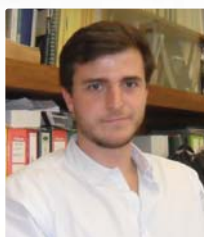


A film for the future

Biodegradable mulch films are emerging as a viable alternative to their more traditional polyethylene counterparts. **Elizabeth Duarte**, **Lopo Carvalho** and **António Almeida Monteiro** describe the benefits of biodegradable mulch, and how their research is looking to improve manufacturing processes



ED: Elizabeth Duarte (left)
LC: Lopo Carvalho (centre)
AAM: António Almeida Monteiro (right)

Could you describe the AGROBIOFILM project?

ED: It is a multidisciplinary project promoting a new biodegradable plastic film to be used as soil mulch in agricultural farming. Our project targets a major market opportunity, using a product called Mater-Bi™ as raw material for the production of improved biodegradable mulches. It has the potential to become a competitive alternative to common polyethylene films and aims to significantly decrease environmental impact. We aim to develop AGROBIOFILM into a widespread product using a multidisciplinary approach.

What barriers are you facing?

LC: The production of mulch films from biodegradable raw materials is still in its infancy. The classic polyethylene plastic mulches are a well-established product over the last 50 years. They have greatly improved production yield, reduced chemical applications and water losses, and have led to the enhancement of farmers' competitiveness. The replacement of polyethylene by biodegradable mulch films should not compromise crop yield and production costs, which is the great challenge. The current barriers centre around the optimisation of the manufacturing process and getting more commercial farmers onside.

Why does the AGROBIOFILM project have such stringent technical and scientific objectives?

ED: AGROBIOFILM is quite an ambitious project. The field and lab experiment results are of great

importance. The research is the key to improving how the biodegradable mulch films are applied to the land, and how they perform during the season and then biodegrade effectively. This requires scientific research into soil conditions, pests, diseases, yield performance, environmental risk assessment and cost effectiveness analyses.

What responses are you receiving from commercial farmers?

AAM: Growers are highly interested in the use of biodegradable films, due to the high cost of removing non-degradable films. However, many growers have tested degradable films with little success, usually because of the poor performance of the materials available in the market. Mater-Bi™ is a completely different material that allows the manufacturing of benchmark biodegradable films. Growers that have tried other materials without success can trial this product for the first time.

Even though the initial cost of biodegradable film is more expensive than polyethylene, some growers have accepted this challenge to increase their own competitiveness.

AAM: Last year during a field visit with growers, the project team offered information on the product. The owner of the field was an experienced melon grower. He asked permission to comment, and said in calm and very convincing voice: "It is very easy. You stretch the film, grow the melons and, at the end of the crop, plough the film into the soil. When you return to the field a few months later to prepare the soil

for the following crop the film is gone! This is a magic film". There were no more questions by the growers that day except about the price and availability of AGROBIOFILM. All of them wanted to use it.

How are you ensuring the biodegradable mulch film is well-adapted to diverse conditions?

LC: Film performance varies greatly among different crops, countries and regions, so we have conducted field tests in Spain, France and Portugal for the most representative crops. As expected, the results to date indicate different performances in different locations.

Who are the various players in your multidisciplinary project?

LC: The consortium behind AGROBIOFILM project spans science, research, manufacturing and the complete business chain. SMEs are responsible for the research, development and production of the biodegradable plastic films. These are then used by universities and a research centre to conduct laboratory and field tests. Commercial growers apply the film to their crops using current growing practices, under the university team's supervision.

How do you think AGROBIOFILM will influence European countries' commitment to reaching certain levels of environmentally-friendly practice?

ED: It is our goal to contribute to the improvement of specific European standards, namely to evaluate plastic biodegradation in soil conditions under aerobic conditions. We intend to provide a significant proportion of the plastic used in European agricultural systems. With our past and future workshops with farmers and others in the field, we hope that the results from our experimental work can contribute to new policies and incentives regarding plastics.

Experts in the field

The new eco-friendly **AGROBIOFILM** project is rolling out an environmentally sustainable, commercially viable biodegradable mulch film for commercial crops, which is set to cover a lot of ground...

THE AGROBIOFILM PROJECT is an astute collaboration of scientists, manufacturers, suppliers and industrial growers using Novamont's very recent Mater-Bi™ CF04P grade as raw material for biodegradable mulch film production. Assistant Scientific Coordinator, Lopo Carvalho, explains: "Our goal is to create mulch films produced from biodegradable, renewable resources that completely biodegrade, preferably before the following crop cycle".

Mulching is a farming technique using materials to cover the soil so that performance of crops, especially exotics, is not at the mercy of weather conditions and other dangers. Plastic-based mulches, usually polyethylene, have been used in the agricultural industry since the early 1960s and today plasticulture is critical to the supply of the massive volume of fruit and vegetables the world is so dependent upon.

Polyethylene films are not biodegradable and are very expensive to remove or recycle. The European Environmental Agency Emission Inventory Guidebook 2009 has catalogued the pollutants emitted from burning polyethylene films. The list includes ammonia, carbon monoxide, heavy metals and dioxins. The practice is technically banned across most of the EU; however, burning and burying of plastic mulch films is still common practice, causing irreversible soil, air and crop contamination. By the same token, the recycling of

polyethylene film requires a preliminary washing step, which consumes crippling amounts of energy, water and money.

