WP1 – Synthesis of the study on the market potential of NoAW biopolymers in agricultural applications

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Introduction

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Introduction

In the course of NoAW project**, three different polymers have been developed**: PHBV, PHBV composites and epoxy prepolymer. **Agricultural applications have been identified as interesting application** for PHBV and PHBV composite during the market study conducted in 2019 in the WP5.

Ecozept, as leader of the Work Package 1 has conducted a **study among a large panel of experts to assess in-depth the market acceptance** of the PHBV and PHBV composites in three agricultural applications and thus verify **the value of directing strategic efforts towards this sector**.
The three agricultural applications are **coated fertilizer, mulch film and horticultural pot**.

The present report presents the **synthesis of the study, core results and conclusions**.

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Introduction

- **Mulch film** intends to cover the soil in vegetable crops in order to limit soil beating, limit evaporation of water from the soil, reduce leaching, reduce weeding, warm the floor, improve the precocity of the crops, etc. Examples of polymer used: Polylactic acid (PLA), Polyethylene (PE), Polyvinyl Chloride (PVC)…

- **Horticultural pots** are used to grow different vegetables, plants, cutting, etc. especially for sprouting. Examples of polymer used: PLA, Polypropylene (PP), PE, wood fibre, coconut peat…

- **Coated fertilizer** is a fertilizer surrounded by a polymer films that allow to gradually releasing the nutriments. Examples of polymers used: Polyurethan, Polyolefin or Polyol and Isocyanate.

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Overall methodology

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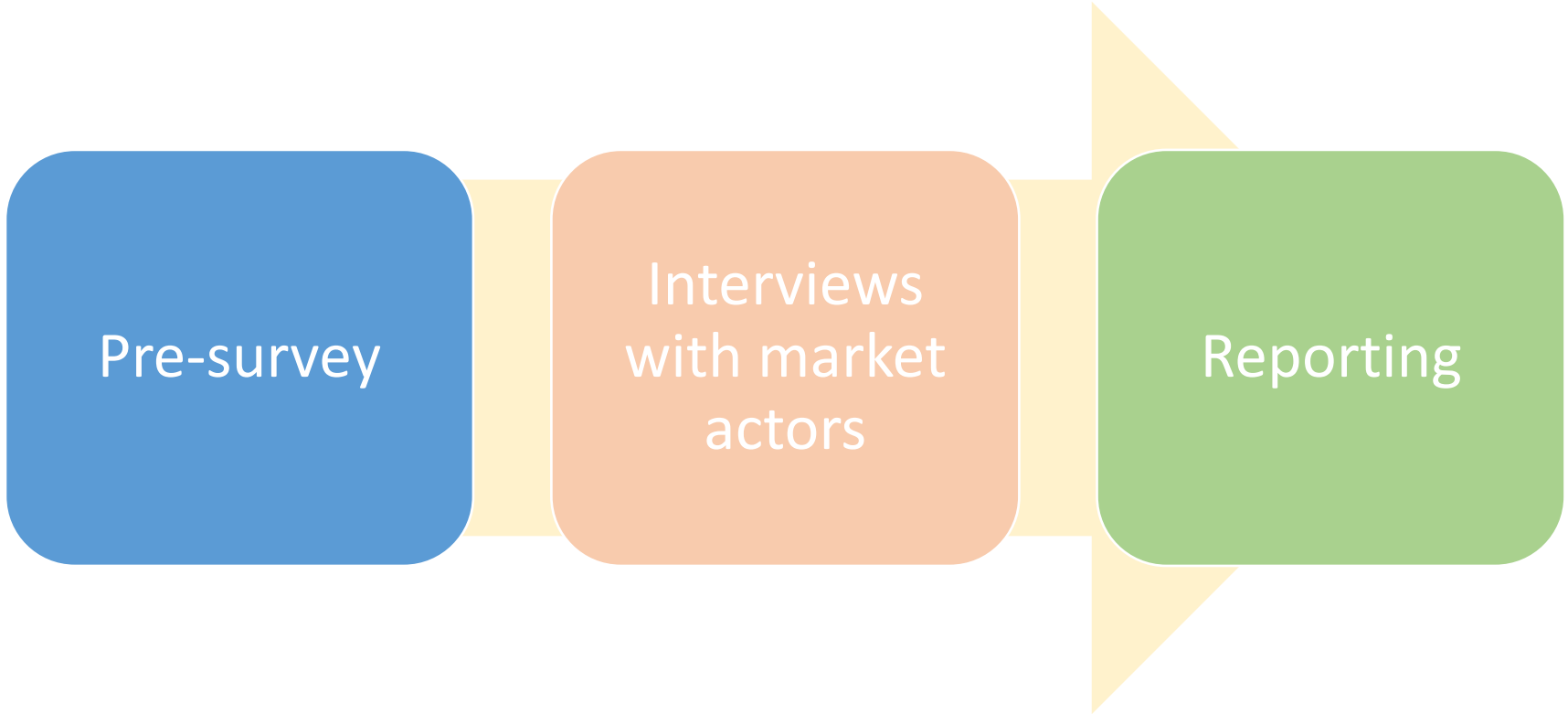
Methodology and objectives of the survey

Objective: assess the market potential of the PHBV and the PHBV composite developed in NoAW in 3 different agricultural applications: coated fertilizer, mulch film and horticultural pot.



