



# SWUP-MED Project

## Sustainable Water Use Securing Food Production in Dry Areas of the Mediterranean Region

***Deliverable 7.5:* Guidelines on socio-economic impacts in local communities when introducing new crops and traits, cultural practices and use of marginal-quality water**

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## Introduction

In the SWUP-MED project (sustainable water use securing food production in dry areas of the mediterranean region) the aim was to improve food crop production in the Mediterranean region, influenced by multiple abiotic stresses. The project has focused mainly in farmers' communities to improve farming systems, by strengthening a diversified crop rotation and using marginal-quality water for supplemental irrigation.

In the project several new crops have been introduced including quinoa and amaranth. In addition new drip irrigation systems to save water has been introduced.

So far the quinoa has been produced in commercial scale in South America, but recent attempts have been made to introduce quinoa in Europe and North Africa to improve cropping systems with respect to food security and crop diversification. Jacobsen (2003) argue that quinoa might be a crop to be introduced under dry conditions in Africa and Asia. Quinoa is regarded as a drought resistant and salt tolerant crop compared with cereals and all other crops. The crop is lower yielding than cereals, and requires additional cleaning of saponine prior to consumption. However, the low yield is compensated by a high market demand and nutritional value. Amaranth may also be a potential crop to be introduced in these regions. Amaranth do not require treatment of saponine prior to consumption (Jacobsen et al 2003).

The description below is primarily based on two case study regions in Adana, Turkey and Bouchane, Morocco.

In **Turkey** cereals occupy 61 % of cultivated area of about 22.5 million hectares arable land, of which 5 millions is fallow. Cereals account for the 53 % of the value of field crops and 23 % of the value of the total crops (TURKSTAT, 2004a).

Family owned farm is the basic unit of agricultural production, and family members provide most of the farm labour. In the last 15 years, the total number of agricultural holdings decreased by about 20 %. This is in line with the fall in the agricultural employment. National average size of farm holdings is 6.1 hectares, with an average number of 6 plots.

Findings from the study and interviews with farmers in Adana, Turkey show that farmers had little, if any knowledge about quinoa. Many farmers indicate that when they consider the introduction of a new crop in their production system they look at the market availability, product prices and yield. Most of the farmers in this region irrigate many crops.

Farmers perceive quinoa as a likely crop to be included in their crop rotation if the current prices can be obtained on the market.

The other farm survey from **Morocco** shows that several farmers in Bouchane region have previous knowledge about quinoa from their neighbors.

The main part of the arable land in Bouchane is grown with rainfed winter cereals (wheat, durum wheat and barley). The cereal yield is fluctuating a lot. Due to low and varying precipitation (<300 mm a year) proper yields are limited to every fourth or fifth year. In some years the fields are not harvested but grassed

by sheep and goats. On farms having a well, a small part of the land, typically 1 ha close to the well, is irrigated (flooded) and reserved for vegetables and other high value spring crops.

The crops introduced to Bouchane by the project, quinoa and chickpea, have the potential to improve drought tolerance and soil fertility of the rainfed land. The crops have been tested on several farms. For several reasons, however, the crops have ended up as high value crops in the irrigated parts of a few farms.

To introduce a new crop it is important that the crop can provide a benefit to the farmers. The majority of farmers in Bouchane indicate that they would be interested to grow a new crop if it can deal with drought. It may be the salt tolerance factor that is most important in this regard given the fact that most farmers apply some sort of irrigation in the region. Moreover, farmers' perception of a new crop is highly related to the crop price. About 58 percent of the farmers reply that crop price has the highest priority to them compared with other parameters like yield (second most important), ease of production, market demand availability and production costs (see D 5.3). Production costs and good soil fertility are not major issues in regard to perception. It is surprisingly that market availability is a minor factor. But the reason for this may be that farmers already have some experience with the crop and sold the crop on the market in Marrakesh and other cities in Morocco.

Some problems and needs in growing rainfed Quinoa in Bouchane are identified: 1) Soil moisture in spring is too low even for Quinoa, 2) Tillage system to preserve soil water and weeding 3) Sowing technique and strategy (hand, broadcast, rows and machine), 4) Harvesting is so forth done by hand, and 5) washing out saponine, to make Quinoa marketable, is water and time consuming.

