

RECYCLING OF AGRICULTURAL PLASTICS IN ITALY

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The University of Basilicata

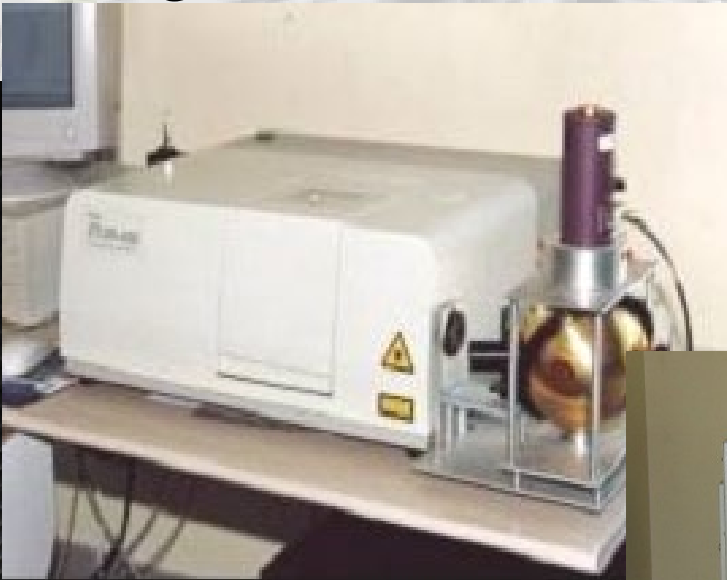
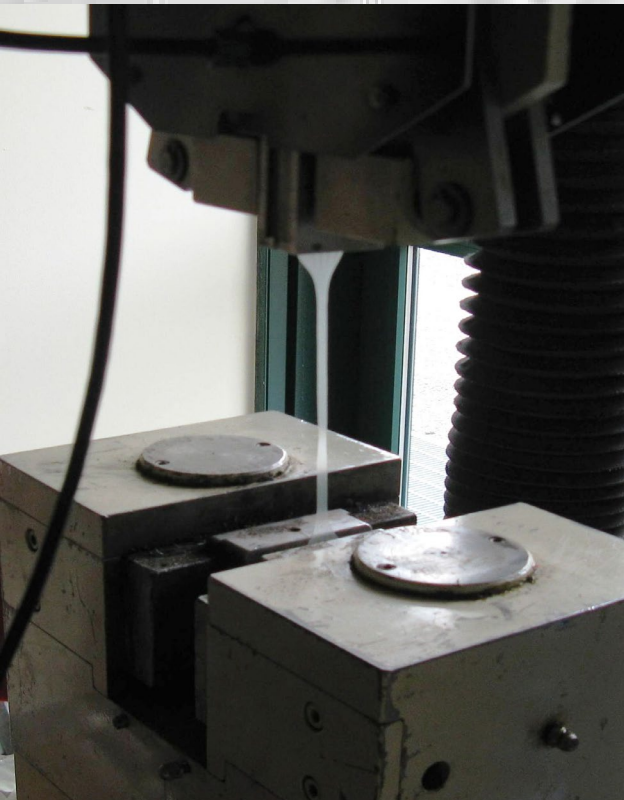
Founded in 1981, the University of Basilicata - a small but dynamic academic reality with its scientific and arts vocation - started its academic activities in 1982.

It is located in Potenza and in Matera (Basilicata Region).



The SAFE School of the University of Basilicata includes laboratories specialized in agricultural plastic material testing.

Spectro-radiometrical analysis



Mechanical testing

Artificial ageing



PLASTIC MATERIALS USED IN THE ITALIAN AGRICULTURE

Plastic materials used in the Italian agriculture

Italy is one of the most plastic-consuming Countries in the European agriculture.

The Italian agriculture makes indeed a wide use of plastic material, mostly films for protected cultivation (greenhouse covering, medium/low tunnel films and mulching films), which contribute to the qualitative and quantitative increase of crop production.

Plastic materials used in the Italian agriculture

Also, temporary coverings of structures for fruit trees, vineyards, and vegetable, ornamental and floricultural cultivations using plastic film and/or nets are widely employed.

