

Grower Summary

Investigating the timing of transmission of carrot viruses to improve management strategies

SF 172

Final report

Project title:	Developing Nutrient Management Recommendations for Rhubarb
Project number:	SF 172
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AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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ADAS


Signature  Date: 31/03/23

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GROWER SUMMARY

Headline

- Nitrogen response experiments at three commercial farm sites between 2020 and 2022 showed no significant increase in marketable yield of rhubarb from increasing N application rates at any of the sites.
- The project provides no evidence that the current recommended N application rates (given in the Fresh Produce Crop Protocol and RB209 5th Edition) should be increased.
- However, growers should be cautious about significantly reducing their N application rates based on the results of this project, without further work to quantify the cumulative effect of reduced N application rates over a number of years.

Background

Rhubarb production in the UK currently occupies 543 ha of land, producing 15,000 tonnes from forced and field-grown rhubarb with a farm gate value of £20m (Defra, 2022).

Fertiliser recommendations for rhubarb are provided in the Fresh Produce Crop Protocol for Rhubarb, and these are based on the recommendations in the 5th edition of RB209 (1988) for crops in the year of establishment. Whilst the Fresh Produce Crop Protocol gives a single set of recommendations, the 5th edition of RB209 gives separate recommendations for establishment and established crops. These recommendations are understood to be based on research carried out at Stockbridge Technology Centre in the 1970's and 1980's, but the evidence to support these recommendations does not appear to be readily available. Due to the lack of available supporting data and changes to modern production systems growers did not wish these recommendations to be re-instated in RB209 when it was updated in 2016 (9th Edition) without further research into the crop's nutrient requirements.

With regard to changes to production, the fertiliser guidance in the Fresh Produce Crop Protocol is believed to be for crops harvested only once in a season (traditionally from March to May). To achieve an extended season supply to meet retailer's demands, growers now harvest up to 3 crops from the same crowns within a single season. As rhubarb is a perennial crop these multiple harvests can occur year on year from the same crowns, placing increased demand on the plants. The Fresh Produce Crop Protocol does include a footnote that extra N can be applied based on previous crop vigour and growth, but little further information is available to the grower, and there is no guidance on the timing of N applications for crops pulled more than once in a season. In addition, newer perpetual varieties have been developed which do not have a period of dormancy, and these may not have the inherent

vigour of the older varieties. Therefore research was required on the nutrient requirements of these perpetual varieties before recommendations for these can be included.

In the absence of recommendations in the 8th edition of RB209, growers and consultants use a combination of expert opinion and the recommendations for established crops from the 5th edition of RB209 and the Fresh Produce Crop Protocol. Typical annual applications of N for established outdoor crops range from 70 to 300 kg N/ha depending on whether the crop is being pulled once or several times in a season, as well as factors such as soil type. Higher applications are usually split. Despite using this advice and recommendations, growers and consultants are concerned that the crop may not be reaching its maximum potential due to the lack of available data to support these practices.

Rhubarb is a perennial crop which requires considerable investment during establishment, and suboptimal nutrient management may adversely affect yields and economic returns over the lifetime of the crop.

The overarching aim of this project was to produce clear fertiliser recommendations for growers of rhubarb for inclusion in RB209 to help growers to optimise nutrient management and minimise the environmental impact of their business activities.

Summary

Field trials were carried out to test the effect of nitrogen application rate and timing in field grown rhubarb at three different sites over three years (2020 to 2022). Field sites were located in an established commercial crop of Timperley Early on the following farms:

- Barfoots Farms Ltd. Sefter Farm, Pagham Road, Bognor Regis, W. Sussex (2020)
- T H Hammond & Sons, New Farm, Redhill, Nottingham (2020 & 2021)
- E Oldroyd and Sons, Hopefield Farm, The Shutts, Leadwell Ln, Rothwell, Leeds (2021 & 2022)

All sites were Soil Nitrogen Supply (SNS) Index 0, and therefore most likely to show a response to N fertiliser. Nitrogen treatments tested the effect of N application rate (up to 360 kg N/ha), and timing (**T1** – early applied pre-emergence/early after bud break; **T2** – after 1st harvest & before 2nd crop regrows; **T3** – after 2nd harvest and before 3rd crop regrows; **T4** – autumn application after final harvest).

