



Controlled Release Nutrition for Agriculture





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Overview

- ❖ Haifa's controlled release fertilizers for agriculture
 - ❖ **Multicote® Agri / Multigro** – for agriculture & horticulture
 - ❖ **CoteN™** – for arable crops
- ❖ Designed to feed plants continuously over months
- ❖ Based on polymer coating technology for best performance
- ❖ A variety of formulas is available, to suit the needs of different plants



The benefits of Controlled Release Nutrition

The benefits of controlled release nutrition



- Optimal Plant Development - Nutrients are precisely supplied in accordance with specific plant needs



Controlled release:
optimal nutrition
throughout the growth
season

Granular soluble fertilizer:
hazardous excess at the beginning
followed by deficiency towards the end
of the growth season

The benefits of controlled release nutrition



Single Application per Season

- ✓ Labor saving
- ✓ Reduced application costs
- ✓ Fewer tractor operations = less soil compaction



The benefits of controlled release nutrition



Minimized Losses

Through leaching, volatilization or fixation in the soil

- Availability of nutrients throughout the growth cycle is ensured
- Optimized use of fertilizers without wastage
- No surplus fertilization is required – reduced application rates
- Ecologically superior (no soil, ground-water or air pollution)

The benefits of controlled release nutrition



- ❖ **Fertilization totally independent of irrigation**
 - ❖ No need for sophisticated dosing and injection systems
 - ❖ In rainy season – no need for technical irrigations
 - ❖ No fertilizer losses where irrigation is applied in excess to prevent salinity build-up



