# The Holistic Approach to Substrates and Nutrition

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# What is a holistic approach?

**A holistic approach requires a 'systems' understanding:**

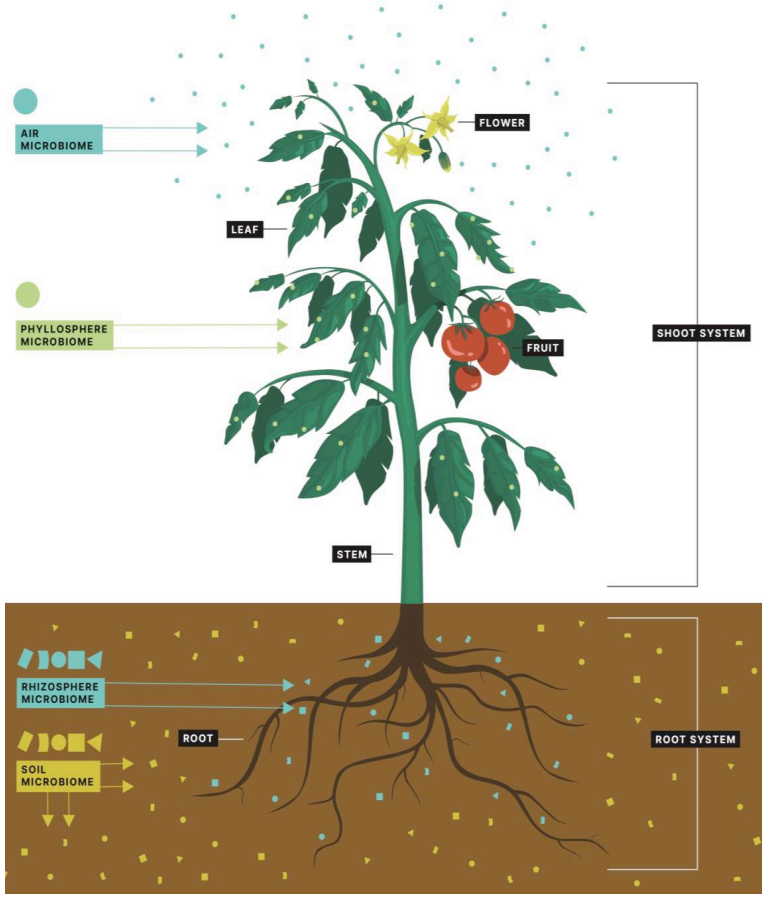
- How does a plant work
- What does a plant need?
- What is the correct substrate for the plant?
- What fertiliser to use for the plant?
- How does the above help control pest and disease in the crop?
- All of the above working together

# What is Holistic Growing?

A systems-approach for agronomy:

- The plant houses smaller ecosystems which sits within a **wider ecosystem**, all of which are in **constant interaction** with one another.
- A healthy plant works with each of these ecosystems to **maximise their health.**

Holistic growing applies the **systems-approach** to understand and utilise **crop natural processes** to **maximise health.**

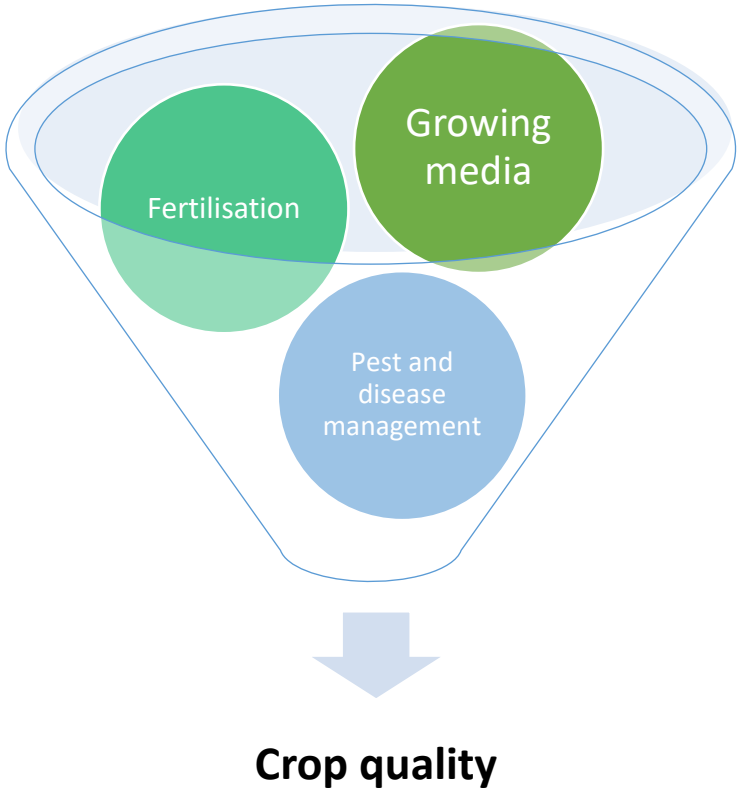


# Holistic Agronomic Approach

Use tools that complement one another to harness plants natural processes

- ↳ **Environment conditions**
- ↳ **Growing Media**
- ↳ **Organic fertilisers**
- ↳ **Bio pesticides**

**Benefits include increased crop health and reduce input costs.**



# The plant microbiome

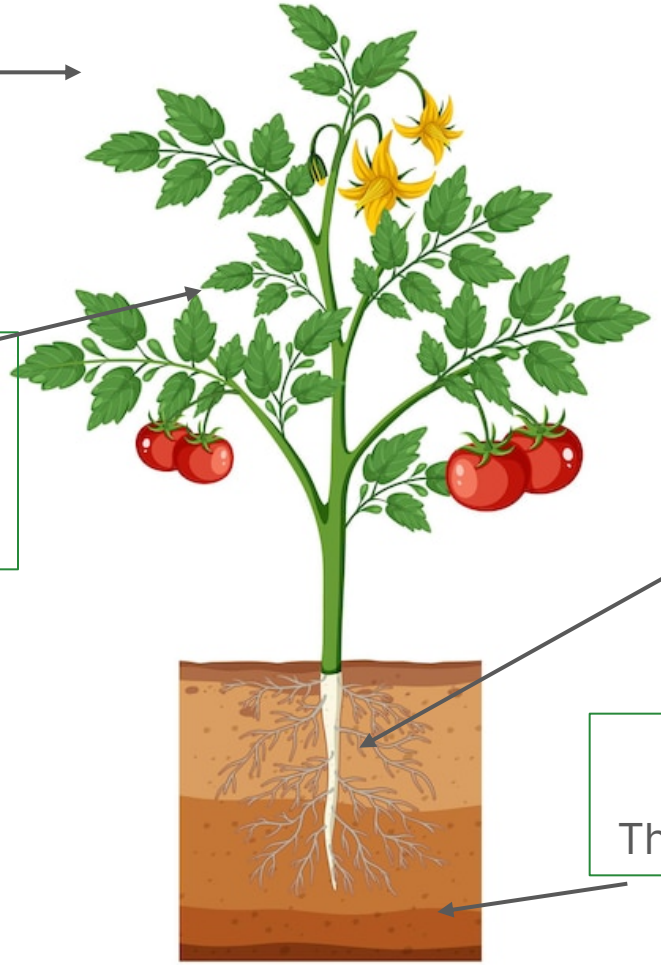
**Above-ground:**

**Air microbiome:**

The airborne microbes that are present around the plant

**Phyllosphere**

The community of microbes that have colonised the above-ground plant surfaces



**Below-ground:**

**Rhizosphere**

The community of microbes that have colonised the rootzone

**Soil microbiome:**

The microbes present in the wider soil

# The Rhizosphere

**The rhizosphere is shaped by microbes in the surrounding growing media and host plant.**

**A healthy rhizosphere can help to:**

- Mediate root and shoot growth
- Improve nutrient uptake and availability
- Induces disease resistance
- Exclude and combat root pathogens

