Root Veg

Levity
CROP SCIENCE

Pioneering Fertiliser

Root Veg

A complete range of fertiliser designed to enhance growth and quality of root vegetables.

Levity are putting crop science at the heart of our product development. Our expertise is in understanding how plants use their food to grow, and then adapting the inputs so that the crop gets better use from it. It allows us to use very low inputs whilst achieving better results.

Our approach is to talk to growers, understand the challenges they face and then go back to the lab and create products that can help them.
We consulted with root vegetable growers around the world and identified key challenges that were poorly addressed by the fertiliser and agchem industry: shelf life, increasing yield without reducing quality, stress and management of Cavity spot and other disorders.

The developed range is the result of several years of intensive development and testing by our team of crop scientists. Our job is to understand how science can help farmers, and deliver easy-to-use products that solve their problems.

We are really proud of this range because it takes fertiliser inputs to a new level. By properly taking the time to understand the crop, we have created very low input products that solve root vegetable problems and allow farmers to produce top quality and yield. This is the first time that products for root vegetables have been built from a proper understanding of the crop, and farmers will be very happy with the results.

The 5 biggest issues facing root veg addressed:

1 Yield:
Fertiliser can often produce leggy growth and create quality issues and disease pressure. Farmers need ways to feed crops and maintain quality.

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Lono is a smart fertiliser that focuses the plant's growth on root development rather than the vegetative growth stimulated by conventional N fertilisers. Lono increases root vegetable yield, lifting size of roots. It also helps crops maintain growth during periods of stress, safeguarding yield.
The key benefits are increased yields, more even size distribution, improved establishment.

2 Quality:
Growers need to ensure that the roots they produce remains firm, and lasts well post- harvest so that fruit does not spoil before it's eaten. They also need to reduce incidence of disorders like Cavity Spot.

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Albina is a pioneering new product that improves shelf life. Albina uses Levity's pioneering chemistry to stimulate calcium absorption into roots, where conventional products cannot. Albina is proven to reduce the incidence and severity of Cavity spot, and to positively impact post harvest shelf life of carrots and parsnips.

3 Bulking:
Getting crops to the best size so that the crop achieves the highest possible quality and grading.

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Damu can increase size of carrot and parsnip roots ahead of harvest by increasing the transfer of photosynthates from foliage to the root.

4 Stress:
The weather and growing conditions are the single largest influence on both yield and quality.

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Indra is a product that improves growth and quality of root crops by helping the crop cope with stress caused by heat, cold, salinity, drought and high UV light. Indra can help protect crops from loss of quality and yield. The key benefit is crop protection to help prevent loss of quality and yield during poor growing conditions.

5 Protection:
Stronger plants are more robust and healthy, Levity's nutrients improve plant strength and health.

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Zeme is Levity's unique silicon fertiliser which strengthens the crop, making it more resilient against pests, disease and stress and improving post-harvest shelf-life. Zeme uses Levity's patent SiX chemistry which dramatically improves silicon uptake and distribution allowing lower rates and better results.

The Results:

What to expect from the Levity approach.

Yield - Our products help growers of root vegetables achieve better yields, and a more even sized. Growers using our products will see less leggy shoot growth and better yields.

Grading - Our products make roots bigger, and more evenly sized.

Stress - Our products allow growers to maintain growth and quality when conditions are tough. They help crops cope with heat, cold, salinity, UV and drought.

Quality - Our products make roots firmer and longer lasting, they reduce Cavity Spot and improve appearance.

Protection - Our products make crops stronger and more resilient. Growers using Levity products achieve lower susceptibility to disease and reduced physiological disorders.

How Our Recommended Fertilizers Work on Carrots

Use Lono To Increase Carrot Yield.

In this section we will look at how Lono can be used to focus growth on the carrot we harvest rather than leafy top growth we discard.

Carrots can take up Nitrogen in three forms: amine (NH^2), ammonium (NH^4) or nitrate (NO^3). The amount of nitrogen taken up by the carrot dictates how quickly the whole crop grows, however, it is the 'form' of nitrogen which dictates where the crop allocates this growth.

Nitrate (NO^3) makes the crop produce more of the growth hormone 'auxin', which are made in the top leaves. Increased auxin production stimulates the carrot to accelerate leaf top growth at the expense of the carrot root. While this does result in slightly higher yields, there is a large amount of growth energy wasted on excessive top growth which could be utilized to increase yield much further.

Conventional amine nitrogen seems like the ideal solution, if the carrot takes up this form of nitrogen, it will produce the growth hormone cytokinin, which favours carrot root growth rather than leafy top growth. However, this is not effective either. When amine nitrogen is used on carrot, small bacteria compete for, and use up the available amine nitrogen and convert it into nitrate. This all happens before the carrot is able to take up even a small amount and results in the crop taking up nitrate anyway. This, like before, results in excessive leafy top growth at the expense of carrot root growth, meaning the farmer does not reach the full potential yield for their crop.