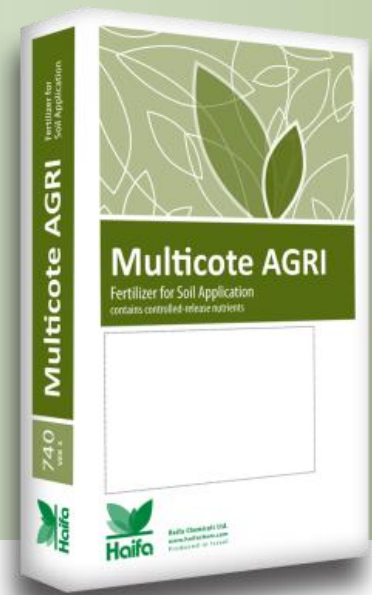
Multicote[®] Products for Agriculture





Multicote® Agri / Multigro

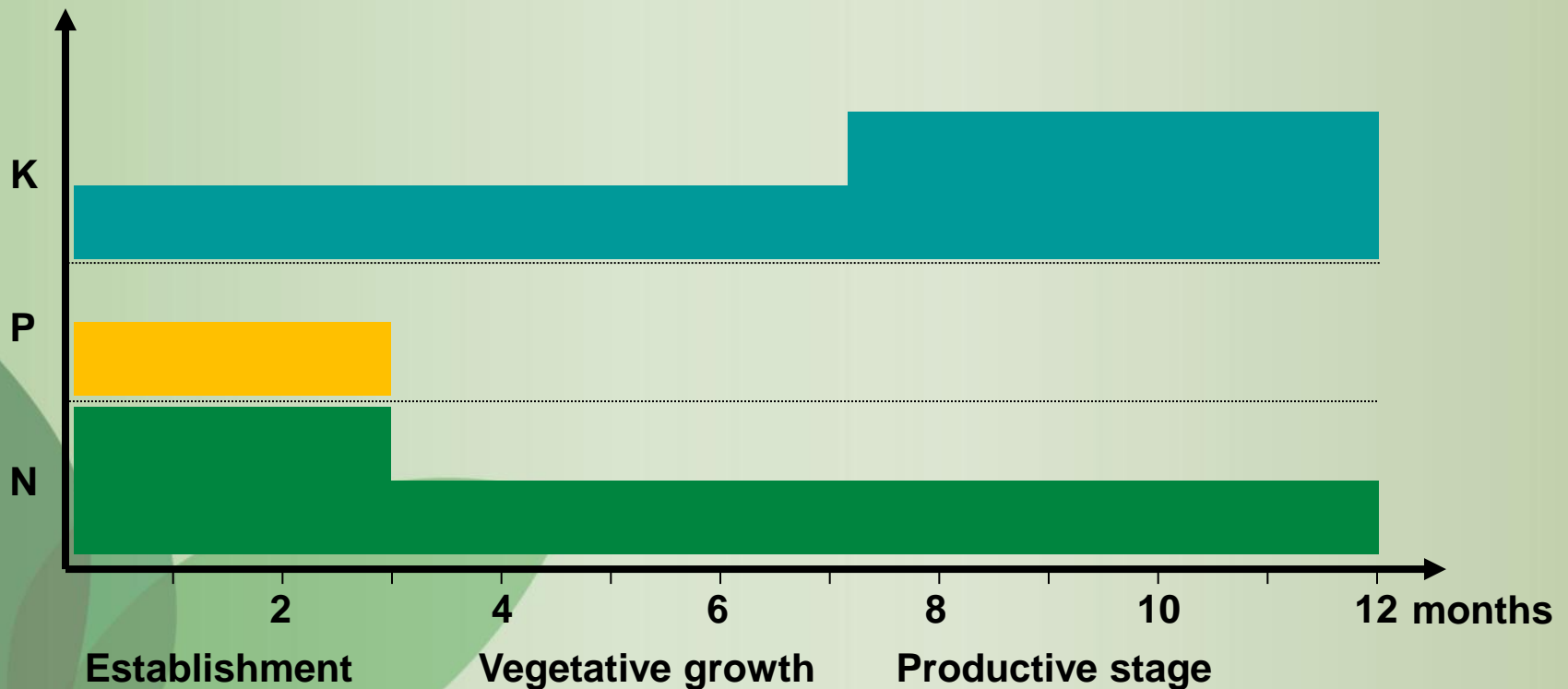
- Combine polymer-coated granules of N, P, K and Mg, and non-coated, readily available nutrients
- Release longevities: 4, 6, 8 and 12 months
- Choice of formulas enable perfect match to crop requirements and growth conditions
- Ideal for: vegetables (open field and protected), herbs, strawberries, fruit trees, bananas, and forest planting



Multicote[®] Agri “Stages”



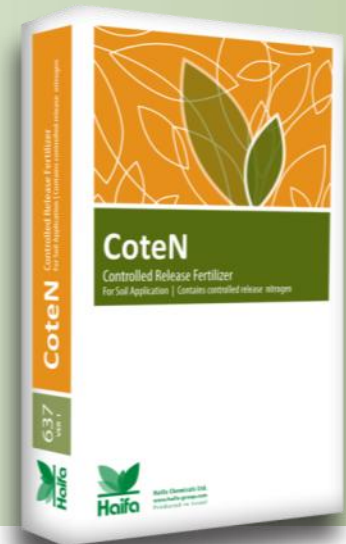
- Formulas with N-P-K ratio that adapts during the season to best match with crop's growth requirements.



CoteN™



- Polymer coated urea for arable crops
- Improves nitrogen-use efficiency
- Recommended where N application rates should be reduced or limited
- Ideal for corn and wheat
- May be blended with non-coated N, P, or K (CoteN™ Mix)

