



**Proactive Producer and Processor Networks for
Troodos Mountains Agriculture
3PRO-TROODOS
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Introduction & Methodology

This report refers to Task 5.2 *Improving processing and producer-processor networks* of the 3PRO-TROODOS project. The scope of this work is to reveal existing innovations by processors located in the mountainous communities of Troodos that can be utilized to create added value. This activity is also linked with the quality label certification process, as processed food products (e.g., spoon sweets from fruits produced in Troodos) are those that have a unique character and therefore an extra value. Equally important is the identification of potential innovations which can be utilized by networks of processors in the Troodos mountains.

The steps followed for this task are the following:

Phase I:

During the 3PRO-TROODOS project, a number of interactions has taken place with local producers and processors, and insight in innovative processing methods and technologies have been identified. The COVID-19 outbreak created delays regarding these meetings and the planned processes and networking activities. Despite these delays, a pool of knowledge has been created that was capitalized and will continue beyond the course of the project, regarding the current and potential innovations.

PA2 and PA4 organized meetings with several such producers and processors in order to:

- (a) Record innovation propositions which can be applicable at the network level;
- (b) Reveal innovation potentials for specific products using techniques of lateral thinking.

To date five innovations have been developed with producer networks. The approach did not follow a structured methodology as the aim of open discussion is a necessity in lateral thinking techniques.

Each innovation has been developed over two to three meetings, during which market needs and producer expectations were studied, in order to identify possible innovation gaps.

Phase II:

The second phase of the work involved the selection of processing innovations with the highest potential for new product development as well as for cooperation among processors and primary producers.

From the findings of Phase I, it was noted that apples and tomatoes had the biggest product waste in terms of lower quality produce. Furthermore, both crops have a good texture and flavour due to the mountainous climate but the quality attributes were affected negatively in terms of outer appearance.

Processes were further undertaken to experiment in processing these crops into:

- a) dry apple chips;



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b) high quality dry tomatoes.

Tests were undertaken at Niki Agathocleous Ltd processing unit, in Agros village. For the dry apple chips the experimental work involved several varieties of local apples in order to test processing potential and the characteristics of the final product (taste, texture, aroma and shelf life). The varieties tested were:

- granny smith,
- pink lady,
- starkin and
- golden delicious.

All four varieties gave positive results with different tasting and texture levels but all with adequate shelf life. The next step in the procedure is to establish and launch a continuous processing line. This requires an investment in new cutting equipment and packaging in modified atmosphere that will extend further the shelf life of dried apple chips, without any additives.

The tomato experimentation was completed successfully, and the new processing product is fully marketed in retail stores. This product is made from cherry tomatoes from Troodos mountains, which are preserved in brine, while local herbs are added for extra aroma and flavor.



Producer Network: Vine Grape producers & processors

Type of innovation:

Modified atmosphere packaging (MAP) for soujoukkos.

The need:

Keep the product for a longer period than storing it in conventional packaging (e.g., paper wrapping) has resulted in the application of vacuum packaging.



The result of the method is longer life for the product but on the negative side the final product is deformed as it is squeezed during packaging. Vacuum packaging therefore results in poor product presentation which in turn prevents the product from being marketed as a gourmet niche product.

The value added in terms of product certification:

With MAP, producers can achieve:

- Improvement of packaging and promotion of products, especially cuts of sausages
- Increase sales by satisfying the growing demand for fresh and preserved natural products
- Extend shelf life without chemicals or freezing
- Increase product life by days or even weeks in the distribution chain
- Maintain the taste, texture and appearance

The innovation also improves presentation and provides differentiation in the appearance of traditional soujoukkos, especially those packaged in cut slices (promoted as appetizer packs).

The technology proposition:

The idea is based on the use of MAP packaging instead of vacuum packaging to improve product presentation on the market. Vacuum packaging increases the shelf life of food products. With this technology the product is placed in an airtight package, the air is sucked and the package is sealed. With the removal of air from the product, oxygen levels in the package decrease, preventing the ability of the oxygen-breathing microorganisms to grow and spoil the product. Vacuum packaging is essentially a "one size fits all" technology - it is based exclusively on removal of air.

