



LUCROP[®] SRF: CULTIVATING SUSTAINABLE SOLUTIONS

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IQS Conference Barcelona, 2024/07/03





AGENDA

- ❖ Scope of Microplastics
- ❖ Definition of Microplastics
- ❖ Derogation criteria
- ❖ Benefits of LUCROP® SRF
- ❖ Physical properties of LUCROP® SRF
- ❖ Potential application fields
- ❖ Summary

SCOPE OF MICROPLASTICS

- EU restriction: no product containing $\geq 0.01\%$ w/w of **intentionally added** microplastic shall be put on the EU market
- Microplastics are **intentionally added** to a range of products to bring specific properties to a formulation or solve formulation challenges

Sector / Product group	Use ^a (tonnes/year)	Release to the environment ^b (tonnes/year)
Cosmetic products	8 700 (4 100 – 13 100)	3 800 (1 800 – 5 900)
- Rinse-off containing microbeads (exfoliators/cleansers) ^c	107	55
- Other rinse-off	6 500 (2 900 – 10 000)	3 100 (1 400 – 4 900)
- Leave-on	2 100 (1 100 – 3 000)	600 (300 – 900)
Detergents and maintenance	17 000 (11 100 – 23 000)	8 500 (5 600 – 11 600)
- Detergents containing microbeads ^c	95	50
- Fragrance encapsulation	400 (260 – 540)	200 (0 – 150)
- Other detergents	15 200 (9 440 – 20 960)	7 700 (4 800 – 10 650)
- Waxes, polishes and air care products	1 300	585
Agriculture and horticulture	10 000 (3 500 – 18 000)	10 000 (3 500 – 18 000)
- Controlled release fertilisers	5 000 (1 000 – 10 000)	5 000 (1 000 – 10 000)
- Fertiliser additives	4 000 (2 000 – 6 000)	4 000 (2 000 – 6 000)
- Treated seeds	500 (250 – 1 000)	500 (250 – 1 000)
- Capsule suspension PPPs	500 (250 – 1 000)	500 (250 – 1 000)
Oil and gas	1 200 (300 – 2 000)	270 (~0 – 550)
Paints and coatings ^d	5 300 (10 200)	2 700 (5 200)
- Consumer uses	5 300	2 700
- Professional uses	(4 900)	(2 500)
Construction products	Not known	Not known
<i>In vitro</i> diagnostic devices ^e	50 (0.5 – 100)	0.27 (0.25 – 0.29)

Sector / Product group	Use ^a (tonnes/year)	Release to the environment ^b (tonnes/year)
Medical devices (MD)		
- (substance-based) MD	Not known	Not known
- MD other than (substance-based)	~10	~10
Medicinal products	2 300 (800 – 3 700)	1 100 (400 – 1 800)
- Ion exchange resins	700 (300 – 1 000)	300 (100 – 500)
- Matrix or polymer film for controlled release	1 600 (500 – 2 700)	800 (300 – 1 300)
- Immediate release	Not known	Not known
Food additives	Not known	Not known
Infill material for synthetic pitches ^f	100 000 ^g (15 400 – 184 800)	16 000 (2 000 – 52 000)
Total (excluding infill material)^g	44 600 (19 800 – 70 000)	26 400 (11 200 – 43 000)
Total (including infill material)^g	144 500 (35 200 – 254 800)	42 400 (13 200 – 95 000)

➔ Overall, around 145.000 tonnes of microplastics are estimated to be used in the EU/EEA each year!

<https://echa.europa.eu/de/hot-topics/microplastics>
<https://echa.europa.eu/documents/10162/a513b793-dd84-d83a-9c06-e7a11580f366>

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e.g. plant protection products:

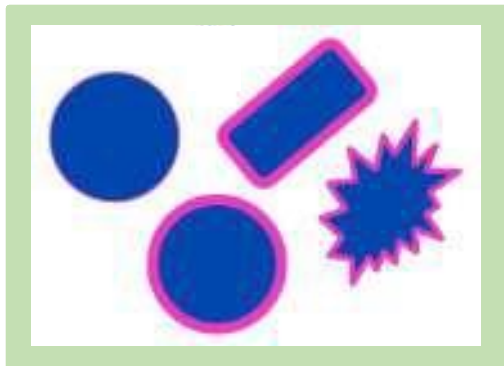
- encapsulation of active ingredients
- to generate a film for seed treatment or seed coating

<https://echa.europa.eu/de/hot-topics/microplastics>
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DEFINITION OF MICROPLASTICS

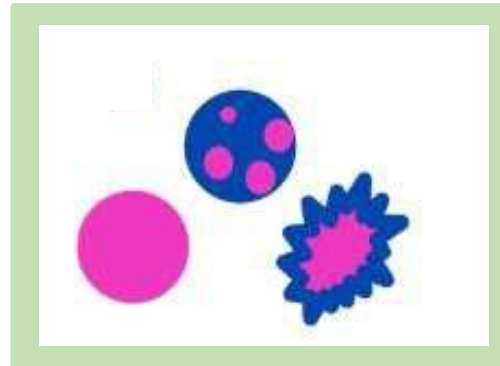
Microplastic is a solid particle containing $\geq 1\%$ w/w of persistent synthetic polymer with size range up to 5 mm.