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Data collection concept

Step	Description	2020											
		J	F	M	A	M	J	J	A	S	O	N	D
Pre-survey	**Objective:** Confirmation of the possible use of PHBV/PHBV composite in agricultural application, first assessment of its weakness and strengths **Target group:** Research experts on agricultural plastics and bioplastics **Number of interviewees conducted:** 7												
Interviews with market actors	**Objective:** Assess the interest of agricultural plastics producers for PHBV/PHBV composite with a focus on potential target markets e.g. organic market, evaluation of the barriers and opportunity to adopt this new product **Target group:** Producers, distributers and users of agricultural plastics in Europe and other experts such as consultants and associations **Number of interviewees conducted:** 11												
Reporting	**Objective:** Synthesis of the survey **Publication:** NoAW support and eventually specialized magazine												

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Methodology: interviews

- **Pre-survey:** Seven interviews conducted with researchers, R&D responsible, directors of organization with a focus activity on innovative material or experimentation and company producing one of the application.
- **Interviews with market actors:** Eleven interviews conducted with company director, product manager, R&D and innovation manager, process technologist, marketing responsible, sales representative in structures that produce or distribute mulch film or horticultural pot from 7 countries (Italy, Spain, Sweden, Greece, Croatia, Netherlands and France). **This step has been not been conducted for coated fertilizer application (see the conclusion on this application for further information).**

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Methodology: interviews

- Telephone interviews: using open-ended questionnaire guidelines.
- Guidelines based on desk research and results of the WP5 market study.
- Discussion based on product brief sent before the interview.
- Analysis based on a defined deductive category system constructed with the guidelines questions and the interviews.
- MAXQDA software was used to conduct this analysis.

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Results on market potential

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Coated fertilizer

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Interest of coated fertilizer sector for PHBV and PHBV composite

Experts were difficult to recruit and had heterogeneous opinion.

Only one expert assessed the suitability of the NoAW PHBV for coated fertilizer application.

This material is technically suitable but is not interesting because it is too expensive and it degrades to fast in the soil and therefore has not an interesting release capacity.

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Strengths and weaknesses of PHBV for coated fertilizer application

	Compared to currently used fossil-based material	Compared to other bio-based and biodegradable material
Strengths	Bio-based raw material Biodegradable Legislation evolution Maybe the price (contradictory)	Suitable quantity of raw material Not in competition with other use Maybe the price (contradictory).
Weaknesses	Maybe the price (contradictory) Release capacity Potential pollution depending on the extraction	

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Target market and market barriers for coated fertilizer application

Market barriers for biodegradable and bio-based coating

- Industrial secrecy and low information communicated on the material currently used
- High price
- Need for raw material available in sufficient quantity
- Current legislation

Activities to overcome these barriers

- Better understanding of bio-based material and their improvement
- Have large quantities of material
- Lower the price of the material Improve legislation.

Target markets

- Users of nitrate and oligo-elements
- Red fruit production
- Territories subject to nitrate regulation

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Conclusion on coated fertilizer

Difficulty to recruit experts and heterogeneous opinions.

There is low diffusion of information in the sector and not real interest identified for NoAW material: the study of this application has not be pursued during the market actors interviews and additional researches on global market.

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Mulch film

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Mulch film market introduction

The amount of mulch films used in Europe for vegetable production represents 83 000 tons in 2019 (versus 77 000 tons in 2018) (Ape Europe) used on 460 000 ha (Figuier, 2016).

Most common end of life of collected films in Europe is still landfilling (about 50 %), followed by energy recovering and finally mechanical recycling (Le Moine, 2014).

CEN norm EN 17 033 frame the criterion on biodegradable mulch film in Europe.

5% of amount of mulch film are biodegradable (according to the CEN norm) in Europe, which represents about 4 000 tons per year (European Bioplastics, 2018).

Recent prohibition from China (January 2018) to import 24 categories of wastes is heavily impacting the European agricultural plastic waste management, highlighting the difficulty to manage properly their end of life.

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Mulch film market introduction : main European actors

- BASF SE (Germany): largest chemical group in the world with various activities (products for agriculture, dyes, plastics, pharmaceuticals, biotechnology, basic petrochemicals, fertilizers, paints, gas and oil, construction products, etc.).

- Armando Alvarez Group (Spain): largest Spanish processor of polyethylene plastic films.

