



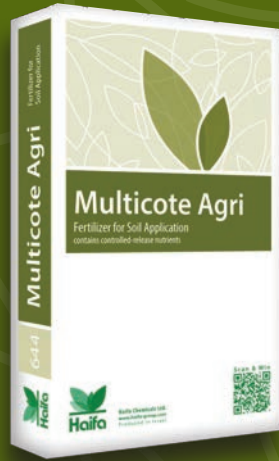
Multicote™ Agri

Controlled Release Fertilizers for Agriculture

Handbook



Haifa Chemicals Ltd.
Pioneering the Future



Multicote™ Agri, a range of controlled release fertilizers for agriculture and horticulture, has been designed to feed crops continuously throughout the growth season – for optimal development and best yield production.

Based on Haifa's polymer coating technology, Multicote™ Agri releases nutrients to the soil in a gradual manner, according to plant's requirements. This maximizes nutrient use efficiency and prevents leaching of nutrients, allowing for reduced application rates and protecting the environment.

The benefits of Multicote™ Agri

- Feeds plants according to their growth needs
- Requires lower application rates, compared to conventional fertilizers
- Single application per season helps saving on labor
- Fertilizer is applied independently of the irrigation system
- Minimizes environmental impacts of fertilization

About Haifa Group

Haifa Group is an Israel-based multinational corporation and a global leading supplier of potassium nitrate for agriculture and industry, specialty plant nutrients and food phosphates. Renowned for its pioneering spirit and innovative solutions, Haifa's global operations span over 100 countries across 5 continents with 14 subsidiaries and 3 production plants.

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1. Introduction

1.1. In brief

Multicote™ Agri Controlled Release Fertilizers are designed to feed agricultural crops continuously throughout the growth season – for optimal growth and yield production. Based on Haifa's polymer coating technology, Multicote™ Agri release nutrients to the soil in a gradual manner, according to plant's requirements. This prevents leaching of nutrients, thus improving nutrient use efficiency and allowing for reduced application rates.

Multicote™ Agri products are highly beneficial

- On light soils, where conventional fertilizers are easily leached
- In rainy areas, when rainfall accelerates nutrient leaching
- Wherever nitrogen application is limited, e.g. by environmental regulations
- For crops with a shallow root system
- For crops with high nutritional requirements
- In cases where mid-season application is not feasible (e.g. when the crop covers the soil surface, in mulched crops and in muddy fields)

Multicote™ Agri is an ideal fertilizer for cash crops in open field, protected crops and fruit-trees. For arable crops, CoteN™ polymer-coated urea is recommended.

1.2. Controlled release – an advanced approach to plant nutrition

The advantages of continuously supplying plant nutrients throughout all crop growing stages are well established. A proven product, Haifa's Multicote™ controlled-release fertilizer line presents growers with a broad range of products, enabling them to raise crops successfully. Multicote™ is the preferred way to provide plants with an ongoing stream of necessary nutrients.

Haifa's Multicote™, a 100% polymer coated fertilizer, led to the development and introduction of Multicote™ Agri, a viable and economical solution that can be applied to a wide variety of agricultural crops.

1.3. Multicote™ polymer-coating technology

The most reliable and effective way to control the availability of nutrients for plant uptake is by regulating their release into the soil solution. This is achieved by encapsulating solid fertilizer particles in a polymeric coating.

During the production process, granules of soluble fertilizer are coated with very fine polymer layers. This polymer coating, which acts as a semi-permeable barrier, allows measured diffusion of nutrients when the fertilizer granules are applied to the soil.

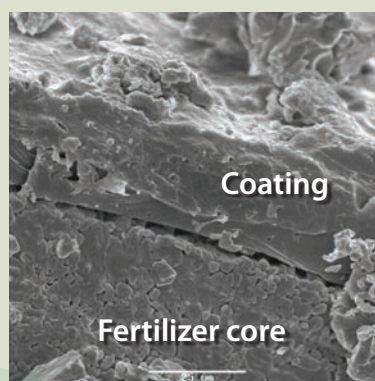


Figure 1: Scanning Electron Microscope picture showing a cross-section of Multicote™ granule

1.4. How does it work?

When Multicote™ granules are applied to the soil, the coating acts as a semi-permeable barrier, allowing a continuous release of nutrients to the root zone.

Multicote™ polymer coated fertilizers release plant nutrients slowly and continuously throughout the growth cycle. A single application of Multicote™ controlled release fertilizer will supply optimal levels of plant nutrients for months. Multicote™ is available in a wide range of formulae and release longevities from two to sixteen months (at a soil temperature of 21°C).

Following application, the granules start absorbing moisture that dissolves the nutrients inside the coating. The dissolved nutrients then diffuse slowly and continuously into the root zone. The rate of diffusion – the actual release rate – is determined by the soil temperature. The release rate increases as temperature rises, just as it does with plant uptake processes.


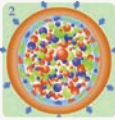
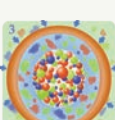
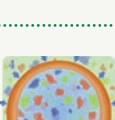

Other soil type-related factors such as humidity, pH, and microbial activity do not affect the release rate.

Multicote™ controlled release fertilizers incorporate today's most advanced technology. Highly sophisticated, these products are designed to simplify the grower's work and minimize errors in application calculations.



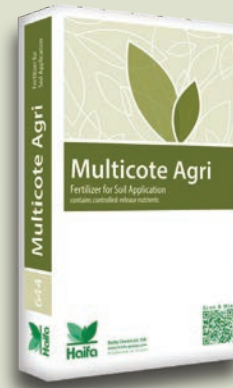
Figure 2: Massive development of roots around Multicote™ Agri granules in the soil

Table 1: Multicote™ release of plant nutrients, stage by stage

1		Multicote™ structure	Core: A granule of soluble plant nutrients Shell: Polymer coating	
2		After application	In the soil: water penetration leads to gradual dissolution of the nutrients	This stage takes 7-10 days, depending on longevity
3		Water penetration	Further dissolution of nutrients and their diffusion through the polymer coating to the soil and into the plants' roots	
4		Complete dissolution		At this stage the release rate slows, according to Fick's 2 nd law of diffusion: $\frac{dC}{dt} = D \frac{d^2C}{dX^2}$ C = concentration t = time D = diffusion coefficient
5		Release is complete		After the release is complete, the coating will degrade gradually, leaving no residues in the soil

1.5. Key benefits of Multicote™ Agri

Multicote™ Agri products contain a particularly high concentration of plant nutrients, which are released to coincide with plant growth needs. Unique benefits make Multicote™ Agri superior to other sources of sustained nutrition:



Feeds plants according to their needs

Multicote™ Agri is designed to provide plants with balanced nutrition, according to their needs, throughout the growth cycle. An accurate supply of plant nutrients ensures optimal development and maximum high quality yields. Precise plant nutrition maximizes the efficiency of both water and fertilizers, saving precious natural resources. It also prevents contamination of soil and groundwater.



Improves nutrient use efficiency and allows for reduced application rates

Multicote™ Agri releases available nutrients at a rate that matches plant uptake. Thus, plants consume most nutrients as soon as they become available, with minimal losses. This enables considerable reduction of fertilizer application rates – up to 30%, as compared to conventional granular or liquid fertilizers. For this reason, Multicote™ Agri is recommended in regions where fertilizer application rates are limited, e.g. by environmental regulations.