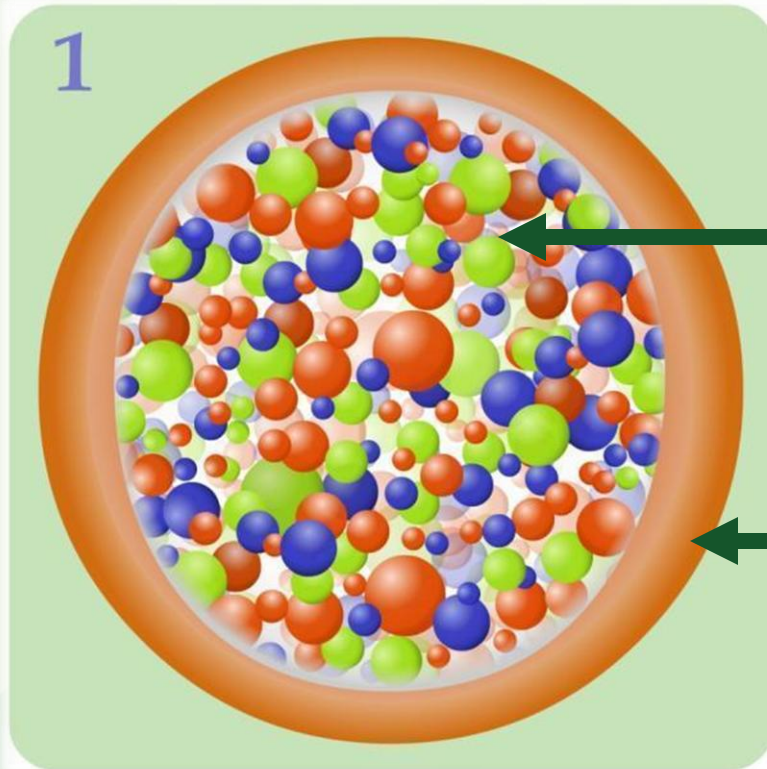




Multicote® Technology



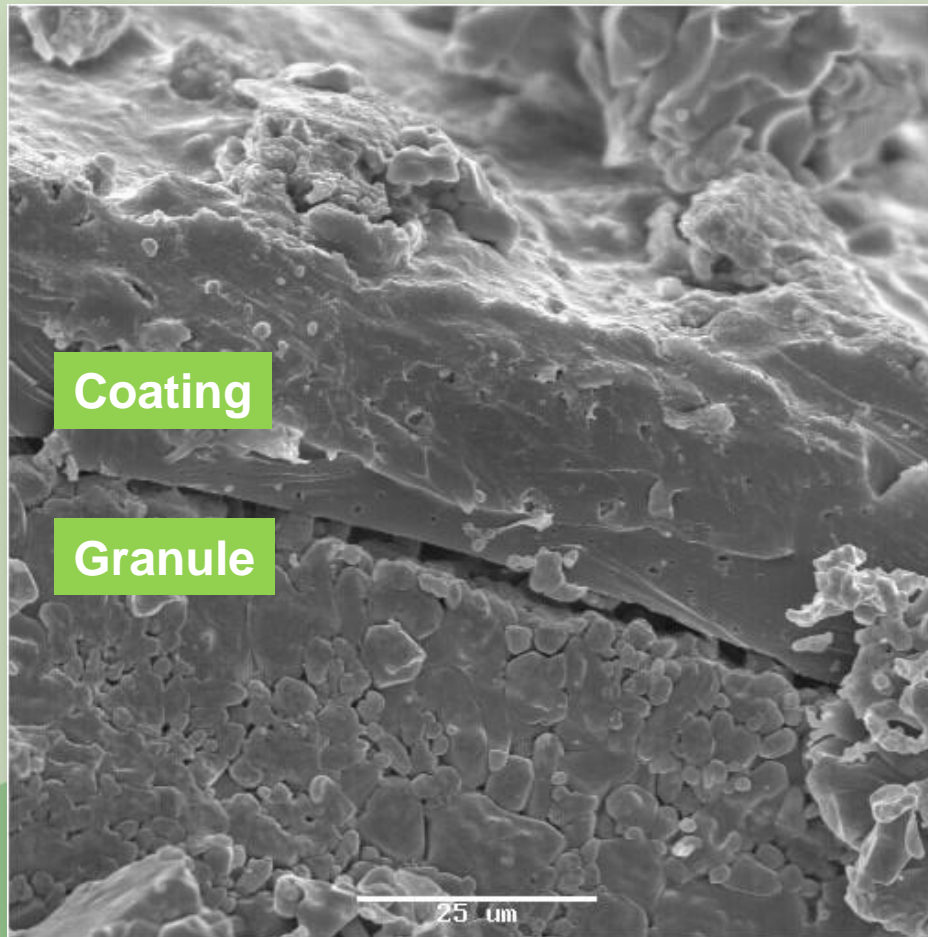
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Core:
Soluble nutrients