A continuous solid polymer surface coating of any thickness



polymer

Any composition with a solid polymer content of $\geq 1\%$ w/w



RAC* & SEAC** REPORTS, DECEMBER 2020

- **Natural** polymers without any chemical derivation
- **Biodegradable** polymers
- Polymers with **solubility in water** above 2g/L
- Substances containing microplastics where the **physical properties** of the microplastic
 - are **permanently modified** in use
 - do not fulfill the definition anymore (e.g. **film-forming** functions)
- Substances containing microplastics where the microplastic is **permanently incorporated into a solid matrix** when used (e.g. concrete, adhesive)

*RAC - Risk Assessment Committee

**SEAC - Socio-Economic Analysis Committee

<https://echa.europa.eu/de/hot-topics/microplastics>

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BENEFITS OF LUCROP® SRF



- Is a bio-derived polymer and made of **biodegradable ingredients** □ **FREE OF MICROPLASTICS**
 - Polysaccharide-based polymer blend
 - Active amount: 70%
 - Readily biodegradable (*OECD 301B*)
- A **sustainable alternative** to traditional latex emulsion polymers
 - e.g. polyacrylate or polystyrene
 - Not water soluble
 - Not biodegradable

} targeted by ECHA microplastics definition!
- Can be applied as **in-can** or **tank-mix adjuvant**
- **Free of hazard labels**
- **EPA-approved 40 CFR 950 (a)** as an inert ingredient in pesticide formulations



LUCROP® SRF

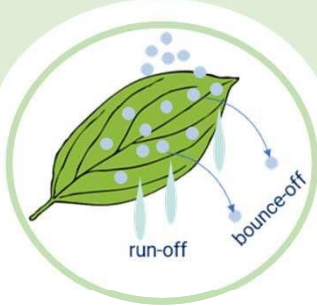
FILM-FORMING

Creates a protective film over the target



ADHESION

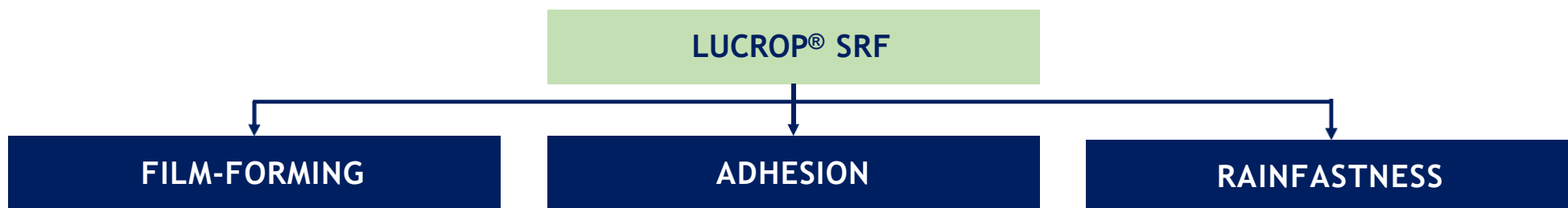
- Improves the adhesion of actives and pesticide sprays to plants
- Modifies the droplets to be inelastic
 - reducing bounce-off & run-off on leaves



RAINFASTNESS

Enhances resistance of pesticide deposits against wash-off by rain





Especially suitable for contact pesticides used in aqueous based agrochemical formulations (SC, SL):

- **Contact herbicides:** Glyphosate & Glufosinate
- **Contact fungicides:**
 - Copper hydroxide; - sulphate; - oxychloride
 - Calcium carbonate; - sulphate
 - Sulphur
 - Zinc oxide
 - Mancozeb
 - Chlorothalonil
 - Captan
 -

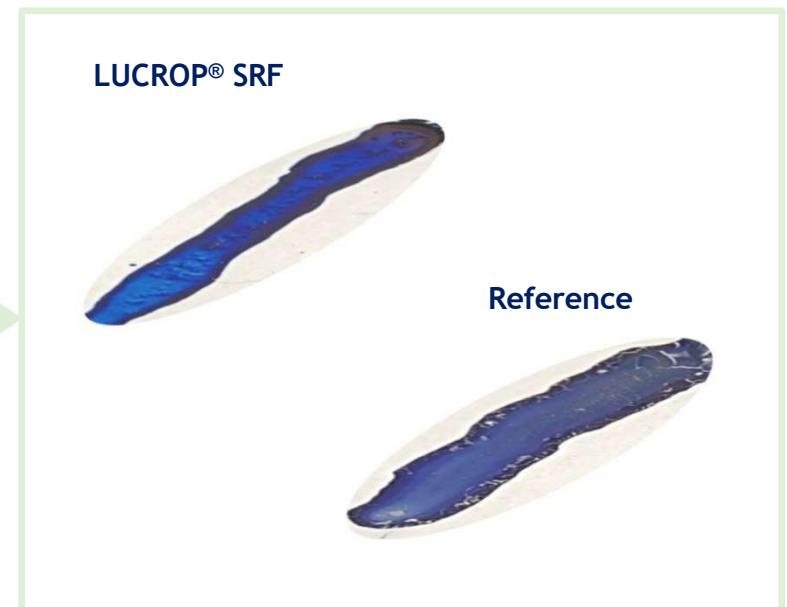


FILM-FORMING

Procedure:

- 1) 2% w/w active aqueous solution was put drop by drop on glass surface
- 2) Methylene blue was used for the visualization of the film
- 3) The solution was allowed to air dry for 24 h
- 4) After drying, a film was formed