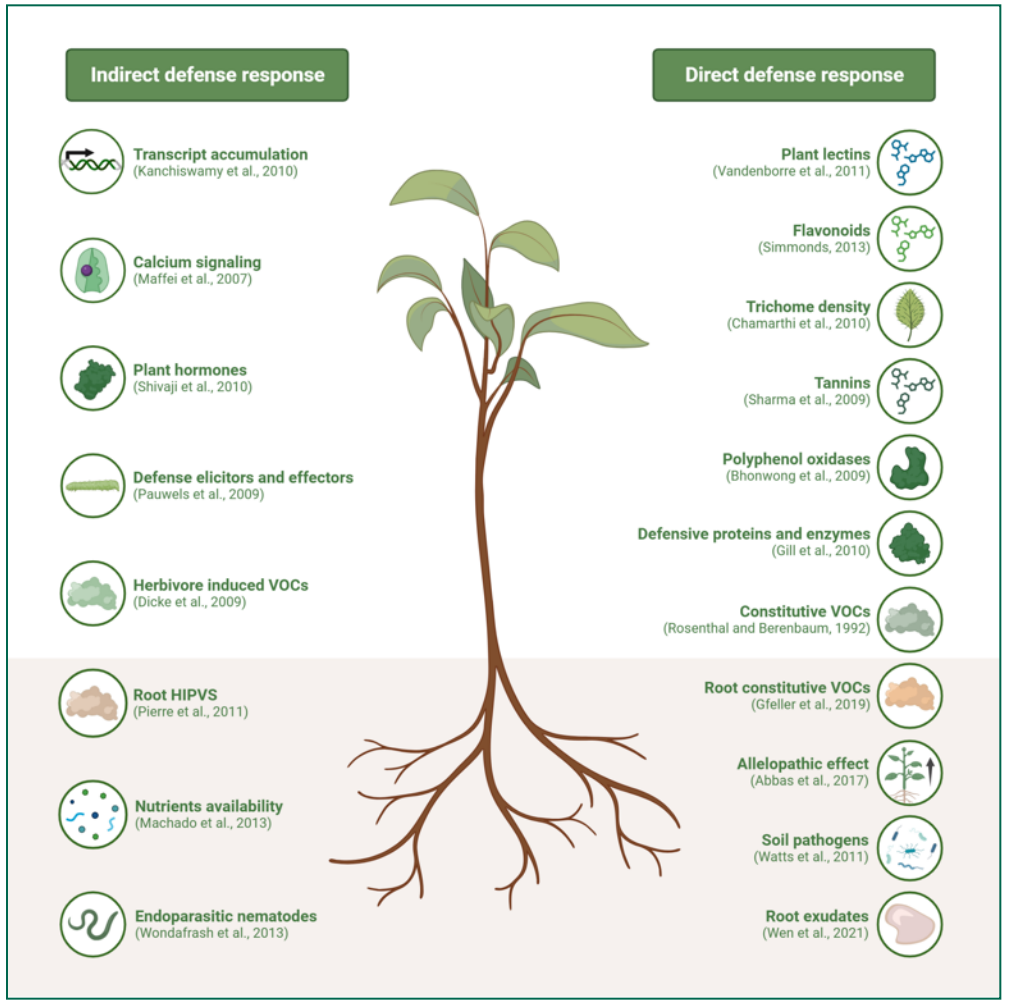
Healthy plants will **manipulate** this community of microbes in their **favour** - Unhealthy plants won't


Dam and Bouwmeester, 2016.

# Stage 3

## The defences of the plant are overcome by the pathogen.

- The first line of defence is the microbiome.
- The second line of defence is plant structural and biochemical defences
- Both are reliant on ***correct plant nutrition*** to function properly



# Growing Environment

- Use the right shading on the glasshouse.
- Use sensors to read light levels, humidity and moisture content in crops.
- Use the data from the sensors to control irrigation, vents and screens.
- Build programs/systems to what work.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# How to choose the right mix

**Considerations:**

- Crop grown
- Indoors or outdoors
- Look at irrigation used on Nursery
- Fertilisation choice for mix to suit crop
- Cost

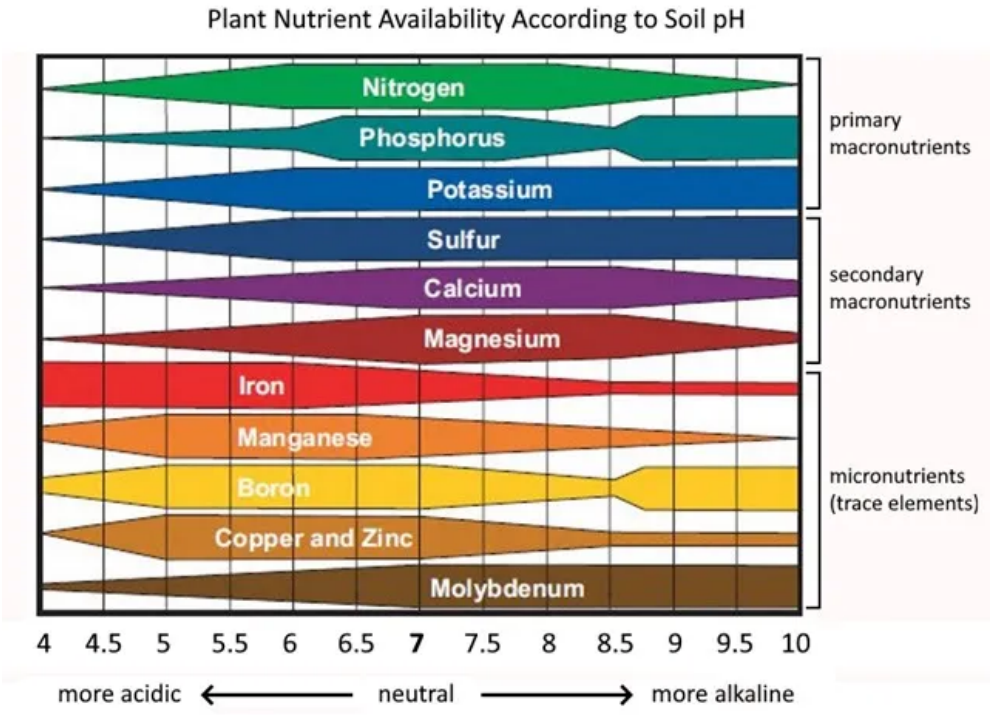
# Requirements for growing media

- Provide anchorage
- Create environment that promotes crop health
- Facilitate gas exchange in rootzone
- Facilitate water uptake
- Facilitate nutrition delivery to the plant

Must be tailored to the specific needs of specific crops.

