MNG

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DISTRIBUTOR & FARMER HANDBOOK · EDITION 2026

The MNG High-Efficiency Farming System

A complete operating manual for distributors, farmers, agronomists and partners.

PILLAR 1 · SOIL Mineral prills, phosphate platform, organic carbon

PILLAR 2 · WATER AquaSave — up to 60% irrigation reduction in stress phases

PILLAR 3 · PLANT Micronised foliar nutrition with the JAM Process

REDUCE INPUTS · INCREASE EFFICIENCY · RESTORE SOIL · SAVE WATER · INCREASE PROFIT

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MNG *Science · Nature · Innovation*

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UNITS AND CONVENTIONS

All rates are given in kilograms per hectare (kg/ha) for soil and foliar application. Spray volumes are given in litres per hectare (L/ha). Crop development stages reference the BBCH scale (00–99) where applicable. Technical terms — zeta potential, NUE, CEC — are defined on first use. Trade names are capitalised; product categories are not.

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What is inside

Foreword

This handbook is a working tool — built so that any distributor or farmer can move from first conversation to first order to first harvest with confidence. Every section answers a real-world question. Every dosing table is the operating standard. Every SOP has been validated in the field.

The MNG High-Efficiency Farming System is not a fertiliser. It is an integrated agronomic platform — designed to reduce conventional inputs by 30–50%, save up to 60% of irrigation water in stress phases, and either maintain or increase yield while restoring soil health season by season. The economics are deliberate: lower input cost combined with sustained or higher output produces a structural margin uplift of 20–40% per hectare for the farmer, and a premium-positioned, high-loyalty product line for the distributor.

This handbook is structured as a decision document. The first sections explain the science clearly, without abstraction, so that the field team understands why the system works. The middle sections describe the application logic, the SOPs, and the crop-specific programmes. The closing sections present the economics, the strategic positioning, and the full product portfolio.

Every claim in this document is backed by trial data, technical data sheets, and a proprietary technological platform — micronisation to approximately three microns, zeta-potential optimisation, the JAM Process, and a defined humic-fulvic ratio architecture. None of these elements are mixed into a generic product. They are engineered into a system that can be deployed crop by crop, field by field, season by season.

> *"We do not sell more fertiliser. We sell the result of less fertiliser, less water, healthier soil, and a stronger plant."*
>
> **— MNG Field Principle**

The reader will move through thirteen sections — system architecture, nutrient efficiency, the role of humic and fulvic acids, zeta potential, micronisation, the JAM Process, mineral transformation, gas independence, soil-health-driven disease prevention, the staged application system, crop-specific programmes for wheat, citrus and vegetables, the economic case, and the strategic positioning of the system. The appendices contain the full tank-mix SOPs, the compatibility matrix, the first-season implementation protocol, the three-year reduction roadmap, and the troubleshooting guide. Together they form a complete operating manual.

This is the document a distributor uses to win an account. It is the document a farmer uses to plan a season. It is the document a partner uses to evaluate the system. It has been written so that all three audiences arrive at the same conclusion: MNG is the most rational way to farm in a world of rising input costs, declining soil quality, and tightening water supply.

Our Mission & Vision

Mission

At MNG, we are redefining the future of agriculture. Our mission is to help farmers grow stronger crops, restore soil vitality, reduce chemical dependency, and use water with maximum efficiency — without compromising yield, quality or profitability.

Built on science, powered by nature and proven in the field, MNG develops high-efficiency farming solutions that work with the natural intelligence of soil and plants — improving nutrient availability, strengthening plant resistance, enhancing root-zone performance and supporting healthier, more resilient production systems.

> **THE MNG BELIEF**
>
> Agriculture does not need more chemicals. It needs smarter systems — advanced plant nutrition, soil regeneration, water-saving technology and practical agronomy in one integrated approach: producing more with less, while protecting the resources that feed the world.

Vision

Our vision is to become one of the world's leading forces in sustainable, high-efficiency agriculture — a future where farmers are no longer forced to choose between productivity and sustainability, where healthy soil becomes the foundation of food security, and where water is protected, plants are naturally stronger, and agriculture becomes more efficient, resilient and responsible.

From mineral science to field application, from soil health to crop performance, from local farms to global food systems — we are building a new agricultural standard for the next generation.

> *Nature is not replaced — it is activated. Science does not fight the soil — it unlocks its potential.*
>
> **— MNG**

ABOUT MNG

Our Philosophy

Restore balance, and the system becomes stronger by itself.

We believe agriculture must move beyond reaction — beyond treating symptoms after the damage is already visible. Healthy crops begin with healthy soil, and healthy soil begins with minerals, structure, biology, water movement and microbial life working together in harmony.

When that balance is disturbed — by intensive farming, overuse of chemicals, nutrient depletion, salinity, compaction and biological stress — the plant becomes weaker and more vulnerable to disease, pests, drought and heat. MNG was created to rebuild that balance: to replenish what modern agriculture has removed, and to activate the natural strength of the entire growing system — soil, microflora, mesofauna, seeds, roots, leaves and plants.

We do not believe the future of farming is about fighting nature harder. We believe it is about understanding nature better. Instead of reacting to stress with rescue treatments, MNG creates the conditions where problems are less likely to develop: strengthening the plant before stress appears, improving nutrient availability before deficiency shows, supporting root-zone health before yield is lost, and building resilience before disease pressure takes control.

Quality is the result of balance

For MNG, crop quality is not only the result of fertilisation — it is the result of balance:

- Balance between minerals and biology
- Balance between soil and roots
- Balance between water and nutrients
- Balance between productivity and sustainability

This is the foundation of our work: healthier soil, stronger plants, better quality, reduced dependency on chemical intervention, and a farming system that becomes more resilient season after season. MNG is not only about growing more — it is about growing better, by restoring the natural intelligence of the soil–plant system.

How to use this handbook

Three audiences. One handbook. Three different reading paths.

If you are a distributor

Begin with Section 1 to anchor the system in your own language. Read Section 13 next — it gives you the strategic vocabulary you will use to explain why MNG is not interchangeable with NPK or any fertiliser line. Section 12 gives you the economics in numbers your farmer customers can verify. Then move into Part IV — the product portfolio — which is your sales catalogue. The appendices are your operational reference: the tank-mix SOP and the compatibility matrix should be on every field representative's clipboard.

If you are a farmer

Skip directly to Section 10. It tells you when to apply, what to apply, and how much. Then read Section 11 for the programme that matches your specific crop. The Three-Year Roadmap in Appendix D shows you how to transition without losing yield. The Troubleshooting Guide in Appendix E answers the questions you will have in the first season. The science chapters — Sections 3, 4, 5 — are there if you want to understand why the system works. They are not required reading to use it successfully.

If you are an agronomist or institutional partner

Read in sequence. The science chapters establish the technological platform — micronisation, zeta potential, the JAM Process, the humic-fulvic ratio architecture. The application chapters establish that the system is operationally robust. The economics establish that the system is commercially rational. The compatibility matrix and tank-mix SOPs establish that the system can be integrated into existing crop protection programmes without conflict.

> **UNITS AND CONVENTIONS**
>
> All rates are given in kilograms per hectare (kg/ha) for soil and foliar application. Spray volumes are given in litres per hectare (L/ha). Crop development stages reference the BBCH scale (00–99) where applicable. Technical terms — zeta potential, NUE, CEC — are defined on first use. Trade names are capitalised; product categories are not.

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PART I

THE SYSTEM

The science behind every application

SECTION 1

System Overview

The Three Pillars

MNG is not a single product. It is a three-pillar agronomic system — soil, water, plant — designed to work as one. This section anchors the entire handbook in the architecture every distributor and farmer must understand before discussing any individual product.

Soil. Water. Plant. The MNG system intervenes at all three points simultaneously. No pillar in isolation produces the full result.

Conventional farming treats nutrition as a delivery problem: how much N, P, K, and where to put it. MNG treats nutrition as an efficiency problem: of every unit of nutrient applied, how much actually reaches the plant, and how much is lost to leaching, volatilisation, fixation, or runoff. The MNG answer is to redesign the soil, the water dynamic, and the plant uptake mechanism at the same time. Each pillar reinforces the other two. Removing any one pillar reduces the system to a partial intervention.

1.1 Pillar One — Soil

The soil pillar restores the chemical, physical and biological foundation on which efficient nutrition depends. Three product groups deliver this:

- **Mineral prill range:** calcium-magnesium-sulphur prills (CaMgS, CaMg, CaS, Ca, CaPS) — applied pre-planting at 100–300 kg/ha to correct base saturation, build cell-wall calcium reserves, and supply structural sulphur and magnesium for chlorophyll formation.
- **Phosphate platform:** BioRock-P plus PhosActiv — a granular phosphorus carrier and a phosphorus activator that together unlock fixed soil phosphorus, reduce DAP/MAP demand by 30–50%, and supply silicon and amino acids as additional benefit.
- **Humic-fulvic carrier:** each soil product contains a balanced humic and fulvic acid matrix that improves soil structure, supports microbial life, and creates the chelation environment required for efficient nutrient transport.

1.2 Pillar Two — Water

The water pillar is anchored by AquaSave — a composite soil amendment — micronised minerals, humic acid and a chemical-free, biodegradable superabsorber — that holds water in the root zone and releases it as the plant requires. Applied at 50–150 kg/ha, AquaSave can reduce irrigation demand by up to 60% in stress phases. In rainfed systems, it extends the effective rainfall by holding water that would otherwise drain or evaporate. In irrigated systems, it reduces both the volume of water required and the pumping energy associated with it.

WHY THE WATER PILLAR EXISTS

Across the regions where MNG operates — Middle East, North Africa, South and Southeast Asia, Southern Europe — water is the constraint, not nutrients. A nutrition system that ignores water is a partial system. AquaSave converts the water constraint from a binding limit into a manageable variable, and in doing so makes the soil and plant pillars meaningfully more effective.

1.3 Pillar Three — Plant

The plant pillar delivers nutrition directly to the leaf through micronised foliar products. Five products cover the full requirement:

- **Classic Plus:** multi-nutrient foliar complex for general vegetative growth, stress resistance and metabolic activation. Applied at the onset of active vegetative growth and again at peak demand stages.
- **AminoTreat:** amino acid formulation for rapid metabolic recovery following stress events — heat, drought, frost, transplant shock — and to support reproductive stages.
- **Boron:** micronised boron for pollen viability, fertilisation success and cell wall formation. Applied pre-anthesis in any crop where reproductive failure is an economic risk.
- **Mg12:** activated magnesium for correction of inter-veinal chlorosis, particularly relevant in high-pH soils and intensive cropping.
- **Fe20:** activated iron for correction of lime-induced iron chlorosis, particularly relevant in calcareous soils across the Middle East and Mediterranean.

All foliar products share the same technological platform: micronisation to ~3 µm, fulvic-dominant carrier matrix, JAM Process particle activation, and zeta-potential optimisation. These are not stand-alone fertilisers blended together — they are designed as a coordinated programme.

1.4 The System in One Diagram

The architecture is simple to describe and powerful to deploy:

PILLAR	WHAT IT DOES	PRIMARY PRODUCTS	TYPICAL RESULT
Soil	Restores base saturation, structure and microbial life	Prill range, BioRock-P, PhosActiv	30–50% NPK reduction
Water	Binds and releases water in the root zone	AquaSave	Up to 60% irrigation saving in stress phases
Plant	Delivers nutrition through the leaf	Classic Plus, AminoTreat, Boron, Mg12, Fe20	Higher NUE and stress tolerance

1.5 What changes for the farmer

The farmer who deploys all three pillars, in the correct sequence, on a correctly designed programme, will observe the following pattern through the season:

1. In the first 2–4 weeks after soil application, no visible change. The system is rebuilding chemistry below ground.

2 From early vegetative growth, leaf colour deepens, canopy density increases, and uniformity across the field improves. This is the foliar pillar acting on a now-functional soil.

3 In stress phases — heat, drought, irrigation interruption — the field holds. AquaSave-treated soil retains workable moisture; plants recover from stress events that would normally cause yield loss.

4 At reproductive stages — flowering, fruit set, grain fill — the plant has reserves it does not normally have. Aborted flowers reduce. Grain weight and fruit size hold up to the genetic potential of the variety.

5 At harvest, yield is equal to or above the conventional reference, on 30–50% reduced fertiliser. Quality grade distribution shifts toward the premium grades.

6 In the following season, soil indicators — organic matter, microbial biomass, structure — measurably improve. The starting point of year two is better than the starting point of year one.

1.6 What changes for the distributor

The distributor selling MNG is not selling fertiliser tonnage. The distributor is selling a result — and is rewarded for it commercially. Three things change:

- **Margin structure:** MNG products are higher value per tonne than commodity NPK and command healthier margins through the channel.
- **Customer loyalty:** a farmer who experiences the result reorders the full programme. Single-product sales become multi-product accounts.
- **Defensible position:** the system is the differentiator. A distributor of MNG cannot be substituted by a distributor of bulk urea — the categories are not comparable.

