NUREL BIOPOLYMERS

inzea® BIOPOLYMERS

AGRICULTURE SOLUTIONS

THE SUSTAINABLE CHOICE

INZEA® BIOPOLYMERS FOR AGRICULTURAL APPLICATIONS

INZEA® biopolymers range offers multiple options for the agricultural sector to transition from the use of conventional plastics towards the use of **sustainable biodegradable solutions**. These biodegradable biopolymers can directly **replace conventional plastics without** the need to **change agricultural equipment**.

MULCH FILM

Certified biodegradable materials for mulch films that **integrate into the soil** after use, **reducing labor** and **waste management** costs while **maintaining crop protection** and **soil health**.

TWINES

Biodegradable twines and plant supports that **decompose together** with crop residues, **eliminating waste separation** and streamlining composting processes.

CLIPS & FASTENERS

Sustainable clips and fastening elements made from INZEA® biopolymers, designed for plant guiding and support, offering mechanical performance with **full soil biodegradability**.

TESTS & CERTIFICATIONS

DIN CERTCO Biodegradable in SOIL (For mulch film grades)

This certification guarantees that the material is **biodegradable in natural soil** without harming the environment. Based on Din Certco protocol aligned with **EN 17033**, it confirms that the product:

- Achieves **90% biodegradation in soil within 24 months**.
- Leaves **no toxic residues** or harmful effects on plants neither earthworms.
- Passes strict **eco-toxicity and chemical safety tests**.
- Does **not inhibit** soil **nitrification**.

TÜV Austria OK Biodegradable SOIL (For mulch film grades)

Is a certification label that guarantees a product's complete biodegradability in natural soil conditions. It ensures that the material will break down in the soil without leaving toxic residues or causing environmental harm, according to strict test criteria:

- Achieves **90% biodegradation in soil within 24 months**.
- Leaves **no toxic residues** or harmful effects on plants.
- Passes strict **eco-toxicity and chemical safety tests**.
- Does **not inhibit** soil **nitrification**.

TÜV Austria OK compost INDUSTRIAL

Guarantees that a material is **compostable in industrial composting facilities** under controlled conditions. It is based on the European standard **EN 13432**, recognised for industrial compostability.

- **≥ 90 % biodegradation** within **6 months at 58±2°C with a 50-60% RH.**
- **Disintegration:** less than 10% of fragments >2 mm after 12 weeks.
- **No negative impact** on final compost quality (eco-toxicity, plant growth).
- **Heavy metal and chemical safety limits** must be respected.

SimaPro

LIFE CYCLE ASSESSMENTS:

NUREL calculates product carbon footprint of all our products using **SimaPro software**, in accordance with the most recognized international standards.

WHY CHOOSE INZEA® FOR AGRICULTURE?

INZEA® offers **bio-based solutions for agriculture** that combine **certified biodegradability** with **excellent agronomic performance**. Designed to integrate into existing farming systems, INZEA grades are compatible with **conventional machinery** and help **reduce environmental impact without compromising operational efficiency**.

BIODEGRADABILITY STANDARD

Compliant with EN17033 and EN13432.

DIRECT REPLACEMENT

Can replace conventional plastics in various applications without equipment changes.

WASTE DISPOSAL

It does not generate plastic waste at the end of the crop; Films can be ploughed into the soil along with the harvest.

COST REDUCTION

Substantially lowers labor costs by removing the need for plastic waste collection and disposal.

NO MICROPLASTICS

Fully biodegradable; no plastic waste left after the crop cycle.

SOIL ENRICHMENT

Once composted, INZEA returns biomass to the soil, enhancing its organic content and closing the natural cycle.

MULCH FILM

INZEA® offers certified biodegradable biopolymers for mulch films specifically developed to address modern agricultural and environmental challenges. These films help **prevent plastic leakage** and the accumulation of microplastics in soil, **minimizing plastic waste** at its source.