# Growing media chemical profile

| Raw material type | pH | EC (µS cm$^{-1}$) | CEC (meq 100 cm$^{-3}$) | AFP (%) | Available water (%) at 5kPa | Dry bulk density (g cm$^{-3}$) |
|---|---|---|---|---|---|---|
| Coarse peat (10-25 mm) | 4.2 - 4.7 | 15.0 – 49.0 | 15.1 - 42.8 | 13.3 - 38.4 | 32.5 – 44.6 | 0.12 - 0.19 |
| Fine peat (0-5 mm) | 4.1 - 4.7 | 24.2 - 49.8 | 10.5 - 20.9 | 8.2 - 9.1 | 35.0 – 43.0 | 0.09 - 0.17 |
| Bark (0-8 mm) | 5.7 - 6.4 | 98.0 - 246.1 | 13.9 - 22.0 | 16.3 – 26.3 | 30.1 - 34.2 | 0.16 - 0.23 |
| Potting bark (5-16 mm) | 5.3 - 5.8 | 20.2 - 46.3 | 7.3 - 11.9 | 38.6 - 49.4 | 35.0 - 43.0 | 0.15 - 0.17 |
| Buffered coir (0-12 mm) | 6.9 - 7.3 | 38.3 - 96.2 | 5.3 - 6.8 | 17.3 - 20.3 | 36.6 - 40.4 | 0.06 - 0.11 |
| Green compost (0-10 mm) | 7.5 - 8.2 | 456.6 - 1739.1 | 15.8 - 20.9 | 5.0 - 15.1 | 35.8 - 46.7 | 0.23 - 0.52 |
| Wood fibre (all tested types [a]) | 5.4 – 8.3 | 5.3 – 441.1 | 9.0 - 14.9 | 25.4 - 51.7 | 13.2 – 24.7 | 0.06 - 0.11 |
| Vermiculite (superfine - medium) | 8.0 - 9.8 | 18.7 - 36.7 | 3.0 - 9.7 | 11.9 - 40.2 | 34.4 - 41.6 | 0.10 - 0.13 |
| Perlite (fine - coarse) | 8.0 - 9.2 | 5.2 - 9.7 | 0.8 - 2.1 | 21.3 - 36.2 | 21.4 - 24.2 | 0.05 - 0.12 |




We are seeing improved nutrient availability at higher pH in peat free compared to peat

# Ingredients: Wood fibre

- **AFP: High (25% - 50%)**
- WHC: Low
- AW: Low (37% - 40%)
- pH: 4.4 – 6.0
- Buffering capacity: Low
- Cation Exchange Capacity: Low
- Electrical Conductivity: Low
- Microbial life: Low
- **Considerations: locks up N in first 8-10 weeks**

# Ingredients: Coir

- AFP: Medium (17% - 20%)
- WHC: High
- **AW: High (37% - 40%)**
- pH: 6.0 – 7.3
- Buffering capacity: Low
- Cation Exchange Capacity: Low
- Electrical Conductivity: Low
- Microbial life: Low
- **Considerations: high in K**

# Ingredients: Green compost

- AFP: Low (5% - 15%)
- WHC: High
- **AW: High (36% - 47%)**
- pH: 7.5 – 8.2
- Buffering capacity: Low
- **Cation Exchange Capacity: Medium**
- Electrical Conductivity: Very high
- **Microbial life: High**
- **Considerations: Quality and properties can vary widely**

# Ingredients: Fine pine bark

- AFP: Medium (16% - 26%)
- WHC: High
- AW: Medium (30% - 34%)
- **pH: 5.7 – 6.4**
- **Buffering capacity: Medium**
- **Cation Exchange Capacity: Medium**
- Electrical Conductivity: Medium
- Microbial life: Low
- **Considerations: locks up N in first 8-10 weeks**

# Ingredients: Clay

- **Buffering capacity: High**
- **Cation Exchange Capacity: High**
- Electrical Conductivity: Low
- Microbial life: Low

# Mix design

- **Wood fibre**: Aeration
- **Coir**: Water availability
- **Green compost**: water availability, nutrient adsorption, soil biology
- **Fine pine bark**: good pH, aeration, some buffering capacity
- **Perlite**: aeration and soil structure
- **Clay**: Nutrient adsorption and pH buffering
- **Wetting agent**: improved water uptake and retention

Growing media has good aeration of small pores and good water holding capacity with sufficient acidity and CEC.

# Difference in fertilisation of crops

**General considerations**

- More leaching in Peat Free mixes, different soil types
- Watering techniques require wetting Agents

**Fertiliser choice**

- Scope for granular organic fertiliser use (DCM)
- CRF type choice is important
- Liquid feed must be tailored to analysis

# Nutrition

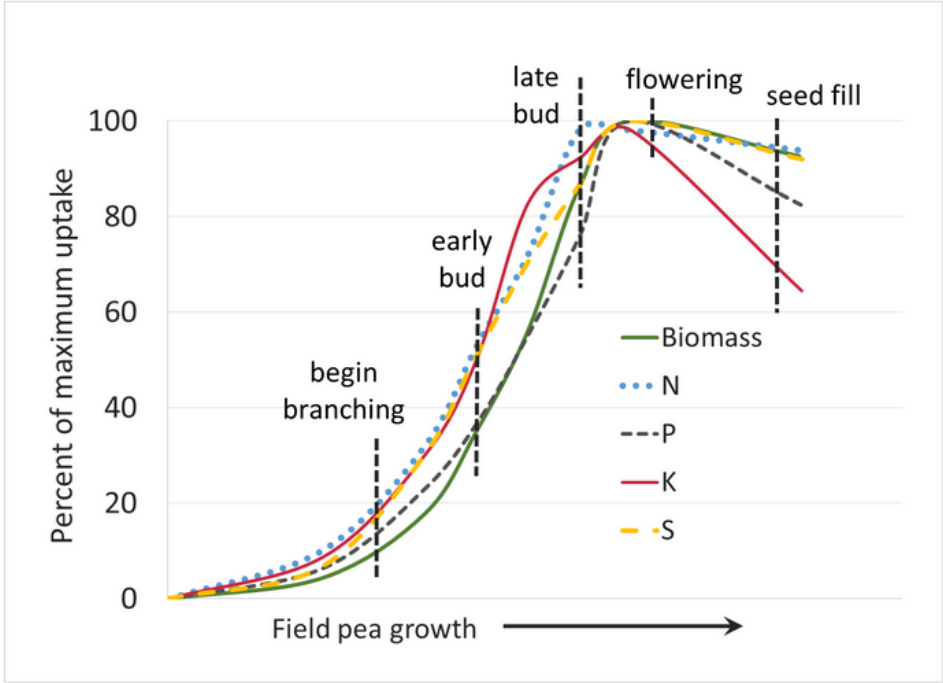
- Plants require a **slow**, **steady** amount of **low-level nutrition** to operate optimally.

- High levels of N will lead to a build-up of compounds in the leaf that act as a **food source for pathogens.**

Incorrect fertilisation will **disrupt plant processes** and limit their ability to mediate their **microbiome** and their natural **pathogen defences**

# Achieving correct plant nutrition

- Plants apportion resources based on their recent environmental conditions.
- They require a small but constant amount of a complete nutrient package to operate optimally.
- Microbiomes also require feeding - but they cannot metabolise mineral nutrients.



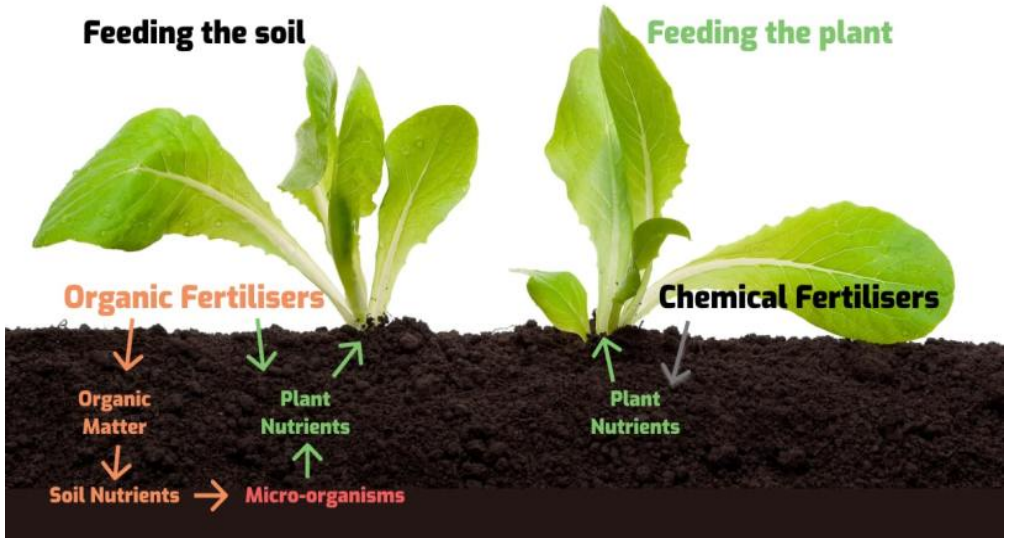

Source: Malhi et al. (2003)

# Nutrition: Using organic fertilisers

- To be taken up by the plant, organic nutrients must first be **mineralised by microbes in the soil.**

- Microbe metabolic speed is **aligned with plant metabolic** speed, meaning **nutrient release is well suited to plant growth.**

- Conversely, mineral feeds **bypass** the soil biology and are not mediated by microbes.