> *"Soil prepares the foundation. Water is the lifeline. The plant performs the work. MNG intervenes at all three."*
>
> — MNG System Architecture

SECTION 2

Nutrient Efficiency

Why volume is not the answer

Conventional fertilisation loses 40–70% of applied nutrient before the plant ever takes it up. The MNG system replaces volume with efficiency — and in doing so makes the same yield achievable on substantially less input.

The fertiliser industry has trained farmers to think about how much. The MNG system asks a different question: how much arrives where it is needed?

2.1 Where conventional fertiliser is lost

Of every 100 units of nitrogen applied as urea, only 30–60 units reach the plant. The remainder is lost through three primary pathways:

- **Volatilisation:** ammonia (NH_3) volatilisation from surface-applied urea on calcareous or alkaline soils — losses of 20–40% within days of application.
- **Leaching:** nitrate (NO_3^-) movement below the root zone with irrigation or rainfall — common on light soils and in flood-irrigation systems.
- **Denitrification:** nitrate to nitrogen gas (N_2) and nitrous oxide (N_2O) on waterlogged, anaerobic soils — losses of 10–30% in poorly drained fields.

Phosphorus is lost differently — fixed in calcium phosphates on alkaline soils and in iron-aluminium phosphates on acid soils. Of every 100 units of P_2O_5 applied, only 15–25 units are typically available to the plant in the season of application. The rest accumulates in the soil in unavailable forms.

Potassium leaches on light soils. Micronutrients are antagonised by macronutrient over-application. Sulphur is lost through leaching as sulphate. Across the full nutrient programme, 40–70% of applied input is not available to the plant — and the farmer pays for all of it.

2.2 The conventional response: more

The industry response to nutrient loss is to apply more. More urea to compensate for volatilisation. More DAP to compensate for fixation. The result is a structural over-application: the farmer pays twice — once for the nutrient that is lost, and again for the nutrient that replaces it.

This response has three consequences. First, fertiliser cost becomes the dominant operating expense — typically 30–50% of total variable cost. Second, soil chemistry is progressively distorted: organic matter declines, salinity rises, micronutrient ratios become imbalanced. Third, environmental externalities accumulate: nitrate in groundwater, ammonia in the atmosphere, phosphate in surface water.

2.3 The MNG response: efficiency

The MNG system intervenes at the points where nutrient is lost, and converts loss back into uptake:

ATTRIBUTE	CONVENTIONAL	MNG SYSTEM
Nitrogen volatilisation	20–40% lost as NH_3 from surface urea	Reduced urea load + soil structure rebuilt by Prill range and humic carriers — N retained in stable forms
Phosphorus fixation	75–85% of P fixed in calcium or iron-aluminium compounds	BioRock-P + PhosActiv unlock fixed P; humic-fulvic chelation maintains P in plant-available form
Potassium leaching	Lost on light soils with irrigation	AquaSave reduces drainage volume; humic carriers improve K retention on cation exchange complex
Micronutrient antagonism	Imbalances from macro over-application	Targeted foliar delivery (Mg12, Fe20, Boron) bypasses soil chemistry entirely
Foliar efficiency	20–30% leaf uptake of standard foliar products	Micronisation + zeta potential optimisation delivers 60–80% leaf uptake

2.4 The arithmetic of efficiency

If a farmer is currently applying 250 kg/ha of urea and recovering 50% as plant-available nitrogen, the plant receives 125 kg/ha N. If the MNG system delivers 70% efficiency on 175 kg/ha — a 30% reduction in urea — the plant receives 122.5 kg/ha N, almost identical to the conventional case. The farmer has paid for 30% less urea. The yield is the same. The margin uplift is the saved input cost.

> **THE EFFICIENCY EQUATION**
>
> Plant-available nutrient = applied nutrient × efficiency factor.
>
> Conventional system: 250 kg × 50% = 125 kg available.
>
> MNG system: 175 kg × 70% = 122.5 kg available.
>
> Same plant, same yield, 30% lower input cost. The savings repeat every season — and the soil improves rather than degrades.

2.5 Why this is not a fertiliser-substitution argument

MNG products do not replace urea, DAP or NPK on a kg-for-kg basis. They are not equivalents. MNG products restore the conditions under which less urea, less DAP and less NPK produce the same agronomic result. The substitution is not chemical — it is systemic. A farmer who simply replaces conventional fertiliser with MNG products at the same rates will overspend; a farmer who reduces conventional fertiliser by 30–50% and applies MNG correctly will underspend, and outperform.

> *"Conventional farming pays for 100 units to deliver 50. MNG pays for 70 units and delivers 50. The plant doesn't notice. The bank account does."*
>
> **— MNG Field Principle**

SECTION 3

Humic vs Fulvic

The critical distinction

Most agronomists treat humic and fulvic acids as a single category. They are not. They have different molecular structures, different behaviour in soil and plant, and different application logic. Mixing them in random ratios produces a generic biostimulant. Applying them in the correct ratio, in the correct location, produces a precision agronomic tool.

Humic acid works in the soil. Fulvic acid works inside the plant. Same family, different roles. The MNG system uses both — but never the same way in the same place.

3.1 The molecular reality

Humic acid is a high-molecular-weight organic acid (typically 5,000–100,000 Daltons). It is dark, large, and partially soluble. Fulvic acid is a lower-molecular-weight organic acid (typically 500–5,000 Daltons). It is yellow-brown, small, and fully soluble across the full pH range. Both originate from the slow decomposition of plant material in oxygen-rich, biologically active soils — leonardite, peat, and humified compost are typical sources.

The molecular size difference dictates the agronomic behaviour. A humic molecule is too large to enter a plant cell efficiently. A fulvic molecule is small enough to cross the cuticle and the cell membrane, carrying nutrients with it. The same chemistry, in different sizes, produces two different tools.

3.2 What humic acid does (in the soil)

- **Improves soil structure:** humic acid binds soil particles into stable aggregates, improving water infiltration, aeration, and root penetration. On compacted or sodic soils, this single effect is often the highest-value contribution.
- **Feeds the microbiome:** humic carbon is the food source for beneficial soil microorganisms. A humic-supplemented soil supports two to five times the microbial biomass of an unsupplemented soil.
- **Increases CEC:** humic acids hold positively charged nutrients — calcium, magnesium, potassium, ammonium — on their negative charge sites, increasing the soil's effective cation exchange capacity (CEC).
- **Buffers pH:** humic acid acts as a pH buffer, stabilising soil reaction in the 6.0–7.5 range where nutrient availability is highest.
- **Detoxifies:** humic acid binds free aluminium, sodium and excessive iron, reducing toxicity to plant roots in problem soils.

3.3 What fulvic acid does (in the plant)

- **Chelates nutrients:** fulvic acids form chelates with metal cations — iron, zinc, manganese, copper — that are stable across pH ranges and are recognised and absorbed by plant transporters.

- **Crosses the cuticle:** fulvic acid molecules are small enough to penetrate the leaf cuticle and cross plant cell membranes, carrying the chelated nutrients with them. This is the mechanism by which foliar uptake is multiplied.
- **Transports inside the plant:** inside the plant, fulvic acids facilitate the active transport of nutrients from the absorption site to the metabolic site — leaf to fruit, leaf to grain, leaf to root.
- **Activates metabolism:** fulvic acid stimulates plant enzyme systems and signal pathways that improve stress tolerance — particularly drought, salinity and heat.

3.4 The MNG ratio architecture

> **THE MNG RULE**
>
> Soil applications carry a balanced humic and fulvic combination — the humic for soil structure and microbial feeding, the fulvic for immediate root-zone nutrient availability.
>
> Foliar applications are fulvic-dominant — because fulvic is what crosses the cuticle. Humic in a foliar spray contributes little to leaf uptake and can interfere with cuticle penetration at high concentrations.

This is not a marketing distinction. It is a biochemical constraint. Random humic-fulvic blends sold as generic biostimulants ignore the distinction; the high-molecular-weight humic fraction is largely wasted in foliar spray, and a soil application without the structural humic component delivers a weaker long-term effect.

The MNG product range is built around this rule. The Prill range, BioRock-P and PhosActiv carry a soil-appropriate humic-fulvic complex. The foliar range — Classic Plus, AminoTreat, Mg12, Fe20, Boron — uses a fulvic-dominant matrix calibrated for cuticle penetration.

3.5 The visible difference in the field

On a farm where the humic-fulvic distinction is respected, two responses are visible. The soil-applied programme produces gradual change — colour, structure, water-holding capacity — over weeks. The foliar-applied programme produces fast change — leaf colour deepens within 48–72 hours, deficiency symptoms reverse, and stress recovery accelerates. Both responses are necessary. Neither is a substitute for the other.

> *“Humic in the soil. Fulvic in the plant. Two molecules, two jobs, no shortcuts.”*
>
> **— MNG Foliar Architecture**

SECTION 4

Zeta Potential

Why particles stick

Every particle in a foliar spray has an electrical charge. So does every plant leaf. If the charges repel, the spray runs off. If the charges attract, the spray adheres and penetrates. The MNG system engineers the charge — every particle, every product, every batch.

A foliar spray that bounces off the leaf is wasted product. The plant has a natural barrier. The MNG system adjusts the particle so it can pass.

4.1 What zeta potential is

Zeta potential is the electrical charge on the surface of a particle suspended in a liquid. It is measured in millivolts (mV) and ranges from strongly negative (typically −60 mV) to strongly positive (+60 mV). The closer to zero, the less stable the suspension; the further from zero, the more stable. A suspension with zeta potential between −30 mV and +30 mV is generally considered unstable — particles aggregate, settle, and lose their dispersion.

In a foliar spray, zeta potential controls two things. First, the dispersion of the spray solution itself: a stable suspension delivers a uniform application, an unstable suspension delivers patches and gaps. Second, the interaction between the spray particle and the leaf surface: the relative charge of particle and leaf determines whether the particle adheres, penetrates, or is repelled.

4.2 Why the leaf is a barrier

Plant leaves are naturally negatively charged at the cuticular surface. The cuticle — a waxy layer of cutin and waxes — is hydrophobic, electrically negative, and chemically inert. Its job is to protect the leaf from desiccation, pathogens and chemical injury. It is not, by design, a permeable surface.

Standard foliar fertilisers — particularly bulk salts dissolved in water — also carry a negative charge at the application pH. The result is electrostatic repulsion between the spray particle and the leaf surface. Three things follow:

- the spray particle does not adhere efficiently — droplets bounce or run off.
- the small fraction that adheres does not penetrate the cuticle — it remains on the surface, exposed to evaporation and photodegradation.
- uptake efficiency on standard foliar products is typically 20–30% of applied nutrient — the rest is wasted.

4.3 The MNG zeta-potential adjustment

The JAM Process — described in detail in Section 6 — engineers the zeta potential of every MNG foliar particle to a precisely tuned target window. The objective is not to invert the charge to positive (which would create flocculation problems in the spray tank) but to moderate the negative charge so that repulsion at the leaf surface is substantially reduced. Tank stability is maintained not by strong electrostatic repulsion alone, but by the combination of moderated zeta potential and steric stabilisation from the humic-fulvic and amino-acid coating around each particle. The result, in operating terms, is a particle that:

1. dramatically reduce electrostatic repulsion at the leaf surface.
2. maintain stable dispersion in the spray tank during application.
3. allow the particle to associate with cuticle wax molecules and begin transcuticular penetration.
4. present the particle to the cuticle in the correct orientation for absorption.

THE SIMPLE EXPLANATION

Standard foliar fertiliser: negative particle meets negative leaf. Repulsion. Run-off. 20–30% uptake.

MNG foliar product: zeta-adjusted particle meets negative leaf. Adherence. Penetration. 60–80% uptake.

Same nutrient. Different particle. Different result.

4.4 What this means at field level

The agronomic consequence is direct: an MNG foliar application at 2 kg/ha can deliver more plant-available nutrient than a conventional foliar application at 4 kg/ha. The farmer applies less, sees the response faster, and recovers more of the nutrient applied. The economic consequence follows: lower applied volume, lower per-hectare cost, higher per-hectare result.

This is not a claim that requires laboratory verification at the farm level. It is observable in the field within 48–72 hours of application — leaf colour deepens, deficiency symptoms reverse, canopy growth accelerates. The same observation, made on a conventional foliar product, requires 7–14 days for an equivalent visible response.

> *"The plant has a natural barrier. We adjust the particle so it can pass."*
>
> **— MNG Foliar Principle**

SECTION 5

Micronisation

The 3-Micron Technology

Particle size determines surface area. Surface area determines reactivity. Reactivity determines how much of the applied nutrient the plant can actually use. MNG products are micronised to approximately three microns — a deliberate target, with measurable agronomic consequences.

Smaller particles. Faster uptake. Less fertiliser needed.

5.1 The size scale

To anchor the scale: a human hair is approximately 70 microns in diameter. A grain of fine table salt is approximately 100 microns. A standard granular fertiliser particle is several thousand microns. A pollen grain is approximately 25 microns. The leaf stoma — the natural pore through which the leaf exchanges gas with the atmosphere — is approximately 10–30 microns.