Saves labor and time

A single application of Multicote™ Agri covers a crop's nutritional requirements throughout its growth cycle. This saves labor and costs associated with fertilizer application. It also eliminates fertilization from the growers' routine tasks, freeing them to concentrate on other growth requirements.



Applied independently of the irrigation system

As Multicote™ Agri is applied directly to the soil, it depends neither on irrigation equipment nor water quantities. When excess irrigation is applied to prevent salinity build-up, soluble fertilizers given through the irrigation system are wasted. Multicote™ Agri prevents this scenario.



Minimizes the environmental impact of fertilization

Due to its high efficiency, Multicote™ Agri minimizes losses through leaching, volatilization or fixation, thus preventing environmental contamination.



Ensures a cost-effective solution for plant nutrition

Multicote™ Agri combines coated and uncoated granular fertilizers, offering cost-effective products that deliver high yields of superior quality.

2. The art of blending

2.1. Multicote™ Agri components

To enable the production of a wide variety of nutritional compositions and release profiles that optimally match the Multicote™ Agri program to crop requirements, Multicote™ Agri formulae combine several components, all containing pure plant nutrients and free

of chloride. Limitations on the number of components in a fertilizer formula are solely technical/practical. Theoretically, there are no constraints.

Table 2 lists the components available when composing a Multicote™ Agri formula.

Table 2: Multicote™ Agri components

	Longevity (months)							
	UC*	2	3	4	6	8	12	16
Potassium nitrate	✓	✓		✓	✓	✓	✓	
Urea	✓	✓	✓	✓	✓	✓	✓	✓
Mono-ammonium phosphate (MAP)	✓	✓		✓		✓		
Ammonium sulfate	✓	✓		✓		✓		
Magnesium sulfate	✓			✓				
Boron	✓			✓		✓	✓	
NPK 15-7-15+ME		✓		✓	✓	✓	✓	✓
NPK 14-14-14		✓		✓	✓	✓	✓	✓
NPK 12-12-14+ME	✓	✓		✓	✓	✓		

* UC - uncoated fertilizer with an immediate effect

2.2. Setting the portion of coated nutrients

Optimal rates of coated N, P₂O₅ and K₂O in blends should take into account soil texture and CEC, irrigation regime and precipitation frequency, type of crop and growth duration. The rate of coated nutrients in a blend should be set to ensure an adequate supply of all elements throughout the growth cycle, while preventing excesses that might harm plants and waste fertilizers.

Simple guidelines, along with field trial results and experience, help growers reach the right decisions.

i. Water

Heavy or frequent rainfall accelerates plant nutrient leaching from the root zone. Nitrogen is more leachable than potassium, while phosphorus is the least leachable. Accordingly, growers should consider blends of different percentages of coated N, P₂O₅ and K₂O.

ii. Soil texture

The soil's capability to retain nutrients is related to clay content and Cation Exchange Capacity (CEC). Thus, heavier soils hold nutrients, while lighter soils give rise to nutrients leaching. Accordingly, lighter soil requires greater rates of coated nutrients.

Table 3 suggests the minimum % coating of each nutrient (N-P₂O₅-K₂O) for a four month growth cycle, taking into account climate, irrigation and soil texture.

Table 3: Recommended percentage of coated N-P₂O₅-K₂O, taking into account watering regime and soil texture

Soil texture	Clay>60% (Clay loam, clay)	Silt>40% (silt, silty loam, silty clay)	50%<sand<70% (medium sandy)	Sand>70% (sand, loamy sand)
Water regime				
(rain) + irrigation does not exceed the crop demand	<25-0-0	<25-0-0	25-0-25	50-0-25
(rain) + irrigation may exceed crop demand; rarely heavy rain	<25-0-0	50-0-25	50-0-25	50-25-50
heavy rain events, rain often exceeds crop demand	50-0-25	50-0-50	75-25-50	75-35-75
Frequent events of heavy rain, rainfall exceeds crop demand; no irrigation	>50-0-50	75-25-50	75-35-75	>75-50-75

iii. Span of the growth cycle

Longer growth cycles demand higher portions of coated plant nutrients in the fertilizer blend. For a crop cycle of six or eight months, it is recommended to increase the rate of coated nutrients in a blend by 25% and 50%, respectively, as compared to a crop with growth cycle of four months.

iv. Plant's initial demand for nutrients

High portions of coated nutrients suit seeded crops that need to germinate before they start consuming fertilizers. Planted seedlings, on the other hand, need an immediate uptake of nutrients to overcome the trauma of "plant shock", and accordingly require higher portions of uncoated nutrients.

v. Ratio of coated/uncoated nitrogen (N)

As nitrogen is likely to leach, most Multicote™ Agri programs include a portion of coated N.

In some cases, when conventional N fertilizers are given in very high rates to suit plant needs, significant quantities are lost due to leaching, denitrification and volatilization, and actual N levels available for plant uptake are low. When most nitrogen is coated, more nitrogen is available to the plant even at reduced application rates. A surplus of nitrogen may reduce yield. Therefore, special care must be taken to avoid potentially hazardous excesses.

For most field crops, which have a growth cycle of about four months in a moderate climate, a coated/uncoated ratio of 50:50 is recommended. Field trials with corn, rice, potatoes and other crops have proven that this ratio produces best yields.

In sandy soils, the coated portion can be increased to up to 70%. A higher portion of coated N should be employed only in cases of unusual conditions or special requests.

In heavy soils, a coated portion of 30% provides good performance and cost effectiveness of the fertilization.

vi. Ratio of coated/uncoated potassium (K)

Although potassium is less mobile than nitrogen, it may easily leach in light or sandy texture soils, especially under frequent heavy rains. Results of a tomato trial indicated that the percentage of coated potassium in the fertilizer blend significantly affected

yield, with 66% of the potassium in a coated form resulting in the highest yield. Higher percentage of coated K lead to insufficient availability of this nutrient for plant uptake, and consequently, reduced yield (Fig 3). Lower percentage of coated K led to K deficiencies at latter stages of the growth season and again, reduced yield.

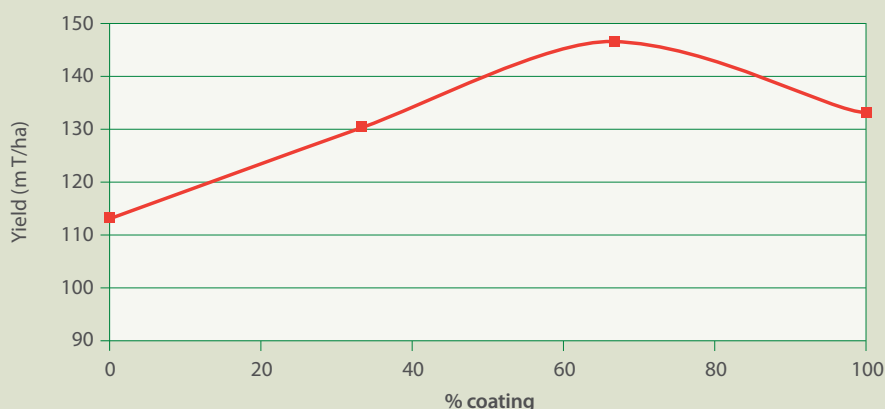


Figure 3: The effect of the ratio of coated potassium on tomato yield

2.3. Longevity and release profiles

After setting the coated portion of each nutrient, release longevity should be determined. For every nutrient, several release longevities are available.

i. Growth season and uptake dynamics

In general, nutrients should be provided according to crop growth and the plant's uptake dynamics. For most field crops, with growth seasons that last for three to five months, it is recommended to use a four-month longevity Multicote™ Agri formula. For long season crops such as tomatoes, which can last for eight months, a combination of four and eight-month longevities of Multicote™ Agri are recommended.

