Deliverable

Action C3. Conclusions & Recommendations of the Project Zero Residues

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PART I. Conclusions regarding the implementation of the Zero Residues (ZR) protocol in stone fruit and application of post-harvest technologies for shelf-life increase.

What kind of environmentally friendly practices have been addressed to develop the Cero Residues protocol?

How does the ZR methodology affect soil quality? In which ways improves it from and agronomical and environmental point of view?

The consumption of fruits produced under the ZR methodology, would it reduce pesticide farm workers exposure to pesticides and/or pesticide residue dietary intake minimizing associated health risks?

Is the Carbon Footprint reduced as a consequence of the Zero Residues methodology application?

What are the pests and diseases that have been controlled under the ZR methodology?

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Which low-impact technologies have been selected to maintain and expand the quality of ZR fruit?

As a summary, which technology is recommended for each stone fruit?

Do the fruit produced under the ZR methodology and submitted to selected post-harvest technologies maintain their organoleptic quality?

¿How has it been possible to increase consumer awareness about the added value of ZR fruit?

At present, is there any opportunity on the market for ZR fruit not sold as a fresh product to be transformed on a high quality transformed product (baby food)?

Is it possible to reduce the waste of ZR fruit by valorising it as a transformed product? Which innovative process has been applied to obtain a babyfood product?

Which organoleptic characteristics present this product? Do kids (final consumers) like it?

PARTE 2: Conclusions regarding the consultation to several agents of the production/distribution chain of ZR fruit and consumers perception.

From a social, economic and environmental viewpoint, is it better to employ the ZR methodology instead of conventional and/or ecologic (bio)?

What is the economic margin that ZR products could yield? What is the relationship between the elaboration processes of pulps in contrast to fruit discard?

How could local, regional or national environmental policies improve as a result of this project results?

What are the existing possibilities to apply the ZR methodology in stone fruit in other countries?

Would it be economically affordable?

DAFO ANALYSIS

PART 1. Conclusions regarding the implementation of the Zero Residues (ZR) protocol in stone fruit and application of post-harvest technologies for shelf-life increase.

What kind of environmentally friendly practices have been addressed to develop the Cero Residues protocol?

The term Zero Residues ZR refers to an agricultural production method whose goal is to obtain fruits/vegetables whose phytosanitary products residue levels are below the detectable analytical threshold (LD < 0.01 ppm). The ZR method is based on the IPM management (pesticides, fertilization and biological control) in contrast to biological agriculture, which only allows the use of certain natural fertilizers and bio-pesticides.

A main principle of the ZR production is to avoid chemical conventional products whose action mode is as total biocides. This helps to restore the natural ecosystem giving to the secondary fauna the opportunity to help on its balance. This production methodology, without being as restrictive as the biological methodology, not only allows the use of some chemical products that have low persistence but also the use of selective biocides as well as sexual confusion techniques.

General soil analysis have been carried out in order to adjust the fertilization to the crops' real necessities, by doing it, we can accurate its use in a more efficient way, but also improve the soil structure and its ground water management (since high nitrate water contamination by agriculture is common).

How does the ZR methodology affect soil quality? In which ways improves it from and agronomical and environmental point of view?

The implemented methodology has significant effects on global soil quality as the soil analysis reflects an **improvement** on the following parameters:

- Organic Matter along with Organic Carbon rates. Although on the apricot and cherry cases, the initial values were so low that even if its rates have improved, those are not still within the optimum range. Those values will arrive to the optimum range if the application of the ZR methodology continues.
- The C/N Ratio values – which are of importance on the N availability for plants - were more balanced and closer to the stone fruits optimum range.
- The pH values have decreased in every case, besides, on peach and flat peach cases the pH has decreased almost in 1 pH unit. Despite decreasing soil pH is very complicated, the final values are still higher than what should be recommended for stone fruit production.
- Since P is the most sensitive nutrient to soil blockage and tents to change into non-assimilable forms, the initial P levels were extremely low. Nonetheless, those levels rose closer to the optimum range, especially in Nectarine. It is foreseeable those values will keep raising in the following years under the ZR methodology application, since this will benefit developing characters like roots, flowers, performance and quality of the fruit.