# DCM Organic Fertilisers

- Made from **natural raw materials**: by-products of food industry
- Require **microbial breakdown** for plant uptake – contributes to **soil diversity**
- Nutrient release is in **synchronisation with plant requirements**
- **Reduced leaching** and reduced chance of **root burn**
- Reduced likelihood of **pest & disease occurrence**

# What?

DCM Minigran organic fertilizers & soil improvers

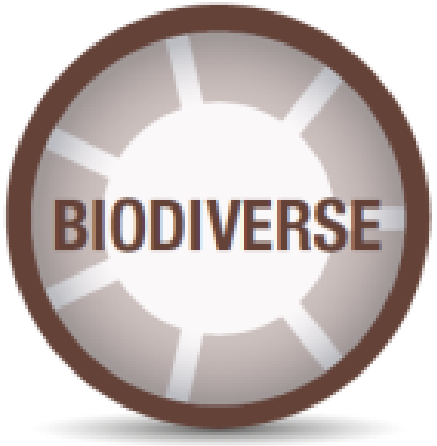

Controlled organic release


Mixture of vegetable animal and mineral ingredients


Natural technology for plants and soil

# What is DCM Minigran Technology?

Each ingredient has its own N-P-K content




Each carbon component is a feeding source for soil life

Mixture of vegetable, animal and mineral ingredients

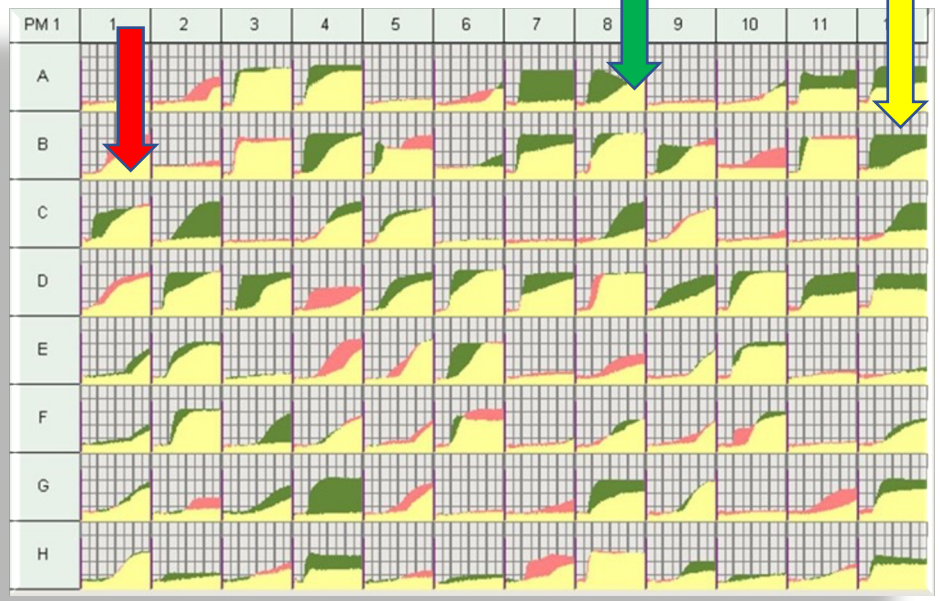
# What is DCM Minigran Technology?

**Each carbon ingredient is a feeding source for soil life.**

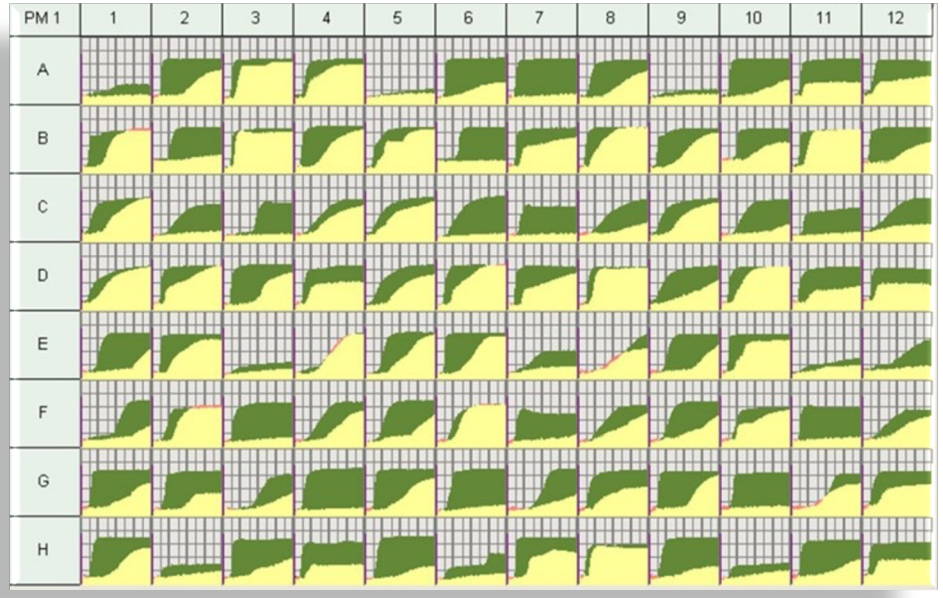
Red: decreased amount of soil life

Green: increased amount of soil life

Yellow: existing amount of soil life




**Potting soil + mineral fertiliser**




**Potting soil + Minigran fertiliser**

# Cyclamen 10cm crop

# Ranunculus crop DCM Vs CRF

# What is DCM Minigran Technology?

Each ingredient has its specific release


Less leaching

Efficient Controlled Organic Release

# What is DCM Minigran Technology?

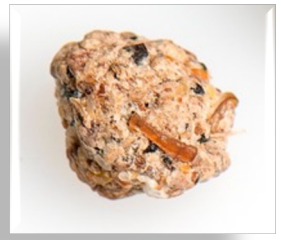
**Each ingredient has it's specific release.**

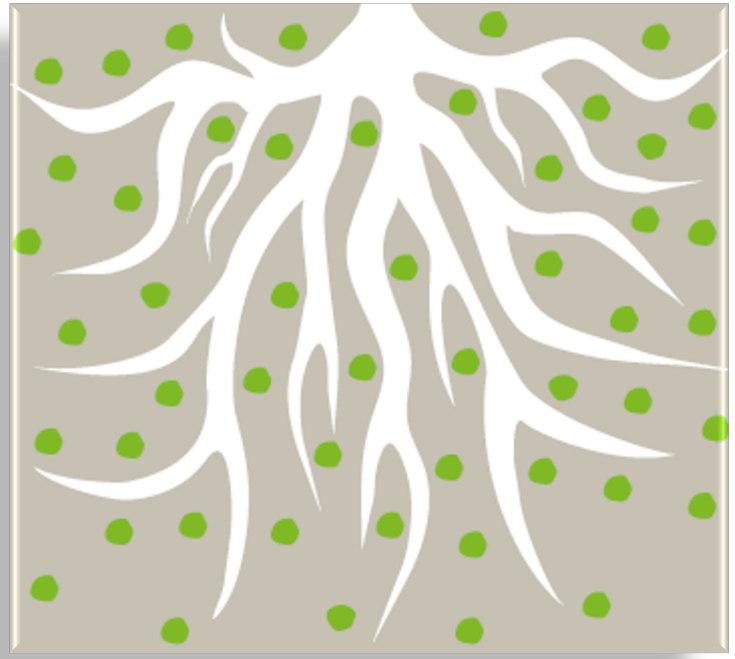
# What is DCM Minigran Technology?