To make the crop favour carrot root growth rather than leafy top growth, we need the crop to take up amine nitrogen. Unfortunately, this is not possible with conventional nitrogen fertilizers.

Levity's Solution - Lono

Levity have developed fertilizer Lono which uses 'LimiN' technology. Lono supplies carrot with 'Stabilized Amine Nitrogen'. This is a unique form of amine nitrogen which is unrecognisable to the bacteria which would usually convert amine into nitrate. This means that nitrogen is taken up by the crop in amine form rather than in nitrate. By helping the carrot to take up amine nitrogen we help it to produce more of the growth hormone cytokinin which favours harvestable carrot root development rather than top leafy growth. This process (known as growth partitioning) helps us to minimise the amount of wasted energy and maximize farmers yields by helping the crop grow in the right place.

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Use Albina to Reduce Disease Susceptibility (Like Cavity Spot) & Improve Quality.

IIt is well established that calcium is needed for carrots to reduce susceptibility to diseases like cavity spot, and also keep quality high. However, farmers often get poor results from applying conventional calcium fertilizers in addressing these issues. In this section we will explore why conventional calcium fertilizers miss the mark in combatting these issues and how our fertilizer 'Albina' supplies calcium in a unique way, allowing for better and more consistent results on improved quality and reduction of physiological disorders like cavity spot.

Why Do Conventional Calcium Fertilizers Miss the Mark?

Carrots don't actually need a lot of calcium to be healthy. In the case of cavity spot, only 2% of the carrot is actually affected, and these are characterised by small, localised deficiencies (dark spots).

In fact, if a farmer lost and entire 50MT/ha crop of carrots due to cavity spot, the actual affected area is only 1MT (2%), and the difference in calcium levels between the affected and non-affected areas is only 4mg/kg (four parts per million). This means that the amount of calcium required to prevent the entire crop loss is only 4g per hectare.

So, why doesn't simply 'applying more calcium' work in reducing susceptibility to cavity spot?

Cavity spot in carrot is rarely due to a lack of calcium applied/available. There are two different limiting factors which dictate how effective carrot is at taking up and using the calcium we apply to it:

Calcium Transport

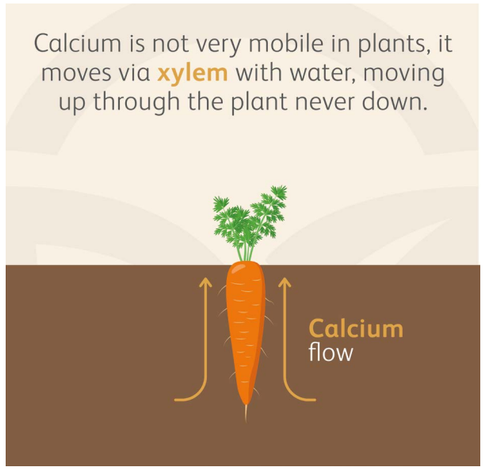
Calcium Absorption

Calcium Transport

Unlike many other minerals, Calcium is not phloem mobile and can only be transported by the xylem. Calcium enters the carrot with water and is transported upwards with transpiration, where is it either absorbed, stored or precipitated from the leaves as excess.

This means that Calcium can only move upwards through the crop. Using foliar applications of calcium to target calcium uptake in a root crop like carrot will be ineffective as it is physiologically impossible for the carrot to move the calcium from the leaves down towards the root.

Calcium must be applied directly to the roots to help ensure good calcium levels in carrot.



Calcium Absorption

"But we still get calcium deficiency problems when calcium is applied to the soil, why?"

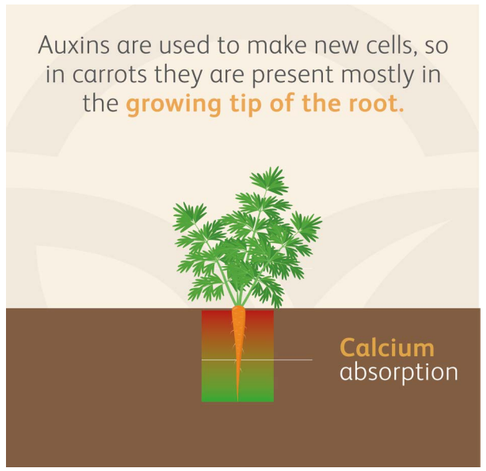
Calcium moves into cells via 'polar auxin transport', this means that calcium is only able to move into the cell when auxin is moved out. Parts of a plant that are low in auxin, can't absorb calcium effectively, regardless of how much is available.