- The fertilisation plan developed during the Project has enabled an optimum use of both macro and micronutrients. This helps trees against diseases allowing the plants potentiate its natural characteristic resistance/tolerance according to its variety.
- The ZR methodology, through the improvement of the agronomical conditions, has also allowed better production yields. Although it has been proved throughout the project that meteorology conditions are a decisive factor on the production yields.
- It has been also proved that some of the quality and shelf life fruit aspects are related to its agronomical management, in relation to this, fruits produced under the ZR methodology have obtained very good results.

The consumption of fruits produced under the ZR methodology, would it reduce pesticide farm workers exposure to pesticides and/or pesticide residue dietary intake minimizing associated health risks?

The multi-residue analysis carried out on fruits during the first campaign (2014) showed that the chemical compounds found were under the MRL (Maximal residual level), therefore, according to law. The more common pesticides were Captan and Spinosad. On another hand, Difenconazol y Fenbuconazol were also the most common fungicides detected. Between the fruits participating on the Project, Apricot was the more susceptible species to different active compounds.

The ZR methodology developed has help into reducing, in every case under the LOD (Limit of detection), the chemical residues present on the fruits produced during the last year. The methodology has encouraged the use of techniques such pheromones for sexual confusion, botanicals, soaps, beneficial insects …

Those changes have enabled that during the last year of the project, all soil and fruit multi-residue analysis have meet one of the main project's goals: none chemical active compounds detected > 0.01 ppm. This made it possible to certify all fruits under the ZERYA standard.

The obtained results have been very positive, since the residue disappearance is also favourable for the beneficial fauna, the soil degradation mitigation, the employees applying the treatments on the field, every worker of the production/commercialisation chain and finally, the consumer.

Is the Carbon Footprint reduced as a consequence of the Zero Residues methodology application?

The overall trend in the project is downwards in all carbon emissions when considering the developed methodology in both Finca Valleluz and L'Alcudia.

Generally, the number of treatments applied has decreased, as shown on the graphics at the Final Technical Report. The Carbon Footprint diminution is achieved thanks to the optimisation of the following processes:

- Increasing the organic nitrogen fertilisation vs. mineral nitrogen fertilisation, and a global diminution on the N fertilisation application throughout the project.
- Improvement of the production yields. The plots managed following the ZR methodology are more productive than the conventional ones if we do not take into account the yield deviations or losses due to meteorological constraints.

- Reduction of phytosanitary products' use. Big amounts of carbon emissions are produced along with the phytosanitary products fabrication itself, as well as its packaging, transportation and final application. By reducing its utilisation, there will be a decrease on the carbon emissions.
- Reduction of fuel consumption since there are less agricultural interventions because of lowering the phytosanitary products use. Besides, some of the products have been combined, so more than one product can be applied at the same time.
- Reduction of food waste. The ZR methodology is designed to reduce food waste since the fruits that do not meet the market characteristics for fresh consumption are allocated in high-value-added industrial processes.

Considering that the optimisation of the processes mentioned above were fully demonstrated throughout the project, the Carbon Footprint data from 2016 from l'Alcudia (SEIPASA) is estimated as follows:

- CONVENTIONAL plot: 3.83 tCO_2/year*ha.
- ZERO RESIDUES plot: 3.72 tCO_2/year*ha.

By analysing the yield of the plots, it is evident that the ZR management has been more efficient hence; it had a lesser Carbon Footprint. Nonetheless, the improved efficiency of the fertilizing practices also happening in the conventional plot, have also helped to reduce emissions between the beginning and the end of the project.

This data are sourced by taking into account all the treatments applied, the yield and the plot's irrigation, but not the fruits transportation nor its manipulation. Similarly, a comparable study conducted in the close region of Murcia (Projyecto Life+ 09 ENV/ES/000441: Lucha contra el cambio climático desde explotaciones agrarias: Sistema común de evaluación de las 4 mayores economías agrarias de la UE; www.lessco2.es), shows the following results: 4.91 tCO2/year*ha for an apricot production and 11.08 tCO2/year*ha for a peach production.