**Uniform distribution**

# What is DCM Minigran Technology?

1 pellet = 94 Minigran granules

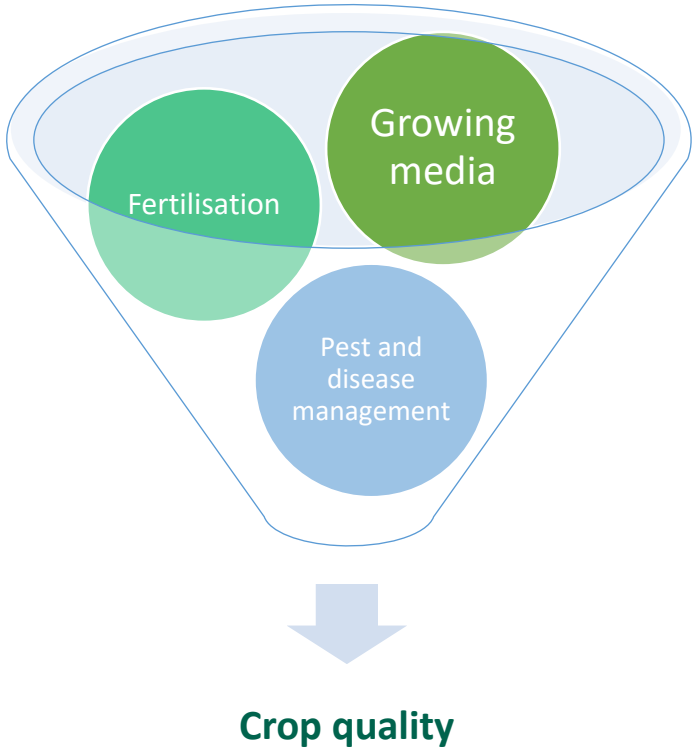




# Holistic Agronomic Approach

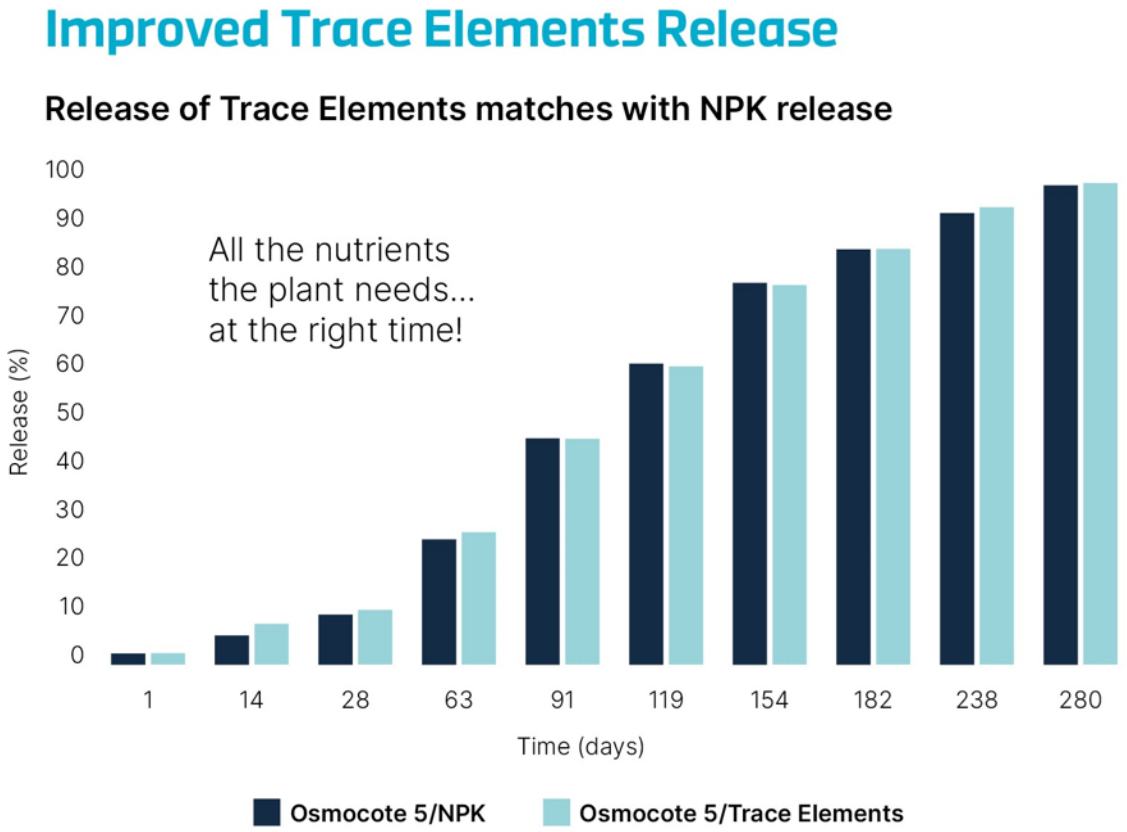
Though many of the tools are organic, **holistic growing is not organic growing**.

Conventional products still have a place in the programmes. In holistic growing we try to simulate natural systems as much as possible, but we also appreciate a commercial growing facility is not a natural growing environment so sometimes conventional inputs are required to meet the demands of commercial crop production.



# Integration of CRF’s

- DCM gives comprehensive nutrition to crop for first 4-5 months
- This can be supplement with CRFs in longer term crops



# How to use CRF’s

- Differing products have different nutrient and release profiles
- Important to select one that compliments organic or liquid feed correctly

## Application Rates for Osmocote 5 and Osmocote Exact Standard

| Recommended Rates gram per Litre | Release Pattern | | Longevity | Light Feeding | Normal Feeding | Heavy Feeding |
|---|---|---|---|---|---|---|
| | Osmocote 5 | Osmocote Exact Standard | | | | |
| **Bedding Plants** For container and baskets use heavy feeding rate | S-curved RELEASE | Standard | 2 - 3m | 1.5 - 2 | 2 - 3 | 3 - 4 |
| | | | 3 - 4m | 1.5 - 2 | 2 - 3 | 3 - 4 |
| | | | 5 - 6m | 2 - 3 | 3 - 4 | 4 - 5 |
| | | | 8 - 9m | 3 - 4 | 4 - 5 | 5 - 6 |
| **Pot Plants** High K formulations available for certain crops | S-curved RELEASE | Standard | 3 - 4m | 1.5 - 2 | 2 - 3 | 3 - 4 |
| | | | 5 - 6m | 2 - 3 | 3 - 4 | 4 - 5 |
| | | | 8 - 9m | 3 - 4 | 4 - 5 | 5 - 6 |
| **Nursery Stock** | S-curved RELEASE | Standard | 5 - 6m | 2 - 3 | 3 - 4 | 4 - 5 |
| | | | 8 - 9m | 3 - 4 | 4 - 5 | 5 - 6 |
| | | | 12 - 14m | 3 - 4 | 5 - 6 | 6 - 7 |
| | | | 16 - 18m | 4 - 6 | 6 - 8 | 8 - 10 |
| **Perennials** High K formulations available for compact growth/flowering | S-curved RELEASE | Standard | 5 - 6m | 1 - 1.5 | 1.5 - 2 | 3 |
| | | | 8 - 9m | 2 | 2.5 | 3.5 |
| | | | 12 - 14m | 2.5 | 3 | 4 |