High auxin producing areas include new shoots, new flowers, and new leaves. Low auxin producing areas include fruits, roots and tubers.

This is why applying calcium to correct physiological disorders can be so ineffective. It doesn't matter how much calcium is applied, parts of the plant with low auxin levels such as carrot roots can't absorb it properly.

Auxins are used by plants to induce cell division in newly growing tissue. In carrots the root grows from the tip, so the new cells in the tip are high in auxin and pretty effective at absorbing calcium, as the cells age they are no longer dividing and auxin levels decrease so capacity to absorb calcium drops off.

When plants are stressed calcium metabolism goes up, and carrot roots are not good at replacing it. This is why stressful growing conditions can lead to higher disease likelihood. Simply having calcium near the roots won't help, to get it into the carrot absorption must be improved.



Levity's Solution - Albina

Levity have developed Albina (with LoCal Technology). Albina Granule is a fertilizer which can be placed in the root zone and helps carrot roots to absorb calcium even when they're more developed and lower in auxin. This means calcium can be effectively absorbed by the carrot root all season long.

Albina contains Levity's LoCal chemistry which is has been widely used and extremely effective on crops like tomato, strawberry and lettuce. Albina's new granule form allows it to be applied in the root zone at planting, for slow release throughout the season. It is the first product ever available that supplies slow-release granular calcium with chemistry that allows active uptake by roots.

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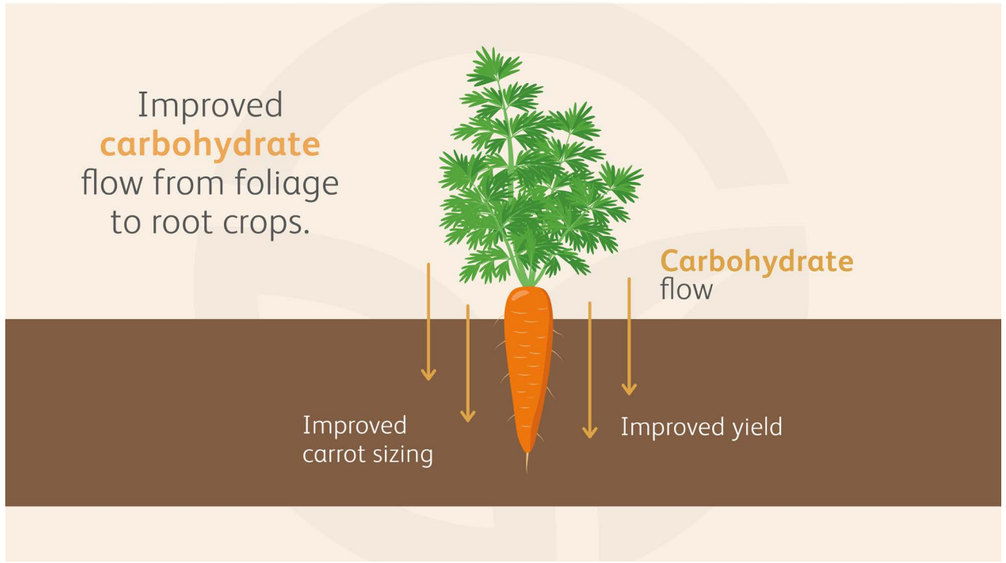
Use Damu To Bulk Roots.

Carrots are a crop in which farmers must carefully balance top growth with carrot root growth.

Carrots deficient in boron make high levels of auxin and low levels of Cytokinin. Auxin synthesis can quickly get out of control resulting in an increased ‘nitrate affect’ and top growth accelerates at the expense of roots. On the other hand, carrot with high levels of boron make lower levels of auxin and high levels of cytokinin. This results in less top growth and better root bulking.

Boron can be used to regulate auxin synthesis and slow down periods of fast top growth. Quantity and timing are paramount in this balancing act because there is fine line between deficiency and toxicity with Boron.



Levity’s Solution - Damu

Levity have developed Damu, a high efficiency product that allows lower rates of boron to be more effective, using stimulants to increase speed of uptake and metabolism. Damu can be used during periods of excess vegetative growth to reduce auxin production and refocus the crop on root growth.

In order to produce carrots, the plant must move sucrose from the leaves down to the roots, and because boron plays a part in this movement, it has a large impact of root growth.

During bulking, carrots translocate sucrose from leaves to roots using bis-sucrose-borate, a phloem mobile complex formed between boron and sucrose.

Damu works by improving the translocation of sucrose between leaves and roots for higher carrot starch formations. Damu applied during bulking supplies the boron needed to fuel carbohydrate translocation alongside Levity’s proprietary stimulant ‘Catalyst’ which stimulates the speed and intensity of the process.