Some of the problems and needs could ideally be solved by introduction of winter varieties, low till methods, research, local experiments, local extension capacity, and simply by giving more time for farmers to develop the best Bouchane practice. First of all the new crops must be profitable to grow, either because of their nutritional value, their marketable value, yield stabilizing effect, soil improving, or water saving effect. The new crops introduced by the project are profitable to grow on irrigated land as a part of the "Maroc Verte" program. In this program investments in drip irrigation is heavily supported. Drip lines receive usually 100 % support up until 5 ha of irrigated land. Farmers are allowed to use water as they like and to irrigate whatever crop they like, but they will need a permission to establish new wells.

A lot of the project survey farms have recently got "Maroc Vert" support for drip irrigation. On average drip irrigation has increased their irrigated land from approximately 1 to 5 ha by using the same amount of water. As a consequence the production of vegetables and other cash crops have increased, and at the same time farmers have become less dependent of the rainfed cereals and the livestock production. Consequently more farmers are likely to establish their own or an extra well, exploiting ground water faster and more efficiently than before.

By introducing new crops and water saving drip irrigation systems it may enable farmers to improve their farming system in several ways:

**The socio-economic impacts in local communities when introducing new crops and practices (water saving and tillage) and use of marginal-quality water can be summarized in the following:**

- New crops like quinoa can enable farmers to grow crops on soils with high salinity
- Highly nutritious crops like quinoa and amaranth can increase added value and profit among farmers.
- New water saving practices like drip irrigation can improve farm income
- New crops may enhance organic cropping practices in the local farm society – and reduce negative environmental impacts
- Small-scale farmers will get access to high value crops
- New crops will build up knowledge based on alternative crops
- Reduce economic risk among farmers by diversification of crops
- Increase biodiversity

Implementation of drip irrigation systems (like Maroc vert programme) will:

- Increase water use efficiency among local farmers
- Increase yield
- Reduce risk of low yields in dry seasons.

However, the introduction may also include some barriers to farmers. Table 1 gives an overview of advantages and barriers for implementing quinoa as a new crop among farmers in Adana and Bouchane.

Table 1. Advantages and barriers for implementing quinoa.

Advantages	Barriers
<ul style="list-style-type: none"> <li>• Drought resistant</li> <li>• Salt resistant</li> <li>• High price</li> <li>• Gluten free (added value)</li> <li>• High durability</li> </ul>	<ul style="list-style-type: none"> <li>• Low yields</li> <li>• Difficult to get seed</li> <li>• Competition with other crops</li> <li>• High content of saponine – must be processed</li> </ul>
<p><i>Specific to Adana</i></p> <ul style="list-style-type: none"> <li>• Farmers are interested in crops that are drought resistant</li> </ul> <p><i>Specific to Bouchane</i></p> <ul style="list-style-type: none"> <li>• A significant share of rainfed arable land in Bouchane - which imply that quinoa – as a drought resistant crop - may be a complement in the crop rotation</li> <li>• Initiatives made by women’s cooperate to clean quinoa</li> <li>• A high value on restaurants in Marrakech</li> <li>• Can be used for couscous</li> </ul>	<p><i>Specific to Adana</i></p> <ul style="list-style-type: none"> <li>• Most areas are irrigated and quinoa has to compete with other irrigated crops</li> <li>• Farmers have little if any knowledge about quinoa</li> </ul> <p><i>Specific to Bouchane</i></p> <ul style="list-style-type: none"> <li>• Low yield is a problem – when a significant share of farmers use farm products for local and home consumption</li> <li>• Irrigation scheme is about to be implemented</li> <li>• Soil moisture in spring is too low even for Quinoa,</li> </ul>

**Based on the findings above we will recommend the following guidelines:**

To introduce a new crop among farmers it important that:

- Farmers should have an incentive to include the new crop in their existing crop rotation.
- Farmers should consider if the new crop should be introduced on irrigated or rainfed land – how to use the crop and water most efficiently
- Development of winter varieties of quinoa and amaranth for the Mediterranean environment is important if these crops are to be introduced to the rainfed cereal crop rotation
- Establishment, harvest and cleaning of the new crops are labour intensive. Room for improvement!
- Develop and ensure a certified seed bank to enable other farmers to adopt new crops

## Supply chain and markets in Turkey

The marketing procedures of agricultural products in Turkey vary from crop to crop. Agricultural crops generally reach to the consumer through various marketing channels. There are numbers of commission agents, traders, wholesalers, retails, and exporters in these marketing channels. Commodity exchanges play an important role in the marketing of agricultural products cereals, legumes, dry fruits and nuts, cotton, sunflower and live animals. About 20% of the supply of agricultural goods is transacted in commodity exchanges. Wheat and cotton lead the list of transacted goods.

Wheat is the most important agricultural commodity in Turkey, both politically and economically. It is estimated that about three million farmers in Turkey produce wheat. Wheat accounts for 67 % of the value of total cereal production and 16 % of the value of total crop production. The share of wheat in the total cultivated cereal area and total cereal area is 41 % and 66 %, respectively (TURKSTAT, 2004a).

Turkey is a durum wheat producing country. Until recently, data on durum and soft wheat are not reported in Turkey. Durum wheat accounts for slightly above 20 % of the total wheat production. Meanwhile, the share of soft wheat has been increasing.

About 30 % of the cereals, especially wheat, is consumed on farm and the rest is marketed at farm gate, local markets and via the Turkish Grain Board (TMO). The wholesale sector was dominated by state or parastatels enterprises and quasi-state organizations for many years until the economic reforms of 2001. In the cereal sector TMO remains the key player, acting as a buffer stock agency to stabilize producer and consumer prices. It carries out support purchases for wheat, coarse grain and other commodities, sells commodities on the domestic markets and imports and exports whenever authorized. TMO usually purchases 20-30 % of the total cereals produced and in some years more than 40 %. Most of the cereals marketed are purchased by local merchants and the milling and feed industries. TMO provides cereals to bakeries, the milling and flour industry, the feed industry and to merchants. TMO is the principal market participant in Turkey, especially in the years when it fixes high prices. TMO is the main cereals purchaser and has the storage capacity of approximately 4.5 million metric tons (12.5 to 15% of the annual production) (TMO, 2006). At times, it rents its storage to farmers and gives them the option to sell their grains whenever they choose, either directly to the TMO or via commodity exchanges. The millers and the feed industry have storage but as the cost of the storage is high, and they can purchase from TMO, they prefer not to hold stock for long periods.

The **retail and food processing** industry will require safe and high quality food from the farming sector. This may push many small farms out of the market since it will be hard for them to comply with the requirements (Berdegue et al., 2003). Small farmers lack the financial resources to make the necessary investment and have difficulty in obtaining loans. In addition, high transaction costs make retailers reluctant to deal with many small farmers rather than with a few large suppliers, especially in the case of unprocessed and perishable products. Small and medium sized farms that want to have a part in the modern retail chain need to form a producer marketing and procurement organization to access inputs and enhance the quality and quantity of their output. Turkey has enacted legislation on farmers' organizations

as an alternative marketing structure to reduce transaction costs and increase small farmers' bargaining power within the food chain.

Turkish agriculture is characterized by a dual structure: traditional and modern. Regional differences in agricultural technology use (land, labour, and capital saving technology) are also a distinct characteristic. The impact of the CAP (Common Agricultural Policy) therefore may also differ across both regions and types of the farming and studies indicate that cereals would be one of the sectors that suffer from EU market integration. The dual structure of Turkish agriculture would be sustainable with traditional farms continuing to produce for their own consumption selling any surplus production locally.

Cakmak (2004) and Grethe (2004) estimated that under the CAP, wheat and maize production would decline but barley and rice production expand.

### **Supply chain in Morocco**

The informal market in Morocco consists of other farms, local markets (Souks) and local restaurants. The formal market entails a more rigid procedure aiming at ensuring the product conforms to standards set by international bodies, national authorities and businesses. Specifically, if the product is to be exported to the EU a number of specific standards have to be met.