When setting a Multicote™ Agri fertilization program, it is crucial to consider the crop's specific requirements as they change throughout the growth cycle. Peppers (Fig. 4), for example, show high nutrient consumption

in the beginning of the season (30-100 days after planting). Therefore, a Multicote™ Agri program for peppers needs a short release duration and low rate of coated nutrients. In contrast, tomatoes have a rather long lag before intensive vegetative growth starts. Thus, nutrient consumption increases from the fifth week after planting, and lasts until the end of the cycle (Fig. 5). As a result, a fertilization program for tomatoes requires low release at the beginning and intensive release from the middle of the cycle to the end. As basil has continuous leaf growth, its demand for nutrients is steady, calling for a nutritional program with a constant release pattern.

For the best match with crop's growth requirements, it is recommended to use Multicote™ Agri "Stages" - formulae that provide nutrition with N-P-K ratio that changes during the season. For instance, high proportion of nitrogen may be released during phases of vegetative growth, followed by high proportion of potassium during productive phases.

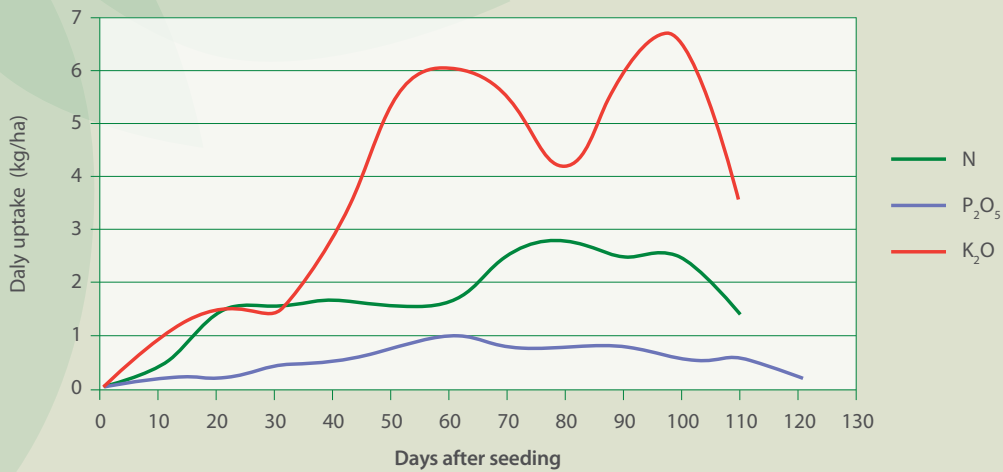


Figure 4: Uptake of nutrients by pepper plants throughout the growth cycle

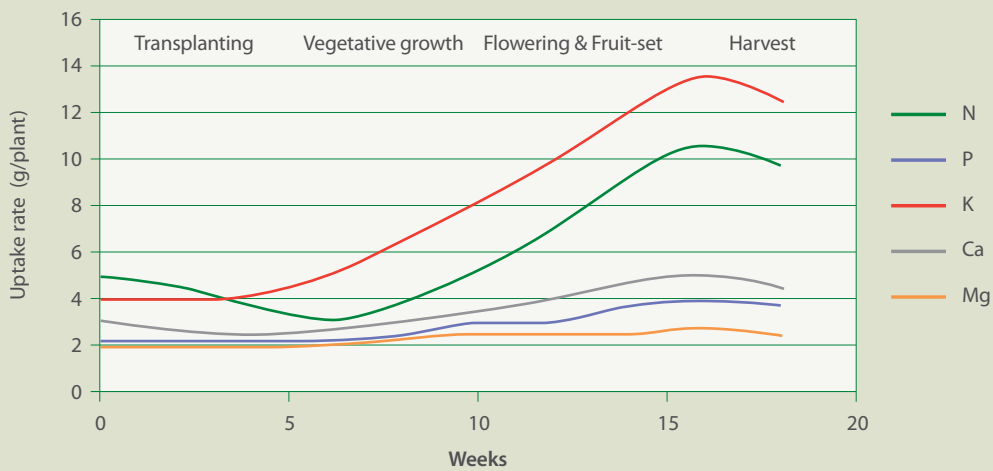


Figure 5: Uptake of nutrients by tomato plants throughout the growth cycle

ii. Soil temperature

The release longevity of Multicote™ products is determined at 21°C, and the actual release rate is governed by the temperature in the

application depth, as detailed in Table 4. Use the table to select the product most appropriate for your crop's needs, according to expected temperatures throughout the season.

Table 4: Release longevity according the soil temperature in a wet environment

Range	15°C (60°F)	21°C (70°F)	30°C (86°F)
Multicote™ 4	6 months	4 months	2 months
Multicote™ 6	7-8 months	6 months	3-4 months
Multicote™ 8	9-10 months	8 months	5-6 months
Multicote™ 12	15-16 months	12 months	7-8 months
Multicote™ 16	20-22 months	16-18 months	9-10 months

3. Application guidelines

3.1. The right placement

To get best performance of Multicote™ Agri, the fertilizer granules should be placed in the active root zone, but at a certain distance from young roots ($\pm 5\text{cm}$). To allow for continuous release, the granules should be placed within the zone wetted by irrigation. (Fig 6.) Accordingly, placement is dictated by the irrigation equipment in use. Covering Multicote™ Agri granules by banding, nesting or incorporating facilitate proper operation. Broadcasting application will significantly reduce the fertilizer’s efficiency and is generally not recommended. Comparing application methods in an eggplant trial, the advantages of nesting and banding over broadcasting are clear (Fig. 7).