- Novamont S.P.A. (Italy): Italian company specialized in bioplastics. It mainly produces an innovative biodegradable thermoplastic material.

- British Polythene Industries PLC (United Kingdom): manufacturers of polyethylene products, over 270 000tons per year.

Other main actors outside Europe: Dow Chemical, Berry plastics Group and AEP Industries in USA, AL-PACK in Canada, or Kuaray Group in Japan

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Biodegradable and/or bio-based mulch film market

According to the experts interviewed, market of biodegradable mulch film should increase in the years to come, especially in Central Europe, Spain and France.

Their price should be more and more interesting as the fine set up in different countries for the PE treatment and recycling (farmers must pay a charge when they bring used mulch film for treatment and recycling) is increasing.

Some experts stated that bio-based or/and biodegradable raw materials are difficult to find, not really available or available in low quantities.

Large mulch film companies are developing bio-based and biodegradable products, notably in Germany, Italy and Spain.

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Experience on biodegradable and/or bio-based mulch film

Market actors quoted several biodegradable and/or bio-based materials already used to produce mulch films in there own companies and in others: PLA, PBAT or mix of these materials as raw material.

They consented that it has been a long work to stabilize process and final products with these materials. Some experts have also conducted tests with PHAs, including PHBH.

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Obstacle to biodegradable or/and bio-based material use in mulch film sector

- Price
- Confusion between degradation and biodegradation
- Biodegradability term is not necessary clear, e.g. conditions of biodegradation and effect on soil
- Previous misleading communication on biodegradable film benefit (especially regarding the time saved to recover them after use)
- European regulation: farmers can use lower-priced fossil-based material, even in organic agriculture
- Processability and mechanized placement in field
- Supply of material in constant quality and sufficient quantity
- Adaption of the sector to these limitations and changes

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Activities to overcome market barriers and target market for mulch film application

Activities to overcome these barriers
• Formulation and blending • Addition of features • Perform the material production • Promote difference between biodegradation and oxodegradation • Improvement of the legislation

Target markets
• Organic sector • Vine production

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Interest for PHBV and PHBV composite for mulch film application

According to the experts, NoAW PHBV should be suitable for mulch film production under different conditions.

Blend and/or additional molecules would be needed to improve technical properties, especially its flexibility and processability.

High HV content is adapted because it increase the flexibility of the material. Less formulation work would be needed compared to other PHBV.

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Interest for PHBV and PHBV composite for mulch film application

Market actors were interested by NoAW PHBV, they explained there are more and more issues with PE and development of new biodegradable material is required by the market (*"it is the future to invest in this type of material").*

They did not express a higher interest for the PHBV composite compared to the NoAW PHBV because of the lack of information on the two materials. They quoted interesting points for this material (price reduction, permeability improvement and interesting raw material) and a main limitation: brittleness, which remains a central aspect.

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Strengths and weaknesses of PHBV for mulch film application

	Compared to fossil based material	Compared to other bio-based and biodegradable material
Strengths	Biodegradable Bio-based raw material Evolution of the legislation on biodegradable films and fear about PE legislation	Raw material not in competition with other uses Better biodegradation Interesting properties of PHBV in general: better permeability and flexibility than other PHAs, cheaper than PCL and more stable than PLA The high valerate content make it more flexible
Weaknesses	More expensive Limited technical properties: flexibility, resistance to storage and transport, processability, need for adaption of the producers	Consistent quality of the polymer More expensive Limited properties of PHBV in general: flexibility (contradiction with high HV content) and processability

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Success factors and obstacles for market acceptance of NoAW material in mulch film sector

Key success factors for market acceptance	Obstacles
• Price • Technical properties similar to fossil based material • Final material compositions and certification on bio-based composition • Possibility to colour the material • Adaption to mulch film production and machines • Having a partner already reliable on the market • Resistance to 2 environments (above and in the soil)	• Proper biodegradation • Resistance of the film (brittleness, acceptance of peeling, perforation and deposit) • Not adapted to every crops • Processability of the material into mulch film (especially extrudability, filmability) • Regular quality of the PHBV • Price • Competitive market with established products • Regulation not restrictive • Doubt on biodegradable product , linked to previous use of oxodegradable materials

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Market opportunities for mulch film application

General opportunities

- PE more and more problematic
- Recycling is costly, difficult and time consuming
- Ban of oxodegradable film
- Current study on biodegradable advantages

Specific opportunities

- No specific market for some experts
- Customers: large vegetable/horticultural growers or agro supply distributers
- Area: Mediterranean area (France, Spain, Italy, Morocco) and U.S.A.
- Short crop cycle (up to 6 months)

Opportunities in organic market

- US organic farmers must use biosourced material
- Heterogeneous opinion in Europe:
  - Same interest as other farmers
  - More interesting (more open to alternatives)
- Biodegradability and biosourced certification needed

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Activities to enter on the market

Technical development of a marketable mulch film is a 3 to 4 years work and for a pilot product is it is around 2 year. 4 mulch films producers are interested for sample to test the material. Conducting these steps with PHBV and PHBV composite could allow to verify which one is the most interesting.