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Carrot cavity spot: ‘calcium conundrum’ cracked

Carrot growers can now tackle cavity spot without recourse to fungicides, liming or cumbersome crop rotations, after scientists succeeded in cracking the ‘calcium conundrum’, writes Adrian Bell.

Rendering the crop unsaleable, and with losses estimated at up to £30m a year, cavity spot remains UK carrot growers’ most damaging disease, compounded by unreliable results from the single fungicide approved for control.

Yet while calcium has often been implicated in the disease, growers have struggled to get consistent results from either soil or foliar applications of the macronutrient.

“Because the pathogen responsible for cavity spot, Pythium, is relatively weak, it can only attack cells with imperfect defences,” explains Dr David Marks, of Levity Crop Science.

Cavity spot in carrots is strongly linked to **low calcium levels**, but despite this applying calcium often does little to reduce it.

“Calcium gives the cell wall rigidity and strength. When levels fall, the fungus takes advantage. “

“We’re talking very small amounts of calcium,” Dr Marks continues. “In a 50t/ha carrot crop suffering complete loss from cavity spot, just 1 tonne of plant tissue would be calcium-deficient - and the difference between healthy and affected tissue is only 4mg/kg. Preventing susceptibility to cavity spot comes down to just 4mg/ha of calcium”.

Understanding why these tiny amounts of calcium are not delivered by in-field calcium applications is the ‘calcium conundrum’. Now, after studying calcium’s behaviour in the plant, Dr Marks has not only explained the conundrum but developed a solution.

“Unlike most nutrients, calcium only moves upward through the plant,” he says.
“When absorbed through the roots, it goes to the leaves where it’s either stored or lost from the plant as excess.

“Meanwhile foliar calcium applications follow the ‘Las Vegas’ maxim: what happens to the leaves, stays in the leaves. Foliar calcium doesn’t correct root deficiencies.”

Yet soil applications are also fraught with difficulty. To absorb calcium, plant cells require high levels of auxin, a plant hormone. Auxin levels vary: areas of high production indude new shoots, flowers and leaves, while low auxin synthesis characterises locations such as fruits, roots and tubers.

“This explains why attempts to use calcium to correct physiological disorders is so ineffective,” explains Dr Marks. “The role of auxin is to induce cell division in fresh tissue. In carrots, where the root grows from the tip, those new tip cells have lots of auxin: calcium absorption is good. Older cells further from the tip have less auxin, so absorb less calcium.”

Dr Marks’ explanation is borne out in practice. Severity of cavity spot gets worse with distance from the root tip (less auxin in the cells), changes in growing conditions (water status and temperature affect calcium absorption) and later harvesting (over-mature carrots have less auxin).

To resolve the problem, Dr Marks and his team turned to a group of naturally occurring compounds that stimulate calcium uptake in the absence of auxin. These ‘calcium transport stimulants’ had been successfully used to control a calcium- related plant disease, bitter pit, in apples - a chemistry technology that Levity termed Local.

“In this instance, we created a granular calcium Fertiliser incorporating LoCal technology.” says Dr Marks.

“Albina is a slow-release prill that can be applied at planting to root crops. It is the first product to supply slow-release granular calcium, via chemistry that allows active uptake by roots.

“Resolving the calcium conundrum, it releases calcium slowly over the growing season. A carrot crop gets calcium in the right place, at the right time, in the right form.”

Dr Marks says it’s understandable how growers are concerned that just one fungicide, metalaxyl, is approved for cavity spot control, raising anxieties about best practice in product stewardship. (AHDB – research into other countries equivalent] has reported anecdotal evidence suggesting that only 50 per cent of routine applications had any effect.

“Albina provides an opportunity to reduce that reliance on fungicides, creating a healthier carrot crop that denies Pythium the opportunity to take a hold.”

The amount of calcium needed to rescue cavity spot is actually **very small.**

Ca Key Facts

- 1% fruit
- 100kg calcium deficient tissue
- 2 to 4ppm

0.2g Ca deficiency per Hectre per crop

‘Valuable tool’ for Lancs grower

Lancashire grower John Appleton says one of the most frustrating things about cavity spot is its unpredictability. “Wet year or dry year, you never know when it’s going to make an appearance. Rotation plays a role, certainly, but then so too does a field’s weed profile, with some weeds - species that Pythium also favours - acting as a host or reservoir of infection.”

Growing for the fresh market, Mr Appleton includes SO acres of early and maincrop carrots within an 850-acre rotation comprising potatoes, sugar and fodder beet, wheat, barley, oats, oilseed rape, and grass.

“We apply Albina at sowing, using a mounted applicator. As calcium is such an important nutrient in its own right, the application has merit beyond cavity spot control anyway, but since we’ve been using it we’ve not had a problem with thedisease,” he says.