Figure 6: Application of Multicote™ Agri granules in the wetted zone is essential for continuity of release

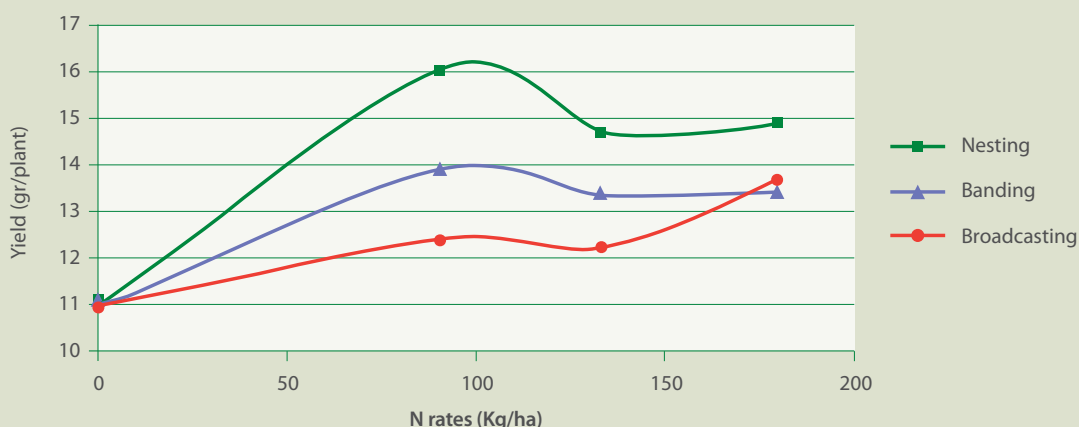


Figure 7: The effect of Multicote™ Agri application method on eggplant yield

Banding or nesting of granules is particularly important with urea (coated and uncoated), Due to the constantly high pH and salinity around the band, which inhibits nitrification and promotes the activity of the urease enzyme, the availability of N to the plant is increased.

Where the field is rain-fed or irrigated at time intervals of a week or more, the upper layer of the soil is likely to dry up, especially in warm, dry weather. In these cases, the fertilizer granules should be placed deeper (approximately 20 cm). The active root system

develops in deeper layers where moisture and nutrients are available and the temperature is relatively constant, i.e. less fluctuation exists between daily maximum and minimum temperatures.

Table 5 summarizes suitable modes of application in various types of crops. Detailed application instructions are brought in following chapters.

Consult a Haifa agronomist to set the application mode most suitable for your growth conditions.

Table 5. How to apply Multicote™ Agri

Crop type	Timing	Application mode	Illustration
Field crops (sown)	Before seeding	5 cm away, 5-10 cm below the seed row.	Fig. 8.1
	Simultaneous with seeding		
	Side dressing at early growth stage		
Field crops (planted), open-field vegetables	Before transplanting	Next to planting row	Fig. 8.2
	At transplanting		
	Side dressing at early growth stage		
Soil-grown protected vegetables	Before transplanting	Next to planting row	Fig. 8.2
	At transplanting		
Vegetables in soilless media	Before transplanting	Mixed with the growth medium	Fig. 8.3
Fruit trees - planting	At planting , or 2 weeks prior to spring flush	In the planting hole, covered with a 3-5 cm layer of soil, or in 2-3 25 cm slots radiating out from the base of the tree, 5 to 10 cm from the stem, 5 to 10 cm deep.	Fig. 8.4, 8.5
Fruit trees – established	2 weeks prior to spring flush and again after fruit-set or early summer	In 2-3 holes around the tree under the canopy, within the wetted zone	Fig. 8.6

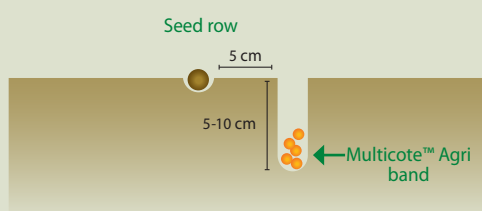


Figure 8.1: Application of Multicote™ Agri in sown field crops

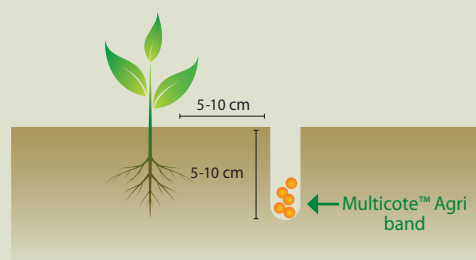


Figure 8.2: Application of Multicote™ Agri in planted field crops



Figure 8.3: Application of Multicote™ Agri in soilless-grown crops

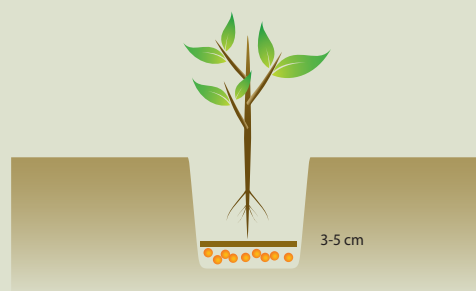


Figure 8.4: Tree planting - application in the planting hole

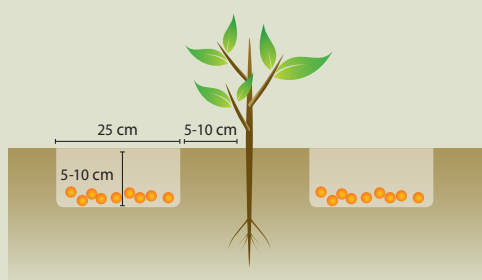


Figure 8.5: Tree planting - application in radial slots

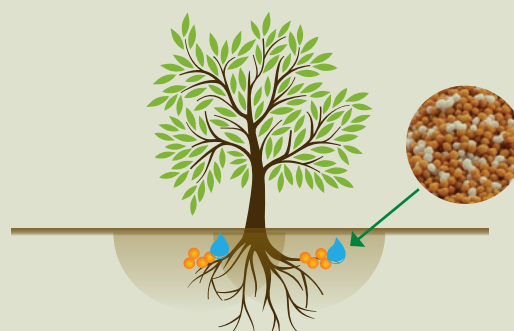


Figure 8.6: Application of Multicote™ Agri in established trees

3.2. Setting a fertilization program

i. Selection of formula

Table 6 summarizes the parameters that should be considered when selecting the fertilizer formula (see chapter 2 for detailed explanations)

Table 6: Consideration in setting a fertilizer formula

Parameter	Considerations	Reference
NPK ratio	Plant growth needs per stage and per season	
Ratio of coated nutrients	Water management, soil texture	section 2.2
Longevity	Span of the growth season, expected temperatures	section 2.3
Release profile	Plant growth dynamics	section 2.3