MAP is a more flexible process than vacuum packaging and can be adapted to the food, with different gases and gas ratios in the mixture used to give the maximum shelf life for that product and to maintain the quality and appearance of the product.

One area where MAP scores well compared to vacuum packaging is in product presentation. In the vacuum package, as the pressure inside the package decreases, the packaging material collapses and



forms tight around the product. For some products, such as fresh meat, this may distort the appearance of the product.

Another aspect in which the two processes differ is the ease of quality control of the packaging process. In MAP packaging, the air is flushed out of the packaging and replaced with the gas mixture, enabling continuous monitoring of the gas content of the packaging during the packaging process. Once the packaging is sealed, any leakage of the modified atmosphere can be detected, allowing the integrity of the seal to be ensured. For vacuum packing, because there is no gas in the pack, leak tests are usually performed by manual inspection, making quality control less simple.

MAP also maintains the organoleptic characteristics and its appearance as the mixture of gases that will be selected will not give the product the opportunity to decompose or chemically deteriorate.

The gases used are oxygen (which its complete absence in various products is not desirable due to the possibility of developing pathogens such as *Clostridium botulinum* under anaerobic conditions), carbon dioxide, nitrogen and sulfur dioxide. The effects of each of these gases are both positive and negative on the microbial growth and the characteristics of the packaged products (color effect, organoleptic characteristics, etc.). Techniques also used for their application are constantly evolving and the application of this technology is constantly expanding since it can be combined with other maintenance technologies (e.g., refrigeration) giving very good solutions to modern consumer requirements for safety, minimal food processing, absence of preservatives and maintenance of nutritional and organoleptic characteristics until consumption.

The research needs:

For the development of the package, extensive experiments should be performed to determine the optimal composition of the selected gases that will replace the air in the package. The gases should limit the growth of mold and yeast in the product and maintain the desired flavor, aroma, and texture of the product. The permeability of the packaging material is also important, and semi-permeable membranes can allow the removal of certain gases from the package while preventing the entry of oxygen gases that cause oxidation and deterioration in the product.

To ensure success in this innovation, there is ongoing collaboration with food research institutes in many countries to gain insight into food processing and work closely with packaging material and machinery suppliers to develop optimal modified atmosphere packaging for each application. The modified atmosphere packaging is influenced by several factors, including the food and its properties, antimicrobial activity, hygiene requirements, delay in pre-packaging, temperature, permeability and other properties of the packaging material, the free volume of gas in the packaging and the residual oxygen level. For example, for low-fat products with high moisture content, MAP focuses on inhibiting the growth of microorganisms, while for high-fat products with low water activity, the primary objective is to protect against oxidation.

Choosing the right packaging materials, such as multilayer materials that combine properties, along with flexible upper film and rigid structures (base trays, trays), is important to maintain the quality and safety



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of MAP-preserved foods. These materials can provide the necessary barrier properties to prevent oxygen and moisture from entering the package, while also allowing the release of certain gases to maintain the desired atmosphere inside the package.

The research cost implication:

The idea requires a laboratory apparatus to inject modified atmosphere into a pack of soujoukkos and evaluate the shelf life and quality characteristics of the products using different gas compositions. This is a feasible project that requires the support of a research lab facility.

The estimated cost of carrying out the various tests is €20,000, which can be funded through several available funding instruments offered by the Research and Innovation Foundation.

Cooperation potential for producers:

If the tests are successful in producing a safe and high-quality product with an adequate shelf life, the company could consider developing a new product that combines traditional grape juice products such as kiofteria and soujoukkos. This product could be marketed as a healthy snack assortment of traditional mountain products, showcasing the unique flavors and cultural heritage of the region.



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Producer Network: Grape juice producers - New recipes for traditional grape juice products – Portos & Retsellia

Type of innovation necessity:

Rebirth with new technology and packaging methods for two forgotten traditional processed and healthy products

The need:

Reintroduce to the market two traditional Cypriot products from the Troodos region, particularly from Pitsilia, that have been lost over time. These products are preserved without processed sugar, relying instead on the concentration of grape juice (must). The first product, Portos, is made by preserving coarsely ground wheat in roasting (petimezi). The second product, Retsellia, is typically made by preserving quinces due to their hardness, although apples can also be used.