“Alongside other methods of cultural control, such as the rotation and selection of more tolerant varieties, Albina is a valuable tool to be able to deploy”.

John Appleton
Lancashire Carrot Farmer

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Albina improves carrot and parsnip yield and firmness

Highlights

- Albina applications significantly increased the yield of parsnips in two field trials by 28% and 38% by increasing the weight of the roots.
- Albina applications significantly increased the yield of carrots in one field trial by 23% by increasing the weight of the roots.
- Albina applications significantly increased the firmness of carrots and parsnips in five field trials by 2-12% that can lead to increased storage and shelf life.

Background

Calcium is an important nutrient for fruit and vegetables as it improves cell wall strength and plant health. This results in increased firmness in the fruit or vegetables that translates into an increased storage and shelf life as well as the ability to withstand diseases and physiological disorders. Additionally, a crop that receives appropriate and complete nutrition will be able to grow more and increase its yield as for the essential plant nutrients (including calcium), if any of the nutrients are not present at the required level, this will act as a brake on plant development and growth, thereby reducing yield.

Growers often appear to apply the appropriate amount of calcium for the plants' needs, but still many plants show symptoms of calcium deficiency. This is due to plants having a poor ability to absorb the calcium and get it to where it is needed, e.g., the flowers, fruit and storage organs, such as the roots in carrots and parsnips. The plant hormone auxin is strongly linked to the transport of calcium into plant cells, where it is needed. The auxin levels decrease as fruit and vegetables grow, so most calcium absorption will be in new leaves and young fruit rather than maturing fruit vegetables and roots. Calcium is transported in the xylem with the water, which only moves up and out of the plants, from the roots to the leaves, so in root crops, such as carrots and parsnips, all the calcium is being transported away from the roots where it is needed to enable full growth and development and to prevent physiological disorders.

Levity Crop Science's product Albina contains calcium as well the pioneering LoCal technology that enhances calcium absorption in the parts of plants that do not normally absorb calcium, such as the fruit, vegetables and roots. The application of Albina, including the LoCal technology, means that crops are able to reach their full potential and yield while physiological disorders caused by calcium deficiency will be controlled.

Methods

Work was conducted as split field trials on grower managed sites in the UK in 2022. The grower managed all the sites commercially with the only change in management being the application of Albina (Levity Crop Science) at the recommended label rate to the treated sections. Data was collected from three carrot trials (two planted with var. Polydor and one with var. Nairobi) and two parsnip trials (one planted with maincrop var. Pearl and one with late season var. Picador).

Samples were collected on 09-10.08.22 when they had not reached maturity and 05-06.10.22 when the sites were ready for harvest. For each trial and each sample date, four samples were taken from the treated and untreated sections. The area lifted was for the carrots 0.25 m x bed width and for the parsnips 0.5 m x bed width. On the 09-10.08.22 samples were taken from two of the carrot trials (one var. Polydor and one var. Nairobi) and both of the parsnip trials, while on the 05-06.10.22 samples were taken from one of the carrot trials (the other var. Polydor) and both of the parsnip trials.

Samples were scored for weight of tops (just 09-10.08.22 as plants were still growing), weight of roots, number of roots, mean root weight and root defects (scored as presence/absence cavity spot and other defects). The root firmness was also measured (unitless scale from 0 soft to 100 hard) as an indicator of storage/shelf-life on the 17.08.22, 15.09.22 and 19.10.22 for the samples collected on the 09-10.08.22 and on the 19.10.22 for the samples collected on the 05-06.10.22. Samples were stored at room temperature.

Statistical analysis was conducted using the Jamovi 1.6.23 for Windows software. Student's t-tests or Mann-Whitney U tests (depending on normality of data) were used to identify significant differences between the Albina + grower standard or grower standard application schedules.

Results

All sampled crops were healthy and there were very low levels of cavity spot and other defects observed at any of the sample dates with no significant differences between the treated and untreated samples.

Carrots

Carrot trial 1

For the Nairobi carrot trial sampled on 09-10.08.22, the Albina treatment resulted in significantly ($p<0.05$) firmer roots on the 15.09.22 (7% increase)(fig. 1) which would suggest that the roots would have a longer storage life and remain fresh longer when with consumers.