- Provide reliable data on characteristics and prices to mulch film producers
- Provide samples for testing (e.g. resistance, UV resistance, stability, etc.)
- Implementation phase: 3 - 4 months

Characterize material

Assess processability of the material

Field trials

Marketing and communication

- Mulch film producers conduct process trials on their machines
- Begin at small scale and then in industrial production conditions
- Trials on potential stabilizers and fillers
- Implementation phase: few weeks step

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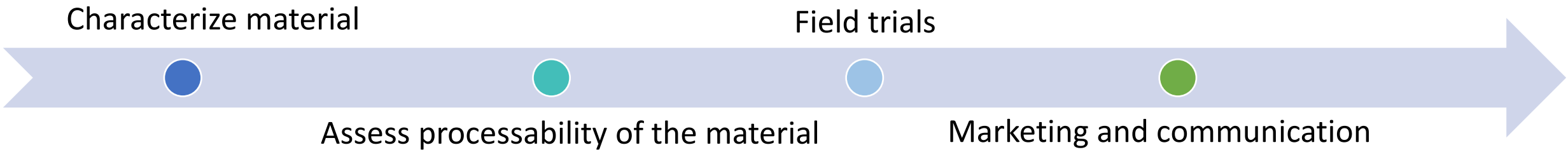
Activities to enter on the market

- Conduct trials in various conditions, areas, and throughout various production cycles, at least three
- Begin on farm scale and then enlarge it to few hundreds hectares
- Involvement of farmer is essential
- Implementation phase: next 2-3 years



- Build evidence on technical suitability of NoAW material
- Get certification on composition and biodegradability
- Prove there is no negative effect with biodegradation and potentially conduct Life Cycle Assessment
- Build sales pitch on proper technicity and ethical difference with other material (e.g. biodegradation, raw material, etc.)
- Target distributers of agro equipment or big growers companies
- Need for legislation adaption, especially regarding non biodegradable material

Interest of the market for NoAW material

Given the limited information available on our product and its "pilot" state, it is necessary to refine several elements to assess more precisely the market potential of NoAW material:

- A better picture of its technical, physical and chemical characteristics
- Its price, which cannot be too far from materials already on the market
- Its processability into film and the ability of this film to fulfil its role (to be perforated, to be deposited in the field, to last long enough and to be impermeable, to be well-buried)
- Biodegradation properties of the film, potentially composed of a mixture of materials
- Final composition of the film produced from PHBV and/or PHBV composite
- Possibility to certify the material and the final film (biodegradation and composition)
- Capacity to supply material in sufficient quantity and quality

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Interest of the market for NoAW material

This characterization will enable to:

- better segment the market and confirm/refine the potential markets identified (crops with rather short cycle times, Mediterranean countries and USA, organic farmers;
- to differentiate the interest between PHBV and PHBV composite;
- precise the need of mixtures with other materials/molecules to be most interesting for the production of mulch film.

As several biodegradable and biosourced products are already on the market and well installed, a better technical characteristics (more resistant, proper holding, better permeability, etc.) or/and a lower price remains fundamental in order to stand out from these other materials.

Several film producers have shown interest in working with our material. The formation of this partnership appears to be the entry point into the sector.

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Next steps to introduce NoAW material on mulch film market

To introduce NoAW material on market a three step plan is proposed:

- Step 1: contact professionals interested in NoAW material to better understand their expectations and how to work with them while drawing up a list of the technical data that is missing (including price) to be provided and those that they can analyze. In particular, it will make it possible to distinguish between PHBV and composite PHBV and to have a first look at the need for mixing and additional molecules.

- Step 2: carry out factory tests to check the processability of material into film and the adjustments to be made. Following validation of this step, field tests will be carried out with the films produced. This last stage will have to be carried out in conjunction with farmers in a variety of conditions and over 2 to 3 seasons.

- Step 3: defining a commercial strategy, notably through the potential certification of the product (biodegradation and composition) and commercial partnerships with film producers.

See slides 29 and 30 for more details.