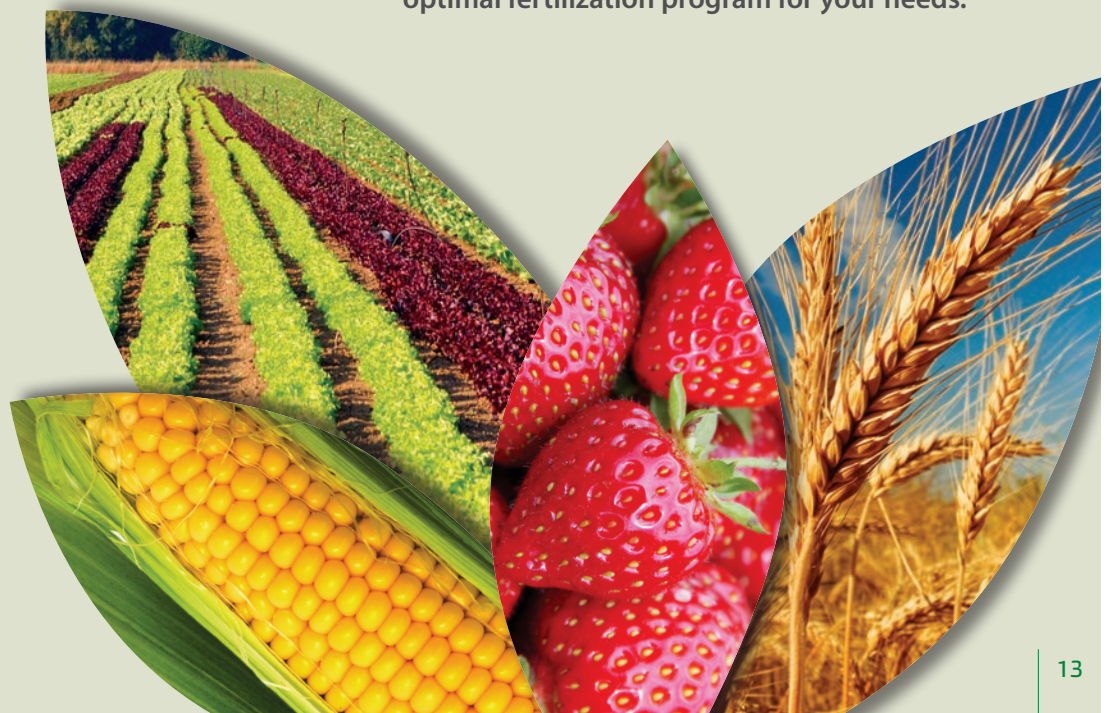
ii. Application rates

Fertilizer application rates should match the crop's growth requirements according to the expected yield, with some excess, in order to prevent depletion of soil nutrients reservoirs. Application rates should be adjusted according to the precipitates and the irrigation method being used: under light rains and precise irrigation (drip, sprinklers), the fertilizer

efficiency is maximal and application rates are lowest. Heavy rains, over irrigation and flood irrigation call for increased application rates.

In all cases, Multicote™ Agri allows for reduction of 20-30%, as compared to application rates of conventional fertilizers.

The exact rates, timing and mode of application should be determined according to specific crop needs, soil and water conditions and the grower's experience. Consult a Haifa agronomist to suit the optimal fertilization program for your needs.



3.3. Application equipment

Various machines are suitable for the application of Multicote™ Agri





4. Multicote™ Agri for various crops

4.1. Cash crops in the open field

High yielding cash crops demand adequate supply of plant nutrients and superior control over their availability throughout the growth season. Both the availability and the balance between plant nutrients must be controlled during the season. Multicote™ Agri products are recommended for these types of crops.

Application guidelines

It is recommended to apply Multicote™ Agri in bands.

In seeded crops, the band should be located 5 cm away, 10 cm below the seed row. In planted crops the band should be located next to the planting row. In any case, make sure that the fertilizer granules are placed within the zone reached by the irrigation water. Multicote™ Agri can be applied before seeding, at seeding time, or at early growth stages.

Set application rate to match crop requirements according to the expected yield (see page 13). Consult a Haifa agronomist to suit the optimal fertilization program for your needs.

Proven benefits

Trials have demonstrated that Multicote™ Agri can successfully replace conventional fertilization practices in a variety of crops, providing better yield results with reduced application rates.

i. Garlic in heavy soil, Yizrael Valley, Israel (2013)

The trial was conducted in a rain-fed commercial field. Multicote™ Agri at 2 application rates was compared to grower's practice of conventional fertilization.

Treatments

#1 Grower's practice:

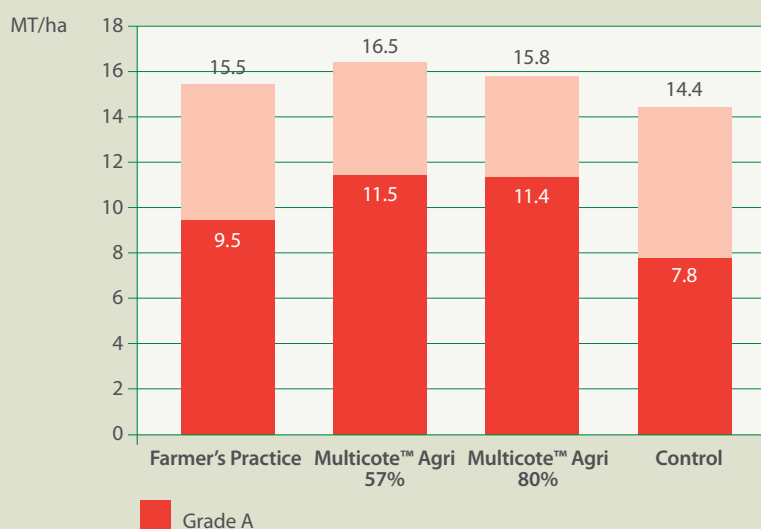
Date	2.12	19.12	3.1	24.1	11.2
Fertilizer	Urea	Ammonium sulfate	Urea	Urea	Potassium nitrate
Rate (kg/ha)	100	350	100	100	200

#2 Multicote™ Agri 57%: 315 kg/ha Multicote™ Agri (2) 43-0-0 (providing 57% N of grower's practice N rate)

#3 Multicote™ Agri 80%: 440 kg/ha Multicote™ Agri (2) 43-0-0 (providing 80% N of grower's practice N rate)

Control: no fertilization

Yield results



Economic analysis

Treatment	cost (\$/Ha)		Yield (MT/Ha)	Net profit (\$/Ha)
	Fertilizer	Application		
farmer's practice	671.1	89.5	15.45	40,946
Multicote™ Agri 57%	295.4	31.6	16.50	45,497
Multicote™ Agri 80%	420.5	44.2	15.79	44,128
Control	0.0	0.0	14.35	36,662



Multicote™ Agri at 57% N rate of farmer's practice resulted in highest yields and net profit. Multicote™ Agri eliminates the need for repeated applications during the rainy season, which cause soil compaction and are sometimes impossible.



ii. Onion, Eden Agricultural R&D Farm, Israel (2013-2014)

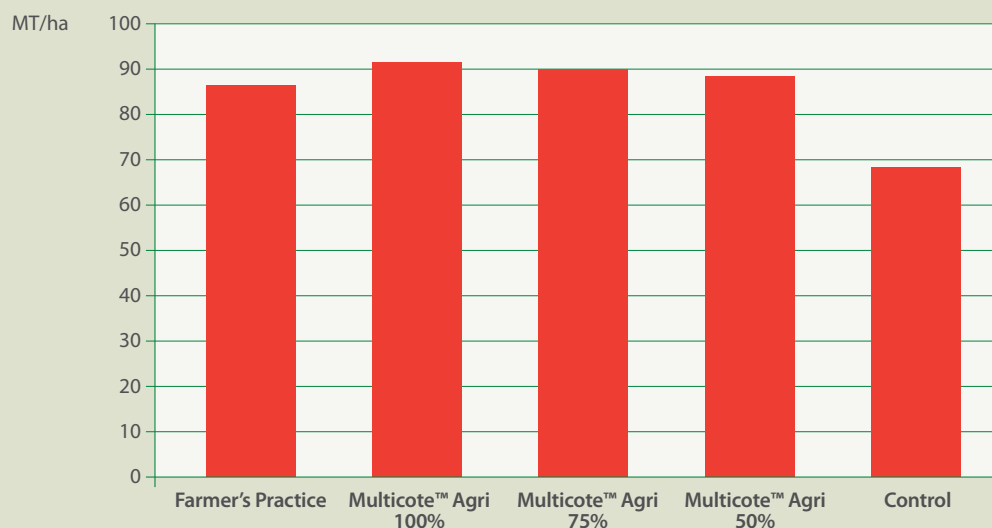
A trial was conducted to assess the efficiency and profitability of coated urea (Multicote™ Agri) in onion, in comparison with conventional fertilization practice.