MNG foliar particles are micronised to approximately 3 microns — smaller than the leaf stoma, smaller than pollen, and small enough to associate intimately with the cuticular wax layer. This is not a marketing number. It is the size at which the surface area, reactivity and physical access to the leaf surface combine to produce the maximum uptake response.

5.2 Why surface area matters

When a particle is reduced in size, its volume scales with the cube of the radius — but its surface area scales only with the square of the radius. Reducing a particle from 30 microns to 3 microns reduces volume by a factor of 1,000 but reduces surface area only by a factor of 100. Per unit of mass, a 3-micron particle exposes ten times the surface area of a 30-micron particle. The available reactive area increases dramatically.

In agronomic terms, this means:

- **More contact:** more of the active material is in contact with leaf cuticle wax, soil moisture, root surface, or whatever environment receives the particle.
- **Faster reaction:** dissolution is faster, ion release is faster, and chemical reactions are more rapid.
- **More uniform release:** nutrient release is more uniform across the application — no large particles dominating local concentration, no fines being blown away.

5.3 Why 3 microns specifically

The choice of 3 microns is not arbitrary. Below 3 microns, the particles begin to behave as a colloid — physical handling, packaging stability and spray suspension become more difficult. Above 5 microns, the particle is too large to penetrate the cuticle efficiently and the surface-area benefit drops. The 3-micron target is the engineering optimum — small enough for full agronomic benefit, large enough for industrial reproducibility.

5.4 Physical and biological consequences

The change from coarse particles to micronised particles is observable at three levels:

Physical

- massive increase in surface area per gram of product.
- uniform distribution of nutrient in the spray tank — no settling, no segregation.
- faster dissolution and ion release.
- better adhesion to the leaf surface — particles do not bounce off.

Biological

- faster nutrient availability to the plant — visible response within 48–72 hours.
- better penetration through the cuticle — direct delivery into living plant tissue.
- higher overall use efficiency — less wasted nutrient.
- reduced application volume per hectare without reducing agronomic effect.

> **THE MICRONISATION PRINCIPLE**
>
> Smaller particles = faster uptake = less fertiliser needed.
>
> MNG micronisation is not a finishing step. It is the design parameter from which the entire foliar product range is built. A non-micronised version of the same chemistry would be a different product, with different field behaviour, requiring different application rates and producing different results.

5.5 The relationship to the JAM Process

Micronisation alone is not sufficient. A micronised particle without zeta-potential adjustment still encounters the electrostatic repulsion problem at the leaf surface. The MNG technological platform combines micronisation with mineral activation and charge stabilisation — the JAM Process described in Section 6 — to produce particles that are simultaneously small, reactive and electrically tuned. The three properties together define the MNG foliar particle.

> *"The size of the particle is not a detail. It is the product."*
>
> **— MNG Manufacturing Principle**

SECTION 6

The JAM Process

Engineering particle behaviour

Most fertiliser manufacturers mix raw materials. MNG engineers particle behaviour. The JAM Process — Joint Activation and Micronisation — is the proprietary technology that combines particle size reduction, mineral activation, and charge stabilisation into a single manufacturing platform. It is the reason the MNG product range is not interchangeable with any conventional alternative.

Three operations, executed simultaneously, producing one engineered particle.

6.1 What the JAM Process combines

The JAM Process is the integrated execution of three distinct unit operations that conventional manufacturing performs separately, partially, or not at all:

1. Micronisation — physical particle size reduction to the 3-micron target.
2. Mineral activation — surface energy modification that increases the chemical reactivity of the mineral substrate.
3. Charge stabilisation — engineering of the zeta potential to a specific window for cuticle penetration and tank stability.

Each of these three operations contributes to the agronomic performance of the final particle. Performed separately, they produce material that is small, or active, or charge-stable — but not all three. The JAM Process is the integration step that produces particles in which all three properties are simultaneously optimised.

6.2 The output specification

Every batch of MNG product leaves the JAM Process with the same specification:

PROPERTY	TARGET	AGRONOMIC CONSEQUENCE
Mean particle size	~3 µm	Maximum surface area; access through cuticle and stomata
Particle uniformity	Narrow distribution	Consistent dissolution and uptake; no large outliers
Mineral activation	High surface reactivity	Faster ion release; faster plant response
Zeta potential	Tuned target window	Adherence to leaf; tank stability; cuticle penetration
Dispersion stability	Stable suspension	Uniform application across the field; no segregation

6.3 Why this is unique versus conventional manufacturing

Conventional fertiliser manufacturing produces granules. The objective of conventional manufacturing is mechanical — produce a granule of consistent size, free-flowing, dust-free, stable in storage. The chemistry inside the granule is the input chemistry. There is no surface engineering. There is no charge engineering. There is no particle-size engineering at the micron scale. The granule is built to be transported, stored and spread — not to be biologically optimised at the moment of plant contact.

Conventional liquid fertilisers are dissolved salts in water. The dissolved ions are uniform in solution but uncontrolled in their interaction with leaf surfaces. There is no engineered particle. There is no zeta-potential management. The product behaves as the chemistry of the dissolved salt dictates.

The JAM Process replaces both approaches with engineered particles whose behaviour at the moment of plant contact is the design objective.

6.4 What the JAM Process produces

FOUR ENGINEERED OUTCOMES

Uniform particles — every particle in the product has the same size, the same activation, and the same charge profile.

Stable dispersion — the spray tank holds the suspension throughout the application; no settling, no segregation, no cleaning headaches.

Optimised zeta potential — particles adhere to the leaf and penetrate the cuticle rather than bouncing off.

High surface reactivity — nutrient release and absorption begin immediately on contact, not over hours or days.

6.5 The competitive consequence

A competitor who attempts to imitate MNG by mixing raw materials will not produce the same result. The chemistry will be similar; the physics will not. The competitive moat is not the formulation — it is the manufacturing platform. This is the reason MNG is positioned as a system, not a product line: a competitor must replicate the JAM Process, not just the input list.

> *“Others mix raw materials. We engineer particle behaviour.”*
>
> **— MNG Manufacturing Position**

SECTION 7

Mineral Transformation

What happens during micronisation

Reducing a mineral particle to three microns is not just a size change. It is a transformation in availability. The same atoms, in the same molecular form, behave differently when the particle is engineered. This section describes what changes physically, chemically and biologically.

Same atoms. Same molecules. Different particle. Different field response.

7.1 Before micronisation

A standard mineral fertiliser particle — a granule of calcium phosphate, a chunk of dolomite, a crystal of magnesium sulphate — is large, dense and slow to dissolve. The exterior of the particle is in contact with the soil solution; the interior is locked in until the exterior dissolves. Nutrient release is gradual, often unpredictable, and dependent on soil moisture, soil pH, and microbial activity. A significant fraction of the mass is unavailable to the plant in the season of application.

On the leaf, a coarse mineral particle in a foliar spray cannot penetrate the cuticle. It either dissolves on the surface — slowly, often after the leaf has dried — or is washed off. Foliar uptake of coarse mineral material is poor. This is the historical reason foliar fertilisers were dominated by salts in solution rather than mineral suspensions.

7.2 After micronisation

The same mineral, reduced to ~3 microns and processed through the JAM Process, behaves differently in three categories:

Physical change

- particle size reduced from millimetres or hundreds of microns to ~3 microns.
- specific surface area increased dramatically — by one to two orders of magnitude.
- uniformity of size and shape — narrow particle size distribution.
- dispersibility in water vastly improved — true colloidal-scale suspension.

Chemical change

- surface energy increased — reactivity of the particle surface enhanced.
- dissolution rate increased — ions become available to the surrounding solution faster.
- interaction with chelating molecules (humic, fulvic, amino acids) accelerated.
- zeta potential engineered through the JAM Process to a target range.

Biological consequence

- on the leaf, the particle is small enough to associate with the cuticle, undergo dissolution at the leaf surface, and deliver ions directly into the apoplast.
- inside the plant, ions transported by fulvic chelation move directly to metabolic sites — leaf, fruit, grain, root.

- uptake efficiency rises from the 20–30% of conventional foliar to 60–80% of micronised foliar.
- the visible plant response is fast — within 48–72 hours of foliar application — versus 7–14 days for conventional foliar.

7.3 The same logic applied to soil products

Micronisation is most visible in the foliar range, but the same principle applies to soil products. The Prill range delivers calcium, magnesium and sulphur in a granulated form designed for soil application — but the mineral material inside the prill is processed for high reactivity. BioRock-P delivers phosphorus from a rock source, but the rock has been ground, activated and engineered to release phosphorus rapidly under the soil chemistry conditions of the typical target field. PhosActiv is itself a phosphorus activator — its job is to multiply the availability of phosphorus already present in the soil and to enhance the performance of any phosphorus product applied alongside it.

7.4 Why this matters for the buying decision

A farmer or distributor evaluating MNG against a conventional alternative must compare not the input chemistry but the output behaviour. Two products with identical input analyses can produce profoundly different field results if the particle engineering is different. The MNG product is the result of the engineering, not the result of the formulation. This is the reason the same nutrient, applied at lower rate, in the MNG system produces a stronger response than the conventional alternative at standard rate.

> THE MINERAL TRANSFORMATION
>
> Before: large particles, low availability, slow plant response.
>
> After: micron-scale particles, high reactivity, fast and complete plant response.
>
> Same atoms. Different particle. Different field outcome.
>
> *“It is not what the analysis says. It is what the particle does in front of the plant.”*
>
> **— MNG Product Principle**

SECTION 8

Gas Independence

A strategic advantage

Conventional nitrogen fertiliser is a derivative of natural gas. Its price moves with the gas market, and its availability depends on industrial supply chains that are increasingly geopolitical. MNG is mineral-based and mechanically processed — independent of gas, independent of geopolitics, and structurally more stable in price.

While fertiliser prices follow gas markets, MNG remains stable.

8.1 Why conventional fertiliser depends on gas

Urea — the dominant source of nitrogen for agriculture worldwide — is manufactured by combining ammonia with carbon dioxide. The ammonia is itself produced by combining atmospheric nitrogen with hydrogen, in the Haber-Bosch process. The hydrogen, in the overwhelming majority of cases, is produced from natural gas through steam methane reforming. Approximately 70–80% of the cost of producing urea is the cost of natural gas as feedstock and energy.

This linkage has three consequences for the farmer:

- **Price volatility:** urea, DAP and other gas-derived fertilisers move in close correlation with the natural gas spot price.
- **Supply risk:** gas supply disruption — pipeline interruptions, plant outages, geopolitical events — translates directly into fertiliser shortages.
- **Geopolitical concentration:** gas-rich nations dominate fertiliser production; importing countries are dependent on a small number of producers.

The 2022–2024 fertiliser price cycle is the most recent demonstration: urea prices in major markets tripled within months, then halved, then rose again, all driven by gas market events that had nothing to do with agronomy.

8.2 How MNG sits outside this cycle

The MNG product range is mineral-based. Its inputs are calcium, magnesium, sulphur, phosphorus, micronutrients, humic and fulvic acids, and amino acids. These are extracted, processed mechanically, and engineered through the JAM Process. None of these operations are gas-dependent at the scale that defines the urea cost structure.

The consequence is that MNG product economics are stable. The price is set by mineral input cost, energy for mechanical processing, and engineering complexity — not by the global gas curve. A farmer or distributor pricing an MNG programme for a five-year horizon can do so with substantially more confidence than the same exercise on a urea-based programme.

8.3 Strategic implications by audience

For farmers

- input cost predictability over multi-season horizons.
- partial protection against gas-driven fertiliser spikes — the MNG portion of the programme does not move with the urea price.
- reduced exposure to fertiliser shortages during gas supply disruptions.

For distributors

- a product line whose pricing is decoupled from the commodity volatility their customers see in urea.
- a defensible margin structure not subject to commodity squeeze.
- a product story that is materially differentiated from the gas-derived competition.

For institutional partners

- a fertiliser solution that contributes to national agricultural input security.
- reduced dependence on imported gas-derived fertiliser.
- alignment with carbon and emissions targets — gas-derived ammonia is among the most carbon-intensive industrial processes in the world.

> **THE STRATEGIC MESSAGE**
>
> MNG is not just an agronomic system. It is a strategic hedge against the gas market.
>
> While urea, DAP and ammonium nitrate move with the natural gas price, MNG products move with mineral input cost — a fundamentally different and structurally more stable cost curve.
>
> *"When gas prices spike, MNG remains the input the farmer can plan around."*
>
> **— MNG Strategic Position**

SECTION 9

Soil Health = Disease Prevention

A strong plant does not get sick easily

Plant disease is a symptom. The cause is most often a stressed plant on a degraded soil. The MNG system addresses the cause. Healthy soil produces strong roots; balanced nutrition produces strong cell walls; activated metabolism produces functional immunity. Disease pressure does not disappear — but the plant's response to it does.

Healthy soil. Strong roots. Strong plant. A plant that is well fed and well rooted does not collapse when disease arrives.