The goal is to reintroduce authentic Cypriot traditional products to the market, which are highly nutritious and do not contain any natural preservatives or additives that can extend their shelf life. Both products are rich in trace elements, minerals, and vitamins, making them a healthy choice for consumers. By collaborating with well-equipped laboratories, we can analyze their composition, demonstrate their nutritional content, and promote them effectively.

The value added in terms of product certification:

Forgotten recipes from the past that are highly nutritious can help bring authentic flavors to the mountains and add value to grape production. Certification is an essential aspect of the marketing process, as it can provide funding for promotion through the Rural Development Program. Therefore, it is crucial that certification under any of the EU quality marks follows the product development process to ensure that the new products receive funding support.

The technology proposition:

- Currently under development

The research needs:

Modernized production techniques, such as concentrating grape juice at low vacuum temperatures, have the potential to improve the organoleptic characteristics of the products.

The research cost implication:

The product development process has relatively low costs, and it is possible to secure adequate funding from investment funds for equipment, such as the vacuum boiler. It is also beneficial to collaborate with educational and research institutions to conduct nutritional analyses, which can help in promoting the



products effectively.

Cooperation potential for producers:

There is significant potential for grape producers to enhance their primary production by utilizing a short supply chain that can help boost local production capabilities. This presents an excellent opportunity for grape producers to explore new avenues for their products and reach out to a wider audience.



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Producer Network: Cherry tomato producers and sun-dried tomato

Type of innovation: Dried Chery Tomatoes with local herbs and olive oil

The need:

Niki Agathokleous LTD is a family-owned processing company that specializes in traditional Cypriot mountain products, such as spoon sweets, jams, soutzioukos, carob syrup, and grape syrup. Located in the picturesque village of Agros in the Troodos Mountains, the company uses modern facilities to maintain the traditional handmade quality, blending old and new recipes with European standards.



One of the company's products was created to address the issue of excess cherry tomato production in Troodos. The resulting gourmet product was developed and tested on a prototype scale and can be seamlessly integrated into the company's product range, showcasing the potential for innovation in traditional products.

The value added in terms of product certification:

This product is targeted at the ever-growing trend of healthy eating, and the use of local herbs in its production enhances its potential health benefits. By using locally grown cherry tomatoes, the product benefits from a "superior" quality raw material due to the mild climate that Troodos mountains provide. When grown traditionally, under the warm Cyprus sun and not in a greenhouse, the resulting raw materials (tomatoes) have a bright red color that is reflected in the final product. However, the crop seasonality associated with local produce creates challenges in maintaining product flow in the market throughout the year.

Regarding the herbs, using fresh or dried locally sourced ones is the preferred option due to their non-irrigated crops resulting in herbs with more fragrance and higher oil concentration. These oils are rich in antioxidants and have been proven to help fight bacteria. Adding herbs to the product can therefore increase its value by making it a functional food, thanks to the added properties.

The technology proposition:

To create the product, the cherry tomatoes are washed to remove any impurities and then cut in half. Excessive juice is drained, and salt and local herbs (such as oregano, sage, and rosemary) are added. The tomatoes are then placed cut-side up on mesh screens to dry.

Drying is a basic form of processing, and it can be used by farmers to preserve excess harvest and minimize post-harvest losses. There are two methods of drying tomatoes:



- Open-air drying: After washing and cutting the tomatoes in halves, they are placed on clean tarpaulins or other flat surfaces with the cut side facing the sun, such as trays on a raised surface covered with plastic mesh. This method takes 2-5 days in windy and non-humid conditions. The resulting dried tomatoes are dark red, leathery pieces with a moisture content of 15-20%. If dried further, the moisture content is reduced to 5%, resulting in dried, hard, and brittle tomato pieces that can be crushed into powder or flakes and used in soups and sauces. Tomatoes stored as powder or flakes will last for a long time without spoilage.
- Artificial drying: Solar-powered or fuel-powered dryers can be used to dry fresh tomatoes. It is important to ensure that the temperature in the dryers does not exceed 65 degrees Celsius, as excessive heat can interfere with the taste of the dried tomatoes.

