MICRO IRRIGATION PLASTIC PIPES & DRIPS WITH ANTI-MICROBIAL & ANTI-ROOTS FUNCTIONALITIES

Riga

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THE PROBLEM & BACKGROUND INFORMATION

Figure 1. Thousands of hectares of micro-irrigation systems around Europe (source: FAO 2012).

According to data provided by FAO, the **total micro-irrigated area in European countries was more than 18.2 million hectares in 2012** (Figure 1). The EU countries consume a large amount of water for agriculture, primarily for irrigation. The use of these micro-irrigation systems shows a great advantage in the agricultural sector due to the fact that its use can reduce the water consumption by about 60 %. Furthermore, this market is expected to grow quickly because of water regulation and the desertification problems.

Micro-irrigation, also known as **drip irrigation** or trickle irrigation, is an irrigation method that applies water slowly to the roots of plants. This by **depositing the water** either on the soil surface or **directly to the root zone**, through a network of valves, pipes, tubing, drippers and emitters. Of the various forms of micro-irrigation, drip irrigation is the one most widely used because it can **save water** and **reduces the use of horticultural chemicals.**

Figure 2. Drip micro-irrigation systems in open field cultivation.

Despite the benefits that micro-irrigation systems present, there are some limitations:

- The **clogging of the emitters**. The small openings can be easily clogged by soil particles, organic matter, bacterial slime, algae or chemical precipitates. The micro-irrigation systems require very exhaustive filtration, even with a good quality water supply.

- The **root intrusion** that leads to the collapse of the water emitters. Current systems with inbuilt anti-root chemical treatments are available. However, most of these chemicals are based on **trifluralin** which has a really high toxicity to fish and other aquatic organism and is not approved for use as a plant protection product in Europe[I].

In this way, a solution to reduce the limitations that affects micro-irrigation systems (pipes and drips) are:

- To reduce algae and pathogens in irrigation water, which may cause biofilm formation inside the tubes, anti-microbial additives will be considered, according the biocide standards[I]: 98/8/CE and RD 1054/2002, in the extruded micro-irrigation pipes.

- To reduce the clogging of the drippers by roots, additives with low toxicity, will be used, as an alternative to trifluralin. They will be imbibed in drippers during the manufacturing process through the injection.

Thanks to the RIGA project the implementation of a **new irrigation systems, with new functionalities such as anti-microbial and anti-roots** (trifluralin free), will not only allow a good functionality up to the end of their shelf-life (which is up to 50 % longer), but will also contribute to a reduction in water consumption (up to 5 % due to the fact that less pipe cleaning is required for a stable performance). The newly developed systems will be cost-competitive, safe for animals and plants and environmentally friendly (since non-toxic substances with herbicide activity will be employed).

The RIGA project is fully aligned with the EU policy towards Environment since it is aimed to reduce not only water consumption, but also reduce the toxic substances in water eliminating the trifluralin in pipes production. RIGA is, therefore, contributing to the Integrated Product Policy, by taking action in the phase of the life-cycle where it is most effective, in this case raw material.

By preventing the generation of agricultural plastic waste, the RIGA project will contribute to the waste related Community Policies, such as: **Directive 2008/98/EC on waste[III], Directive 1999/31/EC on the landfill of waste and Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste and by searching for economically viable alternatives it is contributing to the Kyoto Protocol.** As stated above, another important environmental issue in the European policy is the toxic substances reduction in the water. In the RIGA project pipes are being developed with alternatives for the toxic trifluralin. According to that, the project is also aligned with EU policy objectives and help to achieve them: **Directive 2000/60/EC** of the European Parliament and of the Council of 23 October 2000 establishing a **framework for Community action in the field of water policy[IV]: Directive 2006/118/EC** of the European Parliament and of the Council of 12 December 2006 on the **protection of groundwater against pollution and deterioration[V].**

4 PROJECT CONSORTIUM & ROLES

Six members from 3 countries have taken part in the project: Belgium, Italy and Spain.

AIMPLAS, technological institute focused on the plastic sector, located in Valencia, Spain, is the coordinator of the project. AIMPLAS has helped in the anti-microbial an anti-root optimization masterbatches to be processed into functional extruded pipes and injected drips

CERSAA is a special agency of the Chamber of Commerce, Industry, Handicraft and Agriculture "Riviere di Liguria" located in the North Western part of Italy and facing the Ligurian sea. It is active in the implementation of projects regarding applied research in the agro-environmental sector and in different extension services addressed to farmers and technicians.

PCS - Ornamental Plant Research is an independent knowledge centre for ornamentals and Public green services, based in the Flanders region of Belgium. Applied research and extension services provide solutions for the bottlenecks in the sector and questions from growers. The focus is strongly directed towards implementing innovation at the grower level.