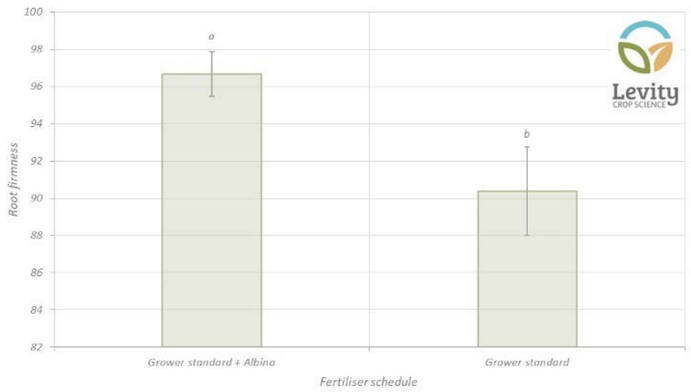

Figure 1. Root firmness increased by 7% for carrot var. Nairobi treated with Albina (Levity Crop Science) and harvested on 09-10.08.22 and scored on 15.09.22 with a unitless scale from 0 (soft) to 100 (hard). Significant differences between Albina + grower standard and grower standard are indicated by lower case letters (n=4, P<0.05, Mann-Whitney U test).

Carrot trial 2

For the Polydor carrot trial sampled on 09-10.08.22, the Albina treatment resulted in significantly ($p<0.05$) increased weight of tops (14% increase) (fig. 2) and roots (32% increase)(fig. 3) and average root weight (33% increase)(fig. 4) as well as firmness on the 17.08.22 (2% increase)(fig. 5) and 19.10.22 (2% increase)(fig. 6). This shows that the yield was increased significantly as each carrot was bigger rather than there being more carrots present (there were no significant differences in the number of carrots present, data not shown). There would also have been an increased storage and shelf life. This trial was harvested before a second sample could be taken so it was not possible to get data for when the crop was mature.

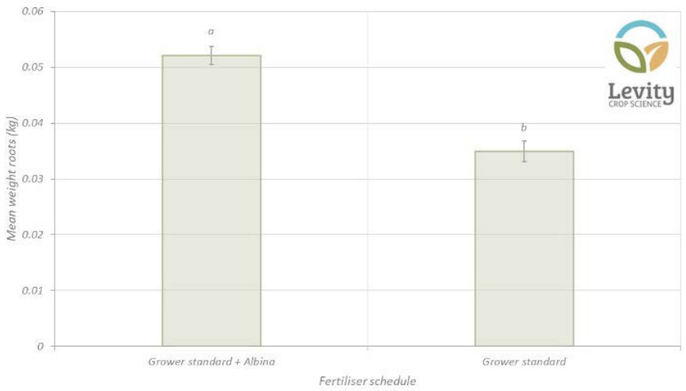

Figure 4. Mean weight of roots increased by 33% for carrot var. Polydor treated with Albina (Levity Crop Science) and harvested on 09-10.08.22. Significant differences between Albina + grower standard and grower standard are indicated by lower case letters (n=4, $P<0.05$, Student's t-test).

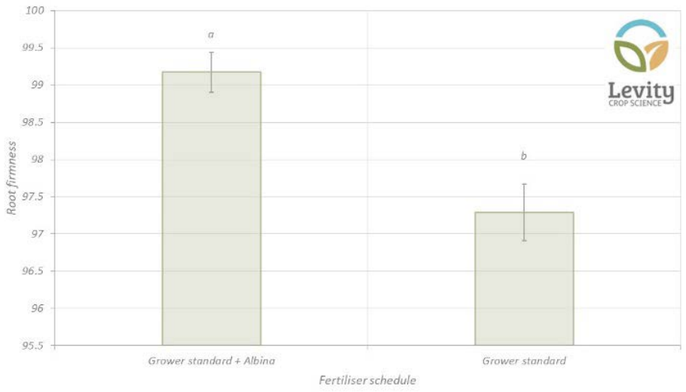

Figure 5. Root firmness increased by 2% for carrot var. Polydor treated with Albina (Levity Crop Science) and harvested on 09-10.08.22 and scored on 17.08.22 with a unitless scale from 0 (soft) to 100 (hard). Significant differences between Albina + grower standard and grower standard are indicated by lower case letters (n=4, $P<0.05$, Mann-Whitney U test).

Carrot trial 3

For the Polydor carrot trial sampled on 05-06.10.22, the Albina treatment resulted in significantly ($p<0.05$) firmer roots on 19.10.22 (3% increase)(fig. 7) which would suggest that the roots would have a longer storage and shelf life.

