Agriculture

LDPE / EVA / EBA / mLLDPE / HDPE / PP

REPSOL

REPSOL PORTFOLIO FOR AGRICULTURAL APPLICATIONS

MB PE, LDPE, EVA, EBA, mLLDPE, HDPE, PP

Repsol Alcudia	**[PE]** Agricultural masterbatches
Repsol Alcudia Repsol Primeva® Repsol Ebantix® Repsol Resistex®	**[LDPE/EVA/ EBA/ mLLDPE]** Greenhouses, double chamber, tunnel, mulch silage, agricultural stretch film, silo bag disinfection and solarisation
Repsol Alcudia	**[HDPE]** Shading net, frost protection, cover net
Repsol Isplen	**[PP]** Frost blanket, netting and twines, raffia

AGRICULTURAL MASTERBATCHES

REPSOL ALCUDIA - AGRICULTURAL MASTERBATCHES

UV/AO Masterbatch

Grade	Additives	Recommended dosage	Thickness µm	TGLV EN 13206 [%]	Haze ASTM D-1003 [%]	Applications
IMB UV2120/5	Hals, UV absorbers, antioxidants	5% for 2 agricultural seasons 160 kLy	180	90	22	Greenhouses and tunnels
IMB UV2130/6	Hals and other additives	6% for 2 agricultural seasons 160 kLy	180	90	40	Greenhouses and tunnels
117/TD	Nickel quencher (green), UV absorbers, AO	7% for 2 agricultural seasons / 10% for 2 years 160 kLy	180	90	22	Greenhouses and tunnels
IMB UV2000	Hals	6% for 3 agricultural seasons / 6.5% for 4 agricultural seasons 2000ppm sulphur 100 kLy	200	92	8	Greenhouses and tunnels
IMB UVH3A IMB UV3020	Hals, UV absorbers, AO	5.5% for 3 years 2000ppm sulphur/ 6.5% for 3 years 3000ppm sulphur 160 kLy	200	92	17	Greenhouses and tunnels

*AO - Antioxidants

REPSOL ALCUDIA - AGRICULTURAL MASTERBATCHES

UV Masterbatch for agricultural and industrial applications

Grade	Additives	Recommended dosage	Application
IMB UVSTRETCH	Hals	2-4% agricultural stretch film 1-3% mulch 1-2% industrial film	Cover hay bales Mulching Industrial film Silage
IMB FI1A	Hals	0.7-2% shrink film 2-5% stabilisation silo bags	Shrink film Silo bags