9.1 The chain of causation

Plant health is the result of a chain. Soil chemistry, soil biology, soil structure produce healthy roots. Healthy roots produce balanced uptake. Balanced uptake produces strong cell walls, functional enzymes, and active metabolic pathways. Strong cell walls and functional metabolism produce a plant that is resistant to disease, tolerant of stress, and efficient in its conversion of resources to yield.

Conventional farming intervenes at the end of this chain — reactive crop protection. Disease appears, fungicide is applied, the symptom is suppressed. This works in the short term but does nothing to address the underlying cause. The MNG system intervenes at the start of the chain — the soil and the plant — so that disease pressure encounters a plant that does not collapse.

9.2 The mechanisms

Calcium and the cell wall

Calcium is the structural element of plant cell walls. Pectin — the molecule that binds plant cells together — is calcium-dependent. A plant with adequate, balanced calcium has thick, stable cell walls; pathogens face a physical barrier. A plant deficient in calcium has soft, weak tissue; pathogens enter without resistance. The MNG Prill range — particularly Prill CaMgS, Prill CaS and Prill Ca — supplies the calcium required to build that wall, in a form that is rapidly available to the plant.

Micronutrients and enzyme function

Plant immune systems are enzymatic. Phenylalanine ammonia-lyase (PAL), peroxidases, polyphenol oxidases — the enzymes that produce defensive secondary metabolites — depend on micronutrients to function. Zinc, manganese, copper, iron, boron and molybdenum each have specific enzymatic roles. A plant deficient in any of these has a partial immune response. The MNG foliar range — particularly Mg12, Fe20 and Boron — keeps these enzymes active.

Fulvic acid and active transport

Fulvic acid moves nutrients from absorption sites to metabolic sites. A plant with active fulvic-mediated transport delivers nutrition to the parts of the plant that need it — including the immune defence stations at the leaf margin and the root tip. A plant without this transport has nutrients stranded where they cannot be deployed.

Soil microbiome and pathogen suppression

A biologically active soil — one with high microbial biomass, diverse populations and stable food webs — actively suppresses soil-borne pathogens. Beneficial fungi compete with pathogenic fungi for the same niches; mycorrhizae form physical barriers around root surfaces; bacterial populations produce antifungal compounds. The humic component of MNG soil products feeds the microbiome that performs this suppression.

9.3 What this looks like in the field

On a farm operating the full MNG system for two or more seasons, the disease profile changes:

- foliar diseases — powdery mildew, downy mildew, rust — appear later in the season and at lower severity.
- soil-borne diseases — Fusarium, Pythium, Rhizoctonia — show reduced crop loss, particularly on crops where root rot has historically been a problem.
- physiological disorders — calcium-deficiency disorders such as blossom-end rot, bitter pit, tip-burn — substantially reduce or disappear.
- crop protection programmes can be reduced — fewer applications, lower rates, broader application windows.

9.4 The economic consequence

Disease prevention is not free. Healthy soil and balanced nutrition cost money — in MNG product, in time, in management attention. The economic case rests on three returns:

1. reduced crop protection cost — fewer fungicide applications, lower rates.
2. reduced yield loss — disease-related crop losses on conventional systems frequently reach 10–30% of potential yield.
3. higher quality grade — disease-free, calcium-sufficient produce commands premium prices in fresh and processing markets.

Together, these three returns frequently exceed the cost of the MNG programme — even before the input savings on conventional fertiliser are counted.

> *“A strong plant does not get sick easily. The job of the agronomic system is to produce that plant.”*
>
> **— MNG Crop Health Principle**

PART II

THE FIELD

Application logic, SOPs, and crop programmes

SECTION 10

The Application System

Step by step

The MNG system works only if it is applied correctly. This section describes the staged application protocol — soil, water, plant — across the full crop cycle, and integrates the operational SOPs that the field team must follow at every step.

Soil before planting. Water at planting. Plant at every critical stage. The protocol is sequential, predictable, and crop-stage driven.

10.1 The Three-Stage Agronomic Protocol

Stage 1 — Soil Foundation (2–4 weeks pre-planting)

- **Mineral prills:** apply CaMg, CaMgS, CaS, CaPS or Ca depending on soil analysis. Typical rates 100–300 kg/ha. Incorporate by light cultivation.
- **Phosphate platform:** apply BioRock-P at 30–50 kg/ha to deliver phosphorus from a rock source with low fixation behaviour. Apply PhosActiv at 15–60 kg/ha to activate fixed soil phosphorus and enhance the efficiency of any phosphorus already present.
- **AquaSave:** apply at 50–150 kg/ha in water-stressed environments. Place in the planting row or on the irrigated zone. Incorporate to 10–15 cm depth.
- **pH management:** if soil pH is below 6.0 or above 7.5, address pH correction concurrently. Soil products work most efficiently in the 6.0–7.5 range.

Stage 2 — Rationalised Conventional Fertilisation

Reduce conventional NPK / urea / MAP / DAP applications by 30–50% relative to the locally validated standard recommendation. The reduction is justified by the documented improvement in NUE achieved through Stages 1 and 3. Applying conventional rates in combination with MNG products consistently results in over-nutrition, lodging, reduced quality and economic inefficiency.

> FIRST-SEASON CALIBRATION
>
> In the first season, use a conservative reduction — 30–40% — and retain a conventional comparison block at 10–20% of the field area for direct visual and quantitative comparison.
>
> From the second season onward, scale the reduction to 50% on the full area where the first season demonstrated yield maintenance.

Stage 3 — Targeted Foliar Programme

The foliar programme is crop-stage driven, not calendar-based. Five products cover the full requirement; specific timing is described in the crop-specific programmes in Section 11.

- **Classic Plus:** comprehensive multi-nutrient foliar complex. Apply at the onset of active vegetative growth and at peak demand stages. Typical rate 1.5–2.5 kg/ha.
- **AminoTreat:** amino acid formulation for stress recovery and reproductive support. Apply after stress events (heat, drought, frost) and pre-flowering. Typical rate 1.5–2.0 kg/ha.

- **Boron:** micronised boron. Apply pre-anthesis and during early fruit set. Typical rate 1.5–2.5 kg/ha.
- **Mg12:** activated magnesium. Apply when interveinal chlorosis appears or prophylactically on intensive cropping. Typical rate 1.5–2.0 kg/ha.
- **Fe20:** activated iron. Apply on calcareous soils or when iron chlorosis appears. Typical rate 1.5–2.0 kg/ha.

10.2 Universal Application Timeline

STAGE	TIMING	PRESCRIBED ACTION
1	Pre-planting (2–4 weeks prior)	Soil enhancers (CaMg/CaMgS/CaS/CaPS) + AquaSave where water management is a priority
2	At planting / early establishment	Conventional NPK/Urea/MAP/DAP at 50–70% of standard recommendation; AminoTreat seed treatment optional
3	Vegetative — active canopy growth	Initiate Classic Plus foliar; add Mg12 or Fe20 where deficiency or risk indicates
4	Stress events (any growth stage)	AminoTreat applied within 48 hours of identified stress symptoms
5	Pre-flowering / reproductive initiation	Boron foliar; continue Classic Plus support
6	Fruit / grain development	Maintain foliar programme; AquaSave-supported irrigation; calcium foliar where quality demands

10.3 Tank-Mix and Spray SOP — Operational Protocol

This SOP must be followed for every foliar application. The most common cause of disappointing field results is not product failure — it is incorrect spray execution. The full SOP is reproduced in Appendix A; the operating essentials are below.

Tank preparation

1. Use clean water with pH between 5.0 and 7.5. Hard water above pH 8.0 should be acidified with citric acid before product is added.
2. Fill the spray tank to approximately half its final volume before adding any product.
3. Start the agitator before adding product. Maintain continuous agitation through mixing and application.
4. Add MNG product gradually — pour slowly into the moving water. Do not dump the full bag in one motion.
5. Once dissolved, top up the tank to final volume. Spray volume should be 200–500 L/ha depending on canopy density.
6. Apply within two hours of mixing. Do not leave mixed product overnight.

Spray conditions

- **Temperature:** above 12 °C, below 32 °C. The ideal range is 18–28 °C.
- **Time of day:** early morning (06:00–09:00) or late afternoon (16:00–18:00). Avoid midday sun.

- **Wind:** below 10 km/h. Spraying in strong wind causes drift and uneven coverage.
- **Rain:** do not spray if rain is forecast within 4–6 hours of application.
- **Humidity:** above 50% relative humidity is ideal. In dry conditions, add a surfactant or spray at the dew point.

Spray coverage

- fine-to-medium droplet spectrum. Use flat-fan or hollow-cone nozzles. Coarse droplets waste product and reduce uptake.
- achieve coverage on both upper and lower leaf surfaces. Uptake is highest on young, expanding leaves.
- spray volume by canopy: cereals at tillering 200–300 L/ha; fruit trees at full canopy 500–800 L/ha; cotton at full canopy 400–500 L/ha.

Jar test for unfamiliar mixes

Before using any unfamiliar tank-mix combination in the field, perform a jar test. Add proportional small amounts of each product to one litre of spray water, in the same order as the field tank. Agitate. Wait 30 minutes. A good mix stays in suspension and produces no precipitate, floc or surface skin. A bad mix separates, forms a layer, or produces sediment — do not apply.

10.4 Tank-Mix Compatibility (Summary)

The full compatibility matrix is in Appendix B. The key operational summary:

PARTNER PRODUCT	COMPATIBILITY	NOTES
Most biological fungicides and insecticides	Compatible	Jar-test first if unfamiliar partner
Urea foliar (low concentration)	Compatible	Up to 1% urea solution
Copper products (Bordeaux, copper oxychloride)	Avoid in tank	Apply on separate days
Strong acid foliar phosphoric (pH below 3)	Avoid	May destabilise calcium content
Emulsifiable concentrate insecticides	Generally compatible	Always jar-test
Systemic herbicides (glyphosate)	Do not mix	Apply on separate days
Wettable powder fungicides	Generally compatible	Jar-test first

10.5 Safety SOP

- wear gloves and eye protection when handling concentrated product.
- wash hands thoroughly before eating, drinking or smoking after application.
- store MNG product in original container, in a dry location, out of direct sunlight, away from food and feed.
- keep out of reach of children and livestock.
- empty containers: triple-rinse, puncture, and dispose according to local regulation.

10.6 Documentation and monitoring

Every application must be documented. The field team should record application date, product, rate, water volume, weather conditions, growth stage, and any observations. This record becomes the basis for season-end review, programme refinement, and the demonstrable evidence of correct execution. The MNG programme produces results; documenting the application is what allows those results to be attributed to the programme rather than to chance.

> *"A well-designed programme delivered through a badly executed spray produces nothing. The SOP is the programme."*
>
> **— MNG Field Operations**

SECTION 11

Crop-Specific Programmes

Wheat · Citrus · Vegetables

The general protocol is the foundation. The crop-specific programme is the application. This section gives the full deployment for the three crop families that account for the majority of MNG distribution: cereals (wheat as the reference), tree crops (citrus as the reference), and high-value vegetables (greenhouse and open field).

Three crops. Three programmes. Three distinct economic profiles.

11.1 Wheat

Wheat is the largest single crop in the MNG distribution territory. The economic case rests on a 30–40% reduction in nitrogen, a measurable yield maintenance or uplift, and a quality premium where protein content is part of the price. The programme below is the operating standard for irrigated bread wheat at 5–7 t/ha yield potential. Adapt rates downward for rainfed systems and upward for high-yielding varieties at 8–10 t/ha.

Soil application (pre-planting)

PRODUCT	RATE	TIMING	PURPOSE
Prill CaMgS	150–250 kg/ha	2–3 weeks pre-sowing	Calcium, magnesium, sulphur foundation
BioRock-P	30–40 kg/ha	Pre-sowing	Phosphorus from rock source, low fixation
PhosActiv	15–25 kg/ha	Pre-sowing	Activates fixed soil phosphorus
AquaSave	60–80 kg/ha	Pre-sowing (where rain or irrigation reliability is a constraint)	Water retention in stress phases
AminoTreat seed dressing	3 g/kg seed	Pre-sowing	Germination energy and stress protection

Conventional fertilisation

Reduce urea by 30% in year one and 40–50% in year two onwards. Reduce DAP by 30–50% in line with the BioRock-P + PhosActiv contribution. Maintain potassium at standard rates unless soil analysis indicates oversupply.

Foliar programme

BBCH	STAGE	PRODUCT	RATE
13–15	3–5 leaves unfolded	Classic Plus	1.0 kg/ha
21–29	Tillering	Classic Plus	1.0 kg/ha
30–32	Stem elongation begins	Classic Plus + Mg12 (if chlorosis)	1.0 + 1.5 kg/ha
37–39	Flag leaf visible	Boron	1.0 kg/ha

BBCH	STAGE	PRODUCT	RATE
55–61	Heading to flowering	AminoTreat	1.0 kg/ha
71–75	Grain milky-dough	Classic Plus + AminoTreat	1.0 + 1.5 kg/ha

Expected outcomes — wheat

- urea reduction: 30% year one, 40–50% year two onwards.
- DAP reduction: 30–50% from year one through BioRock-P + PhosActiv.
- yield: maintained or +5–15% in year one; +10–20% in subsequent years on a continuing programme.
- protein content: typically, +0.5–1.5 percentage points where protein is a price-relevant attribute.
- water requirement: 10–25% reduction where AquaSave is deployed.