There are biodegradable films that have the same starch matrix as the Agrobiofilm product (Mater-Bi™), but still comprise fossil carbons. The new Mater-Bi™ grade (CF04P) used for the film extrusion is more sustainable and cheaper, which is exciting news for the industry. It is unique in its use of high proportions of renewable materials created through the cleavage of vegetable oils.

The manufacture of the AGROBIOFILM product expends less energy than conventional plastics. Conventional extrusion temperatures range from 180-220 °C, while starch-based, biodegradable polymers need only 140-160 °C.

IS GREEN POLICY THE BEST POLICY?

Social trends are gradually tending towards sustainability. The general public, law makers and private companies are turning their attention to the desperate need for bioplastics.

Legislation is promoting the use of bioplastics, promoting their emergence across a vast scope of industry and society; an obvious example is shopping and rubbish bags. In many countries environmental credentials are starting to be viewed as a competitive advantage, which raises the

appeal of AGROBIOFILM in Europe. AGROBIOFILM addresses several environmental objectives of the European Policies and the Common Agricultural Policy, namely for soil contamination, residues management and energy savings.

An environmental protectionist approach puts agricultural sectors in a precarious economic position. Europe is subject to more stringent environmental trends, regulations and legislation than other countries such as China, the US, Brazil, Indonesia and other Asian and Latin American countries with more permissive agricultural policies, who also practise large economies of scale. This threatens to furrow the level playing field.

RISING TO THE CHALLENGES

The R&D teams are hard at work combating the inherent difficulties that come with crop films. The quality of the material is a crucial link forging success or failure in the product chain. The mulch film can rip, shrink or stretch upon contact with the soil or in extreme temperatures, causing premature degradation. Equally, the film must fully degrade in good time, regardless of crop, climate and soil type.

Further challenges are in the microclimate beneath the film. Compared with polyethylene, biodegradable mulch is susceptible to higher water infiltration in wet weather and water evaporation

in dry heat. The film is apt to foster a moist, clammy nursery for disease and pests, or make the fruit dirty. And finally, the films must be easy to use, and cost-efficient.

The SMEs forming the AGROBIOFILM consortium have ample expertise in the production and marketing of the new product. In their work plan, the consortium explains that the gap lies in the expertise to address significant scientific barriers and thus there is a need to be assisted with technological development.

"The procurement of cross disciplinary scientific knowledge and collaboration is essential," Carvalho reveals. "The success of this project will only be realised if all the stakeholders work in close proximity with the research team and have access to project data in real-time."

During the course of this project, field experiments have been conducted by the AGROBIOFILM R&D teams on four of the most susceptible target crops: peppers, melons, strawberries and vines.

Many of the results to emerge from the project were the first ever obtained in this field of study. There is a lack of good statistical sources for the biodegradable mulch film market. The AGROBIOFILM consortium suspects that a number of previous experiences and results in the biodegradable film industry have not been reported due to embarrassment at business failure.

Likewise, the groundbreaking group is unaware of any other scientific reports on recycling scrap wastes and incorporating them into the material; as such, the development of such literature has become another goal of the project. The consortium is also exploring a wider range of mulch film colours.

Initial results demonstrated a biodegradation rate that met international standard certification, but still left undesirable fragments of plastic in the soil one year after having being ploughed, leaving the scientists with plenty food for thought. The overall results suggest that this third-generation biodegradable mulch film gives the same fruit quality and yield as conventional polyethylene.

LINKS IN THE CHAIN

From the supplier angle, AGROBIOFILM provides manufacturers with a state-of-the-art platform to develop a profit-making, eco-friendly product. Participating suppliers are in prime position to establish the lead in the European market worth around €110 million annually.

AGROBIOFILM intends to present a superior product to the market, offering farmers a film adapted to the needs of their particular crops and location. The level of fossil carbons will vary in accordance with the target soils, using as little as possible while ensuring degradation.

Growers expect to continue using their own machinery without compromising the biodegradable behaviour of mulch. To entice growers, the agronomic superiority required of a product means it must be at least as efficient as the existing mulch films with regard to weed control, water savings, disease control, yield, quality, and early harvest dates.

AGROBIOFILM must come to fruition by fulfilling its three imperatives: environmental sustainability, compliance with current growing methods, and matching or improving on polyethylene crop performances. The seeds for progress are sown and point to a productive and fertile future.

INTELLIGENCE

AGROBIOFILM

DEVELOPMENT OF ENHANCED BIODEGRADABLE FILMS FOR AGRICULTURAL ACTIVITIES

OBJECTIVES

To strengthen the competitiveness of the SME consortium by developing and launching a new generation of enhanced biodegradable mulch films that are superior to existing biodegradable films in both cost and performance – enabling the direct substitution of the unsustainable PE films.

PARTNERS

Silvex, Indústria de Plásticos e Papéis, SA (SVX), Portugal • Biobag International AS (BB), Norway • ICS Environnement (ICSE), France • Instituto Superior de Agronomia da Universidade Técnica de Lisboa (ISA), Portugal • Centro Tecnológico de la Agroindustria (ADESVA), Spain • Unité Mixte de Recherches Ingénierie des Agropolymères et Technologies Emergentes (IATE), France • Faculty of Agricultural Sciences, Aarhus University (AU-DJF), Denmark • Hortofrutícolas Campelos, Portugal • Explotaciones Agrarias Garrido Mora, Spain • Olivier Madeville, Domaine de Vaissière, France

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MANUAL PLANTING