What are the pests and diseases that have been controlled under the ZR methodology?

Throughout the tree experimental years of the Project, it has been possible to identify the potential pests and diseases that may affect the Project plots depending on its location and climatological conditions:

DISEASE	Peach	Nectarine	Apricot	Cherry	Flat peach
Peach Blight (*Monilia spp.*)	X	X	X	X	X
Gray Rot (*Botrytis spp.*)	X	X		X	X
Gum spot (*Coryneum beijerinckii*)	X	X	X	X	X
Powdery mildew (*S. pannosa* & others).	X	X			X

PEST	Peach	Nectarine	Apricot	Cherry	Flat peach
Green aphid (*Myzus persicae*)	X	X			X
Twig borer (*Anarsia lineatella*)	X	X	X		X
Oriental moth (*Grapholita molesta*)	X	X			X
Fruit fly (*Ceratitis capitata*)	X	X	X		X
Red spider mite (*Tetranychus urticae*)	X	X			X
**Thrips (*Frankliniella*	X	X		X	X
Defoliating Caterpillars			X		
Root borer (*Capnodis tenebrionis*)			X		
Black aphid (*Myzus cerasi*)				X	
Cherry fruit fly (*Ragholetis cerasi*)				X	
Spotted wing fly (*Drosophila suzukii*)				X	
San Jose Scale (*Quadraspidiotus perniciosus Comstock*)	X	X	X	X	X

Thanks to the ZR methodology, it has been possible to control the diseases and pests listed above. Besides, since most of the applied treatments have been biological and based on prevention, farmers have used the Predictive Models application developed by ZERYA to help them decide the proper moment for each treatment depending on several parameters such as temperature, humidity, rain episodes, pest population…

It is important to highlight that it is the first time that the *Bacillus amyloliquefaciens's* (BUZ-14 strain) potential has been studied for its suitable applications on stone fruit. It has been demonstrated then its capacity to control Brown fruit rot on cold storaged peach. This disease – that causes important damages and economical loses – is developed due to several *Monilinia* species. *Bacillus amyloliquefaciens* (cepa BUZ-14) is then a promising biological control product due to its suitable application on post-harvest and commercialisation.

Which is the available information for those interested on implement the ZR production model in other crops/areas?

One of the main goals of this project was to capture the knowledge and the acquired "know-how" in different documents of free disposal for the agricultural community. The purpose of those documents will be to make it possible to extend the ZR methodology to other crops or regions.

A guide for Stone fruit production including Zerya's Technical Regulations have been produced and approved by the project's technical committee. This guide includes, among other, information about the following aspects:

- Recommended phytosanitary and fertilisation products.
- Historical of pests and diseases incidence.
- Pests monitoring protocols.
- Alternative biological control methods in place of using the conventional ones.

This Zero Residues "step by step" guide contains then the technical regulations, the required qualification and the mandatory criteria for those farmers interested on this methodology. The Project has also developed a training seminar on the ZR methodology that can be freely downloaded from the project's website www.zeroresidues.eu.

Which low-impact technologies have been selected to maintain and expand the quality of ZR fruit?

The studied stone fruits exhibit major differences on the respiration rates, which implies that these present different behaviours with respect to the post-harvest technologies assayed on this Project (AMAP and CA in cabin and Paliflex unit). On the basis of the large number of tests performed during the three campaigns, the following conclusions – by type of technology - have been yielded:

1) AMAP ("Active Modified Atmosphere Packaging"

This technology is especially adequate for the packing of the three cherry varieties studied on this Project (Early Bigi, Satin and Sonata) with plastic film from BOPP (Biaxially Oriented Polypropylene) material. Preliminary fruit respiration studies, together with the physic-chemical and sensory results, concluded that the optimal number of microperforations should be between 12 and 16 per package (area unit). By using these customized packages it is possible to increase the commercial shelf life from 3 to 8 days (at room temperature in the selling point). These 5 days implies a 265 % increase with respect to cherries packed in no microperforated plastic films. It is therefore a very significative technological improvement, as it will allow to accessing new export markets guaranteeing the quality of the product at consumption.
In contrast, the AMAP packaging is not recommended for the rest of fruits (apricot, nectarine, flat peach and peach), as no benefit could be observed with respect to control fruits packed with no microperforated conventional films.

