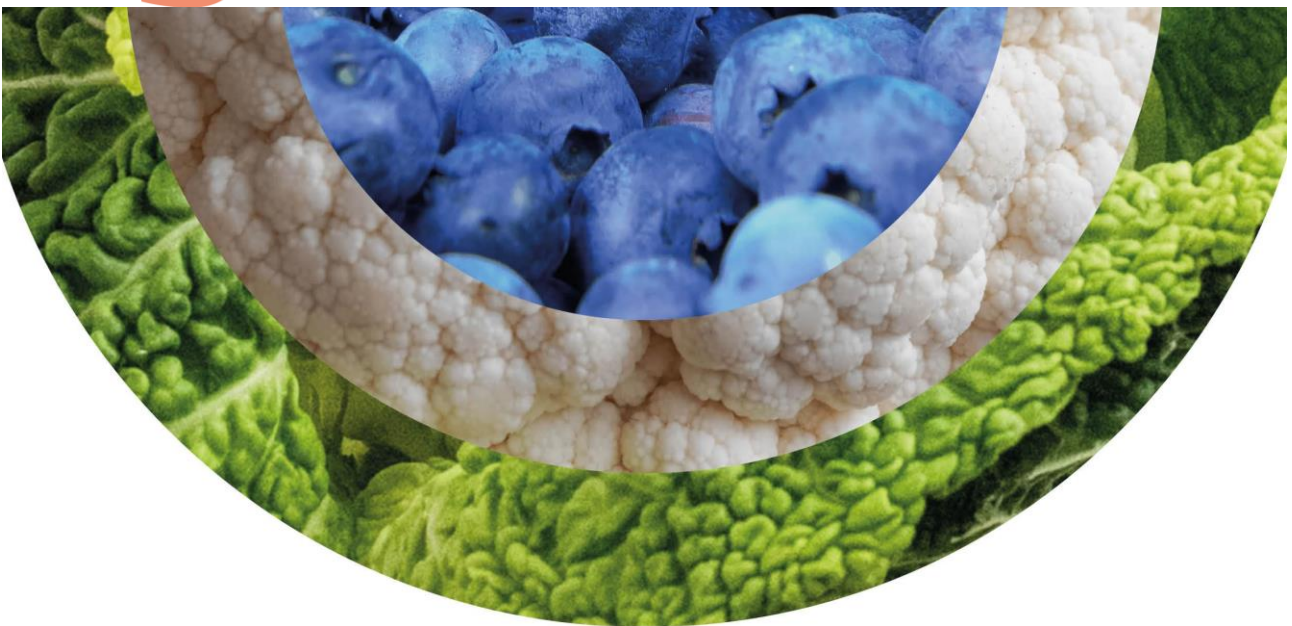




# Agro2Circular



## D1.2– Residues Management Plan

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### TECHNICAL REFERENCES



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- \* PU = Public  
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## Disclaimer and acknowledgement

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## 1 Executive summary

This deliverable describes the Residues Management Plan. The involved stakeholders are defining an action plan to collect the different residues generated during the project:

- Food packaging and organic wastes (MCT, ALM, and CITRO).
- Vegetable wastes and agricultural films (PROEX).

The action plan includes collection, transportation, storage and logistics. A specific protocol for hygienic conditioning of organic materials is going to be established. Data for the DIS tool are being collected by ECO.

This deliverable is a living document that will be updated over the course of the project. The current version is just a first draft that is to be completed within the following month and includes identification of the main waste streams and a preliminar caracterizacion of the wastes to be managed in the project.



## 2 Agro-food waste Management Plan

### 2.1 Identification of the main waste streams

In the waste management plan, the first aspect that must be addressed is the identification of the type of selected waste generated by the different agri-food companies, indicating where it originates and at what point in time for its subsequent management.

The amount of waste generated<sup>1</sup> by agri-food companies varies from year to year depending on the season, market demand and the quality of the fruit and vegetables. With the collaboration of the agri-food companies that are part of A2C consortium, the following waste streams have been identified.

#### Broccoli



The waste consists of a solid with a high moisture content differentiated in green/white units, corresponding to stems and whole pieces of unsuitable raw material.

It is generated in agricultural cooperatives (producers), as in the case of ProExport, considering as waste what is generated in the warehouse (i.e., excluding the field).

Approximately 20% of the volume of broccoli generated is not used for human consumption. Broccoli production in Spain last season amounted to more than 517.000 tonnes. The Region of Murcia accounts for just over 40% of this production. This means that the Region of Murcia generated around 41.400 tonnes of broccoli waste, of which ProExport generated 33.400 tonnes of broccoli waste.

Today, broccoli harvesting is spread throughout the year, but especially during autumn, winter, and spring.