Results:



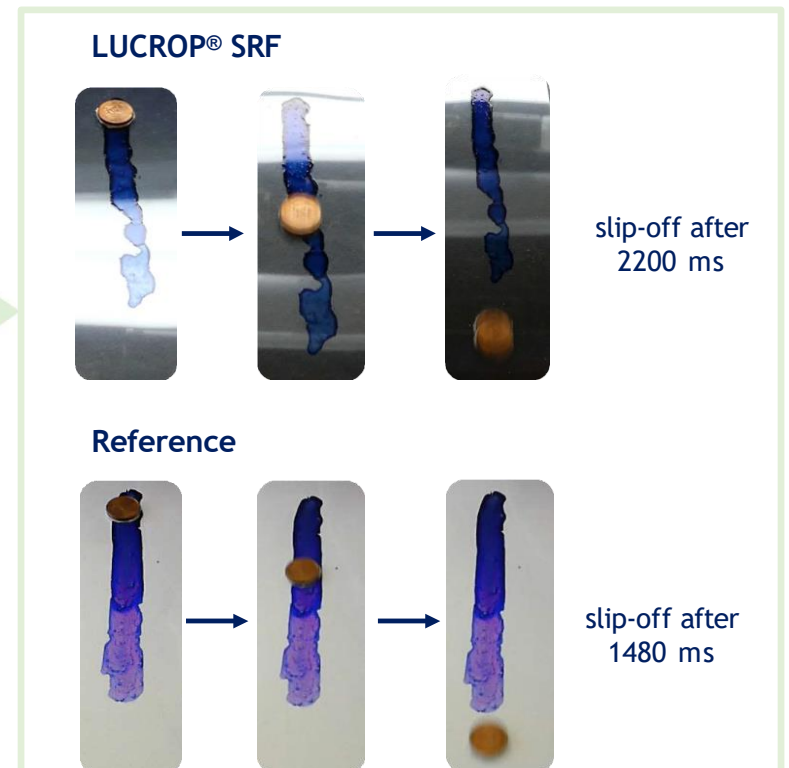
Comparable film formation of LUCROP® SRF with the reference product.

ADHESION

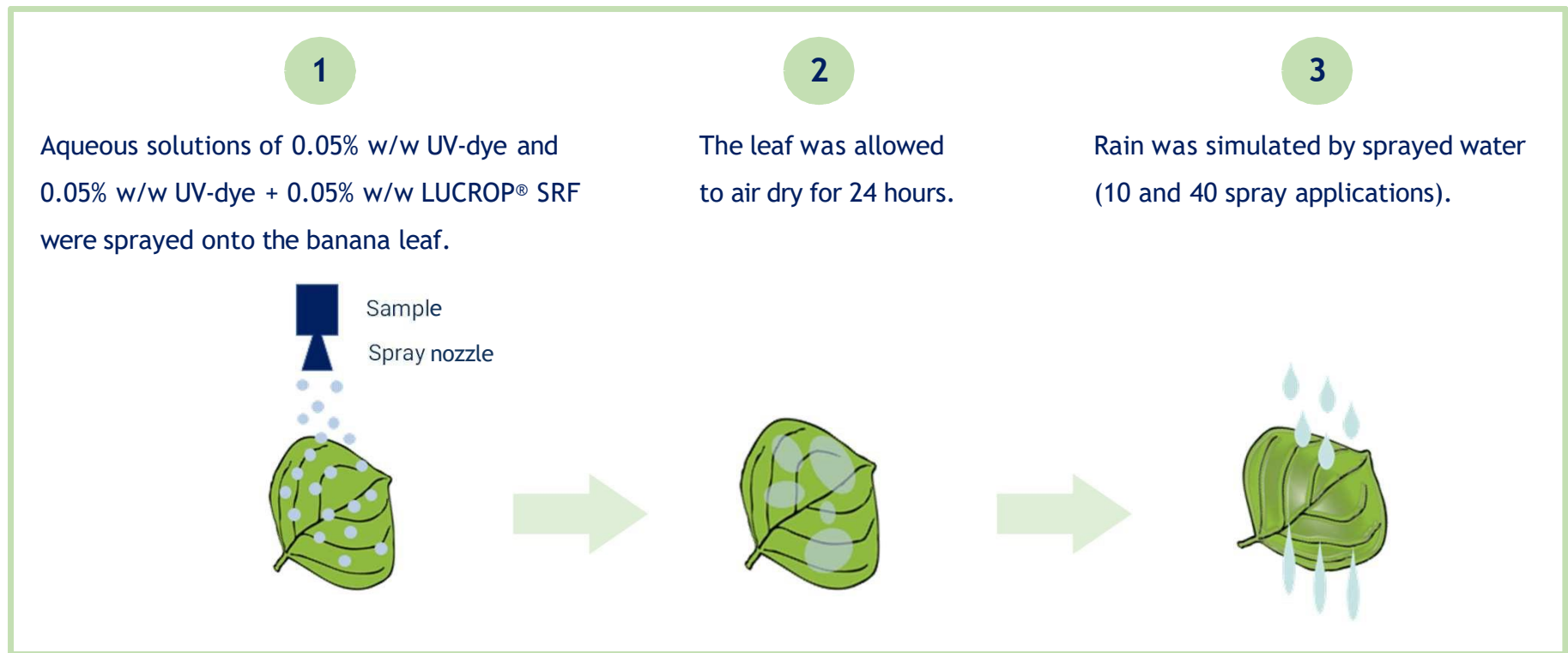
Procedure:

- 1) 1ct. coin was coated with a cellulose cloth and put onto the prepared film.
- 2) The coin was moved up.
- 3) The time at which the coin slipped off was noted.