REPSOL ALCUDIA - AGRICULTURAL MASTERBATCHES

Thermal and antidrip MB

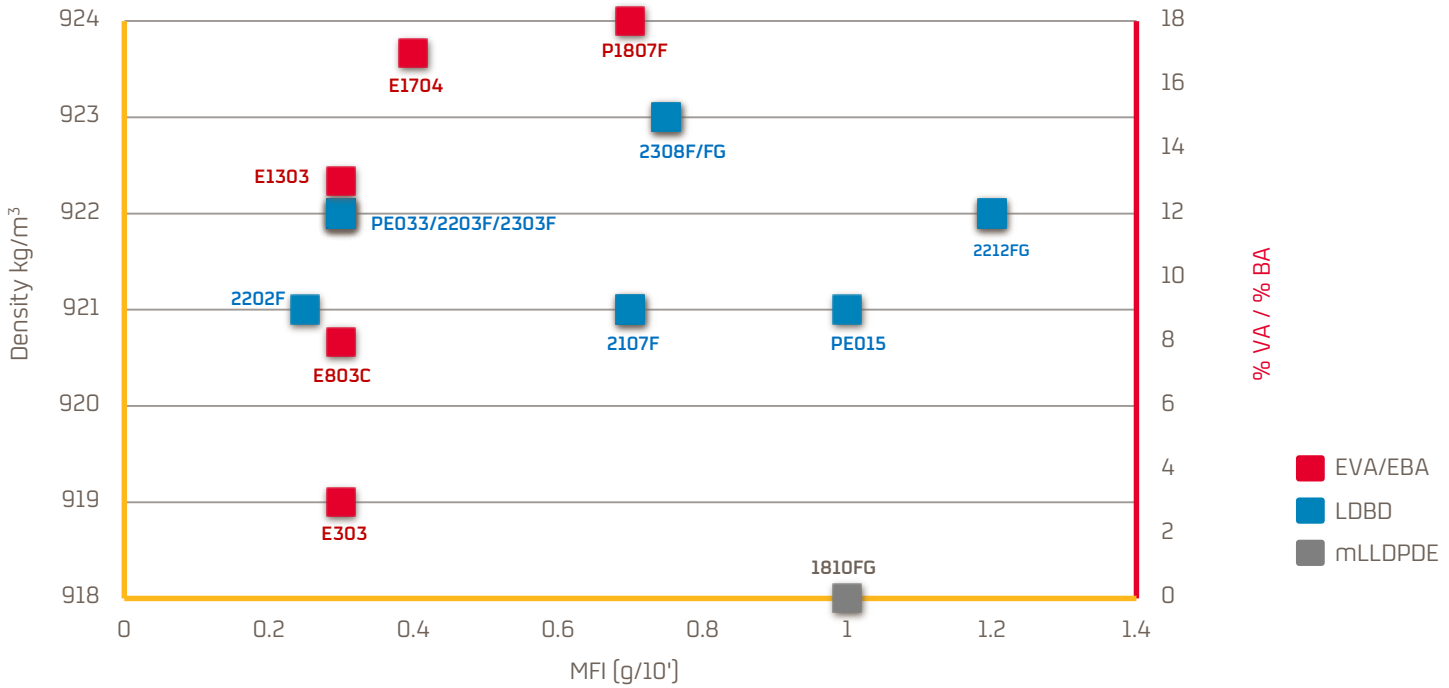
Grade	Property	Additives	Recommended dosage	Application
IMB TERMIC	Thermicity	Mineral fillers	4% for thermicity 80% in EVA > 5% AV	Greenhouses, tunnels and mulching
IMB CARGA	Thermicity	Mineral fillers	3% for thermicity 80% in EVA > 5% AV	Greenhouses, tunnels and mulching
IMB TERMICLARO	Thermicity	Mineral fillers	8% for thermicity 80% in EBA > 3% AB	Greenhouses, tunnels and mulching
IMB TER60	Thermicity	Mineral fillers	6% for thermicity 80% in EBA > 3% AB	Greenhouses, tunnels and mulching
IMB AGCD	Antidrip	Antidrip additive and HALS	5% for 200 microns; 7.5% for 50 microns	Greenhouses and double chambers

BLOWN FILM

- Repsol Alcudia
- Repsol Resistex®
- Repsol Primeva®
- Repsol Ebantix®

BLOWN FILM

LDPE / Repsol Primeva® / Repsol Ebantix®/ Repsol Resistex®



FILMS APPLICATIONS

The polymer

LDPE

Advantages

- The most used for durations less than 3 Agricultural Seasons
- Good mechanical properties
- Greater creep resistance
- Cost

Disadvantages

- Less transparency
- Less thermicity
- Less photostability

EVA/EBA

Advantages

- The most used for durations longer than 2 Agricultural seasons
- High photostability
- Optical properties
- High thermicity
- Mechanical properties

Disadvantages

- Low creep resistance
- Greater dust accumulation
- Cost

FILMS APPLICATIONS

Polymer properties

Property	LDPE	mLLDPE	EVA	EBA
Photostability	+ +	+ +	+++	+ ++
Transparency	+	+++	+++	++
Thermicity	–	–	+++	++ +
Mechanical properties	++	+++	+++	+++
Creep	+++	++	+	+ +
Sealability	+++	+++	+++	+++
Extrusion (Wider blowing)	+++	++	+++	+++

EVA: Ethylene copolymer + vinil acetate (9 %)
EBA: Ethylene copolymer + butil acrylate (5.5 %)

(+++) optimal; (++) good; (+) medium; (–) insufficient

GREENHOUSES

Structures Recommendations

Below there are some examples of structures and formulations, **although it is recommended to contact the technical service to obtain the most appropriate recommendations** in each particular application.

GREENHOUSES

What are its advantages?