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Next steps to introduce NoAW material on mulch film market: distribution of tasks

NoAW consortium

NoAW coordinators

- *Contact film producer (with material producer) and develop partnership*

Material assessor

- *NoAW material properties assessment*

PHBV and PHBV composite producer → Mulch film producer → Mulch film distributer → Farmers

- *Contact film producer (with NoAW coordinators) and develop partnership (testing of the material, further steps, production development)*
- *Provide sample to film producer*
- *Price assessment of NoAW material*
- *Develop patent and look for investment for an industrial development*
- *Get certification for the material, regarding its biodegradation (TUV) and final composition (DIN CERTCO and USDA)*
- *Commercialization and develop a long term business partnership with mulch film producer*
- *Build business model of the material and commercialise it*

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Next steps to introduce NoAW material on mulch film market: distribution of tasks

NoAW consortium

- NoAW coordinators
- Material assessor
- PHBV and PHBV composite producer

- *NoAW material properties assessment and trials on processability into film*
- *Manage trials on field test with farmers*
- *Verify conformity to biodegradation norm EN 17033 and get certification of the mulch film regarding biodegradation (TUV) and/or bio-based material (DIN CERTCO and USDA)*
- *Develop business model for the film*
- *Commercialisation of the film*

Mulch film producer → Mulch film distributer → Farmers

- *Commercialisation of the film*

- *Involvement in field test of the film*

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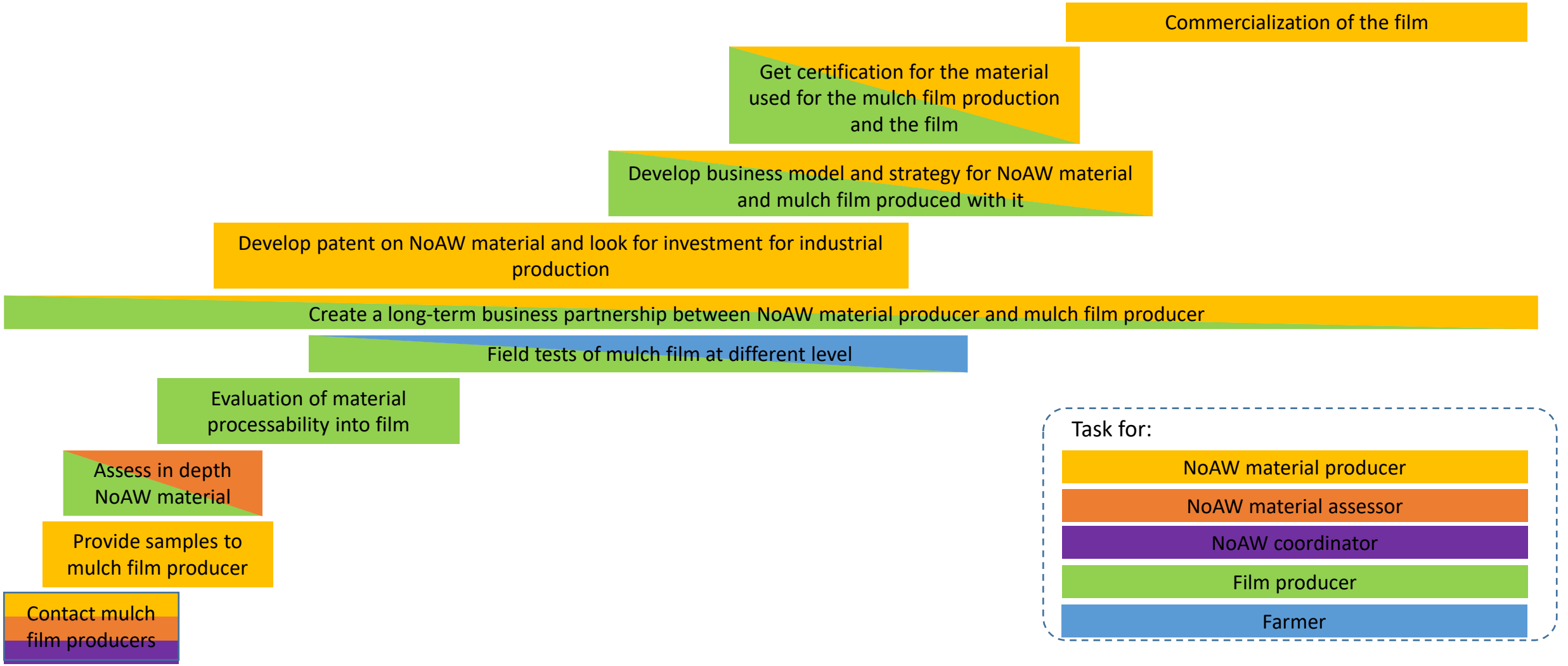
Calendar to introduce NoAW material on mulch film market



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Horticultural pot

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Horticultural pot market: introduction

The world market for horticultural pots and planters was estimated at 340 million $ in 2017 and should reach 430 million $ by the end of 2025 (iCrowdfr, 2018).
In the European market, garden pots are commonly distributed both off- and online through garden centers, “Do it yourself” outlets, florists and general home decor retailers.

The total European garden market sales increased by one percent in 2015, compared to 2014, to 88.1 billion € (IFH Köln, 2015).