Treatment	Fertilizer	%N of farmer's practice	N (kg/Ha)	Fertilizer (kg/Ha)	Cost (\$/ha)
Farmer's practice	46-0-0 (a)	100%	300	652	793
Control – no fertilization	-	-	-	-	-
Multicote™ Agri 100%	42-0-0 (b)	100%	300	714	727.5
Multicote™ Agri 75%	42-0-0 (b)	75%	225	536	555
Multicote™ Agri 50%	42-0-0 (b)	50%	150	357	382.6

a) Granular urea applied on 10.12.13, 2.1.14, 14.1.14, 29.1.14, 13.2.14, 25.2.14, 12.3.14, 20.3.14, 25.3.14, 31.3.14

b) Polymer-coated urea, applied before planting

Yield results



All Multicote™ Agri treatments resulted in higher yields compared to the farmer's practice. With insignificant differences between Multicote™ Agri treatments, application rate of 50% N is the most profitable.

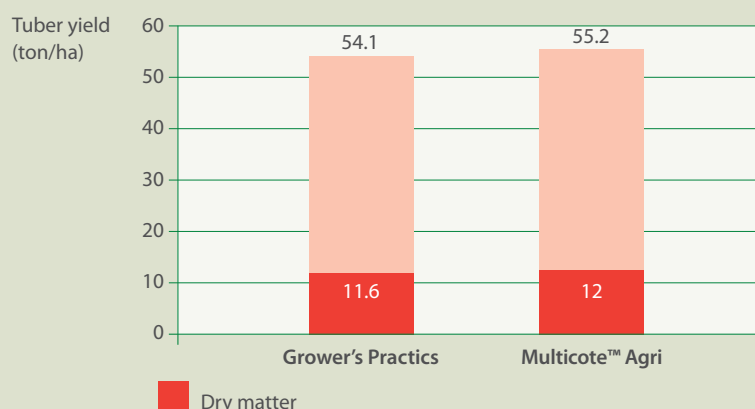


iii. Potato in sandy loam, Kibbutz Ruhama, Israel

A trial in Potato cv. Venus was conducted to compare Multicote™ Agri with conventional practice of single application of granular urea.

Treatment	Fertilizer	N kg/ha
Grower's practice	Urea 46-0-0	400
Multicote™ Agri	43-0-0 (70% coated)	240

Yield results



Multicote™ Agri treatment resulted in more efficient nitrogen use: higher yields and dry matter content with reduced application rates.



iv. Sweet Potato, Cudgen, NSW, Australia

The trial checked Multicote™ Agri at 3 application rates on sweet potato cv Beauregard.

Treatment	Fertilizer	kg/ha		
		N	P ₂ O ₅	K ₂ O
Grower's practice	Granular fertilizers	112	128	200
Multicote™ Agri Hi	Multicote™ Agri 6M 14.5-16-25 61-0-70% coated	102	112	175
Multicote™ Agri Med		84	93	145
Multicote™ Agri Low		74	82	128

Grower's practice was applied in 3 applications. Multicote™ Agri was applied in a single application, by incorporating it into the soil at bed formation before planting.

Results

Treatment	Tuber size distribution (%)			Total yield Ton/ha	Income US\$/ha
	Small	Medium	Large		
Grower's practice	6	16	15	28.7	9,020
Multicote™ Agri Hi	9	31	8	36.9	16,610
Multicote™ Agri Med	11	32	9	35.3	16,975
Multicote™ Agri Low	12	18	15	32.8	12,580



Multicote™ Agri at all application rates resulted in higher yields compared to the grower's practice. Best profitability was obtained with Multicote™ Agri at the medium application rate (75% of grower's practice rates).



4.2. Protected crops

Traditionally, protected crops are fed with liquid fertilizers or fertilizer solutions. In most cases, water is applied in excess to leach out the medium and prevent salt buildup. The surplus of irrigated water, however, leaches out plant nutrients, causing fertilizer loss and ground water contamination.

Multicote™ Agri is applied independently of the irrigation regime, which considerably reduces losses by leaching. Additional benefits are: elimination of the need to maintain sophisticated dosing systems, easy application and no need to recycle leachates.

Multicote™ Agri provides high quality plant nutrients in a reliable composition and may save up to 50% of fertilization rates.

Application guidelines

In soil-grown crops, apply Multicote™ Agri in bands, next to the planting row, before or at transplanting. In soilless crops, mix Multicote™ Agri with the growth medium.

Set application rate to match crop requirements according to the expected yield (see page 13). Consult a Haifa agronomist to suit the optimal fertilization program for your needs.

Proven benefits

Field trials and demo plots have shown that base-dressing with Multicote™ Agri at 60-70% of conventional application rates resulted in better nutrient use efficiency, higher yields and improved quality. The overall results increased growers' net profits and minimized adverse environmental impact. Three examples are brought hereunder.

i. Melons in plastic tunnels, CEHM Experiment Station, France

Single application of Multicote™ Agri was compared to conventional fertilization in Melons cv Figaro grown in tunnels.

Treatment	Kg/ha N-P ₂ O ₅ -K ₂ O-MgO	% of conventional	Timing of application
Conventional	150-168-250-110	100	Base dressing plus 2 side dressing applications by fertigation
Multicote™ Agri	20-15-10-0	40-27-12-0	At planting

Results

	Total yield (MT/ha)	No. of fruits/ sq. meter	Mean fruit weight (g)
Grower's practice	26.1	3.95	660
Multicote™ Agri	37.8	5.63	672

Multicote™ Agri at significantly reduced application rates resulted in more fruit per plant, larger fruit and a higher total yield.



ii. Tomatoes in greenhouse, HaBesor Farm, Israel

The trial compared between Multicote™ Agri 16-8-26 (6 months longevity, 90-0-100% coated) at two application rates and liquid fertilizers in tomatoes cv Hazera-189 grown in greenhouse.

Treatment	Kg/ha			Application method
	N	P ₂ O ₅	K ₂ O	
Liquid	660	240	840	Fertigation: 2-days intervals
Multicote™ Agri 50%	264	132	429	Pre-plant: Irrigation only, same as grower's practice
Multicote™ Agri 65%	432	216	702	

Results

Treatment	Total yield (T/ha)	Marketable yield (T/ha)	Mean fruit weight (g)
Control	126.72 a	111.23 a	166 a
Multicote™ Agri 50%	124.89 a	109.97 a	173 b
Multicote™ Agri 65%	140.16 b	126.83 b	171 b

Multicote™ Agri at 65% of conventional application rates increased the total and marketable yield. At 50% of conventional application rates, Multicote™ Agri resulted in similar yields to the liquid treatment. At both application rates, Multicote™ Agri increased fruit size.

