Grower Summary

SF 172

Developing Nutrient Management Recommendations for Rhubarb

Annual Report 2022

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Date project commenced:	1 April 2019
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1. Grower Summary

1.1 Headline

- Rhubarb crowns are likely to contribute significant amounts of nitrogen for early season growth, particularly before the roots and leaf canopy have developed.
- Whilst this may reduce the impact of pre-emergence applications, it will be necessary to ensure sufficient nitrogen is present when developing crowns exhaust internal reserves and become increasingly reliant on new nitrogen from the soil – particularly in conditions where nitrogen uptake is likely to have been limited in the previous season.
- Whilst no clear nitrogen response has been demonstrated in the trials to date, minor trends indicate that optimum nitrogen applications are likely to approach 180 – 240 kg N/ha.

1.2 Background

The perennial nature of rhubarb creates a complex cropping system where optimisation of nutrient provision can be difficult. Current grower practice (as demonstrated in the grower survey reported in the 2020 annual report of SF 172) showed considerable variation in both volume and timing of N applications, with growers targeting pre-emergence and post-harvest applications, using application rates between 100-250 kg N/ha/year against current RB209 recommendations of 70-300 kg N/ha/year for established crops. Recommendations for rhubarb are significantly out of date and may not reflect current practice, such as the use of multiple selective pulls, or include references to practices that are no longer suitable (e.g. manure use). Other cultural approaches including the use of wool waste (“shoddy”) and the discarding of leaves onto the soil surface as a secondary source of nutrients add further layers of complexity to understanding the nutrient requirements of rhubarb. The recent increases in fertiliser costs are likely to provide further impetus for growers to optimise N applications to ensure that crop requirements are met to produce target yields whilst minimising the economic and environmental costs of application. In order to fully address this area, and to provide evidence to update RB209, project SF 172 was undertaken to explore the nutrient requirements of rhubarb over multiple seasons. The impact of covid-19 prevented a full season of treatments and harvests in 2020, and so research activities in the 2021 season are the first full year of this project. However, key messages from the 2020 season were incorporated in the trial design for 2021 (particularly reducing focus on pre-emergence applications) in order to maximise the relevance of the evidence produced to both commercial practice and the biological needs of the crop.

The work will address the following objectives:

1. To update information on nutrition and feeding for rhubarb
2. To determine whether additional N feeding of green rhubarb increases yield, quality and season length when pulled multiple times during a season
3. Knowledge exchange to include provision of speakers for AHDB or third parties events throughout the project duration
4. To update relevant sections of the Nutrient Management Guide (RB209)

1.3 Summary of 2021 Trials

Trials in the 2021 season were focused on three scenarios. Varied rates of N application were tested with the majority of applications targeted at the post-harvest period after the first harvest, with smaller applications made either after the second harvest (Category A – Trial 1) or before emergence (Category B- Trial 2). In addition, the application of N in the late season was tested (Category C – Trial 3). A summary of application rates and timings are given in **Figure 1** and a summary of treatments given in Table 1 and Table 2 below, with background site information given in Table 3.

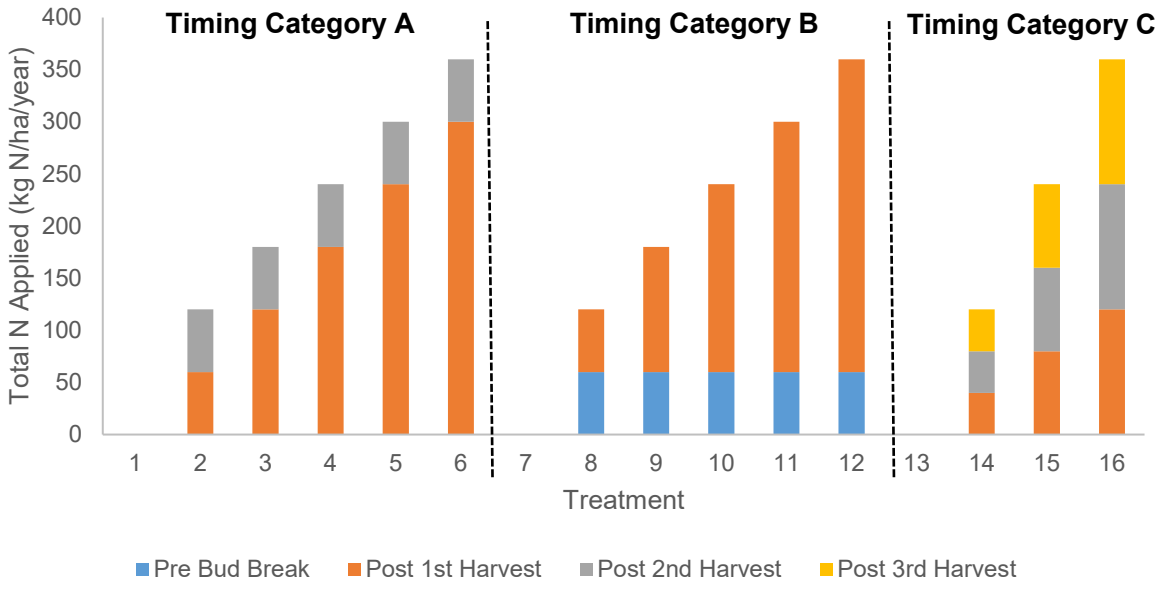

Figure 1. Summary of nitrogen treatments in the 2021 season.