These rates are a general guide. Contact your ICL Technical Area Sales Manager for specific crop rates.
Recommendations powered by AngelaWeb 3.0

# Analysis done to decide if liquid fertilisation is needed

Original

**Sample**

Research-/ordernumber: 317752/006114437
Date sampling: 25-07-2023
Date report: 08-08-2023
Test code: 310
Receiving date: 08-08-2023
Sample was taken by: Third party

FERRING NURSERY

**Results**

| | | analysis | at EC 0,67 | target | low | normal | high | basi sche |
|---|---|---|---|---|---|---|---|---|
| | pH | 6,7 | 6,7 | 5,9 | | | | |
| mS/cm 25°C | EC | 0,9 | 0,9 | < 1,8 | | | | |
| Cations mmol/l | $NH_4$ | < 0,1 | < 0,1 | < 0,1 | | | | |
| | K | 3,2 | 3,1 | 1,6 | | | | |
| | Na | 1,9 | 1,9 | < 3,5 | | | | |
| | Ca | 0,8 | 0,8 | 1,2 | | | | |
| | Mg | 0,4 | 0,4 | 0,5 | | | | |
| Anions mmol/l | $NO_3$ | 2,6 | 2,5 | 4,0 | | | | |
| | Cl | 2,0 | 2,0 | < 3,5 | | | | |
| | S | 1,2 | 1,1 | 0,8 | | | | |
| | $HCO_3$ | < 0,1 | < 0,1 | | | | | |
| | P | 0,33 | 0,32 | 0,50 | | | | |
| Micro-nutrients µmol/l | Fe | 10 | 10 | 10 | | | | |
| | Mn | 1,0 | 1,0 | 2,0 | | | | |
| | Zn | 2,9 | 2,9 | 2,0 | | | | |
| | B | 12 | 12 | 10 | | | | |
| | Cu | 0,5 | 0,5 | 0,7 | | | | |
| | Mo | 0,1 | 0,1 | | | | | |
| mmol/l | Si | 0,14 | 0,14 | | | | | |
| | K/Ca | 4,0 | | 1,3 | | | | |

Original

**Sample**

Research-/ordernumber: 318749/006125053
Date sampling: 08-08-2023
Date report: 21-08-2023
Test code: 310
Receiving date: 21-08-2023
Sample was taken by: Third party

FERRING NURSERY

**Results**

| | | analysis | at EC 0,67 | target | low | normal | high |
|---|---|---|---|---|---|---|---|
| | pH | 6,7 | 6,7 | 5,9 | | | |
| mS/cm 25°C | EC | 0,9 | 0,9 | < 1,8 | | | |
| Cations mmol/l | $NH_4$ | 0,1 | 0,1 | < 0,1 | | | |
| | K | 3,0 | 2,8 | 1,6 | | | |
| | Na | 1,8 | 1,8 | < 3,5 | | | |
| | Ca | 0,9 | 0,8 | 1,2 | | | |
| | Mg | 0,4 | 0,4 | 0,5 | | | |
| Anions mmol/l | $NO_3$ | 1,9 | 1,8 | 4,0 | | | |
| | Cl | 1,8 | 1,8 | < 3,5 | | | |
| | S | 1,4 | 1,3 | 0,8 | | | |
| | $HCO_3$ | < 0,1 | < 0,1 | | | | |
| | P | 0,40 | 0,37 | 0,50 | | | |
| Micro-nutrients µmol/l | Fe | 11 | 11 | 10 | | | |
| | Mn | 0,6 | 0,6 | 2,0 | | | |
| | Zn | 2,5 | 2,5 | 2,0 | | | |
| | B | 13 | 13 | 10 | | | |
| | Cu | 0,6 | 0,6 | 0,7 | | | |
| | Mo | 0,2 | 0,2 | | | | |
| mmol/l | Si | 0,18 | 0,18 | | | | |
| | K/Ca | 3,3 | | 1,3 | | | |