Unlike conventional plastics, INZEA® biopolymers biodegrade directly in the field **without leaving residues**. Certified under EN 17033 and TÜV AUSTRIA OK biodegradable in SOIL, they preserve topsoil integrity and contribute to improve soil health.

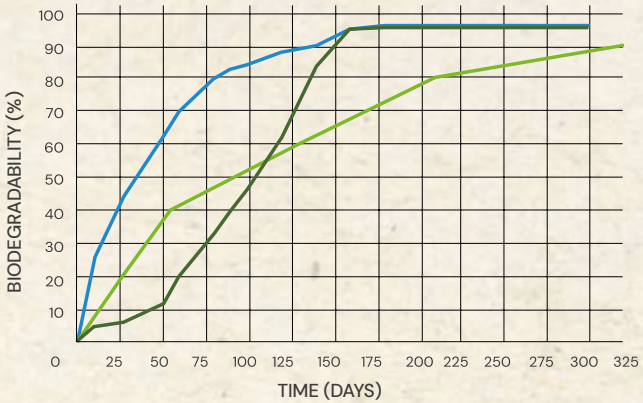
INZEA biopolymers fully **deliver proven agronomic performance**. They are compatible with **conventional machinery**, ensuring **efficient crop protection**, while **maintaining soil temperature** and **moisture levels** comparable to traditional films.

As a **cost-effective solution**, that helps to **reduce labor**, **time,** and **waste management** by eliminating the film retrieval after harvest.

Discover our full range of biodegradable mulch film grades

LIFE CYCLE OF BIODEGRADABLE MULCH FILM

CERTIFIED SOIL BIODEGRADATION



INZEA® grades developed for agricultural mulch films are **certified to meet the EN 17033 standard**, which ensures that the films **biodegrade efficiently in soil** without causing **any environmental harm**.

INZEA® offers two biopolymer grades specifically developed for agricultural mulch films, both certified soil biodegradable.

- CELLULOSE
- F08M
- F09M

SOIL OK bio-degradable TÜV AUSTRIA SOIL S0436

BIODEGRADABLE IN SOIL DIN Geprüft

TWO GRADES ADAPTED TO YOUR NEEDS

INZEA offers **two distinct biopolymer grades** for agricultural mulch film, each tailored to the **specific moisture requirements of different crop**, **climates**, and **regions**.

Thanks to their outstanding adaptability to **humidity and environmental conditions**, these **biodegradable in soil** certified materials enable efficient in-field biodegradation. After harvest, the films can be **incorporated directly into the soil**, enhancing its quality while **eliminating plastic waste** and **simplifying post-crop management**.

INZEA® BIOPOLYMERS

INZEA F08M [1, 2]
Highly moisture resistant and durable, suitable for long-cycle crops and humid climates
Example: Cucumbers in Poland.

INZEA F09M [1]
Suitable for short-cycle crops and moderate humidity conditions.
Example: Tomatoes and lettuces in the Mediterranean climate.

[1] *Available in **black version** (please enquire for conditions).*
[2] *F08 UV grade also available for **enhanced UV protection**.*

CROP DURATION AND MOISTURE ADAPTATION BY INZEA GRADE*

	DURATION (MONTHS)	INZEA F08M (µm)	INZEA F09M (µm)
LETTUCE	2-3	10-12	12-15
TOMATO	4-5	12-15	15-18
PEPPER	5-6	12-15	15-18
AUBERGINE	5-6	12-15	15-18
COURGETTE	3-5	12-15	15-18
CUCUMBER	3-4	12-15	15-18
CORN	1	-	8-10

** Evolution and duration of the material subject to climatic conditions*

PROCESSING PERFORMANCE OF INZEA® MULCH FILMS

PERFORMANCE & STABILITY

INZEA offers **excellent performance** and **stability** in **conventional blown extrusion lines**, achieving a **wide thicknesses range** (8 - 100 µm).