Treatments were applied to replicated 3.8 x 7m plots at Hammonds Ltd. (site 1) and E. Oldroyds & Sons (site 2) as required in spring 2021, with three successive harvests at each site from March to September 2021. In addition to gross and marketable yield, samples were taken for biomass analysis to estimate total N offtake in the above ground parts of the plant.

Table 1. Summary of treatments and timings for timing categories A and B.

	Treatment Number	Application timing (kg N/ha)			Total applied (kg N/ha)
		Treatment 1 (Pre-emergence)	Treatment 2 (Post 1st Harvest)	Treatment 3 (Post 2nd Harvest)	
Timing A	1	0	0	0	0
	2	0	60	60	120
	3	0	120	60	180
	4	0	180	60	240
	5	0	240	60	300
	6	0	300	60	360
Timing B	7	0	0	0	0
	8	60	60	0	120
	9	60	120	0	180
	10	60	180	0	240
	11	60	240	0	300
	12	60	300	0	360

Table 2. Summary of treatments and timings for timing category C.

Treatment Number	Application timing (kg N/ha)			Total applied (kg N/ha)
	Treatment 2 (Post 1st Harvest)	Treatment 3 (Post 2nd Harvest)	Treatment 4 (Autumn)	
13	0	0	0	0
14	40	40	40	120
15	80	80	80	240
16	120	120	120	360

Table 3. Average SMN results for trial sites.

	Site	Soil Available N (kg N/ha)			
		0-30cm	30-60cm	60-90cm	Total (0-90cm)
Trial 1 & 2	1	20.2	14.2	13.7	48.1
	2	10.6	16.4	3.8	30.8
Trial 3	1	19.6	16.8	13.9	50.3
	2	9.6	9.7	7.2	26.5

1.4 2021 Season Results

Whilst good crop development was seen at both sites, there was not a significant response to N application at either site, nor a significant response to timings of application (Figure 1, Figure 2). However, these data suggest that significant productivity can be seen even at 0 kg N/ha, especially for the initial harvests, which would indicate the sufficient N was available in the soil and in the crown reserves to fulfil N requirements for growth. However, there is a minor, non-significant trend which indicated that peak N response was being seen around 180 – 240 kg N/ha – this was due to a drop off in early harvests at lower N concentrations, whilst applications above this threshold either did not lead to a proportionate increase in yield or led to a minor reduction in marketability due to increased stick length above the required specification and (potentially) greening.

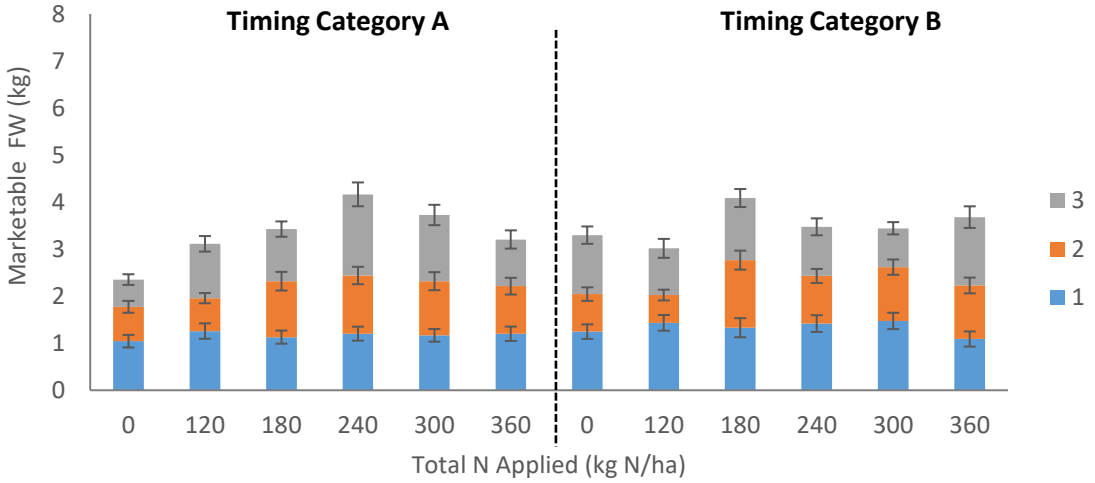

Figure 1. Marketable Fresh Weight per crown by harvest (Site 1)