Results:



RAINFASTNESS – PROCEDURE:



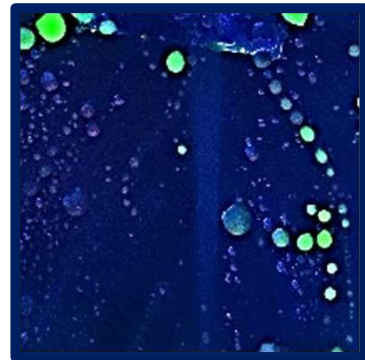
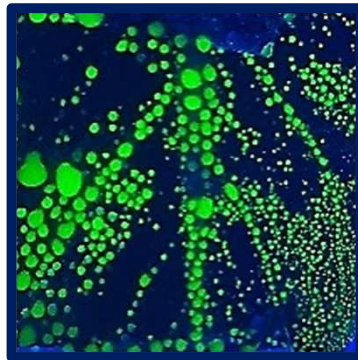
RAINFASTNESS – RESULTS:

Sprays of water

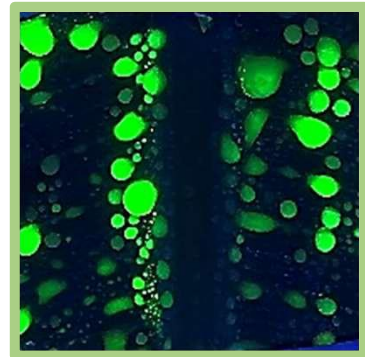
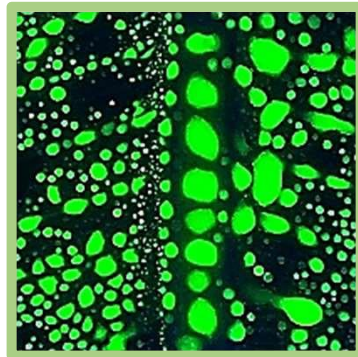
10x

40x

UV Dye + Water



UV Dye + Water +
LUCROP® SRF



- Water droplets are more easily washed away compared to those containing LUCROP® SRF.
- Even after 40 spray applications, more than 50% of the droplets remain on the leaf.

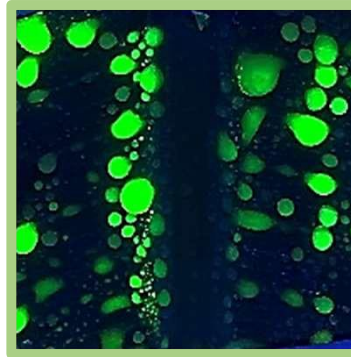
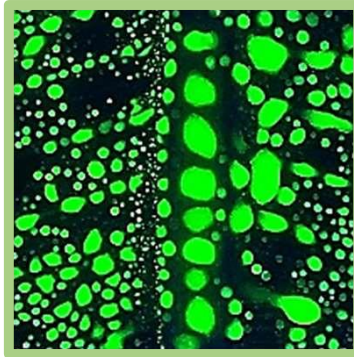
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Sprays of water

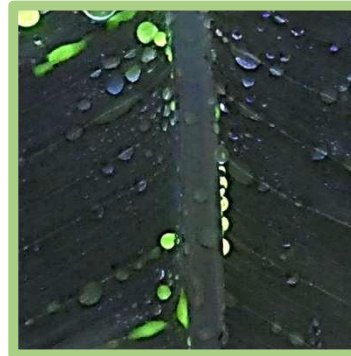
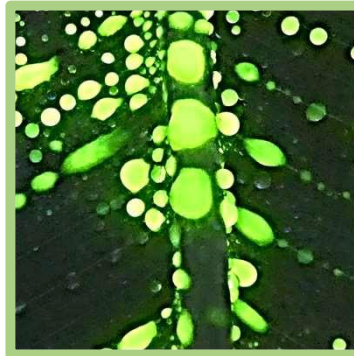
10x

40x

UV Dye + Water +
LUCROP® SRF



UV Dye + Water +
Reference



- Evenly distribution of droplets & better coverage of the leaf by the addition of LUCROP® SRF than the reference product
- After rain simulation, more than 90% of the droplets are removed by using the reference product

INFLUENCE OF WETTING AGENTS ON RAINFASTNESS PROPERTIES

Preparation procedure:

- 1) A premix of 85% w/w LUCROP® SRF and 15% w/w wetting agent has been prepared.