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<sup>1</sup> The agricultural production data have been obtained from the Statistical Yearbook of the Spanish Ministry of Agriculture, Fisheries and Food, 2020. DE ESTADÍSTICA, of the Spanish Ministry of Agriculture, Fisheries and Food, 2020 (<https://www.mapa.gob.es/estadistica/pags/anuario/2020/ANUARIO/AE20.pdf>)



### Cauliflower



The waste consists of a green solid with whitish parts of stems, with a high moisture content, corresponding to leaves and stems.

It is generated in agricultural cooperatives (producers), as in the case of ProExport, considering as waste what is generated in the warehouse (i.e., excluding the field).

Approximately 10% of the volume of cauliflower generated is not used for human consumption. Cauliflower production in Spain last season amounted to more than 189.000 tonnes. The Region of Murcia accounts for just over 16,5% of this production, almost entirely attributed to ProExport. This means that ProExport generated more than 32.000 tonnes of cauliflower and around 3.200 tonnes of cauliflower waste.

Cauliflower collection takes place especially in winter.

### Artichoke



The waste consists of a solid green with slight browning, with a high moisture content, corresponding to bracts and stems. The residue undergoes rapid browning.

It is generated in agricultural cooperatives (producers), as in the case of ProExport (considering as waste what is generated in the warehouse and excluding the field), as well as in vegetable canning and frozen vegetable companies that sell artichoke hearts, quarters, slices or bottoms (after blanching).

Artichoke production in Spain last season amounted to about 200.000 tonnes. If we consider the producing companies, approximately 5-10% of the volume of artichoke generated is not used for human consumption. As the Region of Murcia accounts for around 44% of the total production, this means that the Region of Murcia generated around 4.400 tonnes of artichoke waste, of which ProExport generated more than 3.000 tonnes of artichoke waste.

However, it is important to bear in mind that artichoke canning companies generate a waste of approximately 50% of the volume of artichoke processed. Thus, considering that the vegetable canning companies in Murcia import artichoke for processing, they are capable of processing between 80.000 and 100.000 tonnes of artichoke per year, generating between 40.000 and 50.000 tonnes of waste.

Artichoke collection takes place between December and May.



## Apple



The waste consists of a solid mainly greenish with slight browning, with a high moisture content, corresponding to pips, skins, hearts and wasted raw material. The residue undergoes rapid browning and is easily putrescent.

It is generated in companies producing cremogenate, jams and marmalades, like Agrotransformados. The points in the process at which the waste is generated usually correspond to: the selection and washing phase (remains of plant material and debris), the extraction phase using a turbopasser and the filtration phase (in

these last two phases, the organic matter that does not pass through the sieve is eliminated).

Apple production in Spain last season amounted to about 640.000 tonnes, of which 113.000 tonnes were destined for processing. Given the low production of apples in the region (0.2% of the total production), the vegetable canning and processing companies require external supply. It is estimated that approximately 25% of the processed apple volume becomes waste. Thus, the Region of Murcia generated around 1.200 tonnes of apple waste. In the case of Agrotransformados, an estimated 350-400 T/year of waste is generated. Almond Laboratories generates a much smaller amount of apple waste.

Apple collection takes place from September to December.

## Grape

Initially, it is planned to work with white grapes. The waste consists of a high-moisture solid with a whitish green colour, differentiating brown units, corresponding mainly to stems and whole pieces of unsuitable raw material, and in some cases some skins.

It is generated in fruit juice processing companies and canned vegetables, like Agrotransformados.

Grape production in Spain last season amounted to around 5.750.000 tonnes, of which 5.462.000 tonnes were destined for wine and grape juice, and 283.000 tonnes were destined for fresh consumption and sultanas.

General grape processing generates 20-25% solid waste, of which 50% are grape skins, 25% stems and 25% seeds. In the case of Agrotransformados, the company generates about 45-50 T/year of grape waste, especially stems and whole pieces of product that do not meet quality standards. Almond Laboratories generates a much smaller amount of this waste.

The grape harvest runs from late summer to early winter.





## Citrus fruit (lemon)



The waste consists of a white and yellow solid with high moisture content, corresponding to peel and pulp.

It is generated in fruit juice processing and vegetable canning companies, like Citromil. There are two main types of lemon waste, generated at different stages: peel, at the juice extraction (squeezing) stage, and pulp, at the pulp decrease stage.

Lemon production in Spain last season amounted to around 940.000 tonnes, of which 181.000 tonnes were destined for processing. The Region of Murcia accounts for more than 58% of the total lemon production.

It is estimated that lemon processing generates a waste volume of approximately 50-55% of the processed lemon volume. Thus, the Region of Murcia generated around 150.000-200.000 tonnes of lemon waste. In the case of Citromil, the company generates about 4,000-4,500 T/year of pulp and 30,000-40,000 T/year of peel.