2) CA (“Controlled Atmosphere”)

2.1) Tecnidex® cabins (fixed systems)

An atmosphere with moderate O_2 and high CO_2 is especially recommended to preserve nectarine and both apricot varieties, as it increased the shelf life during cold preservation in 7 and 5 days, respectively. Regarding the conservation conditions in air (control), this means a 100 % increase of shelf life.

A very low O_2 and high CO_2 atmosphere made it possible to increase shelf-life of apricots and nectarine, but this induces an associated risk of “off flavours” as a result of the production of ethanol and acetaldehyde. For peach and flat peach such atmosphere does not provide any benefit, and it even can affect to the texture and flavours of the fruit.

2.2) Palliflex® (flexible system)

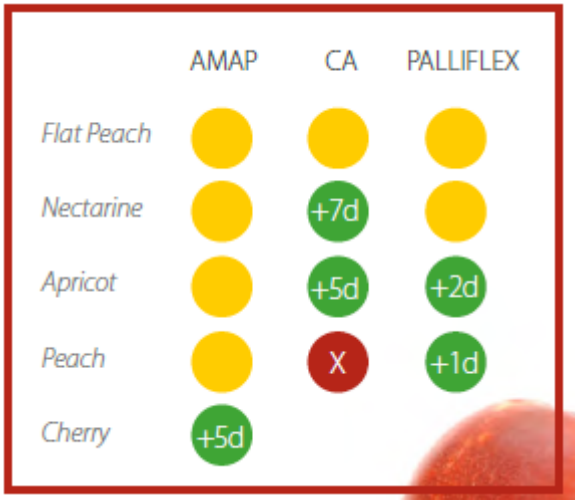
Studies performed with Palliflex included two ranges of atmospheres, which are considered more extreme in composition: i) very low O_2 (2%) and moderate CO_2 (3%); and ii) moderate O_2 (10%) and very high CO_2 (20 %). The goal of these atmospheres is to limit as much as possible the respiration of the fruits, reducing the damage caused by microorganisms and avoided fruit maturation decay.
The only clear benefits of this technology were observed for apricot and peach. An atmosphere with a moderate O_2 (10%) and very high CO_2 (20%) is especially recommended for both apricot varieties (Traver and Kou) as it prevents the maturation of the fruit, increasing shelf-life during commercialization (selling point simulation) in two days. Concerning peach, it is recommended the opposite atmosphere – very low O_2 (2%)

and moderate CO_2 (3%) – being the increase of shelf life during commercialization of one day.

As a summary, which technology is recommended for each stone fruit?

According to the former quality parameters, some recommendations can be extracted for each of the fruits studied on the Project. In order to make results easier to interpret, this table simulates a "semaphore": **green** = highly recommended, **yellow**=not recommended (no observed benefit on the fruit with respect to technology cost) and **red**=not at all recommended (bad for the fruit).

(**AMAP**)-Active Modified Atmosphere Packaging: R.T.ºC
(**CA**)-Controlled Atmosphere: 4ºC; Moderate O^2 (10%)/High CO_2 (10%);
(**Palliflex**)-R.T.ºC, (Moderate O^2/Very high CO2), Very low O^2/ Moderate CO_2



Do the fruit produced under the ZR methodology and submitted to selected post-harvest technologies maintain their organoleptic quality?

Absolutely. The efforts devoted to the joint work in pre- and post-harvest, result in a synergy, whose result is a high organoleptic fruit quality during a longer time, as shelf life has been improved.

There are several physic-chemical and sensory parameters taken into account in order to determine the end of the commercial shelf-life, as a consequence of fruit quality depreciation. As a general rule, in this project it has been established that the end of the commercial shelf-life the moment when, at least, a 25% of the fruits exhibit a firmness lower than client requirements (standard values from Lafuente Tomey). Additionally, other results such as organoleptic profile, presence and severity of internal damages on the fruits, and off-flavours from ethanol and acetaldehyde metabolic routes are taken into account for shelf life estimation.