11.2 Citrus

Citrus is the highest-margin tree crop in the MNG portfolio. Calcium nutrition for fruit firmness, boron for fruit set, iron for chlorophyll on calcareous soils, and water management through AquaSave together address the four most common limitations on citrus productivity in the MNG territory. The programme below is the operating standard for mature commercial citrus orchards (5+ years of age) producing 30–50 t/ha.

Soil application (annual, post-harvest or early winter)

PRODUCT	RATE	TIMING	PURPOSE
Prill Ca or Prill CaPS	200–400 kg/ha	Post-harvest or early winter	Calcium for fruit quality and cell wall
BioRock-P	40–60 kg/ha	Annual	Phosphorus supply, low fixation
PhosActiv	30–50 kg/ha	Annual	Phosphorus activation, amino acids, silicon
AquaSave	100–150 kg/ha	Around drip line, year of planting and again year 3	Water retention in root zone

Conventional fertilisation

Reduce nitrogen by 30–40% from local recommendation. Reduce phosphorus inputs by 30–50% in line with the phosphate platform contribution. Maintain potassium and calcium nitrate where these are part of the fertigation programme — calcium nutrition through Prill Ca is additive, not substitutional.

Foliar programme

STAGE	PRODUCT	RATE	PURPOSE
Pre-flowering (40 days before bloom)	Boron + Classic Plus	1.0 + 1.0 kg/ha	Pollen viability, vegetative support
Full bloom	Boron + AminoTreat	1.0 + 2.0 kg/ha	Fruit set, stress protection
Petal fall to early fruit set	AminoTreat + Classic Plus	1.0 + 1.0 kg/ha	Reduce fruit drop, support cell division

STAGE	PRODUCT	RATE	PURPOSE
Active fruit growth (3–4 sprays at 14-day intervals)	Classic Plus + Calcium foliar	1.0 +1.0 kg/ha	Cell expansion, fruit quality
Pre-harvest (30 days)	Classic Plus	1.0 kg/ha	Final quality and storage attributes
Iron chlorosis (whenever symptoms appear)	Fe20	1.0 kg/ha	Chlorophyll restoration on calcareous soils

Expected outcomes — citrus

- nitrogen reduction: 30–40%.
- phosphorus reduction: 30–50% through the phosphate platform.
- yield: maintained or +10–15% in year one; +15–25% by year three.
- fruit quality: improved peel firmness, better calcium-to-nitrogen ratio, improved storage and shelf life.
- water requirement: 30–50% reduction in stress phases through AquaSave.
- disease pressure: reduced incidence of physiological disorders (pitting, creasing, calcium-deficiency disorders); reduced fungicide programme intensity.

11.3 Vegetables — Greenhouse and Open Field

High-value vegetables — tomato, pepper, cucumber, lettuce, leafy crops, brassicas — are the segment in which the MNG system produces the strongest visible response and the strongest economic return per hectare. Calcium nutrition for fruit firmness and disorder prevention, boron for fruit set, calcium-mediated disease resistance, and water-use efficiency are the four primary pathways. The programme below describes the operating standard for greenhouse tomato as a high-value reference; the same logic applies to pepper, cucumber and other indeterminate vegetable crops with appropriate timing adjustment.

Soil / substrate preparation (pre-planting)

PRODUCT	RATE	PURPOSE
Prill CaMgS or Prill CaPS	200–400 kg/ha	Calcium, magnesium, sulphur foundation
BioRock-P	40–50 kg/ha	Phosphorus source, low fixation
PhosActiv	30–50 kg/ha	Phosphorus activation, silicon, amino acids
AquaSave (open field)	100–150 kg/ha	Water retention; greenhouse use depends on substrate

Conventional fertilisation

Reduce conventional NPK by 30–40% from the standard fertigation recommendation. Greenhouse fertigation programmes must be re-balanced rather than simply reduced — the MNG soil and foliar contribution alters the EC and ion balance the grower delivers through the drip system.

Foliar programme

STAGE	PRODUCT	RATE	FREQUENCY
Transplanting / first 7 days	AminoTreat	1.5–2.0 kg/ha	Single spray after transplant shock
Pre-flowering (first truss visible)	Boron + Classic Plus	1.0 + 2.0 kg/ha	Single spray
Flowering and fruit set	Classic Plus + Boron	1.0 + 1.0 kg/ha	Every 10–14 days through fruit set
Active fruit growth	Classic Plus + Calcium foliar	1.0 + 1.0 kg/ha	Every 7–10 days
Stress events (heat, low light)	AminoTreat	1.0 kg/ha	Within 48 hours of stress
Iron / magnesium deficiency	Fe20 or Mg12	1.5 kg/ha	On symptom appearance

Expected outcomes — vegetables

- conventional NPK reduction: 30–40%.
- yield: maintained or +10–20% in year one; greater uplift on crops where calcium-deficiency disorders (blossom-end rot, tip-burn) have historically been yield-limiting.
- quality grade distribution: shift toward premium grades; reduced cull rate.
- disease pressure: reduced botrytis, fusarium and other calcium-related disease severity.
- water-use efficiency: improved through AquaSave (open field) and through substrate water management (greenhouse).

> THE VEGETABLE OPPORTUNITY
>
> Per hectare of vegetable crop, the MNG programme typically returns the highest absolute margin uplift in the entire portfolio. The combination of calcium-mediated quality, reduced fungicide pressure, and yield maintenance on lower input regularly produces a $1,500–4,000/ha margin uplift in commercial vegetable systems. For the distributor, this is the segment that converts product trial into multi-product, multi-season relationships.
>
> *“Three crops. Three programmes. The same architecture every time: soil, water, plant.”*
>
> **— MNG Programme Logic**

PART III

THE BUSINESS

Economics, ROI, and the strategic case

SECTION 12

Economics

Cost · Yield · ROI

The agronomic case for MNG is supported by the science. The commercial case is supported by the numbers. This section gives the cost-yield-margin model that distributors and farmers should use to evaluate the system before deployment, and to verify performance after harvest.

Less input. Same or higher output. The arithmetic produces the margin. Then the soil improves. Then it produces it again.

12.1 The four economic levers

The MNG system creates economic value through four distinct mechanisms, each measurable, each independent of the others:

30–50%	Up to 60%	+10–15%	+20–40%
FERTILISER REDUCTION	WATER SAVING	YIELD UPLIFT	MARGIN UPLIFT

12.2 Lever 1 — Fertiliser cost reduction

The first and most immediate economic lever is the reduction of conventional fertiliser. A 30–50% reduction in urea, DAP and NPK translates directly into a per-hectare cost saving. The MNG programme cost partially offsets this saving, but the net is positive in every modelled scenario.

LINE ITEM	CONVENTIONAL	MNG SYSTEM	DELTA
Urea applied	250 kg/ha	150 kg/ha	−100 kg/ha
DAP applied	100 kg/ha	60 kg/ha	−40 kg/ha
NPK / micronutrient	Standard rate	70% of standard	−30%
Conventional cost (illustrative)	$300/ha	$180/ha	−$120/ha
MNG product cost (illustrative)	—	$70–110/ha	+$70–110/ha
NET FERTILISER COST	$300/ha	$250–290/ha	−$10–50/ha

The illustrative numbers above use representative fertiliser prices for the MNG distribution territory. Actual values depend on local fertiliser pricing and the specific crop programme. The structural pattern — net fertiliser cost slightly down or flat — holds across most scenarios. The economic value comes from the next three levers.

12.3 Lever 2 — Yield maintenance or uplift

Yield in the first season is typically maintained at the conventional reference. From the second season onward, with the soil in active recovery and the foliar programme refined, yield typically increases by 10–15%. On the better-managed farms with full programme deployment, yield uplift of 15–25% is observed by year three.

The economic impact of yield uplift is large. On a wheat crop at 6 t/ha and $300/t, a 10% yield uplift is $180/ha — substantially larger than any input cost saving. On a citrus crop at 40 t/ha and $400/t, a 10% yield uplift is $1,600/ha. On greenhouse tomato at 200 t/ha and $800/t, a 10% yield uplift is $16,000/ha.

12.4 Lever 3 — Water saving

Where AquaSave is deployed, irrigation water requirement drops by up to 60% in stress phases. The economic value depends on the local water cost structure:

- on pumped groundwater, the value is the avoided pumping cost — typically $20–80/ha per season.
- on purchased irrigation water, the value is the avoided water bill — frequently $50–200/ha.
- on rainfed systems, the value is the avoided yield loss in stress years — variable but frequently the difference between a good year and a poor year.

12.5 Lever 4 — Quality and price grade

On crops where price is differentiated by quality grade — fresh vegetables, citrus, table grapes, premium wheat — the MNG system shifts grade distribution toward the premium grades. This effect is particularly pronounced on calcium-sensitive crops (tomato, pepper, apple) and on crops where protein content (wheat) determines price. A grade-shift of 10 percentage points from second to first grade typically adds 10–25% to gross revenue.

12.6 The composite ROI

The four levers combined produce the structural margin uplift cited at the head of this section: 20–40% on the most-managed crops, 10–20% on more challenging baselines. The pattern is reproducible across crop and country combinations because the underlying mechanisms — efficiency, water, quality — apply universally.

CROP	FIRST-SEASON ROI	STEADY-STATE ROI (Y2–Y3)
Wheat (irrigated)	+10–15%	+20–30%
Citrus (mature orchard)	+8–12%	+18–28%
Tomato (greenhouse)	+15–25%	+30–45%
Cotton	+8–12%	+18–25%
Maize	+10–15%	+20–30%
Field vegetables (open)	+12–20%	+25–40%

12.7 The distributor margin case

For the distributor, the MNG programme produces a different commercial profile from conventional fertiliser distribution:

- **Higher product margin:** MNG product margins are higher than commodity NPK margins — typically 25–40% gross margin versus 8–15% on bulk fertiliser.
- **Higher basket size:** a single farmer customer typically buys soil, water and plant pillar products — multiple SKUs per account.

- **Lower customer churn:** farmers who experience the result reorder the programme. Customer churn is materially lower than commodity fertiliser channels.
- **Competitive defensibility:** the MNG distributor is the technical authority in the territory, not just the lowest-price retailer.

> **THE COMPLETE ECONOMIC CASE**
>
> Conventional system: high input cost, vulnerable to gas price, declining soil, yield plateau, low distributor margin, high customer churn.
>
> MNG system: reduced input cost, gas-independent, improving soil, yield uplift, healthy distributor margin, high customer retention.
>
> The numbers move in the same direction at every level — farmer, distributor, system.
>
> *"The MNG farmer pays less, sells more, and farms a soil that is improving rather than degrading. That is not a fertiliser conversation. That is a margin conversation."*
>
> **— MNG Commercial Position**

SECTION 13

Strategic Positioning

Why MNG, not just fertiliser

MNG is positioned not as a fertiliser line but as an agronomic system. This section gives the distributor and the field representative the strategic vocabulary to defend that position against price-led competitive pressure, and to anchor the conversation with the farmer in results rather than tonnage.

Three sentences. Three positioning statements. Memorise them. Use them.

THE POSITIONING STATEMENTS

MNG is not a fertiliser. It is a nutrient-efficiency system.

MNG is not a replacement. It is a soil-restoration system.

MNG is not just a product line. It is a risk-reduction system.

13.1 Why this matters

A distributor who sells MNG as a fertiliser will lose to whichever competitor has the lower urea price next month. A distributor who sells MNG as a system will not face price competition at all — because there is no comparable system in the market. The framing of the conversation determines the entire competitive dynamic. Three minutes of strategic positioning at the start of the customer relationship is worth more than three months of price negotiation later.

13.2 Position One — The Nutrient-Efficiency System

The first positioning statement reframes the entire economic comparison. A urea bag is bought on the price per tonne. An MNG programme is bought on the cost per kilogram of plant-available nutrient. These are different units of measurement. A farmer who understands the difference will not compare MNG to urea on price per tonne — and will not let any salesman do so either.

The technical case is in Section 2. The conversational version is short:

> *"You don't pay for fertiliser. You pay for what the plant uses. We deliver more of what the plant uses, on less product. Compare on that basis."*
>
> — Distributor Field Script

13.3 Position Two — The Soil-Restoration System

Conventional fertiliser, applied year on year, degrades soil. Organic matter declines. Salinity rises. Microbial biomass falls. Soil structure deteriorates. This is not opinion — it is the documented trajectory of intensive cropping systems on every continent. The farmer who has been farming the same land for ten or twenty years has direct, personal evidence of this trajectory.

MNG reverses the trajectory. The humic component of the soil products feeds the microbiome. The mineral prills restore base saturation and structure. The reduced urea load reduces the soil acidification spiral. Over two to three seasons, soil organic matter, microbial biomass, and structural quality measurably improve. The farm becomes more productive over time — not less.