- Crops out of season
- It allows to establish the most suitable climatic conditions for each crop
- Greater protection and/or control against extreme weather conditions
- Precocity in production
- Higher productions and better quality
- Greater control over pests, weeds and diseases
- More efficient use of productive resources

GREENHOUSES

What properties are sought?

MECHANICAL:

- Tensile strength
- Tear resistance
- Impact resistance
- Creep resistance

DURATION:

- High stability against UV radiation
- Resistance to phytosanitary chemicals

RADIOMETRIC:

- Maximize PAR transmission
- Control the IR transmission
- Filter and transform UV, NIR, MIR, FIR radiation

GREENHOUSES

Thermal covers

DIFFUSER THERMALS:

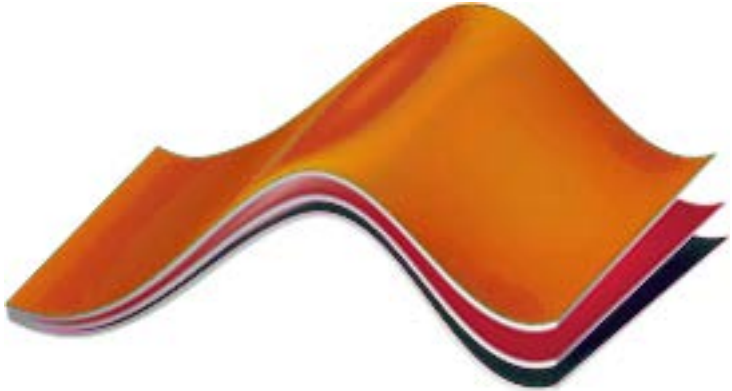
- They are suitable for Mediterranean climate zones (low cloudiness, high irradiation and low rainfall)
- Avoid shadows inside the greenhouse
- They are based on mineral charges with the best IR block and light diffusion
- They are not prodegradant

CLEAR THERMALS:

- They are preferred in areas of wetter climate
- The diffuse component of global solar radiation is the majority because of the high cloudiness
- They are based on “transparent” mineral fillers
- They are not prodegradant

GREENHOUSES

Repsol formulation proposal



It is recommended the use of Repsol Resistex® 1810F/FG mixed with the LDPE and EBA grades to improve mechanical properties and temperature resistance in areas of contact with the greenhouse structure.

THERMAL

A: E303 + UV MB*

B: E803 o E1303 + UV MB* + Thermal MB**

A: E303 + UV MB*

NOT THERMAL

A: 2303F/PE033/2203F + UV MB*

B: 2303F/PE033/2203F + UV MB*

A: 2303F/PE033/2203F + UV MB*

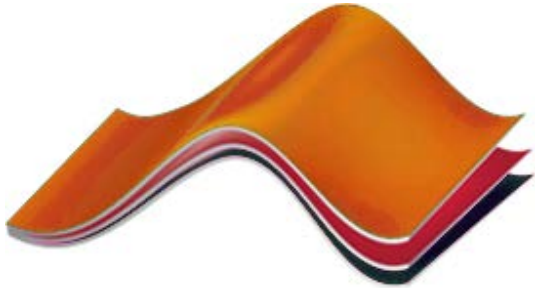
** Select the type of UV MB and dosage based on duration, UV radiation, thickness and exposure to contaminants such as sulphur, chlorine, etc.*
*** For diffuse thermal films, dose IMB CARGA or IMB TERMIC; for clear thermal films dose IMB TERMICLARO*

DOUBLE CHAMBER

Repsol formulation proposal

The double chamber is a passive heating technique. It consists of a plastic sheet that divides the greenhouse into two chambers - lower and upper - with the aim of increasing the accumulated heat during the day in the lower one and slowing down the loss of this heat during the night. (*)

- Increase in minimum night temperature
- Reduction of temperature and relative humidity oscillations, combined with adequate ventilation management during the day.
- Elimination of drip on the crop.