Local produce of Quinoa has only been introduced on the market in Morocco in modest amounts from farmers in Bouchane, located in the province Kelâat Sraghna. The farm gate price paid to the farmers from a local womens' cooperative that clean and pack the seeds is currently 40 MAD pr. kg before cleaning and packaging (2012). The womens' cooperative are then paid 60-80 MAD (6-8 Euro pr. kg) at the market in Marrakesh for a cleaned and packed product.

Agriculture in Morocco is mainly dominated by small scale farms and the production consists mostly of cereals and animals. Due to a variety of reasons the production of cereals has been fluctuating the last decade and the import of wheat has been following the same pattern. Morocco is a net-importer of agricultural products and is therefore dependent upon foreign food exporters mainly of wheat, which is consumed at high levels in the country. The distribution of farmers' products is done both through governmental channels and via the private markets. The food retail sector mainly consists of small independent grocery stores, however larger supermarkets are existing in Morocco and the developing trend of these stores is growing.

Morocco has a relatively advanced and well organized agricultural supply chain, which ensures capacity for taking advantage of new products such as quinoa. Furthermore, the domestic market is maturing with urban consumers willing to embrace new products. Consequently, a market for a crop like quinoa might exist both in the domestic market but also on potential export markets.

Looking at the **food retail sector** three main supply channels for the consumer can be identified according to the USDA (2009):

- Large retail and wholesale supermarkets
- Small retail supermarkets, convenience stores, large grocery stores
- Small Independent grocery stores

Of the large supermarkets there are around 38 stores and most of them located in the larger cities such as Casablanca, Rabat, and Marrakech. Mainly the mid- to high income consumers use these to purchase both food and non-food commodities. A wide range of food products are found in the large supermarkets including imports and domestic products and accounts for around 40-50% of the total sales in these large supermarkets. Some of these supermarkets are Marjane, METRO, and Aswak Assalam (USDA 2009).

Around 400 small retail supermarkets exist in Morocco of which some are independent, some are part of a chain and some have self-service. These supermarkets include butcher shops, frozen products and alcoholic beverages. ACIMA and the Label Vie are two of these supermarkets with 31 and 16 stores in Morocco with approximately 5,000 and 2,000 different items in each, respectively (USDA 2009).

The small independent grocery stores are the main source of food purchases for the Moroccan population. Mainly domestic produced food is sold in these shops and there are around 45,000 of small grocery stores in Morocco. Many of these shops are family owned and mainly occupy one full time employee. Local products are by far the largest share of food sold in Morocco mainly from small family owned shops or retail outlets. Only around 10-15% of the population frequently buys imported products (USDA 2009).

The structure of the Moroccan domestic retail sector provide quinoa producers and processing companies such as the womens' cooperative mentioned above with several options for selling their products. The local markets (SOUKs) and the small independent grocery stores rely on locally produced food products of which quinoa could be introduced. In the long-term, however, introducing quinoa or quinoa-products to the large supermarket chains could lead to more stable and standardised products, which in turn could be exported to the European market. The relatively advanced level of the Moroccan retail sector offers producers and processors with a variety of opportunities.

As stated by Aloui and Kenny (2004), the Moroccan food export sector has been going through a reform process since the mid-1980s. State monopoly of food exports has been abandoned, and private export groups have emerged. The current organizational framework is one in which the level of integration in the supply chain plays a critical role.

The industry is heavily dominated by integrated export groups that control the overall chain from farm to market. The producers in these export groups have access to new imported technology and benefit from the well-trained local labour force, know-how and logistics.

## Discussion

Quinoa is produced and marketed as an organic crop and sold at relative high end-user prices compared with cereals. Bolivia and Peru are the main quinoa producing countries with a total production of nearly 30.000 tons and 40.000 tons respectively in 2009 (FAO 2012). The average producer price is about 1 USD or more per kg. In 2009 Europe imported 6.525 tons of quinoa from Bolivia and Peru of which the majority originates from Bolivia (CBI, 2009). The 3 most important European markets for quinoa are France, the Netherlands and Germany.