After drying, the tomatoes are placed in glass jars, filled with olive oil, and stored at room temperature.

The research needs:

This innovation proposition does not require any significant scientific research regarding processing requirements. However, minor research work is essential in selecting the most suitable variety of cherry tomatoes for the drying process, which can help maximize the volume of dried material, texture, and taste of the final product. This research can also help optimize the drying process and improve the overall quality of the product.

The research cost implication:

Initial testing of the product can be done with minimal investment costs since no special equipment is needed to dry the tomatoes. They can be dried in open air on mesh screens. However, for larger productions, a good-sized dehydrator and a more efficient way to slice the tomatoes in half will be needed.

The varietal testing can be done through bibliographic review and by planting several varieties and evaluating their performance during processing. This will help determine the most suitable variety of cherry tomatoes for the drying process, taking into account factors such as volume of dried material, texture, and taste. Such research can help optimize the drying process and improve the overall quality of the product, and it can be done with minimal investment costs.

Cooperation potential for producers:

This innovation relates to vertical integration and cooperation of primary producers in the mountainous region of Troodos with local processors. The quality attributes of the mountainous production of cherry tomatoes, coupled with the intense aromas of the local herbs can result to a very unique mountainous product which could be marketed at a premium, especially when associated with the place of origin.



Producer Network: Apple producers & local food processors

Type of innovation: Dried apple slices (crisps)

The need:

The need for apple processing arises from the fact that a large proportion of the apple production results in low-quality produce. However, this low-quality produce can receive added value when processed near the place of production.



Apple processing can offer significant opportunities for mountainous food processors to develop high-quality nutritional fruit snacks. As consumer demand for healthy eating increases, fruit snacks offer great potential in the market, especially when linked to a mountainous place of origin. This innovation has the potential to increase the economic value of the region and create new opportunities for primary producers and processors alike.

The value added in terms of product certification:

The need for healthy, nutritious eating is a fact of the fast-paced life we lead today. A fruit-based crisp made without the addition of any preservatives can meet this need. Additionally, the need to utilize excess production and products that are too small or have minor defects and will not fetch a good price in the market can help minimize the volume of produce ending up in landfills.

The target market for this product includes everyone, but especially families with children who need a treat that meets low sugar, low salt, and high nutritional value standards. The idea behind the product is to meet these standards by drying thinly cut apple slices and, if possible, infusing them with various herbs and aromas from local cultivation, making them not only a healthy snack but a functional food depending on the kind of herbs used. This innovation has the potential to benefit both primary producers and processors, as well as to promote healthy eating habits in the community.

The technology proposition:

Using locally sourced fresh produce can have a significant impact on the local producer community by utilizing excess and defective produce, as mentioned before, and providing an additional source of income for locals. Many varieties of apples thrive in the Troodos mountains due to the area's mild climate, leading to an overproduction from farmers.

Research shows that slightly unripe apples are better suited for this application due to their higher starch content. If fully ripe apples are used, the starch will be converted to sugars, which can interfere with the crisping process. This can also help with farmers' yields as damaged and smaller fruits can be harvested in



advance, allowing fruit with better characteristics to grow bigger. The local variety named "kathista," derived from the British cooking type variety "peasgood nonsuch," could prove quite favorable for the proposed innovation process.

Overall, this innovation has the potential to benefit both primary producers and processors in the region, and by utilizing excess and defective produce, it can help minimize the volume of produce ending up in landfills.

From initial testing, it was found that the product cannot be produced using only drying. A two-step process must take place, starting with drying the apple slices naturally with open-air drying or artificially in food dehydrators at 40-50°C. The dried slices are then crisped in an oven at a higher temperature. After crisping, the products can be packaged preferably with the use of Modified Atmosphere Packaging (MAP) and marketed.