A: 1810FG

B: 2212FG or E303 + 7.5% IMB AGCD*

C: 1810FG or E303 + 5% IMB AGCD*

(*) IMB AGCD: Antidrip + HALS

TUNNEL

Requirements and advantages

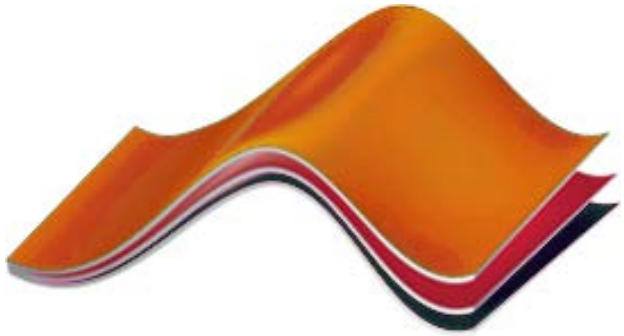
The tunnel is a technique that protects crops from the moment of sowing until the time of harvest. They are used for crops of high commercial value such as strawberries, raspberries and blueberries.

The main advantages associated with the use of this type of structure, among others, can be classified into advantages of structure, protection, management and production:

- Ease of installation, maintenance and assembly
- The crop is protected from adverse weather conditions
- Higher crop yield and quality

TUNNEL

Repsol formulation proposal



A: E303 + 2-4 % MB HALS*

B: E1303 + 2-4 % MB HALS*

A: E303 + 2-4 % MB HALS*

** Ex: Film 100 microns, 160 kLy, 2 winters:*

- *4% IMB UV2130 / 6 for high diffusion*
- *3.5% IMB UV2120 / 5 for medium diffusion*
- *2.5% IMB UV2000, for high transparency*

SILAGE, AGRICULTURAL STRETCH FILM, SILOBAG

Requirements and advantages

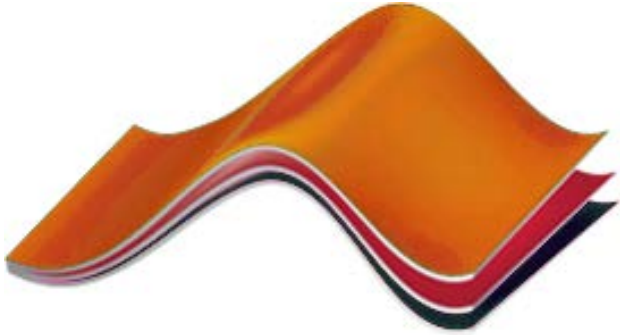
They are forage conservation processes, which allow the producer to store the product in their own field, thereby reducing uncertainty and the risks of not being able to have an adequate storage and transportation place, before marketing.

The properties sought in the plastic are:

- To preserve the forage of light, water and air.
- During its period of use, the forage is kept in optimal condition.
- Avoid fermentation of stored grass for cattle.

AGRICULTURAL STRETCH FILM

Repsol formulation proposal



A: MF1810F + 50-70 % P1820F/P1807F + 20 % PIB + 2-4 % IMB STRETCH*

B: P1820F/P1807F + 2-4 % IMB STRETCH*

C: MF1810F + 10-20 % 2308F + 2-4 % IMB STRETCH*

**Dosage depending on thickness*

MULCHING

Requirements and advantages

What is it?

- It is a technique that involves covering the soil to protect the crop from atmospheric agents and promote better results in our crops.
- It can be applied in horticultural crops such as: eggplant, watermelon, zucchini, melon, tomato, strawberry, lettuce, broccoli, pepper, etc.

What requirements should plastics have?

- Good mechanical properties, must be resistant to:
  - Strength
  - Tear
  - To the impact of very low temperatures
  - To stretching (elongation)
- Thermicity in certain geographical regions

What are the advantages?

- Increase soil temperature by retaining heat
- Precocity in production due to the increase in soil temperature
- Good mechanical properties
- Increase the performance of fertilizers and irrigation water
- Reduce the presence of weeds

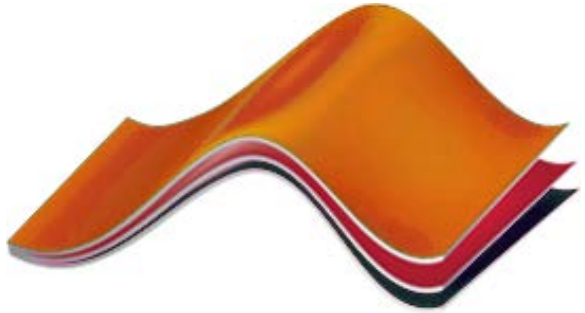
MULCHING

Repsol formulation proposal

Thermal mulching

- It is recommended the use of Repsol Ebantix® EBA copolymers to increase film thermacity and the use of Repsol Resistex® mLLDPE grades to meet mechanical property requirements.