Other manufactured plastics are used in the form of irrigation and drainage pipes, silage films, pots for ornamental plants and flowers, nursery containers, soilless culture substrate, bags, containers, *etc.*

Plastic materials used in the Italian agriculture



Plastic materials used in the Italian agriculture

According to most recent estimations, Italy is the most EU Country – together with Spain - as for consumption of plastic material in agriculture, with a *total annual amount of more than 400,000 tons*, which generates a *yearly waste flux of about 250,000 tons* of plastic material.

Plastic materials used in the Italian agriculture

Agricultural application	Covered surface	Consumed plastics	Lifetime	Produced waste
	ha	tons	months	tons/year
Greenhouses and walking-on tunnel films	26,000	54,675	36	18,225
Low tunnel covering films	27,000	29,350	12	29,350
Mulching films	90,000	46,495	12	46,495
Vineyard covering film	12,000	25,000	7	3,571
Nets		5,300	96	663
Silage film, bale wrap film		8,500	12	8,500
Micro irrigation systems	113,000	130,000	24	65,000
PP twine for hay and straw		10,000	12	10,000
Fertilizers sacks		12,000	12	12,000
Pesticide containers		2,500	12	2,500
Semi-rigid sheet Tanks, Pots, Crates, Packaging fresh production Other (pipes for drainage, application for mushrooms, tobacco, cattle, etc.		2,000 10,000 8,000 17,000 32,000 11,000 (80,000)	6 - 36	50,000
TOTAL		403,820		246,304

Plastic materials used in the Italian agriculture

Use	Basic composition	Additives used
Greenhouse film	EVAC; PE-LD; Multi-layers (EVAC/PE-LD/EVAC)	Antifog, Photosensitive, UV stabilizers, Long Infra-red properties enhancer masterbatch.
Low tunnel film	PE-LD; EVAC; PVC	UV stabilizers; Infra-Red properties enhancer.
Mulch film	PE-LD	Coloured pigments; Carbon black
Nursery film	PE, EVAC	Carbon black
Shrinkwrap	PP; PE-HD; PE-LLD; PVC	UV stabilizers
Irrigation tubes, drippers	PE-HD; PVC; GRP	Coloured pigments
Nets	PE-HD; PP	UV stabilizers; coloured pigments
Plastic cover	PE	UV stabilizers; coloured pigments
Containers of agrochemicals (fertilizers) - Heavy duty bags	PE-LD	Coloured pigments
Containers of agrochemicals (pesticide) - Heavy duty bags	PE-LD; PE-HD	Coloured pigments

Crop protection with agricultural plastics in Italy

Agriculture is the most important sector for the application of plastic material as a primary building component.

Within civil and industrial constructions – in which other building materials (*i.e.*, bricks, concrete, steel, wood, *etc.*) are more widespread – the use of plastic material is limited to complementary applications, as window or door frame, as well as flooring, insulating or facing covers.

Crop protection with agricultural plastics in Italy

Employed as a covering material in protected cultivation, plastic plays a central role, by performing a passive effect – protecting the crops from negative weather conditions – and, at the same time, an active effect, realizing a more favorable environment for the cultivation.



Crop protection with agricultural plastics in Italy

Region	Greenhouse (tons)	Middle/low tunnel (tons)	Covering vineyard * (tons)	Mulch (tons)	Total (tons)
Piedmont	977	528	0	326	1.831
Trentino Alto Adige	230	120	0	52	402
Lumbarby	3.080	3.932	0	1.027	8.039
Friuli Venezia-Giulia	345	96	0	68	509
Veneto	3.358	3.760	0	1.119	8.237
Liguria	805	288	0	195	1.288
Emilia-Romagna	2.875	4.152	0	3.200	10.227
Tuscany	2.185	960	0	540	3.685
Marche	1.334	600	0	310	2.244
Umbria	575	240	0	160	975
Latium	7.634	3.120	450	3.100	14.304
Abruzzo	780	600	1.050	195	2.625
Molise	85	54	20	0	159
Campania	8.520	3.040	90	5.725	17.375
Apulia	1.950	2.920	13.000	20.100	37.970
Basilicata	563	1.020	1.160	198	2.941
Calabria	713	360	200	250	1.523
Sicily	18.166	3.370	9.000	9.800	40.336
Sardinia	500	190	30	130	850
TOTAL	54.675	29.350	25.000	46.495	155.520