> *"Every season of conventional farming, your soil gets worse. Every season of MNG, your soil gets better. After three seasons, the land is the difference."*
>
> **— Distributor Field Script**

13.4 Position Three — The Risk-Reduction System

Modern farming faces three structural risks that conventional fertilisation makes worse, not better:

- **Input price volatility:** urea, DAP and gas-derived fertilisers move with the natural gas market. The MNG portion of the input bill is gas-independent.
- **Water risk:** water is the binding constraint across the MNG territory. AquaSave converts water from a fixed limit into a manageable variable.
- **Climate and biotic stress:** disease pressure, heat stress, drought, salinity — all rising. A balanced, calcium-rich, well-rooted plant absorbs these stresses better.

The MNG system is, structurally, a hedge against each of these risks. The economic value of this hedge is most visible in the bad years — the drought year, the price-spike year, the disease-outbreak year. In those years, the MNG farmer holds while the conventional farmer falters. Across a five-year horizon, this risk reduction is frequently the single largest economic contributor — larger than input savings, larger than yield uplift.

> *"In the good years, MNG makes you more profitable. In the bad years, MNG keeps you in business."*
>
> **— Distributor Field Script**

13.5 The conversation architecture

In every customer conversation, the distributor moves through three stages:

1. Anchor the system. Explain the three pillars in 60 seconds. Use the language of soil, water, plant — not the language of NPK.
2. Reframe the economics. Use the four-lever model in Section 12. Replace cost-per-tonne with cost-per-result.
3. Position the risk reduction. Connect MNG to the structural risks the farmer already worries about — input prices, water, disease, climate.

From this base, every product conversation, every dose recommendation, every comparison to a competitor flows naturally. The customer is not buying a bag of fertiliser. The customer is buying a system that reduces input cost, restores soil, saves water, increases profit, and reduces risk. Five outcomes. One programme. No commodity comparison.

THE POSITIONING SUMMARY

MNG is a system, not a product.

The system reduces input, increases efficiency, restores soil, saves water, and increases profit.

The buying decision is not about fertiliser. It is about which farming model the farmer wants to operate.

“We do not compete on the bag price. We compete on the harvest, the soil, and the next ten seasons.”

— MNG Distributor Position

PART IV

PRODUCT PORTFOLIO

Soil · Water · Plant — the complete product line

Soil Pillar — Prill Range

Five mineral prills. Five soil profiles. The starting point of every MNG programme.

The Prill range delivers calcium, magnesium, sulphur and phosphorus to the soil in a granulated, uniformly sized format that can be applied with conventional spreading equipment. Each prill is built around a humic-fulvic carrier that is intimately blended with the mineral content, so that nutrient release is coupled with chelation and microbial feeding from the moment of application. The five products in the range cover the full spectrum of soil chemistry encountered in the MNG distribution territory.

Prill CaMgS

The all-purpose foundation prill

Composition Calcium oxide approximately 38%, magnesium oxide approximately 8%, sulphur approximately 6%, with humic-fulvic carrier matrix and trace elements.

Application 150–300 kg/ha pre-planting, incorporated by light cultivation. Most widely used prill across cereals, vegetables and tree crops on neutral to alkaline soils.

Purpose Restores base saturation, supplies structural calcium for cell walls, magnesium for chlorophyll, and sulphur for protein synthesis.

Field signature Improved leaf colour and canopy density within 4–6 weeks; measurable improvement in soil structure by season-end.

Prill CaMg

Calcium-magnesium for acidic and structurally degraded soils

Composition Calcium oxide approximately 42%, magnesium oxide approximately 10%, with humic-fulvic carrier and trace elements.

Application 200–400 kg/ha pre-planting on soils where calcium and magnesium are the dominant deficiencies and sulphur is already adequate.

Purpose Aggressive base-saturation correction and pH buffering on acid soils; structural improvement on compacted or sodic soils.

Field signature Visible improvement in root penetration and water infiltration; chlorophyll deepening on magnesium-deficient crops.

Prill CaS

Calcium-sulphur for sulphur-poor systems

Composition Calcium oxide approximately 38%, sulphur approximately 12%, with humic-fulvic carrier and trace elements.

Application 150–300 kg/ha pre-planting on cropping systems with documented sulphur deficiency — oilseeds, legumes, intensive cereals on sulphur-depleted soils.

Purpose Combined calcium and sulphur supply, particularly important for protein-driven crops (wheat, oilseed rape, soybean) and brassicas.

Field signature Improved protein content and oil content; deeper green canopy on sulphur-responsive crops.

Prill Ca

Pure calcium for fruit-quality crops

Composition Calcium oxide approximately 50%, with humic-fulvic carrier and trace elements.

Application 200–400 kg/ha annually on fruit and vegetable crops where calcium nutrition is the primary quality driver. Apply post-harvest or in early winter on tree crops.

Purpose High-density calcium supply for fruit firmness, storage life, and prevention of calcium-deficiency disorders (blossom-end rot, bitter pit, tip-burn).

Field signature Reduced cull rate from physiological disorders; improved post-harvest storage; firmer fruit at harvest.

Prill CaPS

Calcium-phosphorus-sulphur for high-demand systems

Composition Calcium oxide approximately 32%, phosphorus pentoxide approximately 12%, sulphur approximately 6%, with humic-fulvic carrier and trace elements.

Application 200–400 kg/ha pre-planting on high-value crops where the combined CaPS supply replaces a portion of conventional DAP and gypsum applications.

Purpose Single-product foundation for crops with high simultaneous calcium and phosphorus demand — vegetables, potatoes, intensive horticulture.

Field signature Strong root development; improved tuber and root crop quality; reduced DAP requirement.

Soil Pillar — Phosphate Platform

BioRock-P and PhosActiv. Two products that, together, replace 30–50% of conventional phosphate fertiliser and unlock the phosphorus already in the soil.

Conventional phosphate fertilisation is structurally inefficient. Of every kilogram of P_2O_5 applied as DAP or MAP on alkaline soils, 75–85% is fixed in calcium phosphate compounds within weeks. On acid soils, the same fraction is fixed in iron and aluminium phosphates. The result is a soil that accumulates total phosphorus year after year while plant-available phosphorus remains constant or declines. The MNG phosphate platform addresses this directly through two complementary products.

BioRock-P

Phosphorus from a low-fixation rock source

Composition Phosphorus pentoxide approximately 25–28%, calcium oxide approximately 35%, silicon dioxide, humic-fulvic carrier, and microbial substrate.

Application 30–60 kg/ha pre-planting on field crops; 40–60 kg/ha annually on tree crops. Replaces 30–50% of conventional DAP/MAP.

Purpose Delivers phosphorus from a rock source in micronised, activated form that resists fixation. The humic-fulvic carrier maintains phosphorus in plant-available chelated forms. Silicon contribution improves cell-wall strength.

Field signature Stronger early root development; reduced fertiliser tie-up; gradual buildup of soil phosphorus availability over multiple seasons.

PhosActiv

Phosphorus activator and unlock agent

Composition Phosphorus pentoxide approximately 12%, amino acids, humic-fulvic acids, organic carbon, microbial substrate, and silicon.

Application 15–60 kg/ha pre-planting depending on soil phosphorus history. Use the higher rates on soils with significant historical DAP/MAP application and locked-up phosphorus reserves.

Purpose Activates fixed soil phosphorus through chelation, microbial mobilisation, and pH-buffering effects. Multiplies the effective phosphorus supply from any phosphorus source applied alongside it. Releases historical fertiliser investment back into plant availability.

Field signature Visible improvement in early-season vigour; reduced phosphorus deficiency symptoms on calcareous soils; observable response within the first season of application.

THE PHOSPHATE PLATFORM RULE

On any farm with a multi-year history of DAP, MAP or NPK application, the soil contains substantial fixed phosphorus reserves.

PhosActiv unlocks that reserve. BioRock-P supplements current-season demand from a low-fixation source.

Together they reduce conventional phosphorus fertiliser requirement by 30–50% — and continue to do so season after season as the unlocked reserves come into play.

Water Pillar — AquaSave

One product. The water saving makes the entire system more economically attractive in any region where water is the constraint.

AquaSave is a soil-applied composite water-management amendment (micronised minerals, humic acid and a chemical-free, biodegradable superabsorber). When applied to the root zone and activated by water, it absorbs many times its mass in water and releases that water back to plants as the soil dries. In agronomic effect, AquaSave behaves as an in-soil water reservoir — buffering the moisture supply between irrigation events, extending the effective rainfall in rainfed systems, and protecting the crop from short-term water stress that would otherwise cause yield loss.

AquaSave

Soil water retention amendment

Composition Chemical-free, biodegradable superabsorber with micronised minerals and a humic-fulvic carrier designed for stable soil incorporation, food-grade and non-toxic, with carrier elements that support placement and incorporation.

Application 50–150 kg/ha incorporated into the planting row, drip line, or planting pit at depth 10–25 cm. On tree crops, apply at planting and again at year three. On annual crops, apply once per cropping cycle.

Purpose Water retention in the root zone. Reduces irrigation requirement by up to 60% in stress phases. Reduces drainage losses. Stabilises soil moisture between irrigation events.

Field signature Crop tolerates short-term irrigation interruptions without visible stress; rainfed yield variance reduced; pumping cost reduced; water bill reduced.

Application logic

- **Place where the water is needed:** placement matters more than rate. AquaSave must be in the root zone, not on the soil surface and not deeper than the active rooting depth.
- **Pair with irrigation, not against it:** AquaSave does not eliminate the need for irrigation; it reduces the volume and frequency required. The most effective deployment is in deficit-irrigation programmes.
- **Activate before the stress arrives:** AquaSave activation requires moisture. On rainfed systems, apply in advance of the rainy season so the superabsorber is fully activated when the crop most needs it.

Where AquaSave produces the largest economic return

- rainfed cereals on marginal soils — converts a stress year into a manageable year.
- greenhouse and high-value vegetable systems on pumped water — direct water-bill reduction.
- citrus and tree crops in summer-dry regions — protects the crop through the irrigation-constrained months.
- any system on pumped groundwater where water is the most expensive input on the farm.

THE WATER PILLAR ECONOMIC CASE

Up to 60% irrigation reduction in stress phases.

Reduced pumping cost, reduced water bill, reduced yield loss in stress years.

On many MNG farms, AquaSave alone pays back the cost of the entire programme.

Plant Pillar — Foliar Range

Five micronised foliar products. The most visible part of the system. The fastest field response.

The foliar range is built on a single technological platform — micronisation to ~3 µm, fulvic-dominant carrier matrix, JAM Process particle activation, and zeta-potential optimisation. The five products differ in their nutrient content and their agronomic role, but they share the same particle architecture and the same field behaviour: high adherence to the leaf, rapid penetration through the cuticle, and uptake efficiency in the 60–80% range.

Classic Plus

The flagship multi-nutrient foliar

Composition A balanced multi-nutrient foliar complex with calcium, magnesium, micronutrients (boron, zinc, manganese, iron, copper, molybdenum), fulvic acid, amino acids, and silicon — engineered through the JAM Process.

Application 1.5–2.5 kg/ha at active vegetative growth and at peak demand stages. Applied 2–4 times per crop cycle depending on programme.

Purpose General vegetative growth support, stress resistance enhancement, metabolic activation. The default foliar product across most crop programmes.

Field signature Deeper leaf colour within 48–72 hours; increased canopy density; improved stress tolerance; broad-spectrum response.

AminoTreat

Amino acid formulation for stress and reproduction

Composition Free amino acids of plant origin, fulvic acid carrier, micronutrients, and metabolic precursors — engineered through the JAM Process.

Application 1.5–2.0 kg/ha. Apply within 48 hours of stress events (heat, drought, frost, transplant); pre-flowering and during reproductive stages; as seed dressing at 3 g/kg seed.

Purpose Rapid metabolic recovery from stress; reproductive support during flowering and fruit set; energy supply during transplant and germination.

Field signature Recovery of stressed plants within 3–5 days; reduced flower abortion; reduced fruit drop; visible vigour increase.

Boron

Micronised boron for reproduction

Composition Micronised boron at agronomically active concentration, in the JAM-engineered carrier matrix with fulvic acid and supporting micronutrients.

Application 1.5–2.5 kg/ha pre-anthesis; repeat at full bloom on tree crops and indeterminate vegetables. Apply at higher rate (2.0–2.5) on boron-deficient soils and on crops with very high boron demand (oilseed rape, brassicas, beetroot).

Purpose Pollen viability and germination; pollen tube elongation; fertilisation success; cell wall formation in young tissues; seed and fruit set.

Field signature Improved fruit set on flowering crops; reduced abortive flowers; improved seed weight and grain set.

Mg12

Activated magnesium for chlorophyll

Composition Micronised magnesium at agronomically active concentration, in the JAM-engineered carrier matrix with fulvic acid and supporting micronutrients.

Application 1.5–2.0 kg/ha. Apply on appearance of interveinal chlorosis or prophylactically on intensive cropping systems on high-pH soils. Repeat at 10–14 day intervals while symptoms persist.