- The IMB UVStretch is recommended for UV protection.



A: 1810FG + 1-3 % IMB UVSTRETCH
B: E1303 + PEBD + 1-3 % IMB UVSTRETCH
C: 1810FG + 1-3 % IMB UVSTRETCH

DISINFECTION AND SOLARISATION

Requirements and advantages

What is it?

- Chemical disinfection: it is the disinfestation of the soil through chemical agents. Films are required to protect the cover from the action of pesticides.
- Solarisation: this is the disinfestation of the soil by means of the heat generated from the captured solar energy and is carried out in the hottest months. A thermal and drip film is required to increase the temperature in order to kill the pathogenic microorganisms.
- Mixed: uses the technique of chemical disinfection, taking advantage of high ground temperatures.

DISINFECTION AND SOLARISATION

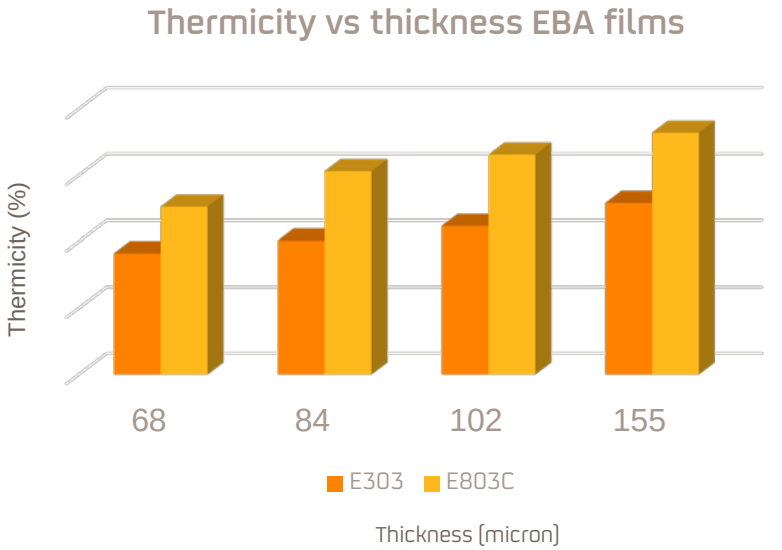
Repsol formulation proposal

Solarisation by temperature

Structure	Materials
A/B/A LDPE/EBA/LDPE	A*: Repsol Ebantix® E303 + Repsol Resistex® 1810F/FG B*: Repsol Ebantix® E1303 *It is recommended to add 1% of IMB UV2120/5 for UV protection

Disinfection with chemical agents

Structure	Materials
A/B/C/B/A PE/tie layer/EVOH/tie layer/PE	A: 2308F or Repsol Resistex® 1810F/FG for less haze B: Not available in Repsol C: Not available in Repsol