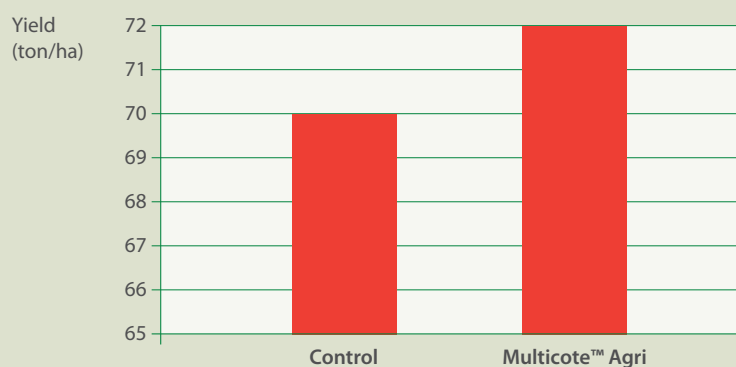


iii. Bell pepper in greenhouse, Prigan, Israel

The trial compared between Multicote™ Agri 17-9-27 (8 months longevity) and liquid fertilizers in bell peppers cv. BK-162 grown in greenhouse. Multicote™ Agri was applied at about 50% of the liquid application rate.

Treatment	Kg/ha			Application method
	N	P ₂ O ₅	K ₂ O	
Grower's practice –Liquid 5-3-8	1,750	1,050	2,800	Fertigation
Multicote™ Agri	875	463	1,390	Pre-plant application, drip irrigation as in the control treatment

Results



Multicote™ Agri significantly increased pepper yield. Higher yield is attributed to larger number of fruits, and also to a slight increase in fruit size.

4.3. Fruit trees

Application of controlled-release fertilizers at planting or during 1st year provides the necessary nutrients required for good establishment and initial growth, without risk to the root system or toxicity to the plant.

In established plantations Multicote™ Agri, applied only once per season, saves on labor and manpower.

Application guidelines

At planting : spread Multicote™ Agri in the bottom of planting hole, and cover with a 3-5 cm layer of soil. Use product with release longevity of 6 or 8 months. Multicote™ Agri may also be applied in 2-3 25 cm slots radiating out from the base of the tree, 5 to 10 cm from the stem, 5 to 10 cm deep.

Established trees: Apply Multicote™ Agri in 2-3 holes around the tree, 30 cm away from the trunk and 10-20 cm deep. Place the fertilizer granules within the wet zone of the watering source (dripper or micro-sprinkler).

Set application rate to match crop requirements according to the expected yield (see page 13). Consult a Haifa agronomist to suit the optimal fertilization program for your needs.

Proven benefits

i. Apple, Volano, Rovereto (TN) Italy (2008-2010)

A 3-years trial was conducted to evaluate the efficiency of a Multicote™ Agri in an apple orchard planted in a sandy soil under conditions of heavy rainfall. The trial plot included 3 varieties: Fuji, Stark and Gala.

Treatment	Kg/ha			Timing
	N	P ₂ O ₅	K ₂ O	
Farmer's practice - Soluble fertilizers	143	93	200	Repeated applications
Multicote™ Agri	100	65	140	Single application at late spring

Results

Yield weight (kg/tree)

Variety	Treatment	2008	2009	2010
Stark	Multicote™ Agri	3.8	4.5	3.6
	Farmer's practice	3.6	3.9	3.9
Fuji	Multicote™ Agri	3.0	2.8	3.3
	Farmer's practice	3.1	2.7	2.7
Gala	Multicote™ Agri	2.7	3.7	3.7
	Farmer's practice	2.7	3.2	3.2

Fruits per tree

Variety	Treatment	2008	2009	2010
Stark	Multicote™ Agri	18.8	21.3	18.8
	Farmer's practice	19.0	20.0	20.0
Fuji	Multicote™ Agri	14.8	16.3	18.9
	Farmer's practice	15.0	15.3	15.3
Gala	Multicote™ Agri	17.8	21.2	20.2
	Farmer's practice	18.0	19.5	19.5

In all three varieties, a single application of Multicote™ Agri at 70% of the farmer's practice application rates resulted in higher yields and more fruits. Generally speaking, the observation repeated in all the trial years.



ii. Citrus, Noordgrens Landgoed farm, Limpopo Province, RSA

A trial was carried out to evaluate the efficiency of Multicote™ Agri (8) 24-6-13 ("Juvenile" formula) in non-bearing citrus groves.

Trial trees: Star Ruby grapefruit on Rough Lemon rootstock.

Conventional orchard was planted in 2004, bearing its first crop in 2009.

The Multicote™ Agri orchard was established in 2010 and first harvest was taken in 2013 (2 years earlier than the conventional methods).

Both orchards were planted on sandy, nutrient-poor soils.

The pictures below depict that Multicote™ Agri significantly enhanced establishment and initial growth



Conventional, 18 months after planting

- Fertilizer applied monthly
- 8 applications since planting
- 1st Harvest: Year 5 after planting 21.7 tons per ha
- 1nd harvest: year 6 after planting 41.5 tons per ha



Multicote™ Agri, 18 months after planting

- Single fertilizer application, 6 months after planting
- 1st Harvest: year 3 after planting 26 tons per ha
- 2nd harvest: year 4 after planting 42 tons per ha

The data is courtesy of Francois Dillman owner of the farm Noordgrens Landgoed in Limpopo Province and Arthur Lilford of Terason.



4.4. Field crops

Due to improved efficiency of nutrient uptake, Multicote™ Agri allows for lower application rates in comparison to conventional fertilizers. This is especially important when nutrient application rates are limited by regulations.

Where conventional fertilization practice involves repeated applications of nitrogen throughout the season or luxurious nitrogen rate at the beginning of the season, it is recommended to use CoteN™ - coated, controlled-release urea. This will spare repeated applications and considerably improve nitrogen use efficiency.

Multicote™ Agri and CoteN™ may be blended with conventional granular fertilizer to create a whole plant nutrition.

Application guidelines

It is recommended to apply Multicote™ Agri in bands.

In seeded crops, the band should be located 5 cm away, 10 cm below the seed row. In planted crops the band should be located next to the planting row. In any case, make sure that the fertilizer granules are placed within the zone reached by the irrigation water. Multicote™ Agri can be applied before seeding, at seeding time, or at early growth stages.

Set application rate to match crop requirements according to the expected yield (see page 13). Consult a Haifa agronomist to suit the optimal fertilization program for your needs.

Proven benefits

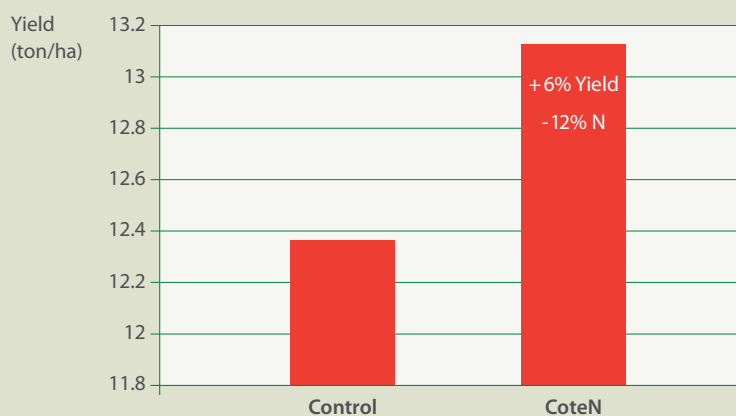
Many field trials and demo plots have shown that pre-plant application of Multicote™ Agri at 60-70% of conventional application rates boosts yield and improves quality, thus increasing grower's net profits, with the additional benefit of minimizing adverse environmental impact.