But quinoa is also imported in UK, Scandinavia, Italy and Spain. So far, there is only a minor domestic production of quinoa in Europe. Quinoa has some characteristics that make a high value crop compared with cereals. From a cultivation point of view, it is very drought and salt resistant compared with wheat and barley. A disadvantage is that the quinoa seed has to be cleaned for saponine before consumption and yields are currently low compared with other crops. From a market point of view, quinoa is gluten free (some consumers are allergic or intolerant to gluten) and as a result there is huge market potential for this kind of commodity in Europe and other high income regions. There are several drivers that suggest that food companies are going to produce more types of “free-from -products” in the next ten years. The celiac disease is regarded as one of the most under-diagnosed diseases in the world (Bogue, 2011). The global market in 2010 was worth USD 1.7 billion with a growth rate of 25 percent per year. By 2015 is expected that the global market will be USD 4.3 billion (Bogue, 2011).

From the findings above in the supply chain descriptions, there appears to be a market potential for quinoa in the Mediterranean region. These socio economic impacts are:

- A system with womens cooperative to clean quinoa (like adopted in Bouchane in Morocco) may create new jobs and an alternative income in local communities
- Introduce new end products like couscous based on quinoa
- New protein rich crops may improve the diet among local consumers
- The establishment of cooperative growers or womens organization will strengthen the cooperation in the food supply chain
- Increase value added in the supply chain from gluten free products
- Integrate producers into the global market chain – by exporting to European countries
- Quinoa has the potential to be a strategic supplement to winter wheat in the Mediterranean area, but further development of adapted varieties are needed

To introduce this crop in the Mediterranean region a strategy should attempt to establish links between food companies or farmers’ cooperative that operate in these regions.

For example, a strategy that aims to increase the awareness of quinoa to these companies and the potential benefits of gluten-free food trends in industrialized countries and in the most developed cities in

Turkey and Morocco (e.g. Istanbul, Ankara, Marrakesh) then it is more probably that the introduction of quinoa in the farmers production system will be a success.

In the business environment the introduction and production of a new crop should start by first considering the market. Several food companies base their new product development process in the market research with the aim to identify new food trends or new market needs. One of the biggest food trends nowadays is the health and wellness trend (Vaidya and Mogelonsky, 2007; Bogue and Yu, 2009; Kearney, 2010). Schaafsma and Kok (2005) indicate that most of the top managers of the food companies and retail expect a strong and further growth of the health food trend.

Part of this trend is also the free-from trend, which has to do with products that are free from an ingredient that some consumer may be allergic or intolerant. As is the case of celiac consumers who are intolerant to product that contain gluten. There are several drivers that suggest that food companies are going to produce more types of free-from (including gluten free) products in the next ten years.

**To introduce new cropping systems in other sypply chains in Mediterranean countries it is important to assess:**

- Who are the key actors on the market for cereals and similar products?
- Description of companies for milling, bakeries and seed supply, involved in the supply chain for cereals and similar crops.
- Which crops may be substituted on the market by these new crops?
- What are the main markets and market segments for buying a high value crop like Quinoa.
- Contact members in key associations that deal with cereals and similar crops.
- Make a description of market segments: Household data - How much does households eat – what is the diet and traditions?

The creation of a market for quinoa in Turkey and Morocco has several beneficial effects for the two regions. One of these benefits is in regard to production of land that have elevated levels of salinity and are not used for other crop production. A drawback of quinoa is its low yields (but high market and nutritional value) compared to corn and wheat – especially in regard to local consumption where yield are regarded important. Furthermore, quinoa has a higher price in the international market compared to corn and wheat. Therefore, the low-yield levels can be covered from the high price.

**In summary**, by strengthening a diversified crop rotation and using marginal-quality water for supplemental irrigation it may enable farmers to increase farm income in local communities – in particular in areas with saline soils and in areas with severe drought. However, it requires an introduction of more adapted winter varieties of quinoa.

An implementation of new crops should carefully consider the likely impact of other crops in farmers crop rotation , market channels and potential institutional and cultural barriers. Moreover the current irrigation

practices may have an impact on farmers adoption of new crops compared with other high value crops. In the supply chain it may create value added to the existing actors and increase labour activity in the local farm community.

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