All these parameters taken into account together, it can be concluded that the fruits produced under the ZR methodology and later submitted to the optimal post-harvest treatment allow guaranteeing for major factors regarding sensory quality and consumer acceptance;

- Fruit firmness and crunchiness

- High characteristic taste and after-taste intensity
- Sour-sweet balance on the fruit
- Preventing the presence of off-flavours

¿How has it been possible to increase consumer awareness about the added value of ZR fruit?

Different dissemination activities were performed in supermarkets placed in Netherlands and Spain. Cherries or peaches (depending on harvest season) were offered to consumers, who also filled in an enquiry to know their potential interest on ZR fruit. Consumers participated on a draw awarded with a two people trip to Spain or the Netherlands, so visitors could check up by themselves the ZR production process.
Dutch consumers' reactions were aligned with comments yielded by producers and local distributors. Consumers highlighted their interest on fresh, healthy products, but they are not willing to pay more for them. Organic products (even if more expensive) are very successful on Dutch supermarkets, where ZR products were presented. However, consumers showed some reluctance to ZR products, which could be explained by a lack of familiarity with the ZR concept.
Regarding Spanish consumers, these are less used to buy organic fruits. However, they seem willing to pay a little bit more by a ZR labelled product, identified as more healthy. Spanish consumers seem to be more aware with respect to the ZR concept. This could be explained by the fact that the producing plots are located less than 50 km around the city.

Apparently, consumers on Zaragoza (capital of the region where the testing supermarket was located) were very aware of this new productive model thanks to many dissemination activities organized by the project consortium (The Night of the Researches, seminars, technical journeys…) where the ZR fruits of the project were freely distributed to attendants. An interesting suggestion would be to focus the dissemination activities on the potential health benefits of ZR fruit and the positive image evoked by the ZR certification.

At present, is there any opportunity on the market for ZR fruit not sold as a fresh product to be transformed on a high quality transformed product (baby food)?

The excess of fruit not sold as fresh product due to superficial defects can be transformed in a new high valued product given the fact that it possesses the ZR certification. Therefore it is possible to reduce the level of fruit residues, contributing to a "circular economy".

Babyfood sector is especially sensitive to the raw materials quality. As a result, this production-distribution channel can be particularly receptive to this kind of fruits ZR certified, given the additional quality guarantee they provide. This project idea was presented to several juice and babyfood producers. From the conversations and interviews several conclusions can be extracted;

- **Added value**: the ZR concept represents a plus to be sol don the babyfood channel. Indeed, babyfood companies may start the ZR trend, given the sensibility of their target consumers segment.
- **Limitation**: babyfood companies have already their own quality control methods, in terms of residues, for raw materials.

- **Opportunity**: interviewed companies consider the option of use pulp and juice from ZR fruits for high quality or Premium products, in order to cover the potential production overcost.
- **Novelty**: even if all the products were accepted, babyfood producers highlighted the interest for flat peaches pulps. It would be a really novel product with the capacity to attract the interest of buyers-consumers looking for new and surprising products.

These opinions reveal that it is possible to relocate the excess of fruit yielded by the ZR methodology to produce a high valued product devoted to the babyfood channel.

Is it possible to reduce the waste of ZR fruit by valorising it as a transformed product? Which innovative process has been applied to obtain a babyfood product?

Peach, nectarine and flat peach not sold as fresh fruits were destined to elaboraty smoothie type juices, as they present a texture and consistency very appropriate for children. Once processed, pulps were stored in 200 mL polypropylene bottles.

Given the fact that the ZR fruits employed as raw material are rich in vitamins – which are thermolabile anti-oxydants – the preservation technique known as High Hydrostatic Pressures (HHP) represents the best solution to improve product shelf-life without altering the functionality of these beneficial molecules.

Bottled smoothies were submitted then to a HHP treatment by a espezialized company, consisting in applying a 600 mPa pressure during 3 min, prior to refrigeration at 4 ºC. This technology makes it possible to obtain a product that maintains:

- The original colour and flavour of fresh squeezed juice
- Intact nutritional and functional qualities

The major attractiveness of pulps obtained in this way is that they can be classified onto the "natural" segment of products, as no preservatives have been employed, which would have been clearly in contrast with the ZR certification of the raw fruits.