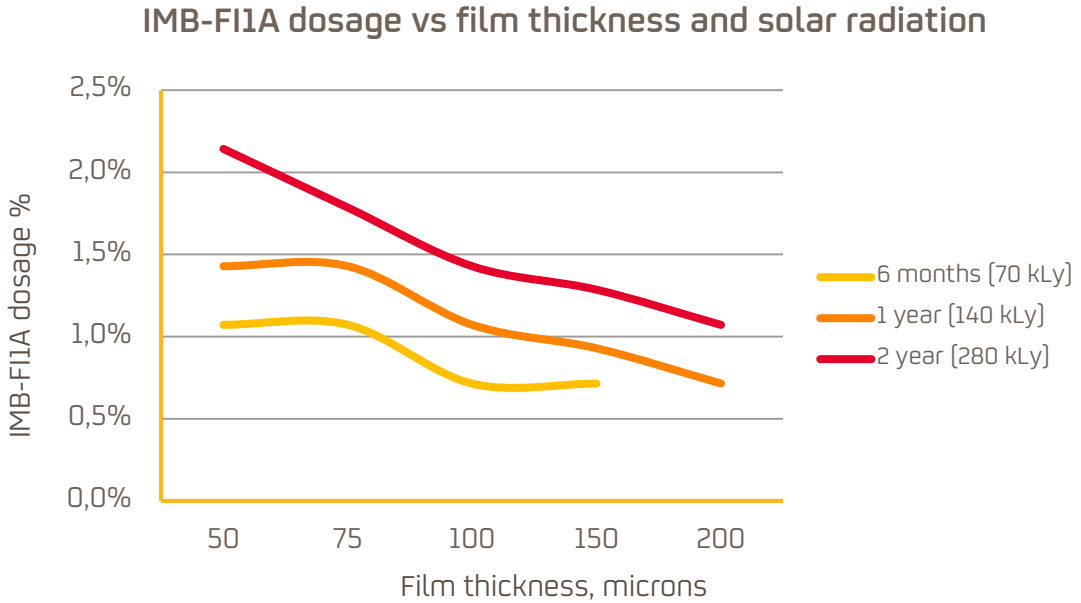


*BA: Butyl Acrylate

SHRINK FILM AND STRETCH HOOD

UV MB

For a 130 micron industrial film exposed during 1 year and with 150 kLy radiation, it is recommended to dose 1.3% of the IMB FI1A.



- These concentrations are recommended for film applications not exposed to prodegradant agents. Some pollutants such as sulphur, chlorine and other chemicals used in the field can affect the stabilizing action of this MB due to its prodegradant effect.
- In this case, it will be necessary to reinforce the additivation or to use another type of UV MB specific resistant to this type of contaminants, such as the IMB UV2000 grade.

REPSOL ALCUDIA HDPE

REPSOL ALCUDIA HDPE

Raffia: fibers, monofilaments, nets, cordage

POLYETHYLENE TECHNICAL TEXTILES

	Melt Flow Index ISO 1133g/10' 190º C 2.16 kg	Density ISO 1183/kg/m^3	PDI	Properties	Applications
R4805EP	0.55	948	Medium	Low fibrillation, high tensile strength at break, easy processing	Blown film for stretched tapes: fabrics, nets and twines
R4805D1	0.55	948	Medium	Low fibrillation, high tensile strength at break, easy processing	Blown film for stretched tapes: fabrics, nets and twines
R4806HT	0.60	948	Narrow	Low fibrillation, high tensile strength at break and toughness, easy processing	Blown film for stretched tapes: fabrics, nets and twines
M5204	0.45	952	Narrow	Highest toughness, high stretching ratio	Monofilaments for very high strength ropes
M5206	0.60	952	Narrow	Very high toughness	Monofilaments for very high strength ropes
M5305	0.50	953	Medium	High toughness	Ropes and twines
M5309	0.95	953	Medium	Medium toughness, soft yarns	Monofilaments for fabrics (netting and twines)

RAFFIA AND MONOFILAMENT

Requirements and advantages

- Shading Net: reduce direct sun radiation that damages plans. Reduce irrigation requirements.
- Greenhouses net: these nets control the light getting through, allowing advantages for pest control. Anti-insect net: acts like a barrier against trips, whitefly, aphids and other small size insects.
- Anti-hail net: fabrics with optimize mechanical properties that protect the crops against hailstorm.
- Anti-birds net: protect fruit trees, seedlings and vineyards from the attack of birds.
- Anti-weeds net: these textiles have a good resistance and easy to install. They prevent the growth of weeds by not enter the sunlight to the soil.