Lemon collection, depending on the variety, takes place from October to June or from March to October, so it is normally available all year round.

## 2.2 Waste management within the company

### Separation

In general, although companies usually generate the different by-products separately, depending on the raw material used in the process, there is no final separation for subsequent waste management, so that in the case of several simultaneous production campaigns, the by-products generated in each of them would be mixed for subsequent management, depending on the volume generated.

Therefore, one of the necessary actions to be undertaken during the project is the separation or segregation of waste immediately after its generation in the same place where it originates.

To this end, the points of generation must be identified and equipped with the necessary containers and materials to deposit them. These containers must have design and construction characteristics appropriate to the type of waste to be collected, be in good condition and be easy to clean and, if necessary, easy to disinfect.

### Internal transport

This corresponds to the transfer of waste collected from production lines to the place where it is stored awaiting collection.



This transport must be carried out according to a frequency determined by the waste generation flow and by means of wheeled containers, pallet trucks or forklift trucks.

### Storage

It is important that the waste is stored for a short period of time, as due to its high-water content, the waste is highly putrescent and highly biodegradable and can undergo rapid fermentation processes.

The most common current form of management is animal feeding. Therefore, waste is collected daily or, in case of low production, every two days.

In the case at hand, waste collection should be carried out daily as many of the compounds of interest present in agri-food waste are readily biodegradable.

## 2.3 Collection and external transport

The collection and transport of the wastes from the place of generation to the place of processing must be rapid and must ensure that the quality of the waste is maintained.

Refrigerated transport is recommended, as well as storage under refrigerated conditions.

The use of freezing processes is not recommended due to the high costs involved and the high quantities of waste generated on a regular basis.

The waste should be processed in the shortest possible time and the necessary pre-treatments should be undertaken to facilitate its subsequent preservation, as well as the following stages of the process of extraction of compounds of interest (e.g., drying, crushing, grinding, decanting etc.).

## 2.4 Preliminary characteristics of the agro-food wastes

The next table shows a summary of the preliminary characteristics of the agro-food waste streams

	<b>Fruit &amp; Vegetable Waste</b>		
<b>Supplier</b>	ProExport	ProExport	ProExport
<b>Type of Waste</b>	Artichoke	Broccoli	Cauliflower
<b>Amount</b>	3,000 T/year	33,400 T/year	3,200 T/year
<b>Conditions</b>	High moisture waste consisting of bracts and stems	High moisture waste consisting of stems and whole pieces of unsuitable raw material	High moisture waste consisting of leaves and stems



<b>Collection</b>	Especially from December to May	All the year, but especially during autumn, winter and spring	Especially in winter
<b>Transportation</b>	TBD	TBD	TBD
<b>Storage</b>	TBD	TBD	TBD
<b>Logistic</b>	TBD	TBD	TBD
<b>Data</b>	TBD	TBD	TBD

<b>Fruit &amp; Vegetable Waste</b>			
<b>Supplier</b>	Agrotransformados/ Laboratorios Almond	Citromil	Agrotransformados/ Laboratorios Almond
<b>Type of Waste</b>	Apple	Lemon	Grape
<b>Amount</b>	350 - 400 T/year	Pulp: 4,000 - 4,500 T/year Peel: 30,000 - 40,000 T/year	45 - 50 T/year
<b>Conditions</b>	High moisture waste consisting of pips, skins, cores and wasted raw material	High moisture waste consisting of peel and pulp	High moisture waste consisting of stems and pieces of unsuitable raw material
<b>Collection</b>	From October to December	All the year	From late summer to early winter
<b>Transportation</b>	TBD	TBD	TBD
<b>Storage</b>	TBD	TBD	TBD

\*TBD: still to be determined.



### 3 PRELIMINARY CHARACTERISTICS OF THE MULTILAYER PLASTIC WASTES

The agro-food companies within A2C consortium generates to types of multilayers plastics; bag in bag aseptic bags and films for soil disinfection.

#### 3.1 Bag in bag aseptic bags

This kind of packaging is made of an inner bag, an outer bag and a spout cap, as it can be seen in next figures.



<b>Outer Ply</b>		PE / Met PET / PE Blue	102 $\mu$
<b>Inner Ply</b>		Multi Layer CoEx PE/EVOH/PA/PE Transparent	110 $\mu$
<b>SPOUT CAP</b>		MDPE - Grey PA (Nylon) – Dark Blue	1 inch, Plug type

All raw materials are Food Contact approved and comply with the FDA applicable requirement of title 21 of the Federal Regulation Code, & comply with EU directive 10/2011 + 90/128/EEC + 1935/2004 + (EC) №2023/2006 & Israel Standard 5113.