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ZONE	GREENHOUSE FILMS	MULCHING FILMS	NET (hail net)
Trapani	543	2.500	29.700
Agrigento	302	2.350	22.000
Caltanissetta	1.146	1.500	5.500
Ragusa	4.800	3.250	6.100
Siracusa	1.360	2.500	5.600
Total hectares	8.151	12.100	68.900

The most used typologies of plastic material are:

Greenhouses and tunnel films (vegetables, flowers, ornamental plants, orchards);

Mulching films (vegetables);

Hail net (orchards and vineyards);

Irrigation pipes and haul drip;

Heavy duty bags (fertilizers and pesticides);

Alveolar containers and Packaging.

Recycling of Agricultural Plastics in Italy



ZONE	GREENHOUSE FILMS	MULCHING FILMS	COVERING (to force)
Foggia	0	3.700	975
Bari A	637	0	0
Bari B	0	4.850	1.230
Taranto	0	5.800	1.080
Brindisi	0	5.950	1.005
Lecce A	480	5.500	0
Lecce B	0	4.500	1.500
Lecce C	550	3.200	0
Total hectares	1.667	33.500	5.790

Main cultivations:

Table grapes, Flowers, Vegetables, Orchards, Tomato, artichoke.

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ZONE	GREENHOUSE FILMS	MULCHING FILMS	NET (hail net)
Caserta	632	632	31.018
Napoli	3.253	3.000	24.225
Salerno	876	2.800	3.286
Total hectares	4.761	6.432	58.529

Main cultivations are:

CASERTA Asparaguses, strawberries, tomato - (protected cultivations) Processing tomato, tomato, other vegetables, orchards - (full air)

NAPOLI Flowers and ornamental plants, asparaguses, tomato, other vegetables -(protected cultivations) Vegetables, processing tomato, tomato, flowers and ornamental plants, orchards

SALERNO Tomato, other vegetables, flowers and ornamental plants - (protected cultivations) Processing tomato, tomato, vegetables, orchards - (full air)

Recycling of Agricultural Plastics in Italy

Typology	Polymer	Amount (ton/ha)	Interest ed surface (ha)	Total amount (tons)
Greenhouses films	CoPE	1,9	500	950
Mulching films	PE	0,7	2,500	1750
Hail net	-	-	-	-
Irrigation pipes	PE (for a term of three years)	0,06	10,000	600
Irrigation haul drip	PE (for a term of two years)	0,03	10,000	300
Heavy duty bags (fertilizers)	PE sacks (from 50 kg) for sowable land	0,003	15,000	45
	PE sacks (from 50 kg) for orchards	0,002	3,000	6
	PE sacks (from 50 kg) for vegetables	0,003	3,000	9
Heavy duty bags (pesticides)	Plastic for orchards	0,003	3,000	9
	Plastic for vegetables	0,001	3,000	3
Washed empties	Plastic for sowable land	0,0005	12,000	6
	Plastic for orchards	0,003	3,000	9
	Plastic for vegetables	0,001	3,000	3
Alveolar containers	-	-	-	-
TOTAL Emilia-Romagna				3,717

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RECYCLING AGRICULTURAL PLASTICS IN ITALY THE «*POLIECO*» CONSORTIUM

Recycling agricultural plastics in Italy the «*Polieco*» Consortium

The collection, transportation and recycling of polyethylene-based materials – *i.e.*, most of the agricultural plastic materials – is governed in Italy by the Law Decree n. 22 dated 1997 (so-called “*Ronchi*” Decree), which has implemented relevant UE Directives in environmental matters, that aligned the Italian legislation with EU requirements.

