand its application and consumption. Applications of amaranth oil in the food industry include its direct use as gourmet oil in salads, dip sauces and smoothies, and as an important ingredient in functional foods and food supplements (e.g. Infant formulas, omega 3-enriched food products). In the North American market, omega-3-enriched dairy products are becoming quite popular, where the market accounted 3.8 % of all dairy products in 2013. Another application is in the nutraceutical industry marketed in a dosage form, such as capsules and pills. A new market could emerge from pregnant women who consume DHA fish oil capsules to ensure a good fetal brain development, giving them the possibility of replacing those capsules with fishy aftertaste with a vegetable DHA source with a more pleasant sensory experience. The high content of squalene in amaranth oil is very valued as ingredient for hair and skin cosmetics. Further uses can be envisaged in pet & animal feed products in addition to other markets that at the moment are not foreseen.

<p>Dissemination concepts:</p>	<p>Project results will be communicated via the AMOR website (to be constructed), various publications will be made available such as press releases available to trade, technical and scientific journals, and brochures detailing benefits and output opportunities from the project.</p>
<p>Profile of additional partners:</p>	<p>SMEs and other companies interested to participate</p>
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