MASTERBATCHES

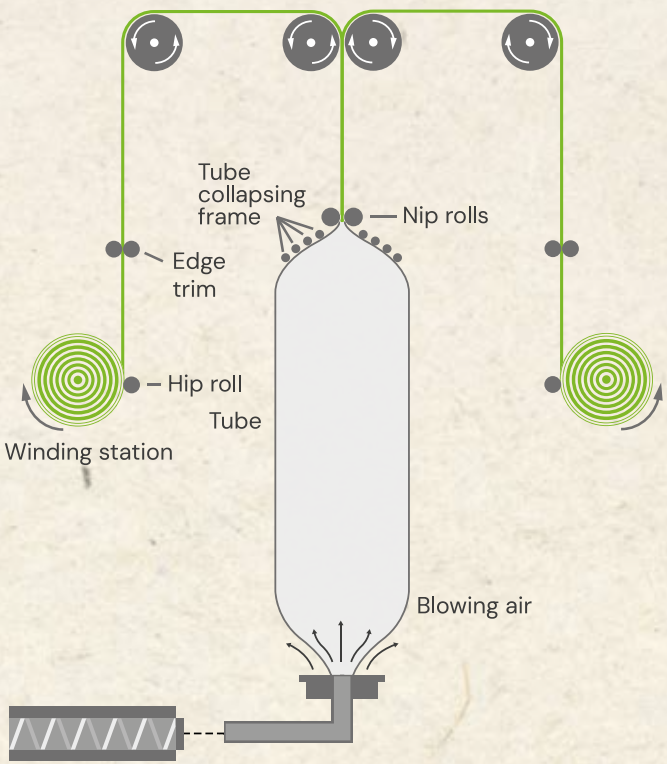
Good compatibility with **compostable black masterbatches**. INZEA grades for agricultural mulch film production are **also available in black colour**.

MECHANIZATION

Excellent field performance using **standard machinery** at the **same speed**.

MONO- & CO- EXTRUSION

INZEA grades are suitable for both **standard monolayer** and **coextrusion lines**, offering **versatility** in film processing.



MECHANICAL PROPERTIES OF INZEA® MULCH FILMS

	THICKNESS (µm)	MODULUS MD (MPa) ISO 527-3	STRESS AT BREAK MD (MPa) ISO 527-3	STRAIN AT BREAK MD (%) ISO 527-3	WVTR 30 °C/90% HR (G/m² day atm) ASTM E398-20
INZEA F08M	10	100	20	200	1,500
INZEA F09M	10	100	20	300	2,200

** All tests carried out with a monolayer airblown pilot line BUR = 3,0*

TWINES

The INZEA® biopolymers range includes specific grades designed for the production of **agricultural twines**. These materials can be processed using **conventional equipment**, following **standard manufacturing practices** for twine.

To meet the needs of sustainable farming, INZEA® offers compostable grades certified as **TÜV AUSTRIA OK compost INDUSTRIAL.**
This certification ensures that the twine can be **composted together with plant biomass** and sent directly to industrial composting facilities after harvest, **eliminating the need for waste separation and simplifying end-of-life management.**

	THICKNESS (µm)	MODULUS MD (MPa) ISO 527-3
INZEA F15C	20	1.500
INZEA F16C	20	1.700

** All tests carried out with a monolayer airblown pilot line BUR = 2,1*

CLIPS & FASTENERS

INZEA® offers specific grades with **mechanical properties optimized for clip applications**, combining suitable elongation and flexural resistance to ensure reliable performance in use.

These compostable clips and fastening elements can be **easily processed using conventional injection moulding techniques**. INZEA® materials are certified according to **EN 13432 or EN 17033**, depending on **application requirements**, offering a truly sustainable end-of-life solution.

CIRCULAR LIFE CYCLE

Biodegradable twines and clips **support plant growth**.

After harvest, supports and plant residues **remain in the field**.

COLLECTED AND COMPOSTED TOGETHER IN **INDUSTRIAL COMPOSTING PLANT.**

The resulting **compost enriches** the **soil** for new crops.

These crops may become raw materials for **future biopolymers**.

NUREL BIOPOLYMERS

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