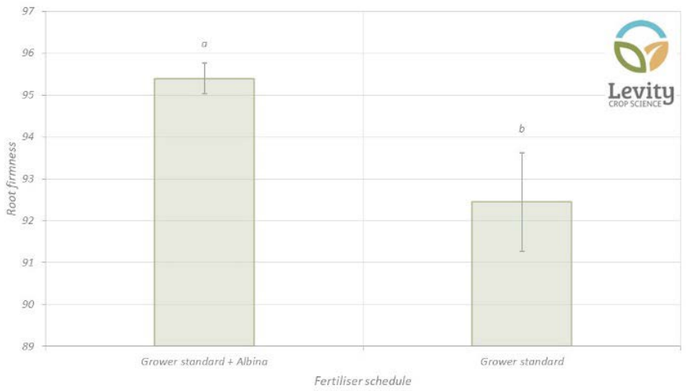

Figure 7. Root firmness increased by 3% for carrot var. Polydor treated with Albina (Levity Crop Science) and harvested on 05-06.10.22 and scored on 19.10.22 with a unitless scale from 0 (soft) to 100 (hard). Significant differences between Albina + grower standard and grower standard are indicated by lower case letters (n=4, $P<0.05$, Mann-Whitney U test).

Parsnips

Parsnip trial 1

For the Pearl parsnip trial sampled on the 09-10.08.22 the Albina treatment resulted in significantly ($p<0.05$) firmer roots on 19.10.22 (12% increase)(fig. 8). While when the trial was sampled on 05-06.10.22, when it was mature, the Albina treatment resulted in significantly ($p<0.05$) increased root weight (28% increase)(fig. 9) and mean root weight (21% increase)(fig.10) as well as firmness (6% increase)(fig. 11). This means that the Albina application had an impact on yield in the two months between the first and second scoring dates. The significant increase in yield again came from bigger parsnips rather than more smaller roots present (again there was no significant difference in the number of roots, data not shown). The impact of the Albina treatment on the firmness follows what we have seen in other work, that it maintains firmness in the treated sample when the untreated sample starts to soften as the difference in firmness for the sample from the first sampling date only showed a significant difference after three months of storage. The impact on firmness was also observed at harvest for the mature sample, so they will have an increased storage and shelf life.

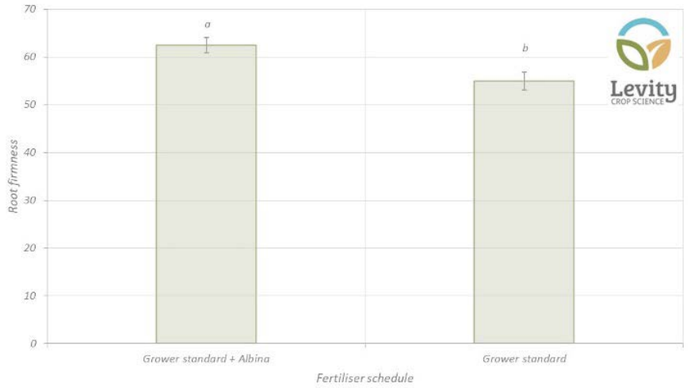

Figure 8. Root firmness increased by 12% for parsnip var. Pearl treated with Albina (Levity Crop Science) and harvested on 09-10.08.22 and scored on 19.10.22 with a unitless scale from 0 (soft) to 100 (hard). Significant differences between Albina + grower standard and grower standard are indicated by lower case letters (n=4, $P<0.05$, Student's t-test).

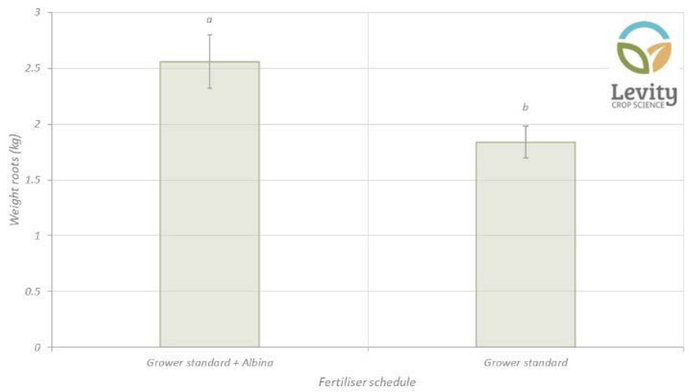

Figure 9. Weight of roots increased by 28% for parsnip var. Pearl treated with Albina (Levity Crop Science) and harvested on 05-06.10.22. Significant differences between Albina + grower standard and grower standard are indicated by lower case letters (n=4, $P<0.05$, Student's t-test).

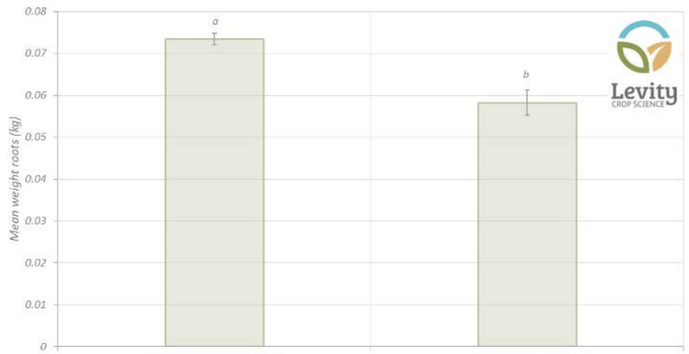

Figure 10. Mean weight of roots increased by 21% for parsnip var. Pearl treated with Albina (Levity Crop Science) and harvested on 05-06.10.22. Significant differences between Albina + grower standard and grower standard are indicated by lower case letters (n=4, $P<0.05$, Student's t-test).