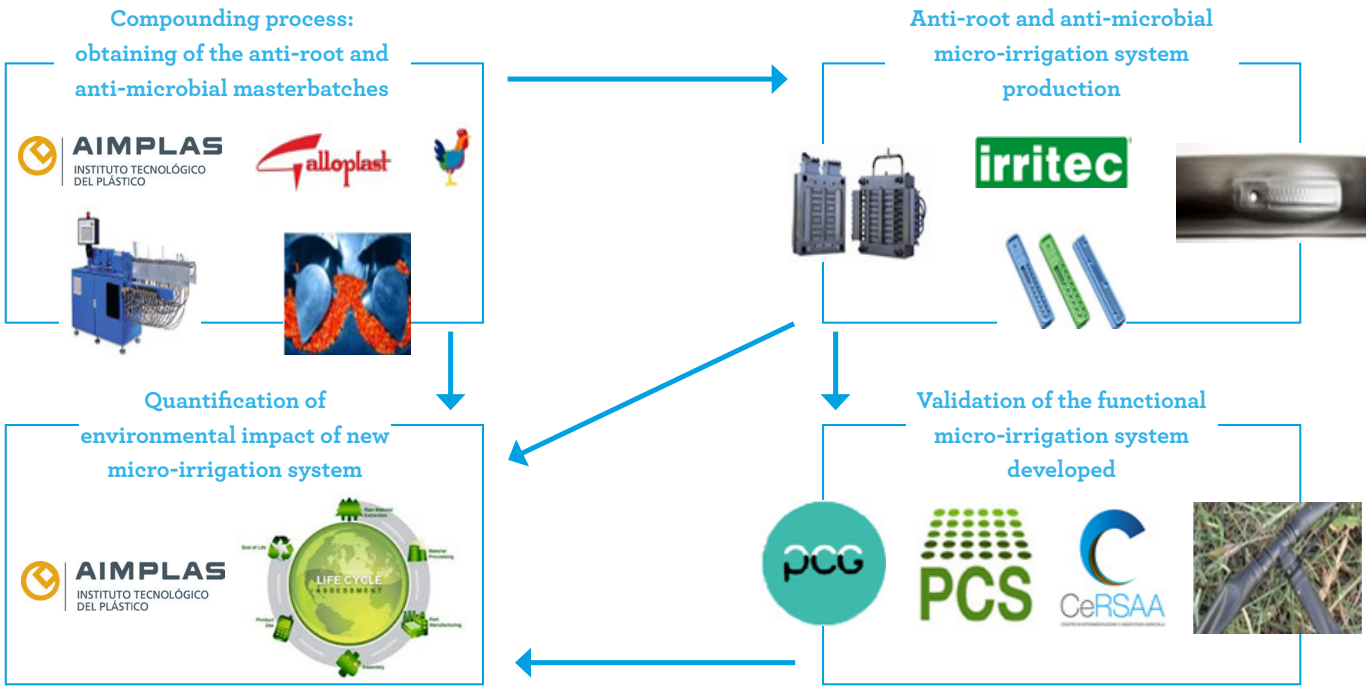
PCG – Vegetable Research Centre is PCG is a center for applied research and extension services in vegetable production recognized by the Flemish government. The main task of the PCG is to collect, translate and disseminate knowledge to all actors in agri- and horticulture. PCG functions as a link between local farmers and agricultural organizations on one hand and research institutions and different branches of government on the other hand.

GALLOPLAST is a Spanish company specialized in the production of masterbatches with additives and pigments for plastic materials. It has obtained 2 masterbatches, one with anti-microbial properties and another one with an anti-roots functionality.

IRRITEC is one of the first global irrigation groups to introduce environmental production systems. It is an Italian company whose role has been the assessment, at industrial scale, of the extrusion manufacturing process of flat pipes and drippers for the new micro-irrigation systems based on standard polyolefin grades, with new functionalities such as anti– microbial and anti– root features.

PCS (Ornamental Plant Research), PCG (Vegetable Research Centre) and CERSAA (Centre for Agricultural Experimentation and Assistance) form the bridge between scientific research and practical applications at grower level.

The interconnections of the different activities are represented in the following figure:



6 PROJECT OVERVIEW & OBJECTIVES

The **main goal** of the **RIGA** project is the **implementation** of **new irrigation systems** based on standard polyolefin grades, with **new functionalities** such as **anti-microbial and anti-roots (trifluralin free)**, which allow to **increase their functionality** up to the end of their shelf-life (up to 50 % longer) and contribute to **the reduction of water consumption** (up to 5 % due to the fact that less pipe cleaning is required for a stable performance), in comparison with the current systems in the market.

The main objectives of the project are hereby summarized:

Reduction of plastic waste.

Reduction of greenhouse gases emissions.

Elimination of toxic substances.

Reduction of water consumption.

ACTIVITIES & MAIN OUTCOMES

The RIGA project has aimed to solve some limitations related to the traditional pipes and drippers and has considered the **production of new micro irrigation systems which are** more cost-competitive, safer for animals and plants and environmentally friendly (since non-toxic substances with herbicide activity will be employed). The new systems developed consist of flat pipes and drippers that can be used for the irrigation and fertigation of different plant species such as vegetable and fruit crops.