The “*Ronchi*” Decree has created the National Consortium “*Polieco*”, that has the primary objective of promoting collection, re-use, recycling and re-utilisation of polyethylene.

Recycling agricultural plastics in Italy the «*Polieco*» Consortium

The companies obliged to join the Consortium as Ordinary Members are:

- producers and importers of raw materials intended for the manufacture of polyethylene products (category A);
- manufacturers and importers of polyethylene products (category B);
- companies recycling and recovering polyethylene waste (category C);
- companies recycling polyethylene waste (category D);
- companies re-utilising polyethylene waste (category D).



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Collection operation



Recycling agricultural plastics in Italy the «*Polieco*» Consortium

Polieco estimates a total amount of agricultural plastic waste equal to around 170,000 tons/year. It declares to collect, transport and recycle *only a part – about 50% - of the whole quantity of Agricultural Plastic Waste (APW)*.

A direct consequence is that, unfortunately, the flux of agricultural plastic waste is currently managed not always in a proper way.

Indeed, the abandonment and burning are unfortunately practices still frequently in use in Italy, although they are against the law.



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CONSEQUENCES:

- ✓ severe and diffuse pollution and degradation of the landscape and environment, damages for vulnerable areas that are very often characterized by natural beauty and attractive tourist sites;
- ✓ risk for domestic and wild animals;
- ✓ obstruction to the natural water flow;
- ✓ exhaustion of landfills causing environmental and economic impacts.



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PRACTICES	CONSEQUENCES
Burying in the fields	<ul style="list-style-type: none">• qualitative degradation of the soil;• irreversible contamination of the soil;• potential threat for the safety and quality of food produced on these areas
Burning in the open field and in uncontrolled sites	<ul style="list-style-type: none">• release of harmful substances, such as CO₂, CO, H₂S, SO₂, NH₃ and dioxin, in higher quantity per mass of material burned than the emissions from controlled incineration because this quantity is completely introduced in the atmosphere;• release of combustion residues harmful to human and animal health through direct exposure - inhalation or dermal contact - or indirect - ingestion of plants or animals food contaminated, as well as polluting the soil and groundwater.



IMPROVING THE RECYCLING OF AGRICULTURAL PLASTIC WASTE

Improving the recycling of agricultural plastic waste

Suitable strategies to reduce agricultural plastic waste pass through:

- the increase of the lifetime duration of the materials by means of additives and proper applications and installation;
- the reduction of the material thickness;
- the introduction and promotion of the use of bio-based materials as alternative to the traditional plastic films produced with fossil raw resources;
- the *transformation of this valuable material into a new commodity*, in the framework of a circular economy approach.

Improving the recycling of agricultural plastic waste

Some scientific and technical projects have recently afforded the issue about an environmentally sound and economically profitable system for the collection, transportation and disposal of Agricultural Plastic Waste in Italy, ***transforming the plastic waste into a new secondary material, through its mechanical recycling.***

Improving the recycling of agricultural plastic waste

Aspects related to a rationalization in the management system of agricultural plastic waste have been the subject of three European-funded Projects:

LABELAGRIWASTE – RTD 6th Framework Programme –
CRAFT Collective research (www.labelagriwaste.aua.gr)

AGROCHEPACK – European Territorial Cooperation
Programme MED (www.agrochepack.aua.gr/)

AWARD – European Territorial Cooperation Programme
Greece-Italy (www.award-project.eu/)

Plastic materials used in the Italian agriculture

The main results of these projects have proposed the implementation of some suitable tools (GIS) at national/international scale.

This tool enables to investigate different development scenarios, as well as to consider new planning strategies for APW management.