In 2015, Spain is the only EU country that showed a significant increase in sales of garden products over the last ten years. Germany is the most important market with sales of 18.1 billion €. With 14.7 billion €, France is placed second, followed by Italy (12.2 billion €) and Great Britain (9.4 billion €). Luxembourg, the Netherlands, Austria and Sweden, have the highest value per capita (IFH Köln, 2015).

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Horticultural pot market: introduction

According to a survey conducted in 2015, willingness to pay of German consumers for biodegradable pot is 15 to 48% more than conventional plastic depending on the kind of plant and pot (Gabriel, 2015). Especially for edible and vegetable plants the consumers showed an increased willingness-to-pay. Quality and environmental aspects are higher-ranked product attributes than the price of biodegradable pots. An extended market potential can be created by combining these biodegradable pots with organically produced plants (ibid.).

A survey conducted by Gardeners' World magazine in 2018 in the UK, showed that 85% of its readers wish to use less plastic, and 66% would be willing to pay more for goods that reduce their plastic use (Barbieri A., 2018).

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Horticultural pot market: main actors

- Euro 3 Plast (Italy): Pot producer.

- Pöppelmann GmbH & Co. KG (Germany): One of the leading manufacturers in plastics processing. It is present in more than 90 countries.

- Soparco (France) : French leader in plastic pots.

Other main actors outside Europe: East Jordan Plastics, Belden Plastics, Summit Plastic Company, Pots Anderson and Landmark Plastic Corporation in USA or Plastic Shengerda in China.

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Biodegradable and/or bio-based horticultural pot market

According to the experts interviewed, biodegradable and bio-based pot is a growing market, notably in UK and Germany. Customers are looking for these material and for pot producer it is important to be ready when regulation will evolve.

None of the experts currently produced marketable biodegradable pot, despite the growing interest for these products. For the moment only industrially compostable pot are available.

Some experts already conducted essays on materials (PLA, PHA, PHBH, lignocellulosic fiber, Mater-bi). Some experts stated that proper bio-based or/and biodegradable raw material is difficult to find because of technical limitation or prices too high. One of them stated that for the moment PHBH is most promising.

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Obstacles to biodegradable and/or bio-based material in pot sector

- Technical issues for the moment, especially regarding mechanized handling
- Processability of these material
- Biodegradation can be too slow and can have negative impact in recycling machines if thrown away
- Price: usable and mass product, retailers who are the key decider in the sector, are not willing to pay too much more for biodegradable pot
- Recycling is more and more used in pot sector and interest retailers.
- Supply of material in constant quality and sufficient quantity
- Adaption of the sector to these limitations and changes
- Biodegradation can be too slow
- Few regulatory constraints
- No certification for biodegradable or biosourced pots

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Target market and market barriers for pot application

Activities to overcome these barriers

- Formulation and blending
- Addition of features
- Work with pot producers
- Perform the PHBV production
- Develop a wide range of pots
- Lower the cost
- Public support
- Communicate on the advantages of these products
- Improvement of the legislation

Target markets

- Organic sector
- Nursery gardeners
- Non professionals
- North of Europe and Canada
- Marine use

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Interest of horticultural pot sector for PHBV and PHBV composite

NoAW PHBV should be suitable for horticultural pot production.

It would need to be blended with other material or additional molecules to improve its technical properties, especially its processability at industrial scale.

Market actors were interested by the NoAW PHBV, notably because of the technology used, its biodegradation capacity and the fact that the raw material allows to lower the price compared to other bio-based/biodegradable material.

They did not express a higher interest for the PHBV composite compared to the NoAW PHBV because of the lack of information on the products. They quoted interesting points for this material (price, environmental impact) and limitation (brittleness, and potentially a slower biodegradation).

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Strengths and weaknesses of PHBV for pot application

	Compared to currently used fossil-based material	Compared to other bio-based and biodegradable material
Strengths	Biodegradable Biosourced raw material	Raw material not in competition with other uses Better biodegradation capacity PHBV in general: more stable and better gaz permeability
Weaknesses	More expensive Limited technical properties: resistance to storage and transport, processability, adaption of the producers Few legal constraints on material for horticultural pot	More expensive Limited properties of the PHBV in general: potentially its sensitivity to external conditions

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Success factors and obstacles for market acceptance

Key success factors for market acceptance
• Price • Certification on bio-based composition • Esthetical properties of the pot • Biodegradation duration, notably adapted to home compost • Resistance: duration during crop cycle (various opinions from 6 months to several years), to mechanized handling, heat, light and water • Same properties than fossil based material. • No negative impact on soil or plant by releasing molecules • Adapted to pot production machine and process (e.g. injection moulding)

Obstacles
• Resistance • Price too high • Convincing key actors: retailers and garden centers • Recycling is a current trend in the sector • No certification • Potential supply issues • Potential negative effect on process machines and production speed

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Market opportunities for pot application

General opportunities	Specific opportunities	Opportunities in organic market

• Market need for interesting biodegradable and bio-based material	• Non professional users (DIY movement) or professional growers working with retailers/garden center
	• Target crops: short cycle duration such as aromatic plants or vegetable seedling. Some experts mentioned blueberries or ornamental plants
		• Heterogeneous opinion of the experts:
		  • Unfamiliar with organic market, which represent a small share
		  • Interesting market, because of sensitivity of the actors
		• Conducting specific tests with these actors could help to better integrate this market

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Results synthesis: horticultural pot

Technical development of a marketable pot is a 1 to 2 years work. Conducting these steps with PHBV and PHBV composite could allow to verify which is the most interesting. 4 pots producers are interested for samples to test the material.

