



Grower Summary

FV 438

The impact of pre-harvest treatments on shelf-life and quality in baby leaf spinach

Final 2015

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Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of this report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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HDC is a division of the Agriculture and Horticulture Development Board.

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Project Title: The impact of pre-harvest treatments on shelf-life and quality in baby leaf spinach

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GROWER SUMMARY

Headline

There is no evidence to suggest that the application of pre-harvest foliar sprays extends shelf-life in baby leaf spinach. Of the nine products evaluated in this study none performed consistently better than any of the others across all sites.

Background

Baby leaf salads are a rapidly growing sector within fresh produce, with a range of species being valued for their visual appearance and flavour. As a result, the industry has seen an increase in sales in recent years. Shelf life is a critical factor for all growers, more so for bagged salad products whose quality specifications are tightly defined by the retailers. These include the ability of leaves to maintain leaf integrity to avoid breakdown whilst still on retail shelves and later in consumers' homes. Growers employ practices such as optimizing nitrogen (N) fertiliser applications, to ensure that quality remains at the specified standard for a given length of time (i.e. the produce shelf-life).

New products with claims or reports to improve shelf-life or appearance continue to make their way to the market. The UK growing industry is regularly presented with a number of pre-harvest foliar-spray chemical or biological products and it is known that some growers are using them. Some of these products are not cheap. Prior to this project, no work had been done to demonstrate the benefits of applying the individual products to a crop in comparison to a no-application control and the products had not been compared objectively within a commercial production environment.

Summary

This aim of this work was to investigate the effects of spraying different chemical and biological products on leaf quality and the extension of shelf life in baby leaf spinach in comparison to a 'no-foliar-spray' control. Six of the products that were evaluated contain a form of calcium (Stopit, InCa, Calsym, Calmax Ultra, CapiTal and Advocate), four contain other trace elements (Calmax Ultra, CapiTal, Advocate and Maxicrop) and three are biological based treatments or they are reported to contain 'bioactive agents' (Maxicrop, Tensile and ProAct, the latter based on Harpin protein). The treatments and contents of the tested products are given in the table below:

Treatment & Composition of products used in the trial:

Treatment no.	Product	Composition, claims and reported nutrient analysis
2	Stopit Yara)	Calcium chloride based (food grade). Analysis; Ca 16
3	InCa (Plant Impact)	Calcium and nitrogen based product (inorganic salts). Analysis; NPK 4.5:0:0 +Ca 7
4	Calsym (Verdesian)	Calcium and phosphorous based (no information available on analysis)
5	Calmax Ultra (Omex)	Inorganic emulsion containing calcium nitrite tetrahydrate plus trace elements. Also contains technology called 'AXM' designed to aid transport of Ca into cells. Analysis; NPK 9:0:0 +Ca 21.8
6	TenSile (Ilex)	Phosphite, potassium, and silicon plus polysaccharides derived from seaweed (2% 'bio-active agents'). Strengthens plant cells and improves shelf life by reducing transpiration and water loss. Analysis; NPK 0:2:8 +Si 8
7	CapiTal (Ilex)	Calcium phosphite based product, including zinc and boron. Analysis; NPK 4:30:8 +Ca 6.6, B 0.8, Zn 2.4
8	AdvoCate (Ilex)	Calcium based product (Calcium chloride 10%) complexed with natural sugars and amino acids (7.5% w/v 'bio-active agents'). Analysis; NPK 3.6:0:0 +Ca 9.0, B 0.02, Zn 1.5, Fe 0.18, Mo 0.1
9	ProAct (PHC)	Harpin protein based product; elicitor-reduces plant stress through Systemic Acquired Resistance (SAR)
10	Maxicrop (Maxicrop)	Seaweed extract; Benefits include stimulation of plant growth, improved biological activity around root zone. Analysis; NPK 3.1:1.4:2.9

**Treatment 1 was the no spray control*

The products were applied at the following rates:

Treatment No	Product (manufacturer)	Rate of application of product (L/ha unless otherwise stated)	Water volume (L/ha)
1.	Untreated control	-	-
2.	Stopit	5.0	200
3.	InCa	1.5	200
4.	Calsym	2.0	200
5.	Calmax Ultra	2.0	300
6.	TenSile	3.0	300
7.	CapiTal	3.0	300
8.	AdvoCate	3.0	300
9.	ProAct	0.2 kg/ha	300
10.	Maxicrop Triple	1.5	300

The study was carried out over six sites across the UK in a single season, these sites were chosen in geographically separate areas to represent the different climatic and soil conditions where baby-leaf is grown. As there were different sowing dates and growing conditions for each site, different spinach cultivars were used at each site.

Prior to drilling, topsoil (for pH, P, K and Mg) at 0-15 cm and Soil Mineral Nitrogen (SMN) samples at 0-30 cm depth were obtained. Treatments were applied twice over the growing period, the first at two true leaf stage and the other approximately 4-7 days prior to harvest. Each treatment was applied with an OPS sprayer with a 1.5 m spray width.

Harvest occurred in the early summer and samples were transported to ADAS Boxworth where they were weighed and then separated into 7 x 100 g samples for each treatment. The full duration of chilled storage at ADAS Boxworth was 7 days, with one sample of each treatment and each site assessed pre- and post-washing for leaf damage, dehydration and bruising. Leaves were washed in line with standard industry practice at Boxworth. For Site 14/1, on the 7th day of storage, leaf dimensions (length, width and stem length) were also measured.

Shelf life measurements that were statistically analysed were the reduction in leaf damage (holes, tears etc); leaf bruising (i.e. based on the industry protocol) and dehydration levels. Yield measurements were also made.

Shelf-life responses

The relative values of the different products varied across all treatments and sites, with no one treatment having an outstanding effect on shelf life extension overall. There were no significant differences in terms of the reduction in leaf damage, dehydration or bruising between treatments at any of the sites, compared with the control. If each assessment parameter was observed individually, treatments that extended shelf life with respect to leaf damage were Inca, Maxicrop and TenSile, which gained one extra day at 2 of the 6 sites. For dehydration, an extra day was gained at two of the six sites for Inca, CapiTal, Stopit and Calmax. There was no extra gain in shelf life length from the treatments for the bruising assessments, although at two of the sites, TenSile, ProAct and Calmax all had reduced levels of bruising compared to other treatments.

Yield responses

Averaged over all sites, eight of the nine treatments yielded more than the control. However, the results varied again between sites, and there were no significant differences between treatments at individual sites. The only sites where all treatments yielded greater than the control were Sites 14/2, 14/4 and 14/5. InCa had the greatest yield responses at Site 14/5 with a 15.3% increase in yield. Site 14/5 had the lowest P index prior to drilling, and therefore the higher yield response at this site may indicate a simple nutrient response, which could have been achieved with other fertiliser products. It was also noted that averaged over sites, the treatments which demonstrated the greatest increases in yield in comparison to the control were Stopit and ProAct, each very different in their chemical composition. Stopit is a nutrient based formulation of calcium chloride, whereas ProAct is a protein based product. Each had an average increase of 5% in yield over the control.

Financial Benefits

The statistical analyses suggest that there are no benefits in using any of these products for shelf life extension on UK summer-grown baby leaf spinach. Growers could avoid using such products, saving them money.

Action Points

- As there was no evidence in these experiments to suggest there was a positive benefit resulting from any of the products used, growers should only consider using them where there is confidence in other reported benefits (i.e. other than shelf life extension),
- Before applying any of the products used in these experiments for improving yield, based on an expected crop response to nutrients, growers should take into account nutrients applied through other fertiliser products, and where necessary seek the advice of a FACTS qualified advisor.