Some examples are shown hereunder.

i. Corn, Terre de Gascogne, Southwest France

Treatments	Base-dressing	Top dressing at 3-4 leaves
Control	40 kg/ha	150 kg/ha
CoteN™ (33% coated)	40 kg/ha	128 kg/ha

Results



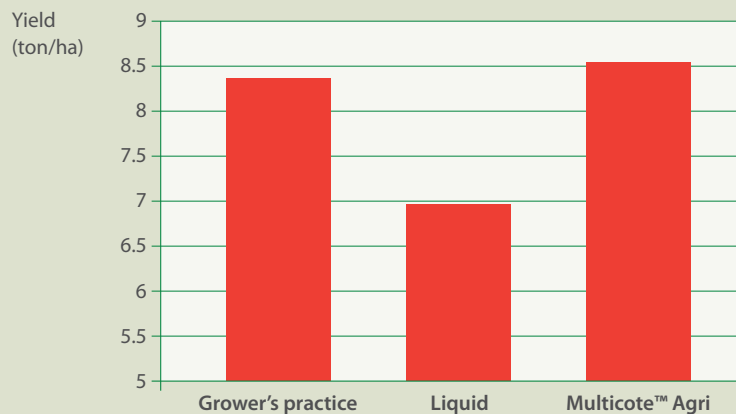
Multicote™ Agri treatment increased yield by 6%, with 12% N less than the control treatment.



ii. Corn, Guanajuato, Mexico

Treatments	% coated material	Kg/ha N-P ₂ O ₅ -K ₂ O	N % of grower's practice
Grower's practice – 2 applications	-	260-76-60	100
Liquid fertilizer	-	234-40-27	90
Multicote™ Agri – base dressing only	30-0-30	182-70-42	70

Results



Multicote™ Agri treatment produced higher yield, with lower N rate and fewer applications.

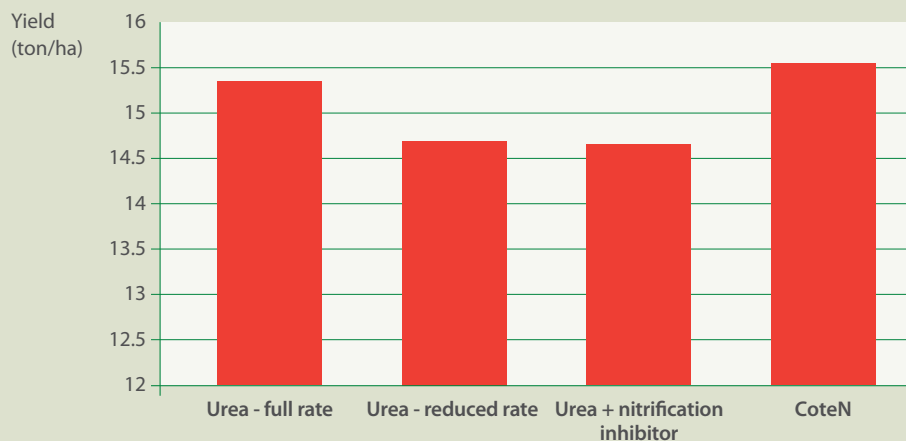


iii. Corn, South France

A trial was conducted to seek the optimal practice to reduce N application rates in corn, to meet environmental regulations.

Treatments	N kg/ha			N % of grower's practice
	At sowing	At 6-8 leaves	At 10 leaves	
Urea – full rate	68 kg/ha from DAP (in an NPK blend)	170	58	100%
Urea – reduced rate		170	0	80%
Urea + nitrification inhibitor		170	0	80%
CoteN™		170	0	80%

Results



Of all the trial treatments, CoteN™ produced highest yield, and was the only one that exceeded the control treatment of full N rate.



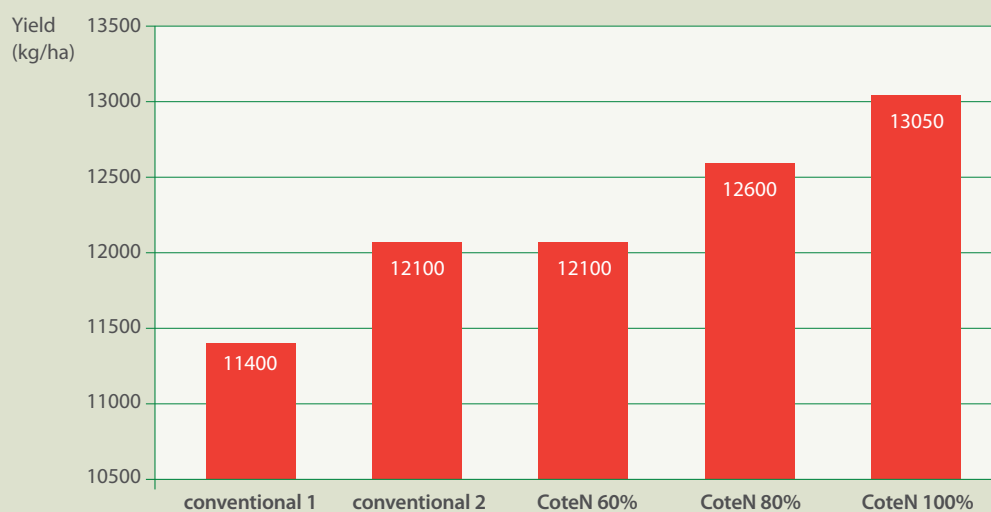
iv. Rice, Brazil (2012-13)

A trial was conducted to compare CoteN™ to conventional fertilization practice in rice, and to set the optimal application rate when replacing conventional nitrogen sources with CoteN™.

Treatments

Conventional 1	250 kg/ha NPK 5-20-30 + (150+70) kg/ha Urea	3 applications
Conventional 2	100 kg/ha MAP + 150 kg/ha KCl + (150+70) kg/ha Urea	3 applications
CoteN™ 100%	CoteN™ Mix 24-11-17 (90-00-00) - 460Kg/ha	1 application
CoteN™ 80%	CoteN™ Mix 22-12-19 (87-00-00) - 405Kg/ha	1 application
CoteN™ 60%	CoteN™ Mix 19-14-20 (83-00-00) - 350Kg/ha	1 application

Results



CoteN™ treatments, including the low application rate (60%) resulted with same or better yield as compared to the conventional treatments. Of all the trial treatments, CoteN™ produced highest yield, and was the only one that exceeded the control treatment of full N rate.





Check the FloraMatch™ mobile app



Haifa's FloraMatch™ helps you to predict availability of nutrients throughout the season and to plan Multicote™ controlled release fertilization accordingly.

FloraMatch™ generates release curves of Multicote™ formulae and calculates nutrient release according to expected temperatures. This lets you visualize plant nutrition over time, and make adjustments if needed.

FloraMatch™ is available as a mobile app for iOS and Android powered devices and also as an on-line software, all free.

Watch the Multicote™ Agri videos



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