This two-step process is essential for producing a high-quality, crispy product that meets the desired standards for low sugar, low salt, and high nutritional value. The use of MAP can help extend the shelf life of the product, while the unique flavors and aromas from local herbs and apple varieties can help distinguish it in the market.

The research cost implication:

The investment cost for a decent-sized production is relatively high, as a good-sized dehydrator and an industrial-size oven are needed for drying and crisping the apple slices, respectively. Additionally, the use of Modified Atmosphere Packaging (MAP) is preferred for better shelf life and preserving the product's characteristics, which can further increase the cost.



Cooperation potential for producers:

The innovation proposition involves a network cooperation of a vertical type, whereby primary producers of local apples can create added value for lower-quality apple production by directing them to the processing industry.



Producers Network: Cooperative company of *Rosa damascene* growers

Type of innovation: Production of men aftershave from *Rosa damascena*

The need:

The application of aftershave can provide a solution to many problems. Different skin types can experience a loss of skin elasticity due to reduced synthesis of collagen, elastin, and hyaluronic acid, resulting in the progressive appearance of wrinkles. Over time, the renewal of keratinocytes slows down, and the skin becomes thinner and less stable, resulting in looseness. The activity of sebaceous glands, which provide natural lubrication to the skin, decreases, and the skin tends to dehydrate.

Aftershave containing rose typically contains less aromatic oil (around one to four percent) and usually contains soothing ingredients. This oil concentration is perfect for use after shaving, and the fragrance typically lasts for about three hours. Aftershave can relieve the skin after shaving, leaving a feeling of freshness. It is suitable for men with sensitive skin who want to reduce redness and irritation after shaving.



The value added in terms of product certification:

Agros rosewater is in the process of being approved as a product of Geographic Indication, and this certification is important for diversifying the product portfolio. Furthermore, there is low demand for food-based rosewater, and excess supply is often a problem for the Agros rosewater Cooperative.

The existing market for men's cosmetics cannot be discussed thoroughly, as it is a very specialized market and there are no clear references. However, one particular category worth mentioning is cosmetics aimed at men over 50. With the market for female cosmetics already saturated, and the market for cosmetics for young men already well-developed, there is a need to meet the needs of older men. In Cyprus and many developed countries, consumers of cosmetics in this category are usually identified as men of higher social and educational backgrounds, such as managers, scientists, and business executives. These individuals often prefer natural, additive-free cosmetics for shaving and represent an important market for the proposed innovation.

The technology proposition:

The skin is the body's largest organ and acts as a barrier against UV radiation, chemicals, and other physical pollutants. The antioxidants present in rose water can protect the cells in the skin from damage.



Rose water also has anti-inflammatory properties, which means it can be applied to the skin to soothe irritation caused by conditions such as eczema and rosacea. Additionally, rose water acts as an inhibitor against elastase and collagenase, which are harmful to the skin. This can help soothe the skin, reduce redness, and improve skin texture.

The technical recommendations governing the production of natural, antioxidant cosmetics are best explained in the following links, which identify the technical aspects of the production process.

<https://www.medicalnewstoday.com/articles/320216.php>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3586833/>

<https://food.ndtv.com/beauty/10-benefits-of-rose-water-you-need-to-know-1239785>

<https://khlorisbotanical.com/library-post/rose-water-a-buyers-guide/>

<http://www.cosmeticanalysis.com/cosmetic-ingredients/rosa-damascena-distillate.html>

The research needs and the cost implication:

To implement the program, the following additional resources will be required:

- A marketing and brand design study, estimated to cost 5,000 euros.
- An external male cosmetics consultant or research body who can advise on the use of aromatic oils in cosmetics for around 5,000 euros.
- Broader medium-term horizon research work on the impact of rose water on men's skin, estimated to cost 50,000 euros.
- Market research for marketing and target marketing activities

Cooperation potential for producers:

Producers already cooperate through the organization of processing and marketing rosewater. The network innovation proposition aims to improve the market base of rosewater by innovating in the diverse uses of the product in the cosmetics market.