Which organoleptic characteristics present this product? Do kids (final consumers) like it?

For all the tested fruits (peach, nectarine and flat peach) a pulp with high sensory quality has been obtained, characterized by a bright colour, intense typical flavour, sweet-sour balance and a highly valued texture. Additionally, the analysis of the aroma profile of these products confirmed that HHP treated pulps keep the original odour volatile molecules during shelf life. This guarantees to maintain the quality standards of this product, given the importance of aroma on the overall product acceptance of consumer.

In an attempt to guess the interest of children (final consumers) on the developed ZR pulps the product was presented on a local nursery (Zaragoza) in front of 3-4 years old kids that acted as mini-experts. Children showed a great interest on the product, drinking all of it and even asking to re-taste again during snack time!

PART 2: Conclusions regarding the consultation to several agents of the production/distribution chain of ZR fruit and consumers perception.

From a social, economic and environmental viewpoint, is it better to employ the ZR methodology instead of conventional and/or ecologic (bio)?

The explanations and arguments provided by all the agents in the production and distribution chain, as well as final consumers, reveal that the strongest aspects of the ZR methodology rely on human health and environmental sustainability.

The most awareness about the ZR methodology is showed by employees on the agrifood sector and phytosanitary products distributors. Additionally it was observed:

- Local authorities did not know the Project but were very receptive to provide the necessary means to disseminate it.
- There is an important percentage of people that manifest that this kind of projects can improve the agrifood sector, and positively influence local economy.
- The major repercussion of the project will be in human health.
- Many interviewed people think that implication of local or national public institutions would provide more visibility to the project.

Production practices under the ZR methodology induce a lower environmental impact to conventional production. This is due to highly respectful pre-harvest practices, both in terms of phytosanitary products rationalization and alternative technologies adoption:

- No pre-established treatments' calendar is employed (only when needed)
- Healing treatments are used according to specificity criteria
- The use of biological control agents (and not chemical) is preferred
- Natural resistance of trees is boosted through appropriate nutrition

However, some needs are still identified in case this production methodology was largely implemented:

- ✓ Improvement of agricultural knowledge of field technicians
- ✓ Public helps or grants to cover initial costs and risks inherent to ZR methodology
- ✓ More availability of information regarding alternative field imputs
- ✓ Recognition of markets in both channels (fresh and processed fruit products)
- ✓ Improvement of awareness of target consumers

What is the economic margin that ZR products could yield? What is the relationship between the elaboration processes of pulps in contrast to fruit discard?

This Project highlights that around 25 % of interviewed consumers in both countries would be willing to pay a little bit more for a ZR product if health benefits were clearly stated. In marketing terms, this figure represents a very important statistical value, as it reveals a great potential for benefit margin.

Finca Valleluz (fruit production) and Lafuente Tomey (fruit confection and distribution) estimate that the selling benefit of this product would be around 20 % in general terms. However, some deviations could be observed depending on fruit variety and harvest season. This percentage may actually increase and additional 5% to 10 % if – as suggested by some interviewed agents – the ZR fruits are commercialized on the frame of Premium quality products in supermarkets and other selling points.

Regarding losses due to impossibility of selling fresh products (due to visual aspect problems), these would be around 0.35-0.50 €/kilo per product. Taking into account that processed pulps could be sold around 1 €/L, even assuming a production cost of 0.60€/L to 0,70 €/L, this would represent a profitable product. However, it is important to take into account the profitability could be less than if discarded fruit were used for conventional juice production, as the HHP one has less a lower shelf life period (28 days).

How could local, regional or national environmental policies improve as a result of this project results?

Results of this research could be employed by Spanish authorities to execute a Sustainability National Plan in the use of phytosanitary products, as reflected on the Law 1311/2012 (14 of September, 2012) related to the European Directive 2009/128/EC (21 of October, 2009) stablishing a general frame for the sustainable use of pesticides.