Year 1 2020 – Barfoots and Hammonds

The onset of the Covid-19 outbreak in March 2020 had a significant impact on delivery of planned trials work in this first year. The first (pre-emergence) N fertiliser application was

applied at the end of January 2020, followed by a single harvest at each site in April 2020. No further N applications were made, or harvest taken from these sites in 2020.

Although Covid-19 impacted on treatment application in 2020, the treatments applied do allow us to test the effect of different early N application rate. Both sites were SNS Index 0 and therefore likely to be responsive to N application. Despite this, there was no significant increase in marketable yield with N rates of up to 375 kg N/ha applied following bud break at either site. This may be because early season growth in established plantations is driven by N reserves in the crown rather than from soil N. These results do not support early N applications to established rhubarb plantations.

Year 2 2021 –Hammonds and Oldroyds

Following the outputs of the 2020 trials, which showed no yield response to early N applications, the N treatment timings were adjusted in 2021 to focus on later season and autumn N applications. There were 16 treatments at each site testing the impact of N rate (0-360 kg N/ha) and application timing. Each site was harvested three times in 2021.

Overall, there was no significant effect of N application rate on marketable yields at either site in 2021, although there was a significant increase in N offtake with increasing N rate.

All treatments at the Oldroyds site were also harvested once in May of the following season to test the effect of the autumn 2021 N treatments. When analysed together, there was no effect of any of the N treatments on total yield or marketable yield. However, there was an indication of increasing marketable yield where N was applied in September 2021 after the third harvest.

Year 3 2022 - Oldroyds

The drought and extreme heat in summer 2022 had a significant effect on crop growth and performance at the site. Only one harvest was taken from the site rather than the planned three. The results from this harvest allow us to test the effect of 60 kg N/ha early N application compared to zero N. There was no effect of early N on total or marketable yields at the first harvest. This is similar to findings from the first year, where there was no significant increase in marketable yield with early N rates of up to 375 kg N/ha applied following bud break at either site. This may be because early season grown in established plantations is driven by N reserves in the crown rather than from soil N.

However, unlike in 2019, application of N did significantly increase stem N content and stem N offtake. This indicates that the crop took up some of the applied N, but did not translate this into increased yield. Because there was only one harvest at the site, it is not possible to

determine whether the additional N uptake would have had any effect on marketable yield at later harvests.

Field trials - conclusions

The lack of a significant yield response to N at all sites is surprising, especially as all had low levels of nitrogen in the soil (SNS Index 0). When this project was commissioned, some growers were questioning whether there should be an increase to the current recommended N rates given in the Fresh Produce Crop Protocol and RB209 5th Edition. The results from this project provide no evidence that the current recommended N application rates should be increased, and conversely actually indicate that recommended N rate should be reduced.

However, growers should be cautious about significantly reducing their N application rates based on the results of this project without further work to quantify the cumulative effect of reduced N application rates over several years. The lack of yield response to N indicates that the crown's reserves from the established crop were likely to have been sufficient to supply most if not all the crop N requirement. The high crop N offtake measured from the zero N control treatments also supports the conclusions that a significant proportion of N for crop growth is taken from reserves in the crown. Total crop (leaves and stem) N offtake from the zero N control treatments from the three harvests at Hammonds and Oldroyds in 2021 was around 100 kg N/ha; accounting for SNS of around 50 kg N/ha at Oldroyds and 30 kg N/ha at Hammonds, still indicates at least 50-70 kg N/ha from crown reserves.

Given that current fertiliser practices may meet (or exceed) N requirements of the crop, it is likely that the crops used for this trial had ample supplies of N in the previous season to ensure strong reserves for the following spring. However, under conditions where poor reserves are set aside – either due to weak crop growth or suboptimal N application over a number of years – there is a potential risk that the crowns could be depleted sooner (and therefore require greater or earlier N applications) to ensure that sufficient yields are produced.

The results from the project does provide some evidence on optimum N application timings. Results from the first and third year of the project when a single early N application was made to the crop and no yield response was measured indicate that there is little need for early N applications. Conversely the yields results from the May 2002 harvest at Oldroyds following the September 2021 N fertiliser treatments indicates that there may be yield benefit to the next season crop from autumn N applications following the final harvest.