The current information about the type, amount and characteristics of the wastes to be managed can be seen in the following table:

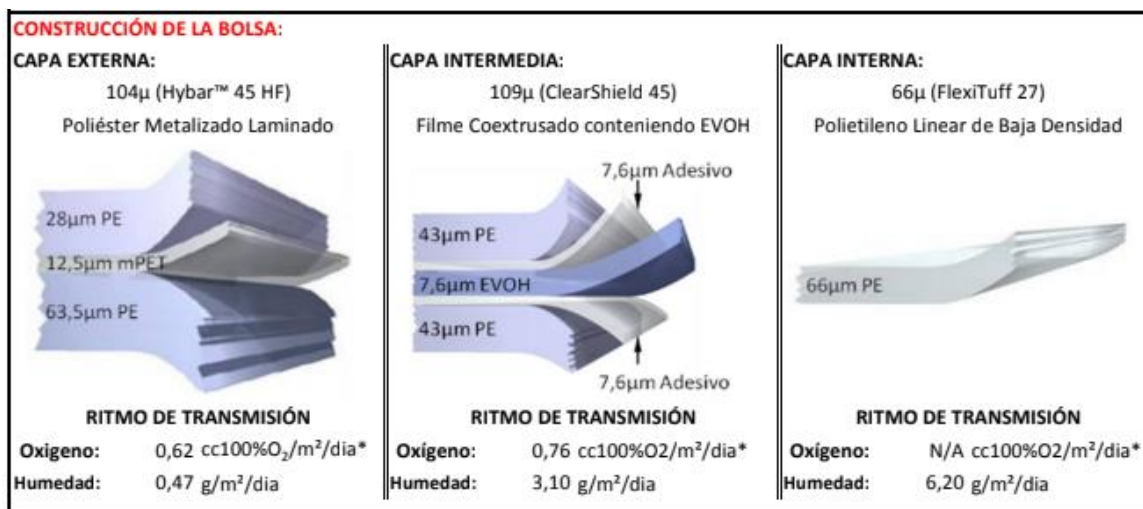
	<b>Food Packaging Waste</b>		
<b>Supplier</b>	Mocitos	Citromil	Laboratorios Almond
<b>Type of Waste</b>	Aseptic bag-in-bag 214 Kg capacity approx.	Aseptic bag-in-bag 20 kg and 190 kg capacity containing Cremogenates, pulps or fruit cubes (apricot, pureed, sieved and tomato concentrate)	Aseptic bag-in-bag 20kg capacity (coconut milk)
<b>Composition</b>	Multilayer external laminate: PE / met-PET inner laminate: PE/EVOH/PA/PE	Multilayer external laminate: PE / met-PET inner laminate: PE/EVOH/PA/PE	Multilayer external laminate: PE / met-PET inner laminate: PE/EVOH/PA/PE
<b>Amount</b>	140 bags/day x 31.724 bags/year x 0.644 Kg /bag x 90 Kg/day = <b>20.430 Kg/year</b>	2000-4000 bags/year x 0.604 Kg/bag = <b>1.208 - 2.416 Kg/Year</b>	200 bags/month x 2400 bags/year x 0.2kg/bag (aprox) x 40kg/month = <b>480kg/year</b>
<b>Conditions</b>	Dirty. With concentrate residues depending on the product used.	Dirty. With fruit and vegetable residues.	Dirty. With coconut milk residues
<b>Collection</b>	TBD	TBD	TBD
<b>Transportation</b>	TBD	TBD	TBD
<b>Storage</b>	TBD	TBD	TBD
<b>Logistic</b>	TBD	TBD	TBD



<b>Data</b>	TBD	TBD	TBD
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\*TBD: still to be determined.

Other agri-food industries (Stakeholders) located in the Region of Murcia produce bag-in-bag plastic wastes with a generation of more than 1.000 Tm/year, and with the structure showed below.



### 3.2 Film from soil disinfection

<b>Agricultural Film Waste</b>	
Film Type	TIF, 10% EVOH barrier, transparent
Crops and zones	Pepper under greenhouse in Cartagena (most), cherry tomato melon and watermelon in Águilas (small amounts)
Amount	250 TONS of TIF films sold in Murcia per year. A bit less of waste.
Conditions	Not degraded as time of use is less than 30 days. Without soil contamination because it is used under greenhouse.
Collection	Up to now it is collected together with mulch films. This point has to be revised and further improved. There are collection points where wastes from several farms are stored



Finally, It has to be remarked that disinfection films are a seasonal (April and October). That means that waste that could be available from Spring 2022 on. So, further tasks regarding getting info directly from the farmers will be scheduled in the Workplan for April-May 2022.

There are currently collection points where wastes from several farms are stored.