REPSOL ISPLEN PP

GRADOS REPSOL ISPLEN PP FOR RAFFIA

Strapping – raffia – monofilaments - twines

	Type	Melt Flow Index ISO 1133g/10' 230º C 2.16 kg	Flexural modulus of elasticity ISO 178 MPa	Tensile strength at yield ISO 527 MPa	Izod impact strength notched ISO 180/A kJ/m² 23º C	Application
HOMOPOLYMER						
PP020G3E	PPH	1	1350	34	5.5	Strapping
PP030G1E	PPH	1.7	1350	34	5	High toughness raffia and monofilaments for netting and twines
PP031G1E	PPH	2	1400	35	5	High toughness raffia and monofilaments for netting and twines
PP040G1E	PPH	3	1450	35	4.5	High toughness raffia and monofilaments for netting and twines

REPSOL ISPLEN PP HIGH MFI HOMOPOLYMER

Multifilament – nonwoven

	Type	Melt Flow Index ISO 1133g/10' 230º C 2.16 kg	Flexural modulus of elasticity ISO 178 MPa	Tensile strength at yield ISO 527 MPa	Izod impact strength notched ISO 180/A kJ/m^2 23º C	Application
HOMOPOLYMER						
PP050Y1E	PPH	5.5	1550	35	-	High tenacity staple fiber, monofilament, BCF/CF, geotextiles.
PP086Y3E	PPH	25	1600	36	-	Multifilament, hygiene nonwoven, BCF/CF.
PP086U6E	PPH	25	1600	36	-	Multifilament, hygiene nonwoven, BCF/CF, UV protection.
PP089Y1E	PPH	30	1650	36	-	Last generation spunbond lines, BCF/CF, staple fibre, hygiene nonwoven.

FROST BLANKET

Requirements and advantages

What is it and which are its advantages?

It is light textile sheets designed to be used directly on the crop. It is used during the first few weeks after the transplant. This type of fabric extend the growing season and protect plants from cold outdoor temperatures and other environmental threats such as fungal spores, wind, and precipitation.

Its advantages are:

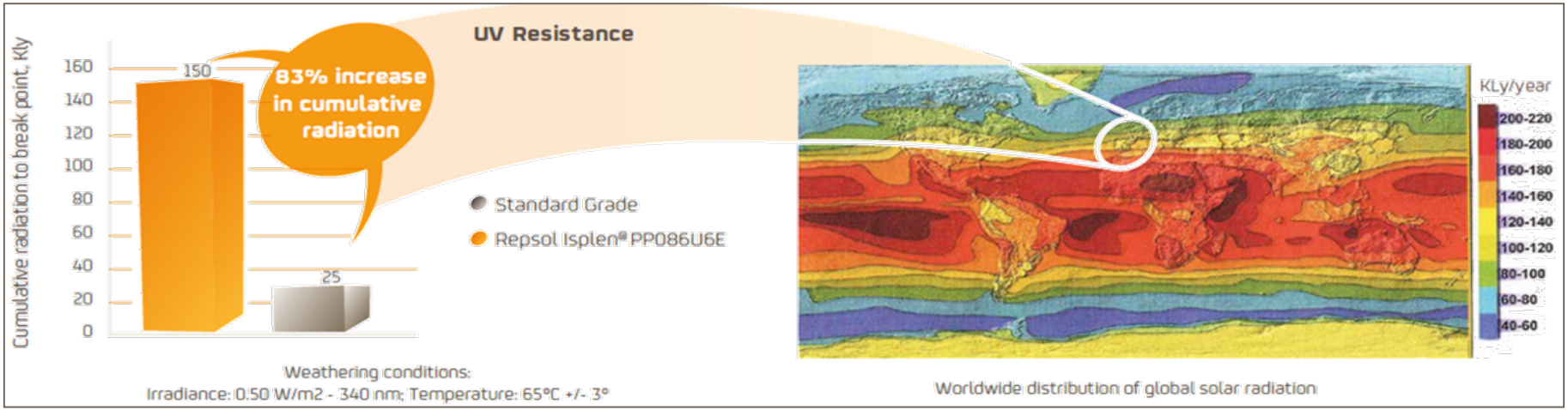
- Increase temperature between 3º to 4ºC
- Avoid frost, protecting the state of the crop
- Sun protection
- Allows ventilation in crops
- Protect crops against insect attack

FROST BLANKET

Repsol formulation proposal

Repsol recommends **Repsol Isplen PP086U6E** to produce frost blankets (woven non woven)

- With stability and extra resistance to UV radiation, even in high radiation areas
- Maximum resistance and durability outdoors



ALL OUR POLYOLEFINS ARE RECYCLABLE