Such National Action Plan defines the goals, means, schedule and indicators to introduce sustainability criteria in the use of phytosanitary products during the 2013-2017 period, in order to:

a) Reducing the effects and risks of using phytosanitary products on human health and environment
b) Favour the integrated pest management techniques and alternative, not chemical methods, such as biological control
c) Apply the rules regarding commercialization and rational and sustainable use of phytosanitary products.

What are the existing possibilities to apply the ZR methodology in stone fruit in other countries? Would it be economically affordable?

Technically, it is possible to address sustainable agricultural practices complying with the ZR method, in stone fruit and other kind of cultivars. The adaptation should take into account soil type, region climatology and specific cultivars. Environmental and economic benefits would vary, in absolute terms, with respect to those obtained in the ZR project. However, they will be aligned, yielding residue-free, healthy products.

Technical field management and post-harvest actions are relatively easy to implement and are affordable for farmers and fruit centrals.

Regarding the selling prices able to guarantee a worthy production for farmers, fruits should be sold at a reasonable but fair price that reflect the effort and risk assumed during the transition process. During this project it has been seen that managers of distribution chains in both Spain

and The Netherlands see a clear interest on fresh/bio product demand. These also highlight that the buying and marketing departments are more and more restrictive and exigent towards fruit suppliers.

According to interviewees, and taking into account the initial barriers observed in Spain and The Netherlands to produce this kind of fruits, a series of recommendation for farmers from other countries interested in the ZR methodology can be provided:

1. European lobby to decrease the maximal residue limits (MRL)
2. Distribution of a good practices production manual among farmers and foreign cooperatives
3. Providing recommend input lists to improve production maintaining low costs that guarantee product competitively.
4. Lobby among distributors to highlight the added value of the ZR products
5. Promoting the consumption of ZR fruit and derivate among children as a healthy and competitive alternative to organic products.
6. Implementing optical preservation post-harvest techniques that guarantee a shelf-life increase.

Regarding the economic viability it is thought that it exist a market niche for ZR fruit. It is expected that European countries not used to the “organic” concept as much as The Netherlands – mainly those in the South: Portugal, Italy and Greece), but with a long tradition in stone fruit production – the ZR certificate would be highly demanded. It is estimated that around 25 % of consumers would be able to pay more for this kind of guarantee.

Finally, this report includes the DAFO analysis related to the integral implementation of the ZR production system on this Project.

Strengths

- Increasing trend towards residue-free interest from consumers as products are perceived as healthier
- After implementing the ZR method during pre-harvest tasks, improvements in fruit tree resistance to diseases and an increase in yield and quality were obtained
- More than 25% of surveyed consumers in The Netherlands and Spain indicated that they are willing to pay a higher price for ZR products
- Experts agree on the fact that Zero Residue stone fruit can already work well as a business-to-business concept (for example in baby food); ZR certificate guarantees always lower risks to retailers then conventional fruit
- The ZR method is an important asset for commercialization in the baby food industry, especially for produce with higher demand (apricot and peach)

Weakness

- Placing a ZR on the shelf next to a "conventional" product may be considered controversial
- For some consumers ZR product may be perceived as expensive: they would rather pay more for an organic product

Opportunities

- EU regulation regarding pesticide use is expected to become stricter in the near future
- Once the ZR method has been introduced at the farm an opportunity for savings in input exists, while maintaining production & quality levels
- For producers wishing to go organic (which is technically challenging in the stone fruit sector), the ZR method can be an ideal tool in the transition phase
- The functional and ecological improvements to the soil are considered an important environmental ecosystem service in this project, although it is difficult to quantify an expact impact
- The use of microperforated films (AMAP) in cherry achieves an increase in shelf life, which can favor the promotion of exports to new markets
- Flat peach is a fruit with high market potential, both as a final product or processed ingredient

Threats

- For the time being, the ZR production method is treated as an alternative production method and not as a substitute of the conventional method
- The ZR production method is not expected to be implemented at large scale, although wholesalers are becoming stricter with suppliers
- The effectiveness of the post-harvest technologies varies among products; no single protocol can be applied