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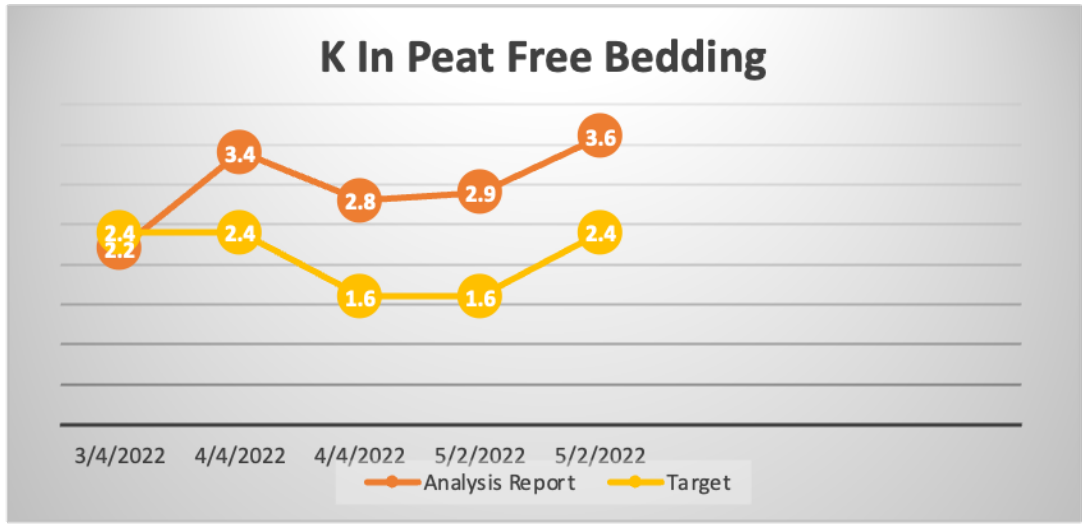
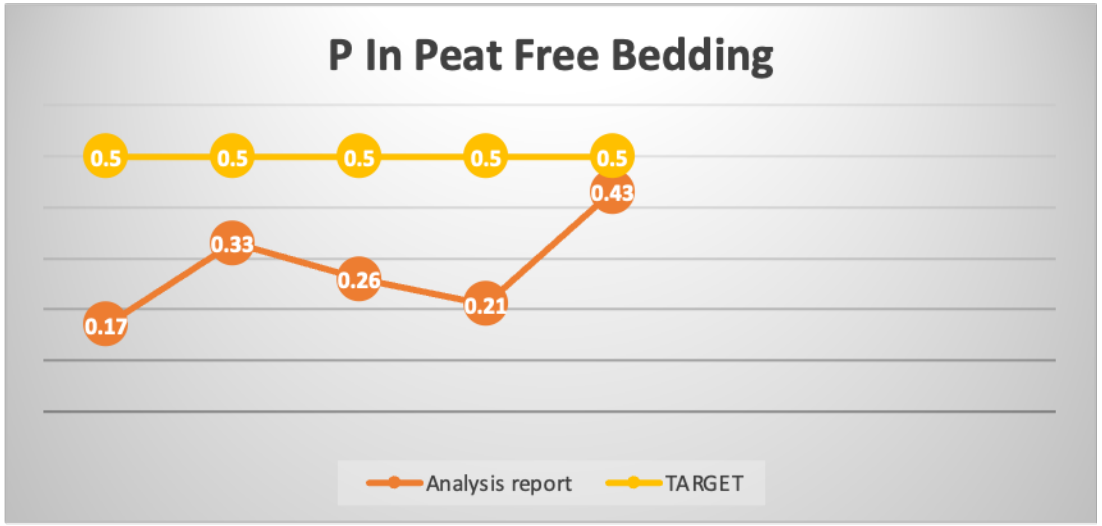
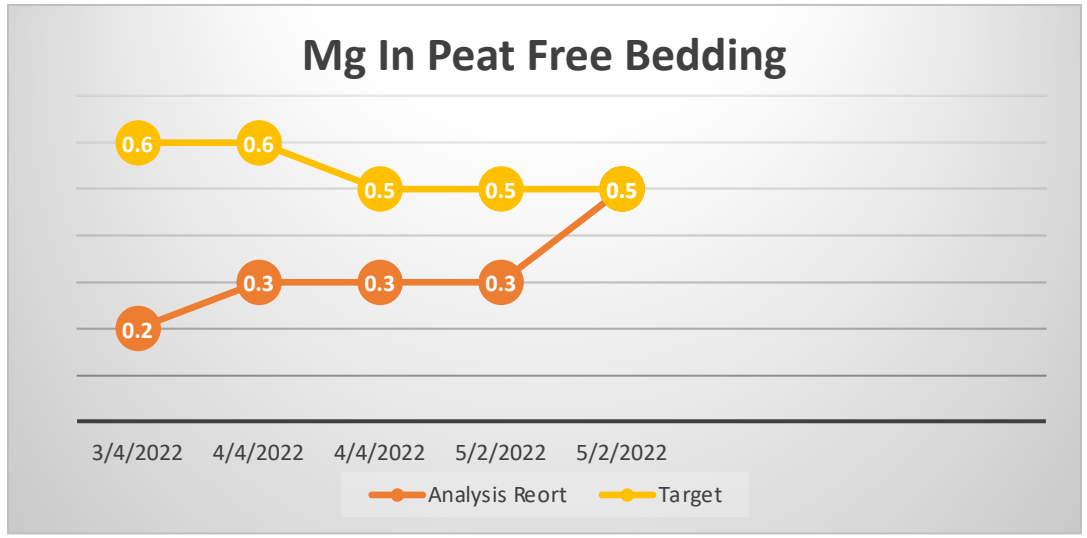
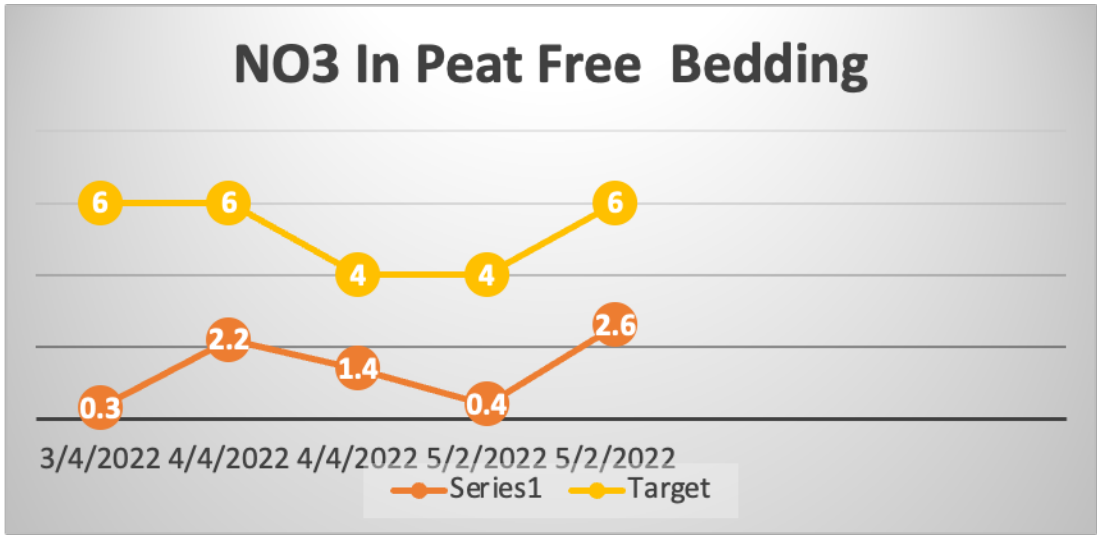

K In Peat Free Bedding
3.4
2.8
2.9
3.6
2.4
2.2
2.4
1.6
1.6
2.4
3/4/2022
4/4/2022
4/4/2022
5/2/2022
5/2/2022
Analysis Report
Target


P In Peat Free Bedding
0.5
0.5
0.5
0.5
0.5
0.43
0.33
0.26
0.21
0.17
Analysis report
TARGET


Mg In Peat Free Bedding
0.6
0.6
0.5
0.5
0.5
0.3
0.3
0.3
0.2
3/4/2022
4/4/2022
4/4/2022
5/2/2022
5/2/2022
Analysis Reort
Target


NO3 In Peat Free Bedding
6
6
4
4
6
2.2
1.4
0.4
2.6
0.3
3/4/2022 4/4/2022 4/4/2022 5/2/2022 5/2/2022
Series1
Target

# Blueberries soil analysis

**Sample No** G064061/01
**Crop** BLUEBERRIES

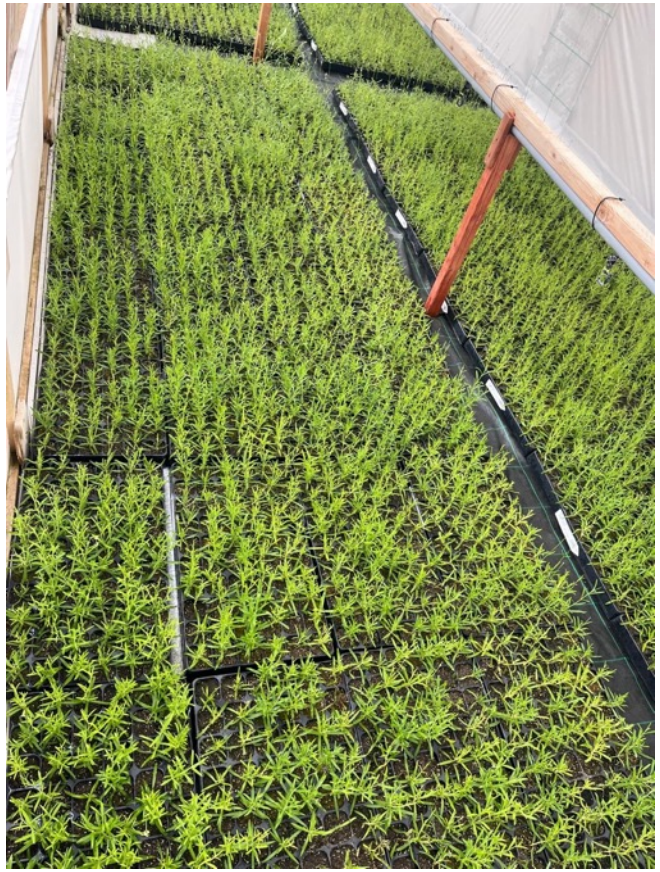
| Analysis | Result | Guideline | Interpretation | Comments |
|---|---|---|---|---|
| pH | 4.4 | 4.5 | Slightly Low | Slightly low. An acidic environment will reduce soil nutrient availability and the efficiency of any applied fertilisers or organic materials.<br>A sub optimum pH will also impact on soil microbial populations and rates of activity.<br>Refer to lime requirement. |
| Phosphorus (ppm) | 10 | 26 | Low | **(Index 1.0)** Adequate fertiliser application is essential. |
| Potassium (ppm) | 67 | 121 | Low | **(Index 1.1)** Adequate fertiliser application is essential. |
| Magnesium (ppm) | 54 | 120 | Slightly Low | **(Index 2.1)** CONSIDER TREATMENT WITH MAGNESIUM. |
| Calcium (ppm) | 332 | 1000 | Very Low | CONSIDER TREATMENT. |
| Sulphur (ppm) | 8 | 10 | Slightly Low | Low priority on this crop. Other crops may be affected. |
| Manganese (ppm) | 6 | 5 | Normal | Adequate level. |
| Copper (ppm) | 1.5 | 2.1 | Low | Low priority on this crop. Other crops may be affected. |
| Boron (ppm) | 0.49 | 2.10 | Very Low | CONSIDER TREATMENT WITH BORON. |
| Zinc (ppm) | 3.4 | 2.1 | Normal | Adequate level. |
| Molybdenum (ppm) | 0.01 | 0.80 | Very Low | Low priority on this crop. Other crops may be affected. |
| Iron (ppm) | 2114 | 50 | Normal | Adequate level. |
| Sodium (ppm) | 22 | 90 | Very Low | Not a problem for this crop. |
| C.E.C. (meq/100g) | 4.7 | 15.0 | Very Low | Cation Exchange Capacity indicates a very low nutrient holding ability - soil applied nutrients will be readily leached. Where possible foliar applied nutrients should be recommended. |
| Lime Req. (t/ha) | 7.0 | | | |