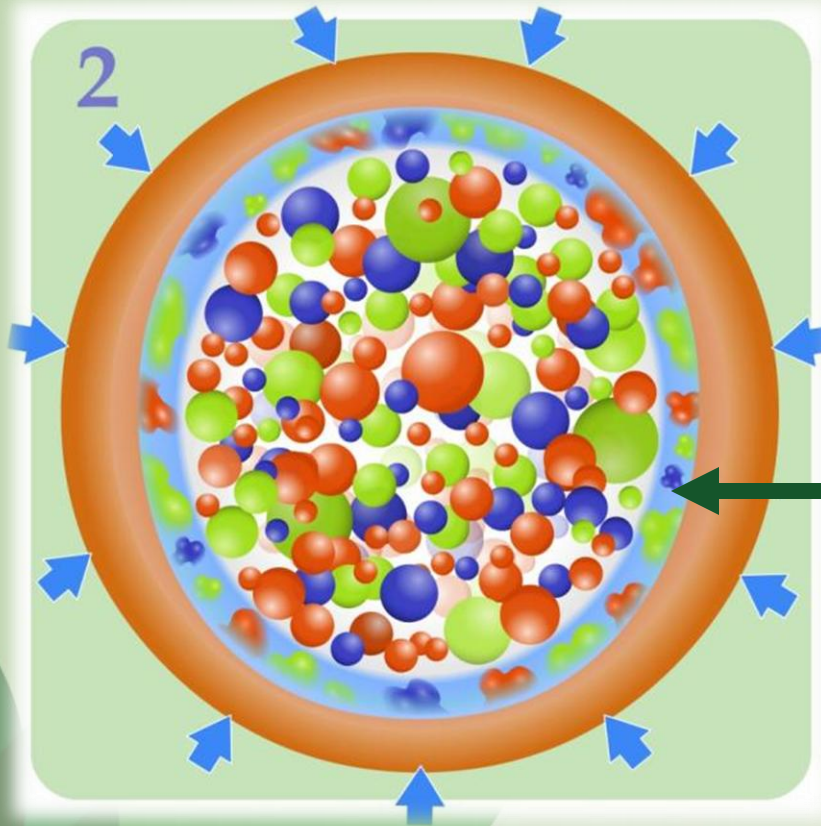
Shell:
Polymer coating

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Scanning Electron Microscope image of coated NPK granule

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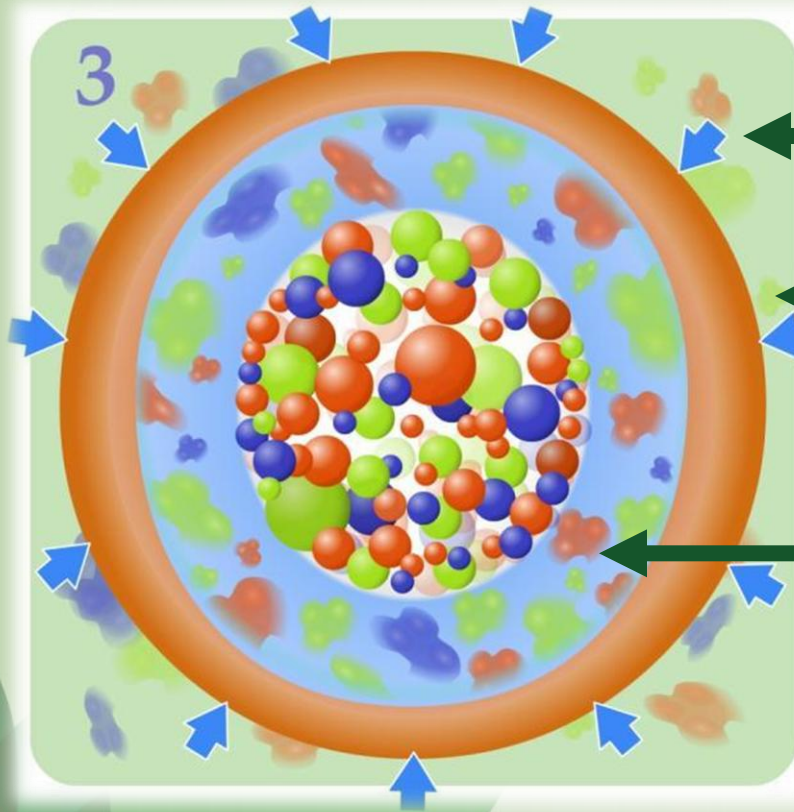
After application in the soil:

Water penetration

Gradual dissolution of the nutrients

This stage takes 7-10 days, depending on the longevity

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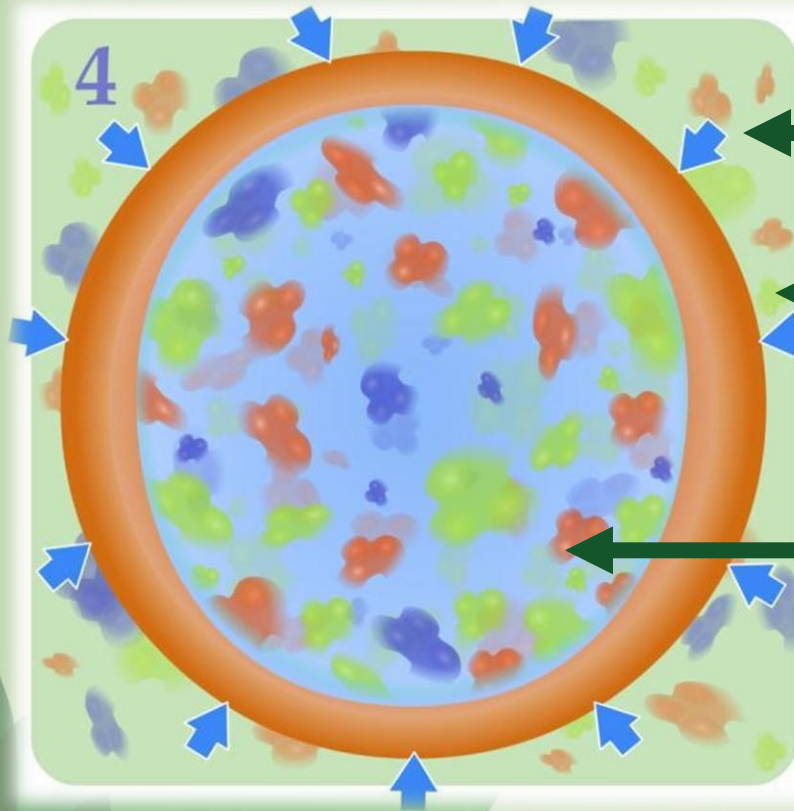