Parsnip trial 2

For the Picador parsnip trial sampled on the 09-10.08.22 the Albina treatment resulted in significantly ($p<0.05$) increased weight of tops (26% increase)(fig. 12). While when the trial was sampled on 05-06.10.22 when it was mature the Albina treatment resulted in significantly ($p<0.05$) increased root weight (38% increase)(fig. 13) and mean root weight (32% increase)(fig. 14) as well as firmness (5% increase)(fig. 15). This means again that the Albina application had an impact on yield in the two months between the first and second scoring dates. The significant increase in yield again came from bigger parsnips rather than more smaller roots present (again there was no significant difference in the number of roots, data not shown). This could be due to the significantly increased weight of the tops at the first sampling date, as plants with a bigger leaf amount will be better able to develop due to a larger area to photosynthesize. Again, the roots at harvest from the Albina treated sample were firmer than those without the Albina treatment, so they will have an increased storage and shelf life.

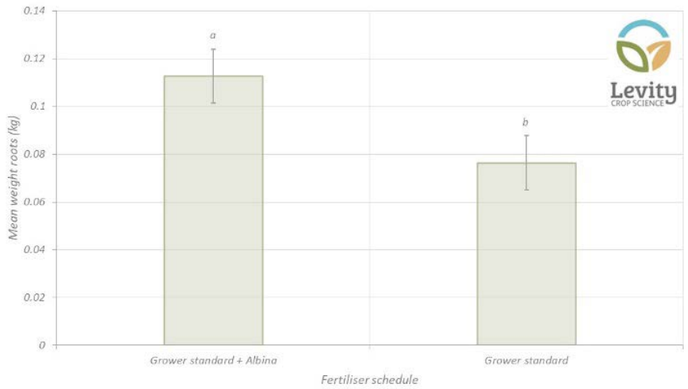

Figure 14. Mean weight of roots increased by 32% for parsnip var. Picador treated with Albina (Levity Crop Science) and harvested on 05-06.10.22. Significant differences between Albina + grower standard and grower standard are indicated by lower case letters (n=4, $P<0.05$, Student's t-test).

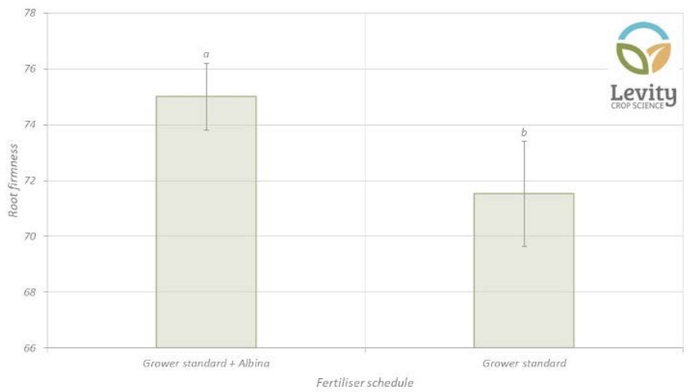

Figure 15. Root firmness increased by 5% for parsnip var. Picador treated with Albina (Levity Crop Science) and harvested on 05-06.10.22 and scored on 19.10.22 with a unitless scale from 0 (soft) to 100 (hard). Significant differences between Albina + grower standard and grower standard are indicated by lower case letters (n=4, $P<0.05$, Student's t-test).

Application Rates:

Lono

Application	Amount	Frequency	Impact
Foliar or drip application	2.5 - 5L/Ha	Monthly applications from 4 leaf stage	Increased yield, better uniformity

Albina liquid

Application	Amount	Frequency	Impact
Soil applied	2L/Ha	Monthly applications from 3 leaf stage	Improved quality, reduced susceptibility to cavity spot, improved post harvest storage life.

Albina granule

Application	Amount	Frequency	Impact
Soil applied	10-20 kg/Ha	Single application in furrow at planting	Improved quality, reduced susceptibility to cavity spot, improved post harvest storage life

Damu

Application	Amount	Frequency	Impact
Foilar	2L/Ha	When top growth is excessive	Improved yield
Foilar	5L/Ha	1 week ahead of harvest	Larger roots via increased bulking

Indra

Application	Amount	Frequency	Impact
Foliar or soil	1L/Ha	Monthly during periods of stress	Improved growth and stress recovery.

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