# Using the Holistic approach

**System Understanding - We have looked at all the systems to make sure they work together**

- How does a plant work
- What does a plant need?
- Making sure the environment is correct
- What is the right growing media?
- What fertiliser to use?
- Healthy growing systems - Biopesticides

# Peat-free propagation



**Less than 1% crop loss**

Lavender (variety ‘Seal’) propagation in the Jiffy propagation mix with 2 g/L DCM ECOR 6.

# At sale

Weaned off in July and given 2 liquid calcium feeds and top-dressed with 2 grams per litre DCM Ecor 5.

Hidcote potted into peat-free 9cm pots after 5 weeks from plug.

# Cuttings in preforma plugs

Clematis '*Princess Diana*'

Hydrangea '*Pink Diamond*'

Fuchsia '*Brutus*'

**2 liquid calcium feeds and top-dressed with 2 grams per litre DCM Ecor 5.**

# General potting mix with DCM

DCM ECOR 5 4 kg/$m^3$ + Calcium Nitrate liquid feed

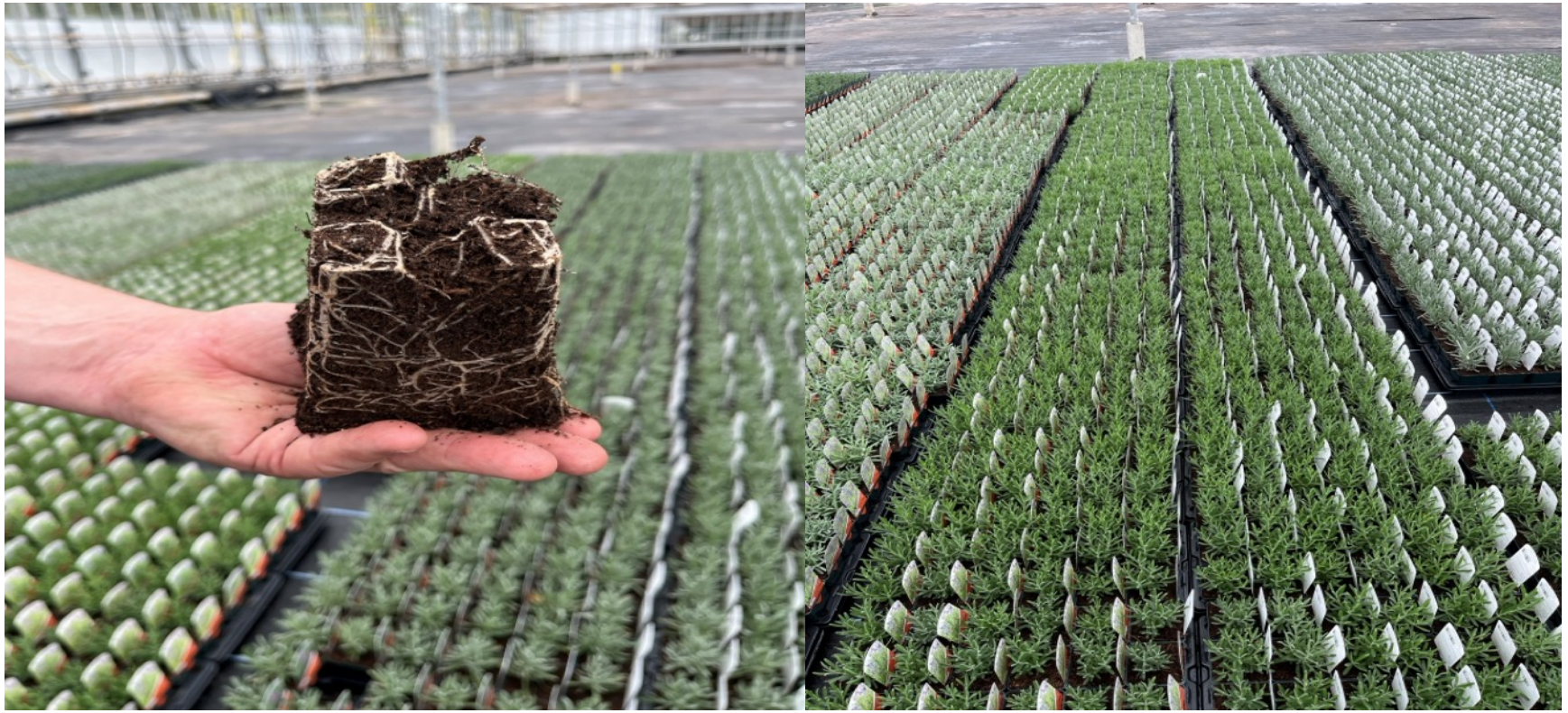
# Peat-free mix with DCM and Osmocote

3kg/m$^3$ DCM ECOR 5 + 3kg/m$^3$ Osmocote 5, 8-9 month

# Peat-free bed and pot bark with DCM

**DCM ECOR 6 3 kg/m$^3$ + liquid feed**

# Herbs



DCM ECOR 5  2kg/$m^3$ + liquid feed

# Peat-free Poinsettia’s

**DCM ECOR 5 2 kg/m$^3$ + 1kg Cal/Mag**

# Peat-free Roses

**Osmocote Exact 12/14month 3kg/m$^3$ & top dressed twice with DCM ECOR 5 3 grams per litre over the season.**

# Peat-free Ericaceous mix with DCM

DCM ECOR 5  2kg/$m^3$ + 2kg CRF, 12/14 month

# Nursery

DCM ECOR 5 NPK 8-5-6, 2 kg/$m^3$ DCM ECOR 3 NPK 11-0-3 2kg/$m^3$, Osmocote Pro 12-14month 2kg/$m^3$

# Watercress

DCM ECOR 6 6kg/$m^3$, DCM Vivikali 2.5kg/$m^3$, DCM Micro mix 250grams/$m^3$

# Organic grown crops using only DCM

**DCM ECOR 3 NK 11-3,DCM Vivikali NK 2-20, DCM Micro Mix**

# Organic grown crops using only DCM

DCM ECOR 1 NPK 9-5-3, DCM Vivikali NK 2-20, DCM Micro Mix

# Port Laurel field grown using DCM/mineral fertilisers

DCM MIX 5 NPK 10-4-8 applied twice in growing season

# Tree planting in soil with DCM

DCM Mix 5 50 grams per tree, DCM Vivisol 25 grams per tree

# Crop Focus for 2025



# Healthy Systems

**Good nutrition**
- Healthy roots
- Strong plants
- Good growth

**Healthy plants**
- Good uptake of fertilizer
- Disease/Pest Management
- Helps biofungicide programmes