Water penetration

Diffusion of nutrients through the coating to the soil

Further dissolution of nutrients

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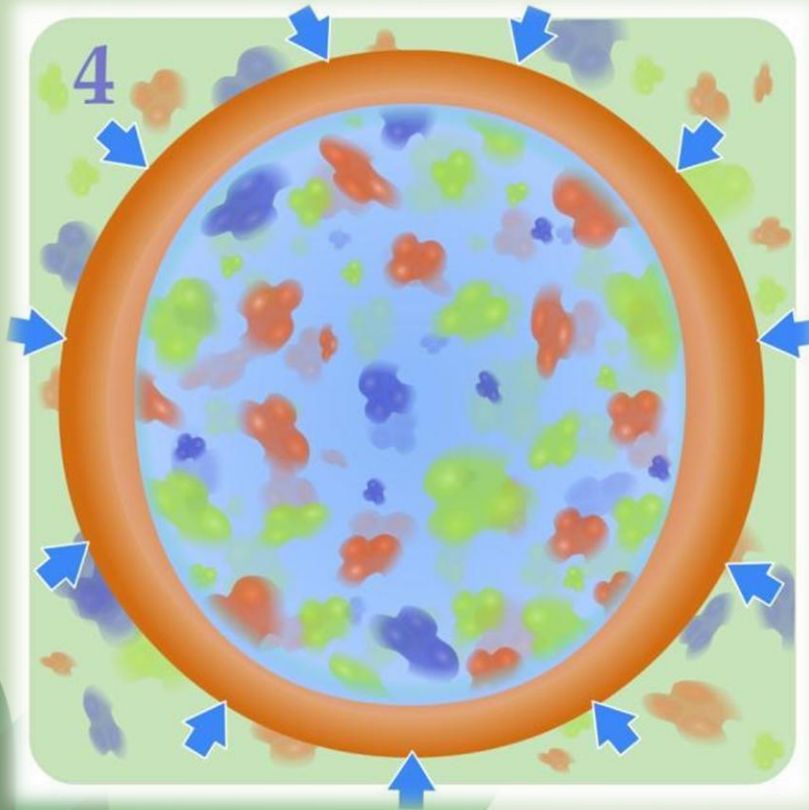
Water penetration

Diffusion of nutrients through the coating to the soil

Complete dissolution of nutrients

At this stage the release rate decays, according to Fick's 2nd law of diffusion.

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Fick's 2nd law of diffusion:

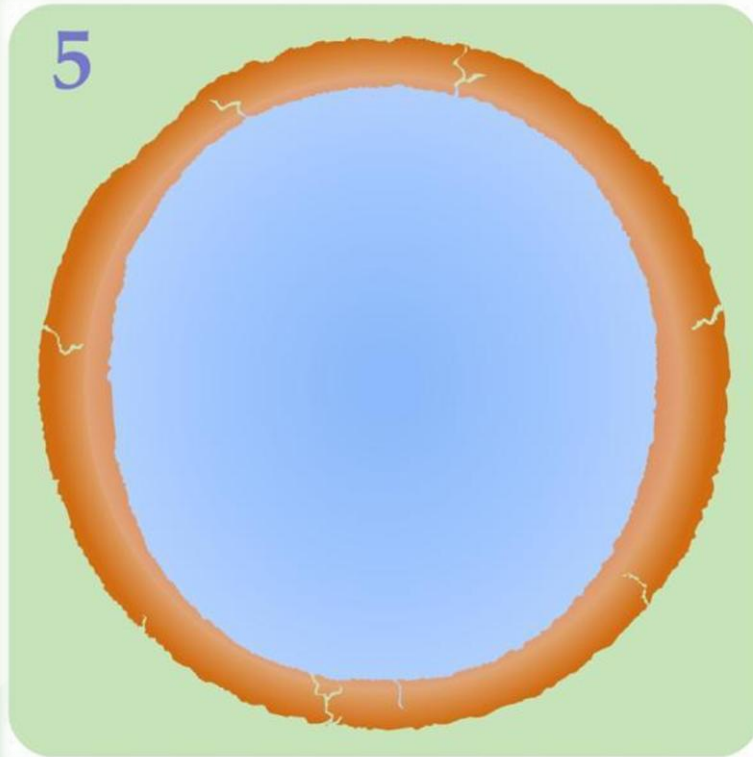
$$\frac{dC}{dt} = D \frac{d^2 C}{dX^2}$$