LUCRAMUL® AMO T
C12-15 Amine oxide



LUCRAMUL® DOS 75
Bis-(2-ethylhexyl)-
sulfosuccinat sodium salt



LUCRAMUL® APG 225
C8-10 Alkyl Polyglycoside



LUCRAMUL® DMB
C12-14 Alkydimethyl-betaines

- **Biodegradable wetting agents** are chosen for trials
- Compatibility has been checked at RT and 54°C for 2 weeks
- No separation or color change occurred after storage test

INFLUENCE OF WETTING AGENTS ON RAINFASTNESS PROPERTIES

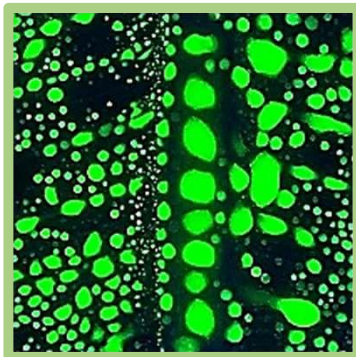
Preparation procedure:

- 1) A premix of 85% w/w LUCROP® SRF and 15% w/w wetting agent has been prepared.
- 2) Aqueous solution of 0.05% w/w UV-dye + 0.05% w/w premix was sprayed onto the banana leaf.
- 3) The leaf was allowed to air dry for 24 hours.
- 4) Rain was simulated by sprayed water (10 and 40 spray applications).

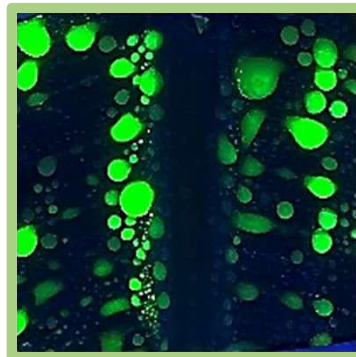
INFLUENCE OF WETTING AGENTS ON RAINFASTNESS PROPERTIES

Sprays of water

10x



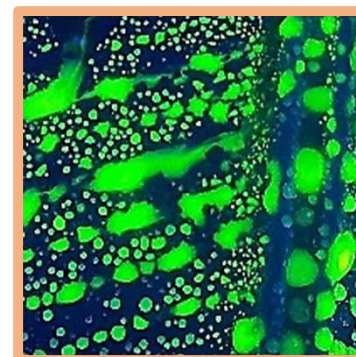
40x



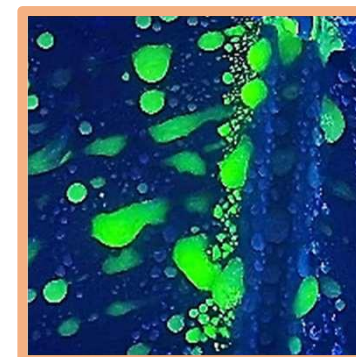
UV Dye + Water +
LUCROP® SRF

Sprays of water

10x



40x

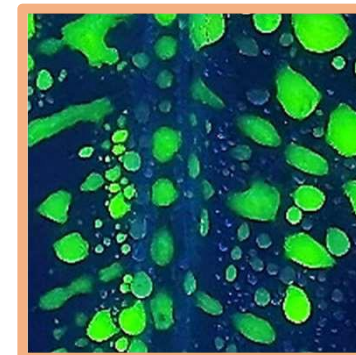
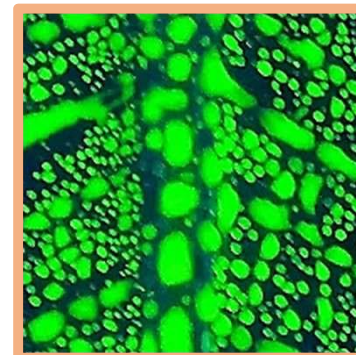


UV Dye + Water +
Premix

(LUCROP® SRF +
LUCRAMUL® DMB)

The spreading and rainfastness properties are improved by the addition of wetting agents:

- the droplets are **easily spreaded** onto the banana leaf
- the droplets are **evenly distributed**
- **more than 65%** of the droplets remain on the leaf surface
- LUCRAMUL® APG 225 improves **highly the resistance** of droplets against wash-off by water



UV Dye + Water +
Premix

(LUCROP® SRF +
LUCRAMUL® APG 225)

CRYSTAL GROWTH INHIBITOR

Background:

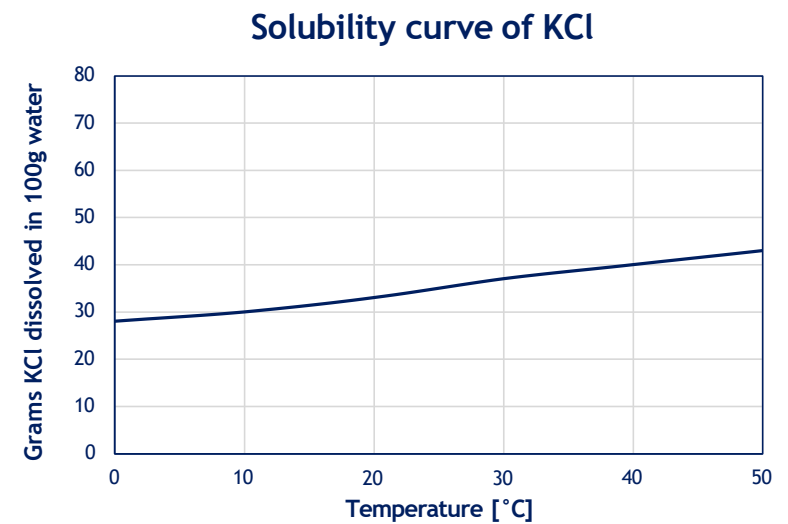
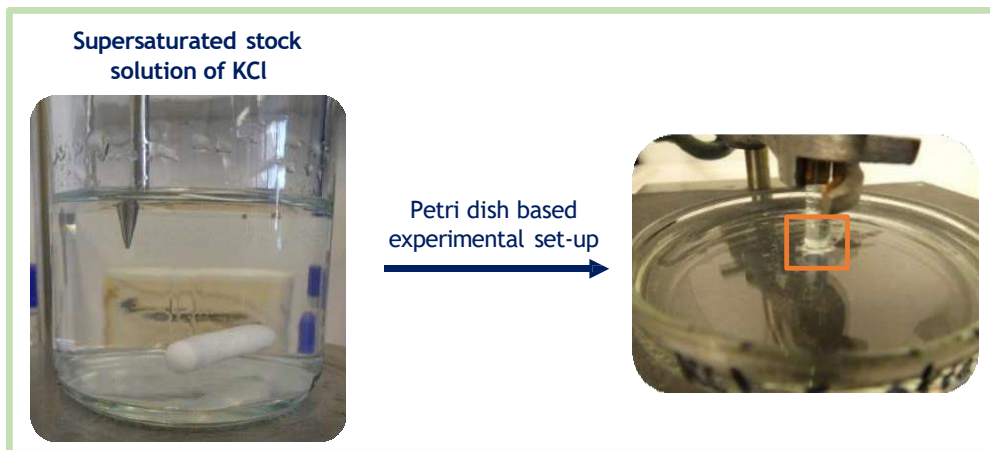
- **Supersaturation** occurs when a solution contains more solute than it can normally dissolve at a given temperature and pressure
- Thermodynamically, these solutions are **metastable**
- The **driving force for precipitation (crystal growth)** is the reduction of the free energy of the system towards a more stable state, typically through the formation of solid crystals
- In the **absence of nucleation sites or under the influence of inhibitors**, crystal growth can be significantly delayed → **prolonging the supersaturated state**

Jonathan W. Steed, Jerry L. Atwood; Supramolecular Chemistry, Wiley, 2nd edition, 2012.

CRYSTAL GROWTH INHIBITOR

Preparation of supersaturated KCl solution □ hot saturation

1. Dissolving the respective amount of solute at 20°C
2. Heating the solution to 40°C
3. Gradually adding KCl to the hot solvent while stirring continuously until no more dissolves
4. Cool down the solution to room temperature

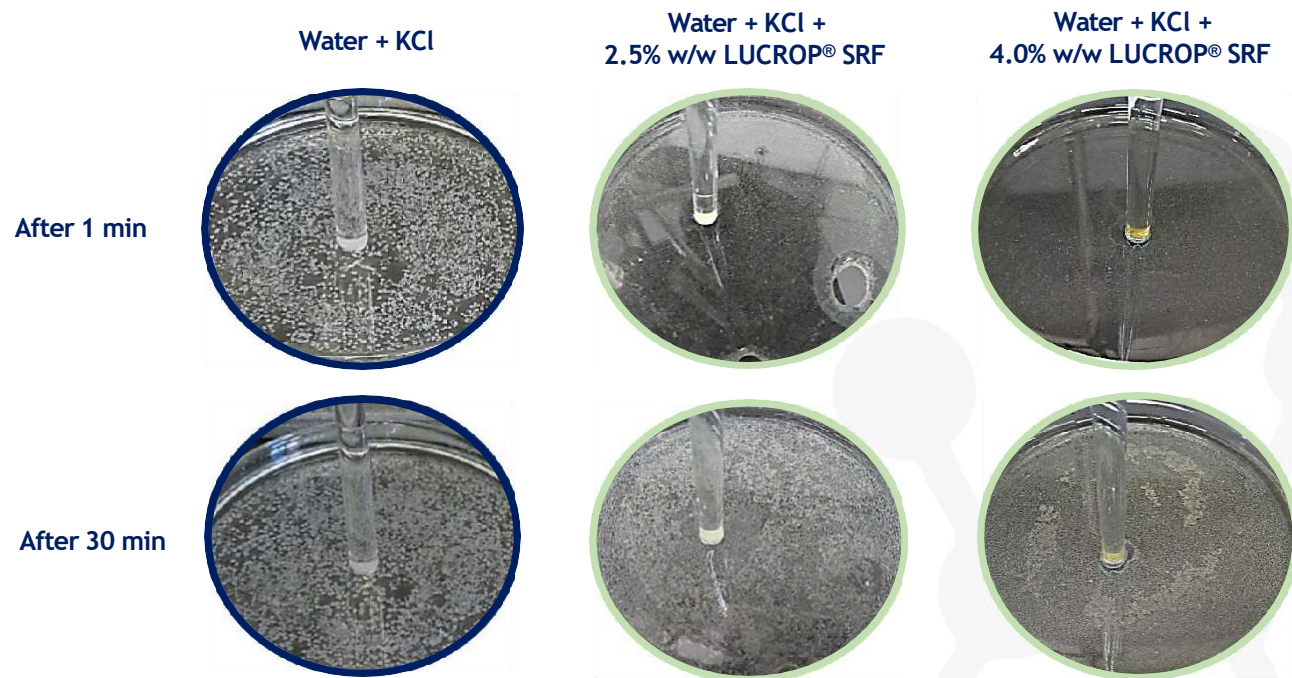


glass rod:
acting as substrate to
the crystal growth

M.J. Quazi et al., Salt creeping as a self-amplifying crystallization process, *Sci. Adv.* 5, 2019.

