Controlled Release Nutrition
Multicote®
Controlled Release Fertilizers

Continuous plant nutrition over months
Enhanced nutrient use efficiency
Labor saving
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Multicote® overview

- A range of controlled release fertilizers
- Designed to feed plants continuously over months
- Based on polymer coated technology
- A variety of formals is available, to suit the needs of different plants
- Products for ornamentals, agriculture and turf
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

- **Multicote®**: 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® Technology
Multicote® technology

Core: Soluble nutrients

Shell: Polymer coating
Multicote® technology

Scanning Electron Microscope image of coated NPK granule
Multicote® technology

After application in the soil:

Water penetration

Gradual dissolution of the nutrients

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

1. Water penetration
2. Diffusion of nutrients through the coating to the soil
3. Further dissolution of nutrients
Multicote® technology

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.
Multicote® technology

Fick’s 2\textsuperscript{nd} law of diffusion:

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

C = concentration

\( t = \) time

D = diffusion coefficient
After the release is complete, the coating will degrade gradually, leaving no residues in the soil.
Multicote® technology

Typical release curve:

% release

Lag | Linear release | Decay

Time
Multicote® technology

Release rate, longevity & temperature

The rate of nutrient release from Multicote increases with temperature:

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

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

- C = concentration, t = time
- D = diffusion coefficient
- 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.

<table>
<thead>
<tr>
<th>temperature</th>
<th>Release rate</th>
<th>longevity</th>
</tr>
</thead>
<tbody>
<tr>
<td>↑</td>
<td>↑</td>
<td>↓</td>
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</table>
The Multicote® Range
The Multicote® range

The Multicote range provides solutions for different market segments:

- **Multicote®** for nurseries and ornamentals
- **Multicote® Agri / Multigro®** for agriculture
- **CoteN™** for arable crops
- **Multicote® Turf / Multigreen®** for professional turf & domestic lawns
Multicote®
for nurseries and ornamentals
## Multicote® products

<table>
<thead>
<tr>
<th>Product</th>
<th>Recommended applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multicote 2</td>
<td>Compost production, gardening</td>
</tr>
<tr>
<td>Multicote 4</td>
<td>Pot-plants and hanging baskets, bedding plants, garden applications</td>
</tr>
<tr>
<td>Multicote 6</td>
<td>Pot-plants, hanging baskets</td>
</tr>
<tr>
<td>Multicote 8</td>
<td>Trees, shrubs, pot-plants and container grown nursery stock</td>
</tr>
<tr>
<td>Multicote 12</td>
<td>Trees, shrubs, pot-plants and container grown nursery stock</td>
</tr>
<tr>
<td>Multicote 16</td>
<td>Container grown nursery stock in tropical and sub-tropical regions</td>
</tr>
</tbody>
</table>
## Release Longevities

<table>
<thead>
<tr>
<th></th>
<th>15°C (60°F)</th>
<th>21°C (70°F)</th>
<th>30°C (86°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multicote 2</strong></td>
<td>3 months</td>
<td>2 months</td>
<td>-</td>
</tr>
<tr>
<td><strong>Multicote 4</strong></td>
<td>6 months</td>
<td>4 months</td>
<td>2 months</td>
</tr>
<tr>
<td><strong>Multicote 6</strong></td>
<td>7-8 months</td>
<td>6 months</td>
<td>3-4 months</td>
</tr>
<tr>
<td><strong>Multicote 8</strong></td>
<td>9-10 months</td>
<td>8 months</td>
<td>5-6 months</td>
</tr>
<tr>
<td><strong>Multicote 12</strong></td>
<td>15-16 months</td>
<td>12 months</td>
<td>7-8 months</td>
</tr>
<tr>
<td><strong>Multicote 16</strong></td>
<td>20-22 months</td>
<td>16-18 months</td>
<td>9-10 months</td>
</tr>
</tbody>
</table>
Multicote® Agri / Multigro® for agriculture
CoteN™ for arable crops
**Multicote® Agri products**

- Combine coated N, P, K and Mg & non-coated nutrients
- Wide variety of nutritional compositions
- Release longevities of 2, 3, 4, 6, 8 and 12 months
- CoteN™: controlled-release nitrogen
Multicote® Agri “Stages”

NPK ratio changes during the growth season, according to growth requirements.
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.
Multicote® Turf / Multigreen
for professional turf & domestic lawns
Multicote® Turf / Multigreen
for professional turf & domestic lawns

- Year-round nutritional programs for turf of all types and all uses
- Formulas with different N:K ratios
- Takes care of the changing nutritional needs of the turf plant
- Products contain potassium nitrate
- Supports seasonal growth processes
## Multicote® Turf products

<table>
<thead>
<tr>
<th>Product</th>
<th>N:K ratio*</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Booster</td>
<td>2:1</td>
<td>Dormancy breaker</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Initiates intensive leaf growth</td>
</tr>
<tr>
<td>Feeder</td>
<td>1:1</td>
<td>For balanced root and shoot growth.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Helps maintaining turf quality and durability during seasons of intensive use.</td>
</tr>
<tr>
<td>Keeper</td>
<td>1:2 or 1:3</td>
<td>High-potassium fertilizer supports autumn growth and builds carbohydrate storage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Promotes drought &amp; frost resistance</td>
</tr>
<tr>
<td>Multi-K® Turf / Multiverdo</td>
<td>1:3</td>
<td>Quickly available potassium fertilizer; “Quick action for tough periods”.</td>
</tr>
</tbody>
</table>
Summary

- Controlled-release products for ornamentals, agriculture and turf
- 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
Multicote®
Controlled Release Fertilizers

Continuous plant nutrition over months
Enhanced nutrient use efficiency
Labor saving
Thank You

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