C = concentration

t = time

D = diffusion coefficient

Multicote[®] technology

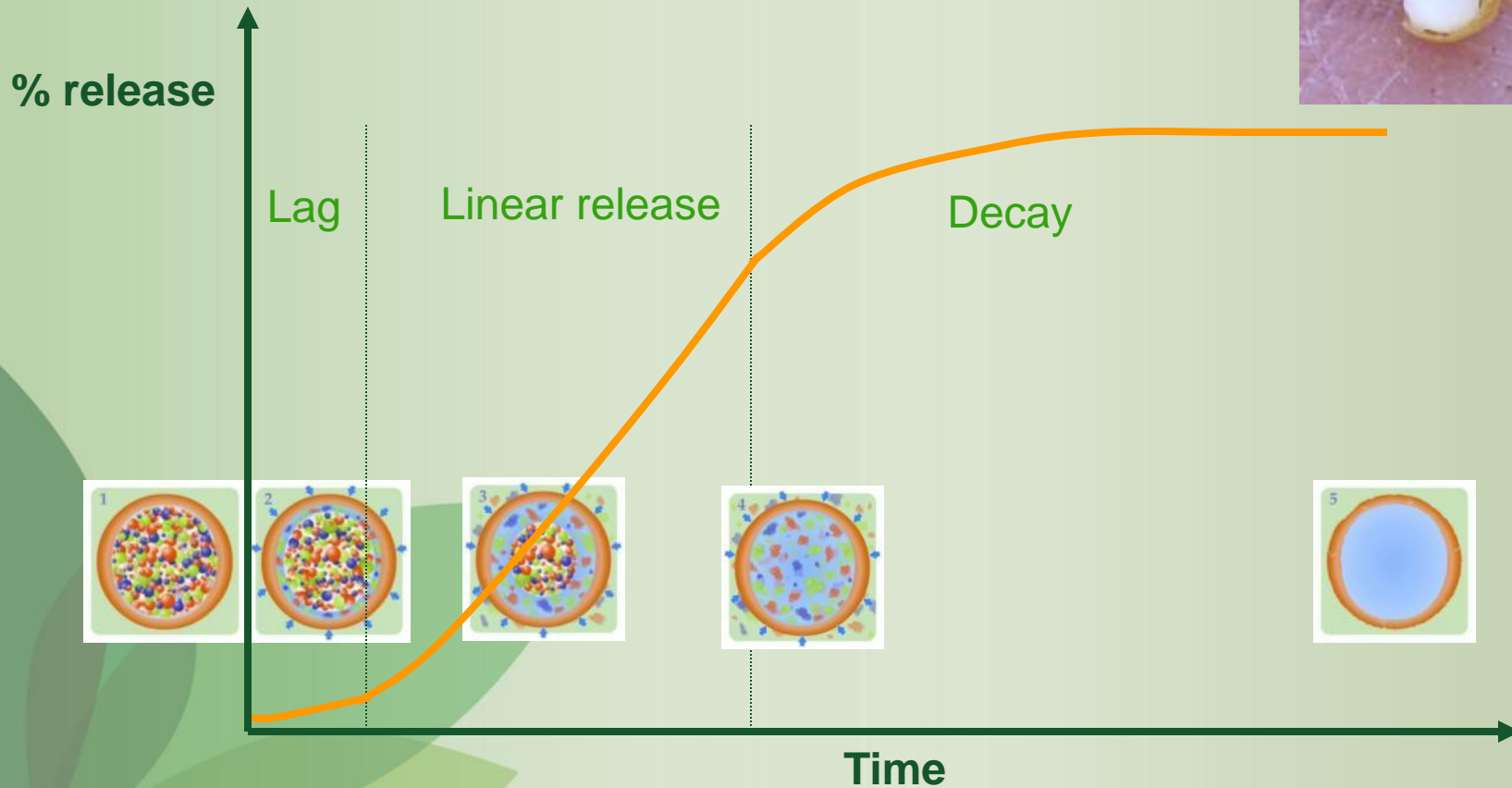


After the release is complete, the coating will degrade gradually, leaving no residues in the soil.