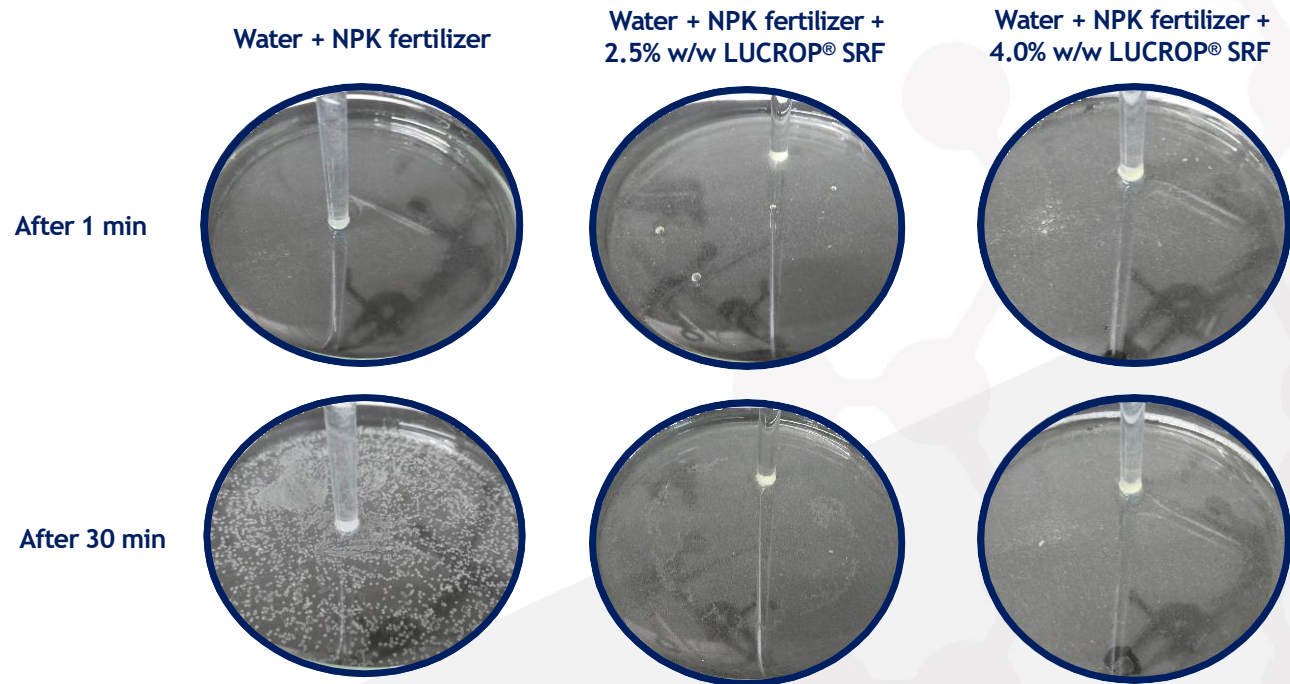
POTENTIAL APPLICATION FIELDS

CRYSTAL GROWTH INHIBITOR



- The crystallization is **prolonged** by the addition of LUCROP® SRF
- With **increasing concentration** of LUCROP® SRF concentration **smaller crystals** are formed

CRYSTAL GROWTH INHIBITOR



Major benefits by the addition of LUCROP® SRF:

- Homogeneous appearance
- Better handling
- Preventing any clogging of the spray nozzle