- Provide reliable data (properties and price) to pot producers
- Provide samples for testing (e.g. biodegradation, effect on soil, etc.)
- Conducting trials on pure material powder and mixes

Characterize material

Assess processability of the material

- Pot producers conduct trials on the material
- Adaption to injection moulding and current machines

Field trials

- Assess the lifetime in different condition, the potential effect on plant growth.
- Work in collaboration with professional growers

Marketing and communication

- Promote through various channels, e.g. industry events
- Demonstrate pot interesting characteristics
- Convince retailers and garden centers
- Get a biodegradation or raw material certification

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Interest of the market actors for NoAW material

Given the limited information available on NoAW PHBV and PHBV composite and their "pilot" state, it is necessary to refine their characterization to assess more precisely their market potential and to build a commercial strategy:

- A better picture of its technical, physical and chemical characteristics and its price. The latter cannot be too far removed from materials already on the market, or will have to be mixed with other materials.
- The ability of this material to be transformed into pot and its to fulfil its role (to be handled, to last long enough according to plant cycle and to be impermeable, to be resistant to different condition).
- The biodegradation properties of this pot.
- The final composition of the pot produced from PHBV and/or PHBV composite.
- The capacity of a PHBV/PHBV composite production site to supply film producers in sufficient quantity and quality.

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Interest of the market actors for NoAW material

This characterization will also enable:

- to better segment the market and confirm/refine-tune the potential markets identified during the present study (plants with rather short cycle times mainly);
- to understand in more detail the differentiated interest between PHBV and PHBV composite;
- to precise the need of mixtures with other materials/molecules to be most interesting for the production of horticultural pot.

Even if technical suitability remains central, general retailers and garden centers seems to be key actors in this sector and price appear to be the main characteristic for material decision. Moreover recycling is a growing solution for this sector.

Several pot producers have shown interest in working with our material. The formation of this partnership appears to be the entry point into the sector. The next step to enter on the pot market are described in the next slide.

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Next steps to introduce NoAW material on horticultural pot market

To introduce NoAW material on market a three step plan is proposed:

- Step 1: contact professionals interested in our material to better understand their expectations and how to work with them while drawing up a list of the technical data that is missing (including price) to be provided and those that they can analyze. It will make it possible to distinguish between PHBV and composite PHBV and to have a first look at the need for mixing and additional molecules.

- Step 2: conducting tests with one or more film producers. As a first step, it will be necessary to carry out factory tests to check the processability of the material and the adjustments to be made. Following validation of this step, field tests will be carried out with pots produced. This last stage will have to be carried out in conjunction with nursery gardener in a variety of conditions.

- Step 3: defining a commercial strategy, notably through the potential certification of the product and commercial partnerships with pots producers.

For more details see slide 48.

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Next steps to introduce NoAW material on horticultural pot market: distribution of tasks

NoAW consortium

NoAW coordinators

- *Contact pot producer (with material producer) and develop partnership*

Material tester

- *NoAW material properties assessment*

PHBV and PHBV composite producer → Horticultural pot producer → Nursery gardeners → Retailers and garden centre

- *Contact pot producer (with NoAW coordinators) and develop partnership*
- *Provide sample to film producer*
- *Price assessment of NoAW material*
- *Develop patent and look for investment for an industrial development*
- *Get certification for the material, regarding its biodegradation*
- *Commercialization and develop a long term business partnership with horticultural pot producer*
- *Build business model of the material and commercialise it*

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Next steps to introduce NoAW material on horticultural pot market: distribution of tasks

NoAW consortium

- NoAW coordinators
- Material tester
- PHBV and PHBV composite producer

- *NoAW material properties assessment and trials on processability into pot*
- *Manage trials on field test with nursery gardeners*
- *Verify biodegradation and get certification of the pot regarding biodegradation and/or bio-based composition*
- *Develop business model for the pot*
- *Commercialisation of the pot*