Multicote[®] technology



Typical release curve:





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Release rate, longevity & temperature

- ✦ The rate of nutrient release from Multicote increases with temperature:

$$\frac{dC}{dt} = D \frac{d^2 C}{dX^2}$$

C = concentration, t = time
D = diffusion coefficient

$$D = D_0 e^{-\frac{Q}{RT}}$$

Q = activation energy, R = gas constant
T = temperature

- ✦ Note: plant uptake rates also increase with temperature
- ✦ The longevity decreases as release rate increases

Multicote® technology

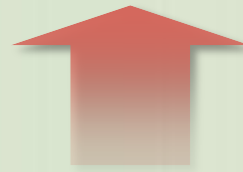


The rate of nutrient release from Multicote® increases with temperature, and the longevity is decreased accordingly.

temperature

Release rate

longevity





When to Use?

Multicote[®] Agri & CoteN[™]
are recommended



On light soils
where nutrients are easily leached



Multicote[®] Agri & CoteN[™] are recommended



As base fertilizers for rainy season crops.
Rainfall accelerates nutrient leaching....

Multicote[®] Agri & CoteN[™] are recommended



.... when the mud makes side-dressing application troublesome.

Multicote[®] Agri & CoteN[™]
are recommended



Where nitrogen application rates are limited by local regulations, so high efficiency of nutrient use is desired

Multicote® Agri & CoteN™
are recommended



For crops with a shallow root system



The Art of Blending



The agronomist's recommendation: “the Art of blending”

- ❖ The right formula (N-P-K)
- ❖ The right longevity (consider temp., crop cycle)
- ❖ Crop nutritional requirements at different growth stages
- ❖ The rate applied compared to farmer practice
- ❖ The % of the coated component (blend)

Setting percentage of coated N



Soil texture Water regime		Sand>70% (Sand, loamy sand)	50%<sand<70 % (medium sandy)	Silt>40% (silt, silty loam, silty clay)	Clay>60% (clay loam, clay)
Arid/semi arid or protected crops	No water excess	75%	75%	50%	50%
Arid/sub Mediterranean	25% above ETKc	100%	75%	75%	50%
Rainy sub continental, humid tropical	50% above ETKc	100%	100%	100%	75%
Humid tropical	ETKc X2 or more	100%	100%	100%	100%



Setting percentage of coated P

Soil texture Water regime		Sand>70% (Sand, loamy sand)	50%<sand<70 % (medium sandy)	Silt>40% (silt, silty loam, silty clay)	Clay>60% (clay loam, clay)
		Arid/semi arid or protected crops	No water excess	0%	0%
Arid/sub Mediterranean	25% above ETKc	0%	0%	0%	0%
Rainy sub continental, humid tropical	50% above ETKc	10%	10%	0%	0%
Humid tropical	ETKc X2 or more	20%	20%	10%	10%

Setting percentage of coated K



Soil texture Water regime		Sand > 70% (Sand, loamy sand)	50% < sand < 70% % (medium sandy)	Silt > 40% (silt, silty loam, silty clay)	Clay > 60% (clay loam, clay)
Arid/semi arid or protected crops	No water excess	25%	25%	0%	0%
Arid/sub Mediterranean	25% above ETKc	50%	25%	25%	0%
Rainy sub continental, humid tropical	50% above ETKc	75%	50%	50%	25%
Humid tropical	ETKc X2 or more	100%	75%	50%	50%



Guideline for setting application rates, longevity and % coating

- More rain / irrigation → more coating
- Lighter soil → more coating
- Coated portion of components $N > K > P$
- Longer crop cycle → more coating, extended longevity
- Warmer soils during growth cycle →
more coating, extended longevity
- Higher expected yield requires higher nutrition rates
- Application method should be considered (top dressing, incorporation, banding).
- Economical analysis compared to available alternatives!



Summary

- ✦ A range of controlled release fertilizers for agricultural applications
- ✦ Based on polymer-coating technology
- ✦ Provide efficient nutrition
 - ✦ For optimal growth
 - ✦ For minimized losses
- ✦ Require single application per season
- ✦ Products address specific requirements of the crop



Controlled Release Nutrition

**Continuous
plant nutrition
over months**

**Enhanced
nutrient use
efficiency**

**Labor
saving**

Thank You

Join-up our knowledge community
www.haifa-group.com/community