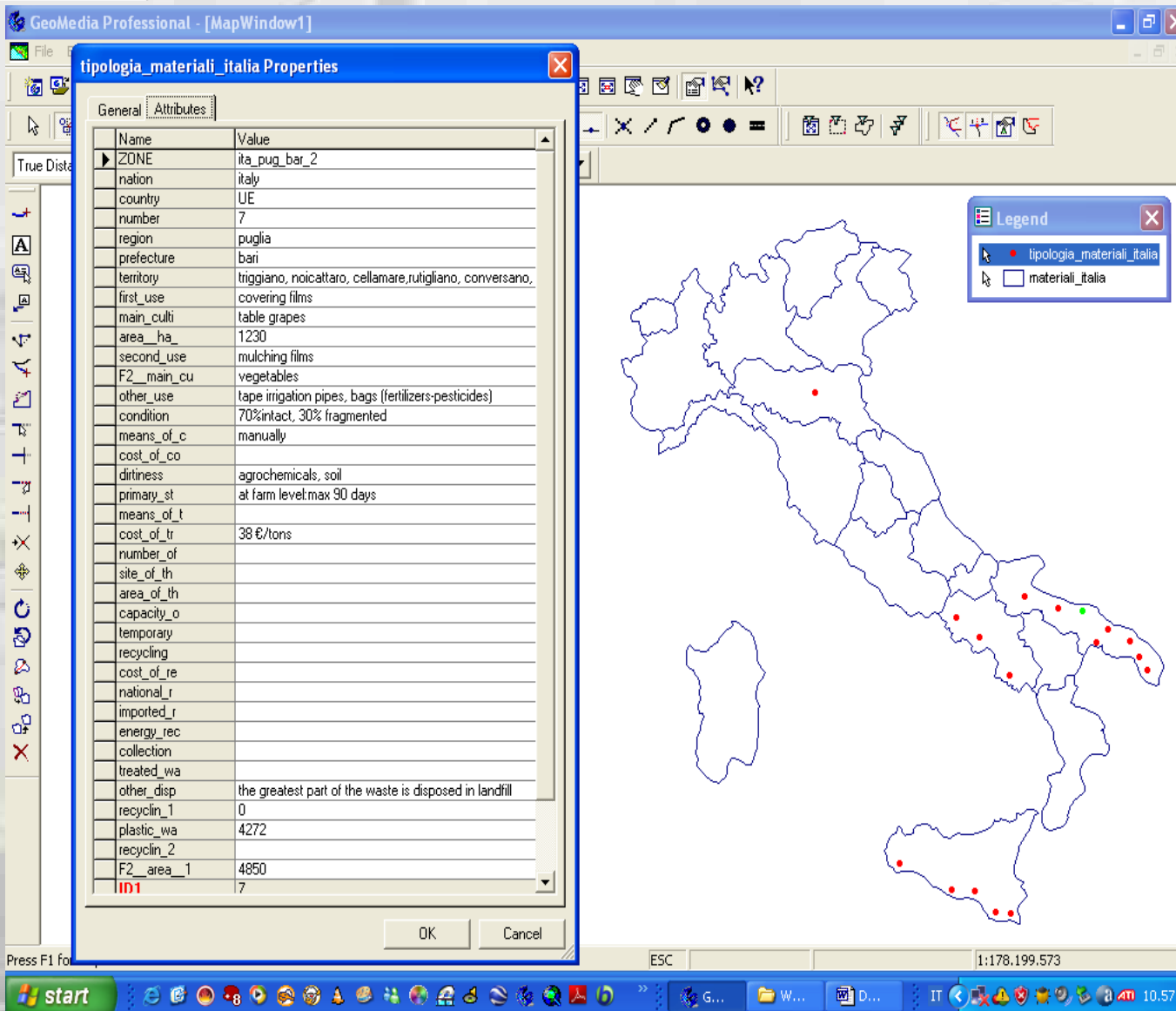
The results of these researches may offer new opportunities for recycling agricultural plastics in Italy and Europe.



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Plastic polymers	Final use
LDPE	greenhouses, tunnels, small and medium tunnels, mulching, storage
LLDPE	mulching
HDPE	Pesticide containers
EVA	greenhouses, tunnels
PVC	Rigid sheets for greenhouses, tunnels
PS	containers, vases
PP	mesh, packaging fresh products, string, chords

This presentation about recycling agricultural plastics in Italy is a part of the relevant entry of the “*Encyclopedia of Polymer application*”, which has been published in 2018 by Taylor & Francis.



***Thank You
for Your attention!***

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