→ Horticultural pot producer → Nursery gardeners → Retailers and garden centre

- *Involvement in field test of the pot*

- *Commercialisation of the pot and the plant potted*

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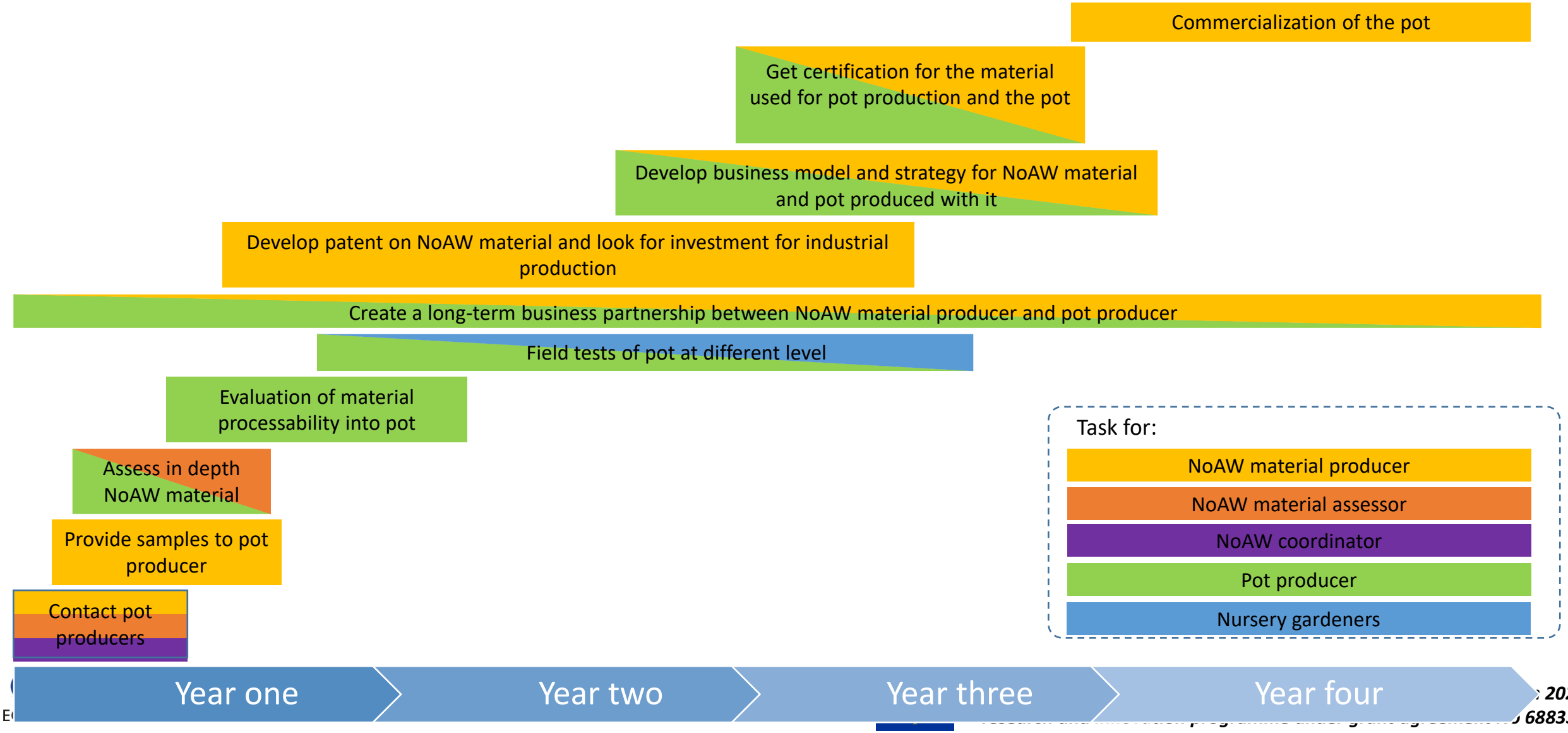
Calendar to introduce NoAW material on horticultural pot market



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General conclusion

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General conclusion

This study has:

- confirmed and refined the interest of the PHBV and PHBV composite developed in NoAW for mulch film and horticultural pot applications
- shown that there is only limited interest in coated fertilizer application

Despite similarities between the analysis on mulch film and horticultural pots applications, some differences have been highlighted.
This is due to technical and market components of each application, but also to the fact that the bio-based and biodegradable material and polymers are at a very different level of development in each sector. Indeed, this use is already launched in the mulch film market, whereas it is at a much more innovative stage, although rising, for pots.

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General conclusion

Although several market elements could be detailed, the elements and questions remained largely at the technical level, particularly due to the lack of information available on the materials and the need to test them

To further define the market potential, a more in-depth characterization of the materials is necessary. An other round of interview was originally planned with experts of the sector to in depth characterize the market potential of the material. This step has been cancelled regarding the lack of technical information on NoAW products.

Many of the experts interviewed were willing to continue working on the polymers developed in NoAW, whether for mulch film or horticultural pots, particularly to assess their suitability and testing it for these uses. The steps to pursue this worked have been described for each application.

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