Purpose Correction of inter-veinal chlorosis; chlorophyll synthesis support; particularly relevant in alkaline soils, intensive vegetable production, and on calcium-rich or potassium-rich soils where magnesium uptake is antagonised.

Field signature Reversal of yellowing between leaf veins within 5–7 days; deepening of green colour; improved photosynthetic capacity.

Fe20

Activated iron for calcareous soils

Composition Micronised iron at agronomically active concentration, in the JAM-engineered carrier matrix with fulvic chelation and supporting micronutrients.

Application 1.5–2.0 kg/ha. Apply on appearance of lime-induced iron chlorosis or prophylactically on calcareous soils. Repeat at 10–14 day intervals on chronic iron-deficient sites.

Purpose Correction of lime-induced iron chlorosis on calcareous soils across the Middle East, Mediterranean and arid regions. Bypasses the soil pH antagonism that prevents soil-applied iron from reaching the plant.

Field signature Reversal of yellowing on young leaves; restoration of green colour in calcareous-soil orchards; improved chlorophyll content in citrus, peach and apple on alkaline soils.

THE FOLIAR PROGRAMME PRINCIPLE

Classic Plus is the foundation. AminoTreat is for stress and reproduction. Boron is for fertility. Mg12 and Fe20 are for specific deficiencies.

The five products together cover the full foliar requirement of any crop in the MNG portfolio. The crop-specific programme in Section 11 specifies which products, when, and at what rate.

MNG
SCIENCE • NATURE • INNOVATION

APPENDICES

Standard Operating Procedures

Operational reference for distributors, field representatives and farmers

APPENDIX A

Tank-Mix and Spray SOP

The most common cause of disappointing field results is a badly executed spray. Follow this SOP literally on every foliar application.

A.1 Tank Preparation

1. Use clean water with pH between 5.0 and 7.5. Hard water above pH 8 should be acidified to within range using citric acid before product is added. Test the water at the start of every spray season; spot-check during the season.
2. Fill the spray tank to approximately half its final volume before adding any product.
3. Start the agitator before adding product. Maintain continuous agitation throughout mixing, transit to the field, and the entire application.
4. Add MNG product gradually — pour slowly into the moving water. Do not dump the full bag in one motion; do not allow product to fall to the bottom of the tank without dispersing.
5. Once the product is fully dispersed, top up the tank to the final volume. Spray volume should be 200–500 L/ha for field crops and up to 800 L/ha for full-canopy tree crops.
6. Apply within two hours of mixing. Do not leave mixed product overnight in the tank.
7. After application, flush the tank, lines, and nozzles with clean water. A second flush with citric-acidified water (pH 5.5) every 5–10 spray loads removes mineral residue from the system.

A.2 Mix-Order Protocol

When tank-mixing MNG foliar products with crop protection chemistry, follow this mix order. The mix order is more important than the absolute rate; an incorrect mix order destabilises the suspension regardless of how carefully the rates are calculated.

1. Water in tank to approximately 50% volume. Agitator on.
2. Wettable powders and water-dispersible granules first. Allow to disperse fully before adding the next category.
3. MNG foliar product (Classic Plus, Mg12, Fe20, Boron, AminoTreat) added next, slowly under continuous agitation.
4. Suspension concentrates and flowables third.
5. Soluble liquids and emulsifiable concentrates fourth.
6. Surfactants, oils and adjuvants last.
7. Top up tank to final volume. Verify the spray solution is uniform, free-flowing, and shows no separation, foam or precipitation.

A.3 Spray Conditions

PARAMETER	REQUIRED	IDEAL
Air temperature	12–32 °C	18–28 °C
Relative humidity	Minimum 50%	60–80%
Wind speed	Below 10 km/h	2–6 km/h (steady, light breeze)
Time of day	Avoid 11:00–15:00	06:00–09:00 or 16:00–18:00
Rain forecast	No rain within 4–6 hours	No rain within 12 hours
Leaf surface	Dry of free water	Slight dew acceptable on cool mornings
THE SPRAY-WINDOW RULE If two of the six parameters above are outside the required range, postpone the spray. A delayed spray is recoverable. A spray that fails because of conditions is wasted product, wasted labour, and a damaged customer relationship.		

A.4 Coverage and Equipment

- **Nozzle selection:** flat-fan or hollow-cone for foliar nutrition. Air-induction nozzles produce droplets too coarse for optimum cuticle interaction.
- **Droplet size:** fine-to-medium spectrum (volume median diameter 150–250 microns). Coarse droplets bounce off; very fine droplets drift.
- **Pressure:** typically 2–4 bar at the nozzle. Verify with a calibration test before each spray season.
- **Coverage:** achieve coverage on both upper and lower leaf surfaces. Lower-surface coverage requires higher water volume and appropriate nozzle angle.
- **Spray volume:** cereals at tillering 200–300 L/ha; field vegetables 300–500 L/ha; fruit trees at full canopy 500–800 L/ha; cotton at full canopy 400–500 L/ha.

A.5 Jar Test for Unfamiliar Mixes

Before using any unfamiliar tank-mix combination in the field, perform a jar test. The jar test takes 30 minutes and prevents an entire field of failed application.

1. Take a 1-litre jar of the same water you will use in the field.
2. Add proportional small amounts of each product, in the same mix order specified above. For example, if your field tank is 200 L with 2 kg of Classic Plus, add 10 g of Classic Plus to the 1-litre jar.
3. Cap the jar. Agitate for 30 seconds. Examine after 5, 15, and 30 minutes.
4. A good mix stays in suspension. The solution remains uniform, with no precipitate, no surface skin, no separation into layers.

5. A bad mix produces precipitate, foam, separation, layering, sediment, or any visible incompatibility. Do not apply this combination in the field.
6. Document the result. Build a local jar-test reference for the combinations used in the territory.

A.6 Safety SOP

- **PPE:** nitrile or chemical-resistant gloves and eye protection when handling concentrated product. Long sleeves and chemical-resistant boots when mixing or applying.
- **Personal hygiene:** wash hands, face and exposed skin thoroughly before eating, drinking, smoking, or any hand-to-face contact.
- **Storage:** store MNG product in original container, sealed, in a dry, cool location. Out of direct sunlight. Away from food, feed, and water sources. Locked storage where possible.
- **Containment:** keep product and mixed solution out of reach of children and livestock. Empty containers triple-rinsed, punctured, and disposed of according to local regulation.
- **First aid:** eye contact: rinse with copious clean water for at least 15 minutes. Skin contact: wash with soap and water. Ingestion: do not induce vomiting; seek medical attention. In all cases, take the product label or this handbook to the medical professional.

A.7 Application Documentation

Every application produces a record. The record is the basis for season-end review, programme refinement, and the demonstrable evidence that the result observed at harvest was produced by the application that was made. The minimum record contains:

- date, time and location (field, block, GPS or block ID).
- crop, variety, growth stage (BBCH where applicable).
- product applied, batch number, rate per hectare, water volume per hectare.
- tank-mix partners (if any), mix order, jar-test result if a new combination.
- weather conditions: temperature, humidity, wind, recent rainfall, forecast.
- nozzle, pressure, ground speed, equipment used.
- operator name and signature.
- any deviation from the standard programme; any observation of crop response in subsequent days.

APPENDIX B

Tank-Mix Compatibility Matrix

Two matrices. The first covers MNG-internal tank mixing — combinations of MNG foliar products in the same tank. The second covers MNG with external partners — agrochemicals, biostimulants, foliar fertilisers.

B.1 MNG-Internal Compatibility

The matrix below summarises tank-mix compatibility for combinations of MNG foliar products applied in the same spray. Soil products are not included — soil products are not relevant to spray-tank compatibility.

	CLASSIC+	Mg12	BORON	Fe20	AMINO
Classic Plus	—	✓	✓	✓	✓
Mg12	✓	—	✓	✓	✓
Boron	✓	✓	—	✓	✓
Fe20	✓	✓	✓	—	✓
AminoTreat	✓	✓	✓	✓	—

Legend: ✓ = compatible at standard rates; — = same product. Compatibility refers to physical and chemical compatibility in the spray tank at the recommended application rates with continuous agitation.

Operating notes for MNG-internal mixes

- two-product combinations (e.g. Classic Plus + Boron) are the most frequently used in field programmes. All such combinations are stable and effective.
- three-product combinations (e.g. Classic Plus + Boron + AminoTreat) are stable provided the mix order in Appendix A is respected and the spray volume is sufficient (minimum 300 L/ha).
- four-or-more product combinations are operationally feasible but increase the risk of suspension instability. For the maximum simplicity and reproducibility of field results, prefer two- or three-product combinations and split larger programmes into separate applications spaced 5–10 days apart.

B.2 MNG with External Partners

The matrix below summarises tank-mix compatibility between MNG foliar products and the most common external partners encountered in field programmes.

EXTERNAL PARTNER	MNG COMPATIBILITY	OPERATIONAL NOTES
Most biological fungicides	Compatible	Jar-test new combinations
Most biological insecticides	Compatible	Jar-test new combinations
Urea foliar (max 1% solution)	Compatible	Use lower MNG end of range; agitate continuously

EXTERNAL PARTNER	MNG COMPATIBILITY	OPERATIONAL NOTES
Calcium nitrate foliar	Compatible	Avoid with phosphorus-rich foliars; jar-test
Copper products (Bordeaux, oxychloride)	Avoid in tank	Apply on separate days, minimum 5 days apart
Strong acid foliar phosphoric (pH below 3)	Avoid	May destabilise calcium-containing products
Emulsifiable concentrate insecticides	Generally compatible	Always jar-test; observe mix order
Wettable powder fungicides	Generally compatible	Add WP first; allow to disperse before MNG
Suspension concentrate fungicides	Generally compatible	Jar-test new combinations
Systemic herbicides (glyphosate, others)	Do not mix	Apply on separate days, minimum 7 days apart
Hormonal herbicides (2,4-D, MCPA)	Do not mix	Apply on separate days, minimum 7 days apart
Sulphur (wettable, micronised)	Compatible at low rate	Below 0.3% sulphur; jar-test mandatory

B.3 Caution Combinations and Mitigations

Calcium-rich foliars with phosphorus-rich foliars

MNG foliar products containing high calcium content can interact with phosphate-bearing partners at high concentration to form calcium-phosphate precipitates. The mitigation is threefold:

- maintain spray solution pH 5.5–6.5 (acidify with citric acid if necessary).
- agitate continuously; use higher water volume (minimum 400 L/ha).
- apply calcium-rich and phosphate-rich products in separate applications where possible. If combination is unavoidable, reduce both rates by 25% and verify physical stability in jar test before tank-mixing.

Calcium-rich foliars with chelated micronutrients

Calcium can displace chelates from EDTA-chelated micronutrient products, producing precipitation of insoluble calcium-iron or calcium-zinc compounds. The MNG Fe20 carrier system is engineered to be resistant to this displacement, but the risk increases when calcium-rich foliars are combined with external EDTA-chelated micronutrients. Mitigation: separate applications by minimum 7 days; if combination unavoidable, reduce both rates by 25% and verify physical stability.

Hard water (high calcium / magnesium content)

Field water with hardness above 300 ppm $CaCO_3$ equivalent reduces the efficacy of any foliar spray. Mitigation: acidify spray water to pH 5.5–6.5 with citric acid before adding product. The citric acid binds the hard-water cations and protects the spray solution chemistry.

> **THE COMPATIBILITY PRINCIPLE**
>
> When in doubt, jar-test. The 30-minute investment in a jar test is the cheapest insurance against a failed field application.
>
> Document every successful and every failed combination — your local compatibility reference is more valuable than any printed matrix because it reflects your specific water, your specific products, and your specific operating conditions.

APPENDIX C

First-Season Implementation Protocol

The first season is the demonstration season. Done correctly, it produces the data that justifies full-farm rollout. Done incorrectly, it produces inconclusive results that delay or block adoption.

C.1 Pre-Season Baseline Assessment

1. Soil analysis — Conduct a comprehensive soil test on all designated trial fields. Test for pH, organic matter, available nitrogen, available phosphorus, available potassium, calcium, magnesium, sulphur, micronutrients (Fe, Zn, Mn, Cu, B, Mo), and where feasible, electrical conductivity (EC) and bulk density.
2. Current practice audit — Document existing fertiliser types, rates, application timing, and associated cost. Document irrigation volume, frequency and source. Quantify current yield and quality outcomes by crop and field block over the past 3 seasons.
3. Target crop identification — Select the highest-value crop or the most agronomically problematic crop for the first-season trial. Prioritising the most economically significant crop maximises the visible return on the trial investment.
4. Trial area designation — Designate 10–50% of the total cultivated area for MNG implementation in the first season. Retain a conventionally managed comparison block (10–20% of trial field area, in the same field) to enable rigorous side-by-side evaluation.
5. Baseline record establishment — Record all baseline productivity, quality, and input cost data with appropriate precision. Photographic documentation of crop status at each major growth stage. GPS-coded sampling points if possible.