The production of new flat drippers and flat pipes with anti-root and anti-microbial properties has been optimized during the injection and extrusion process. The amount of additives used was adjusted to obtain products moret suitable for given field conditions.

Field and greenhouse trials were designed in order to validate the developed pipes and drippers with the final aims of translating research results into practice and providing pipes and drippers manufacturers with viable indications for final product improvement.

Different aspects regarding distribution of water, presence of biofilm inside pipes, flaws in drippers and pipes, crop quality were taken into consideration during the trials.

Pipes and drippers containing antimicrobials and anti-root additives **provided promising results** in comparison to the traditional products:

- New pipes guaranteed a **constant flow rate** during the whole experimentation period.

- The measured **pressure** inside tubes was maintained **constant** during the whole trial.

- The presence of **anti-microbial additive inhibited the fungal population growth** inside pipes, with a clear correlation with increasing additive concentration.

- **The occurrence of small cracks and failures** on drippers can be considered **negligible** with regards to the specific environmental conditions that characterized the trials carried out in Belgium and Italy.

- Finally, **innovative pipes assured a comparable yield and crop quality**, compare to the classical systems.

Moreover, a Life Cycle Assessment is being performed to evaluate the environmental impact of the new pipe. As this pipe can be used for longer periods, less plastic waste is generated, so less gas emission is produced.

Figure 3. Greenhouse cutivation with RIGA micro-irrigation system.

RIGA MARKET & EUROPEAN ADDED VALUE

1. Growth annual rate.

Drip irrigation is the fastest growing market segment in terms of both revenue and area with **19 % CAGR**[1] from **2011 to 2016 in terms of revenue and a market figure of 827.3€ million by 2016.** Micro irrigation systems are very important in order to maintain an internal climate in green house application. Orchard crop is the largest and fastest growing crop segment and is expected to grow at a CAGR of 19.3 % from 2011 to 2016. Micro irrigation systems for field crops are another growing segment for the micro irrigation system market.

Farmers who switch from trench systems or sprinkler irrigation to **drip systems can cut their water use by 30 to 60 %.** Crop yields often increase at the same time, because plants are effectively 'spoon-fed' the optimal amount of water (and often fertilizer) when they need it. **Rising water scarcity and cost effectiveness of micro irrigation systems** over other crop protection and fertilizer application methods are expected to drive the demand for the micro irrigation system market in the near future. Increasing population and water scarcity are another **driving factor** for this market.

In Europe there are more than 24 Million of hectares irrigated with different methods. From this, **the 2.25 % of total irrigated crop area (700,000 ha) is irrigated using a micro irrigation system.** That means that around **11,000 million of meters of polyethylene micro-irrigated pipes (16,000 m/ha and 200,000 Tons) are consumed in Europe annually, representing a very big market for pipe manufacturers.**

RIGA project will allow the EU manufacturing companies (i.e. Pipes and drippers manufacturers) to broaden their range of products by offering a new product, inexistent nowadays, into the market: a pipe for micro-irrigation that will contribute reducing the current environmental impact of the polyethylene pipes.

RIGA will increase their volume of business, since it is expected that the new pipe will have a higher acceptance by farmers, due to its advantages compared to the existing pipes, contributing to minimize environmental impacts, improving soil quality and reducing costs in the agricultural sector.

CONCLUSION

The European Grant for the RIGA project has helped the Consortium to:

- Find **new business opportunities** for the companies participating in the project (IRRITEC and GALLOPLAST)

- **Solve real farmers' and growers' problems** in Europe through the information provided by the research centres that participate in the project (CERSAA, PCG, PCS)

- Start innovative experimentations about irrigation technologies that could lead to the development of equipment and devices having a **lower environmental impact** due to the reduction of plastic consumption in the agricultural sector thanks to the expertise of project coordinator (AIMPLAS)

As a results, the project has developed **new micro irrigation systems with antimicrobial and anti-root properties** which contribute to minimize environmental impacts, improves soil quality and reduce costs.

All these facts make **RIGA results potentially highly acceptable among farmers** thanks to the advantages shown by the **new pipes** in comparison to the existing ones.

For further information

I EC Nº 1107/2009
II 98/8/CE and RD 1054/2002, in the internal layer of co-extruded micro-irrigation pipes.
III Council Directive 1999/31/EC of 26 April 1999 on the landfill of wastes. Official Journal L 182, 16/07/1999 1-19.
IV Water protection and management (Water Framework Directive) //europa.eu/legislation_summaries/environment/water_protection_management/l28002b_en.htm>
V http://europa.eu/legislation_summaries/environment/water_protection_management/l28139_en.htm

RIGA

"Microirrigation plastic pipes and drips with anti-microbial and anti-roots functionalities"

ECO/13/630411

The project has a total duration of 30 months (from July 2014 to December 2016) and a budget of 1,282,647 M€ (EU contribution: 50 %)

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