□ The crystallization is remarkably reduced by the addition of LUCROP® SRF

POTENTIAL APPLICATION FIELDS

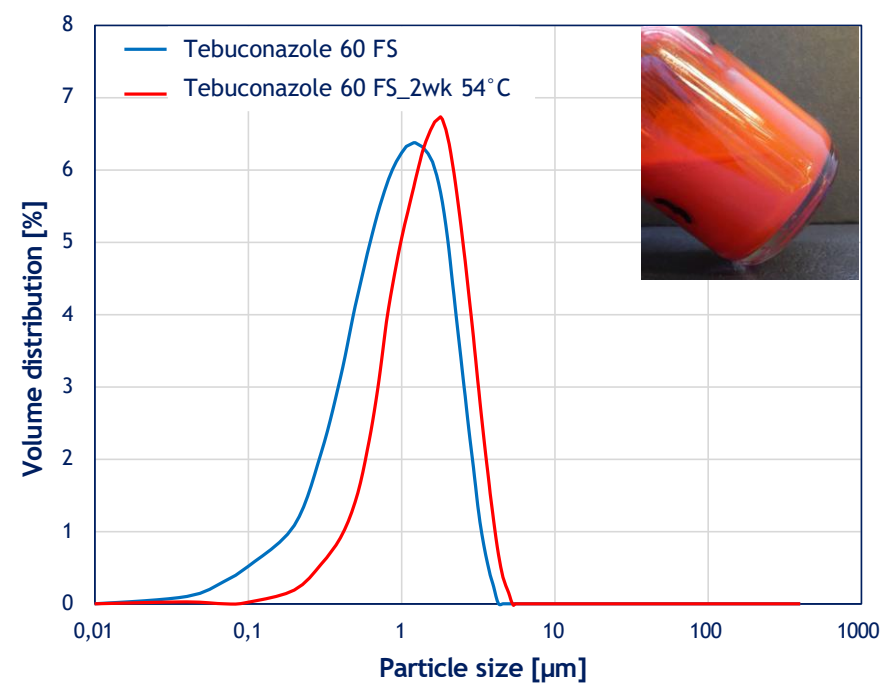


BINDER FOR SEED TREATMENT

TEBUCONAZOLE 60 FS recipe

Product	Function	Amount / % w/w
Tebuconazole 97%	Active ingredient	6.11
LUCRAMUL® PPS A 16	Dispersing agent	4.60
LUCRAFOAM® S 06	Defoaming agent	0.90
Irgalite Rubine D 4280 (P.R. 57:1)	Solid pigment	7.50
LUCROP® SRF	Binder	2.00
Propylene glycol	Anti-freezing agent	6.80
LUCRACHEM® VIS 6 (10% aq.)	Rheological modifier	8.00
Xanthan Gum (2% aq.)	Rheological modifier	0.40
Water	Continuous phase	63.69
Total		100.00

Particle Size Distribution



⇒ Monomodal size distribution, slightly change of particle size after storage

POTENTIAL APPLICATION FIELDS



BINDER FOR SEED TREATMENT

Seed Treatment - Preparation procedure:

- 1) 10g wheat seeds are filled into a plastic cup
- 2) The formulation is diluted at a ratio of 2:1 (formulation:water)
- 3) For the coating process, 230mg of the diluted formulation is added to 10g of wheat seeds and shaken for 30 seconds



POTENTIAL APPLICATION FIELDS

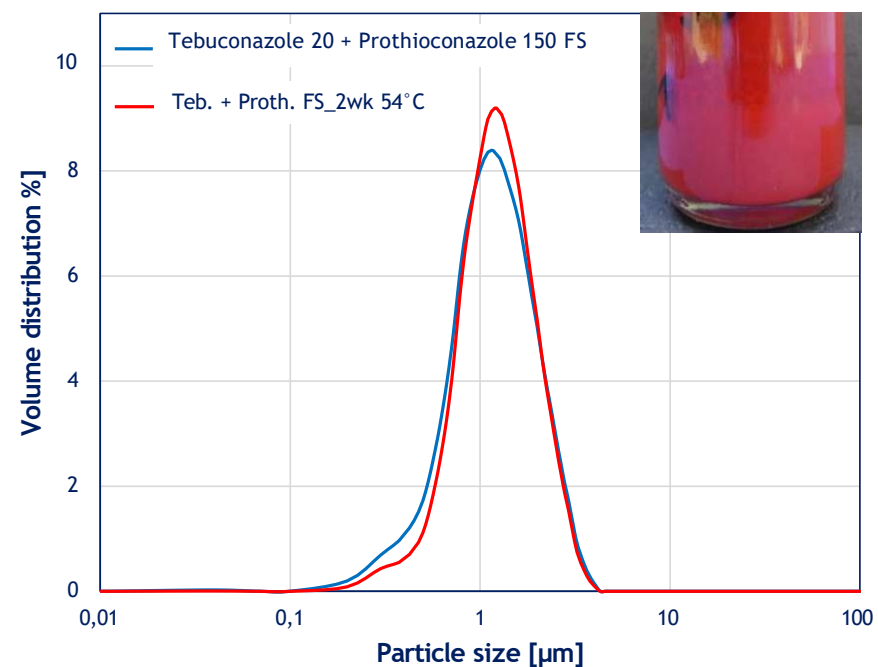


BINDER FOR SEED TREATMENT

TEBUCONAZOLE 20 + PROTHIOCONAZOLE 150 FS recipe

Product	Function	Amount / % w/w
Tebuconazole 97%	Active ingredient	1.71
Prothioconazole	Active ingredient	12.80
LUCRAMUL® SPS 16	Dispersing agent	4.60
LUCRAFOAM® S 06	Defoaming agent	0.90
Colanyl Red FGR 131	Liquid pigment	35.00
LUCROP® SRF	Binder	2.00
Propylene glycol	Anti-freezing agent	6.80
LUCRACHEM® VIS 6 (10% aq.)	Rheological modifier	8.00
Xanthan Gum (2% aq.)	Rheological modifier	0.40
Water	Continuous phase	27.79
Total		100.00

Particle Size Distribution



⇒ Monomodal size distribution, no change of particle size after storage

POTENTIAL APPLICATION FIELDS



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Xanthan Gum (2% aq.)	Rheological modifier	0.40
Water	Continuous phase	27.79
Total		100.00



soy beans



wheat seeds

SUMMARY



- **LUCROP® SRF** is composed of **biodegradable ingredients** and completely **free of microplastics**
- Is a **sustainable alternate** to conventional synthetic polymers
- Combines **film-forming, adhesion & rainfastness properties** into a convenient product
- **Comparable or even better performance** to reference products
- Can be applied as **in-can or tank-mix adjuvant**
- **Prolongs & reduces the crystal growth** in supersaturated electrolyte solutions & fertilizers
- Potential application as **binder for seed treatment**

ACKNOWLEDGEMENT



- **Lukas Cordes** Application Lab technician
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- **Justin Zager** Application Lab technician
- **Dr. Jan Porada** Technical Sales Manager
- **Laetitia Le Bert** Sales Manager
- **Dr. Mahmoud Elgammal** Manager of Agro Business Unit

THANK YOU FOR YOUR ATTENTION



<https://agro-solutions.levaco.com>