C.2 First-Season Implementation Protocol

1. Apply soil enhancers (Prill range, BioRock-P, PhosActiv) at the recommended rate 2–4 weeks prior to planting. Ensure thorough incorporation by light cultivation. Surface application without incorporation reduces efficacy by approximately 50%.
2. Reduce conventional NPK / urea by 30–40% from the standard recommendation. This is the conservative first-season reduction. More aggressive reductions (50%) are appropriate from year two onward as the soil response is characterised.
3. Initiate the foliar programme at the onset of active vegetative growth. Do not wait for deficiency symptoms to develop — prophylactic application at critical growth stages is the MNG protocol, not a reactive intervention.
4. Monitor crop development weekly. Compare canopy development, leaf colour, plant height and overall vigour against the retained conventional comparison block. Photograph and record at each major growth stage.
5. Document all applications. Record application date, product, rate, water volume, weather conditions, growth stage, equipment, operator, and any observed deviations from expected response.

6. Conduct harvest assessment. Total yield by weight or volume on a defined area; quality grade distribution; input cost reconciliation; and a structured comparison against the conventional block.

C.3 Stepwise Nitrogen Reduction Model

On research-grade evaluations and on field trials designed to characterise the dose-response relationship between MNG and nitrogen reduction, a four-treatment design is recommended:

TREATMENT	NITROGEN RATE	MNG PROGRAMME
Control	100% standard nitrogen	None — conventional baseline
Treatment 1	80% standard nitrogen	Full MNG system
Treatment 2	70% standard nitrogen	Full MNG system
Treatment 3	50% standard nitrogen	Full MNG system
Optional	Reduced nitrogen (variable)	Full MNG system + microbial partner

This design isolates the contribution of nitrogen reduction across a meaningful range. The optimal commercial reduction is typically Treatment 2 (70%) in year one and Treatment 3 (50%) from year two onward — but the trial design produces the data that confirms the optimal rate for the specific soil, crop and climate combination.

C.4 Optimisation in Subsequent Seasons

1. Increase the conventional NPK reduction to 50% based on demonstrated first-season yield maintenance.
2. Fine-tune foliar application timing and rates based on first-year crop response observations.
3. Expand the MNG programme to additional crop types or to the full farm area.
4. Adjust soil enhancer rates downward as soil structural and biological indicators improve. The system reaches a steady-state at lower input than the first-season starting point.
5. Establish annual soil testing as a routine practice to track organic matter, microbial activity, and nutrient availability trends.

> **THE FIRST-SEASON PRINCIPLE**
>
> The first season is not the season for the deepest reductions. The first season is the season for the cleanest demonstration.
>
> A 30% reduction with a clean trial design and clean data is worth more than a 50% reduction with an inconclusive comparison.
>
> Year one builds the evidence. Year two scales the result.

APPENDIX D

Three-Year Chemical Reduction Roadmap

The MNG system is a transition, not a substitution. A farm cannot move from conventional chemistry to a minimal-input regenerative system in a single season without risk. The three-year roadmap paces the transition so that yield never falters and soil biology genuinely recovers.

Each year of the roadmap has a specific chemical-reduction target, a specific set of soil-biology milestones, and a specific shift in the MNG product weighting. Farmers who complete the three-year cycle arrive at a system that is cheaper, more resilient, and measurably more regenerative than where they started. Farmers who abandon the transition midway — typically after a difficult monsoon or stress year — lose much of the benefit. The advisor's responsibility is to prevent that abandonment by managing expectations correctly from year one.

D.1 Year One — Reduce and Substitute

Chemical reduction target

- **Synthetic fertiliser:** 30–40% reduction from the farmer's current conventional rate. This is the conservative first-season cut — large enough to demonstrate input savings, small enough to absorb any first-season variability without yield risk. Farms that were heavily over-fertilised can absorb the upper end of this range; farms already operating near recommended rates start at the lower end.
- **Fungicides:** 20–30% reduction, enabled by biological seed treatments and the healthier plant tissue produced by the foundation soil and foliar programme.
- **Growth regulators (chlormequat, CCC):** 50% reduction or elimination on wheat and rice — Classic Plus and balanced calcium-magnesium nutrition replace the mechanical anti-lodging need.

MNG programme composition

- **Soil pillar (full deployment):** Prill CaMgS at full label rate on every crop. Prill CaS, CaMg or Ca where the specific soil constraint applies. BioRock-P replacing 30% of conventional DAP. PhosActiv unlocking historical phosphorus.
- **Water pillar (full deployment where applicable):** AquaSave in-row on field crops and in planting pits on orchards. Full label rate — the water-saving benefit begins immediately and is the easiest economic case for the farmer to verify.
- **Plant pillar (full foliar programme):** two to four foliar applications per crop according to the BBCH protocol. This is where the precision-nutrition effect shows up in the same season.

Biological introduction

- introduce biological seed treatments: Trichoderma for most crops, Rhizobium for legumes, Azotobacter and PSB where soil testing indicates benefit.

- introduce compost or vermicompost at 5–10 t/ha where not already practised — feedstock for the next year's microbial build.
- begin residue retention — no burning. Surface residues feed the surface microbiome and reduce erosion.

Year One milestones

- yield maintained at conventional reference or +5–15%.
- input cost reduced by 10–20% net of MNG product cost.
- soil organic matter measurably increased by season-end.
- first observable improvement in soil structure (water infiltration, friability).

D.2 Year Two — Deepen the Transition

Chemical reduction target

- **Synthetic fertiliser:** 40–50% reduction from the original conventional rate. The deeper cut is justified by the soil response and yield maintenance demonstrated in year one.
- **Fungicides:** 30–50% reduction; a meaningful share of the disease pressure of year one is now absorbed by healthier plant tissue and balanced nutrition.
- **Growth regulators:** eliminated on cereals where the year-one programme demonstrated adequate lodging control.

MNG programme refinement

- soil pillar maintained at full rate; the foundation continues to build.
- water pillar refined based on year-one experience — placement, rate, timing of AquaSave optimised for the specific field.
- foliar programme tuned to the specific crop and stage response observed in year one. Some applications can be reduced; others may be intensified.
- biological partners scaled — additional seed treatments, foliar microbial sprays, expanded compost / vermicompost integration.

Year Two milestones

- yield +10–20% over the original conventional baseline.
- input cost reduced by 25–35% net.
- soil organic matter clearly above the year-one baseline.
- microbial biomass and diversity measurably increased.
- disease and stress events absorbed without yield loss — the resilience signature of the system becomes visible.

D.3 Year Three — Steady-State Regenerative

Chemical reduction target

- **Synthetic fertiliser:** at the steady-state reduction — typically 50% from the original conventional baseline. Some systems reach 60–70%, but 50% is the reliable, reproducible reduction in most contexts.
- **Fungicides:** at minimal-intervention level — preventive applications only at high-pressure stages.
- **Growth regulators:** eliminated.

MNG programme at steady state

- soil pillar may be reduced from year-one rates as the soil reaches its restored steady-state. The Prill range can step down to 75% of year-one rate on most crops.
- water pillar maintained on tree crops; reapplied in field crops on the standard cycle.
- foliar programme is fully optimised — the right product, at the right rate, at the right BBCH stage, for the specific crop, on the specific field.
- biological partners are integrated as a standing component of the production system.

Year Three milestones

- yield +15–25% over the original conventional baseline.
- input cost reduced by 30–45% net.
- the soil is measurably healthier than at the start of the transition — organic matter, microbial biomass, structure, water-holding capacity all improved.
- the farm is structurally less vulnerable to weather, price, and disease shocks than it was three years earlier.
- the system is reproducible; the farmer is confident; the result is the new normal.

> **THE THREE-YEAR PRINCIPLE**
>
> Year one is the demonstration year. The reduction is conservative; the result is convincing.
>
> Year two is the deepening year. The reduction is meaningful; the soil response is visible.
>
> Year three is the steady-state. The system is the new operating model — cheaper, more profitable, more resilient than the conventional starting point.

APPENDIX E

Troubleshooting Guide

In every first-season programme, two or three things go wrong. The most common categories are below, with the diagnostic questions and the corrective actions.

E.1 Slower Than Expected Initial Response

If the field response in the first 4–6 weeks is slower than anticipated, work through this diagnostic sequence:

- verify that soil enhancers were adequately incorporated. Surface application without tillage incorporation reduces efficacy by approximately 50%. If the prill is still visible on the soil surface 2 weeks after application, incorporation was inadequate.
- confirm soil pH is within the target range. Soil pH outside 6.0–7.5 substantially compromises product performance and nutrient availability. If pH is outside this range, address pH correction concurrently with the next application cycle.
- check foliar spray coverage. Verify nozzle calibration, operating pressure, and water volume. Inadequate coverage on the lower leaf surface is a common cause of reduced foliar response — particularly on indeterminate crops with dense canopies.
- verify spray water quality. Hard water (above 300 ppm $CaCO_3$) reduces foliar spray efficacy. Acidify with citric acid to pH 5.5–6.5 before adding product.
- verify spray timing relative to BBCH stage. The MNG foliar programme is stage-driven; an application five days early or five days late can be significantly less effective than an on-stage application.

E.2 Persistent Nutrient Deficiency Symptoms

If deficiency symptoms persist on a crop receiving the MNG programme, work through this diagnostic sequence:

- increase foliar application frequency during the critical growth period. If visual symptoms are present, applications every 7–10 days may be warranted until the symptom clears.
- introduce targeted micronutrient products (Mg12 for magnesium-related symptoms, Fe20 for iron-related symptoms, Boron for boron-related symptoms) based on the symptom pattern and soil analytical data.
- investigate potential soil structural limitations — compaction layers, poor drainage, anaerobic conditions in waterlogged areas — that may be impeding root function independent of nutrition. A compacted soil cannot deliver nutrients regardless of how much is applied.
- verify the soil-applied programme. If Prill applications were skipped or under-rated in the previous cycle, the foundation that supports foliar response is missing.
- conduct petiole or leaf tissue analysis. Tissue analysis distinguishes between deficiency due to inadequate supply, antagonism between nutrients, and physiological dysfunction unrelated to nutrition.

E.3 Inconsistent Results Across Field Areas

If MNG response is strong in some parts of a field and weak in others, work through this diagnostic sequence:

- collect comparative field data across treated and untreated blocks: yield per hectare, marketable quality grade, harvest uniformity, and crop stress resilience indicators.
- investigate soil variability. Within-field variability in pH, compaction, drainage, organic matter and salinity is the single most common cause of within-field response variability. Soil sampling on a grid (every 50–100 m) often reveals the underlying pattern.
- monitor plant physiological indicators across the field: leaf colour, SPAD chlorophyll index, plant height, root development, overall vigour. The pattern of response often reveals the limiting factor.
- conduct targeted nutrient analysis: petiole or leaf tissue sampling, nitrogen uptake efficiency, comparison of nutrient inputs versus crop removal (the nutrient balance).
- assess water quality for foliar applications. High bicarbonate, extreme pH, or elevated salinity in irrigation or spray water can antagonise foliar product performance independently of any other variable.
- confirm that application timing is precisely aligned with crop growth stage. The value of stage-specific foliar applications is dependent on accurate crop phenology monitoring; if growth stage varies across the field, application timing may need to vary correspondingly.

E.4 First-Season Yield Did Not Increase

If first-season yield is equal to (rather than above) the conventional reference, this is not a failure case. It is the expected outcome for the conservative first-season reduction. The economic gain in year one comes from the input cost reduction, not the yield uplift. The yield uplift typically appears in year two as the soil response compounds. Manage the farmer's expectation accordingly:

- year one: equal yield, lower input cost, soil rebuilding.
- year two: higher yield, lower input cost, visible soil improvement.
- year three: higher yield, lower input cost, restored soil at steady state.

E.5 Spray Tank Stability Problem

If a tank-mix produces visible separation, precipitation, or unusual foam:

1. Stop spraying immediately. Do not apply an unstable spray solution — the agronomic result will be unpredictable and may damage the crop.
2. Determine which combination caused the instability. Repeat the jar test in a controlled manner if necessary.
3. Adjust the mix order. Re-mix in the order specified in Appendix A.2.
4. Adjust spray water pH. Most tank-mix instability is resolved by acidifying the spray water to pH 5.5–6.5 before adding product.
5. If instability persists, separate the application — apply the MNG product alone, and apply the conflicting partner on a separate day.

6 Document the failed combination in the local compatibility reference. Avoid the combination in future applications.

E.6 When to Escalate

If the troubleshooting sequence does not resolve the issue, escalate to the MNG technical team. Escalation requires documentation: the specific symptom or concern, the soil analysis, the application records, photographs, and a clear description of what has been tried. The technical team can address issues that exceed the field-level diagnostic — manufacturing-batch verification, region-specific soil chemistry, unusual water quality, and complex pest-disease-nutrition interactions.

> **THE TROUBLESHOOTING PRINCIPLE**
>
> Most apparent failures are not failures of the MNG system. They are failures of execution — incorporation, timing, water quality, mix order, growth stage.
>
> The diagnostic discipline above resolves 80% of cases at field level. The remaining 20% deserve technical escalation.
>
> Documenting both the success cases and the troubleshooting cases builds the territory's collective knowledge — the most valuable asset the distributor accumulates over time.

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