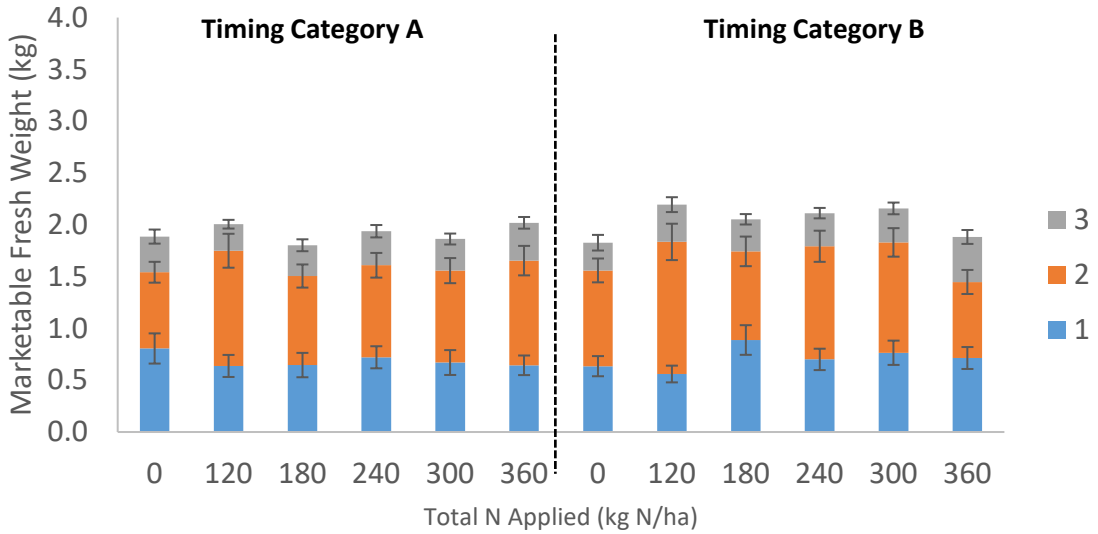

Figure 2. Marketable Fresh Weight per crown by harvest (Site 2)

1.5 Crop N Offtake

Similar to the yield outputs, crop N offtake did not show any significant response to N treatment (Figure 3, Figure 4), although a minor increase in offtake was seen at site 1 which appeared to plateau around the 240 kg N/ha mark, corresponding with the observations made from the yield data. Due to the high variability in the data it is difficult to draw any firm conclusions from these trials, although apparent trends are present which are to be tested in the final year of this project.

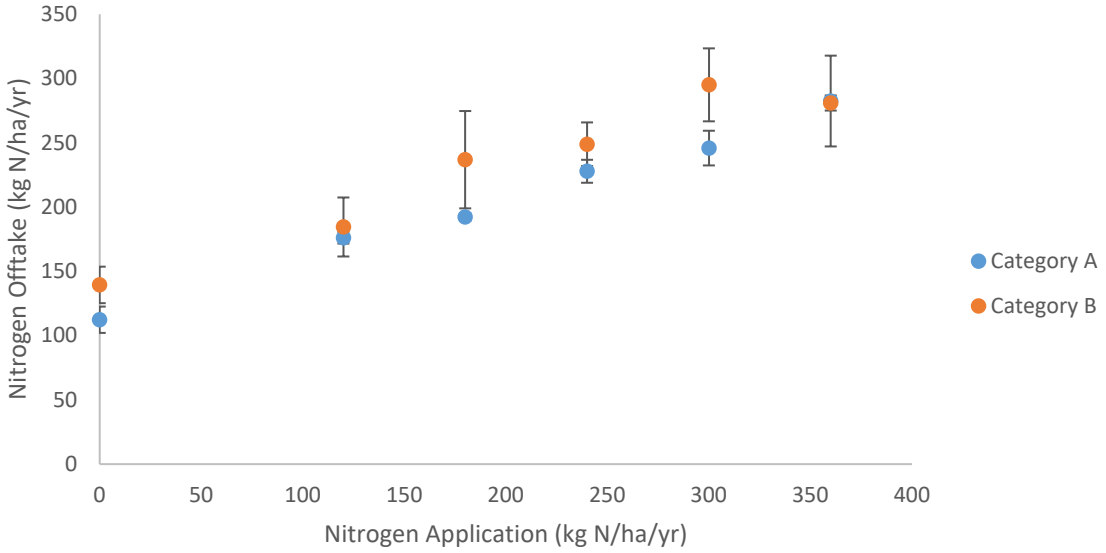

Figure 3. Total crop N offtake at Site 1.

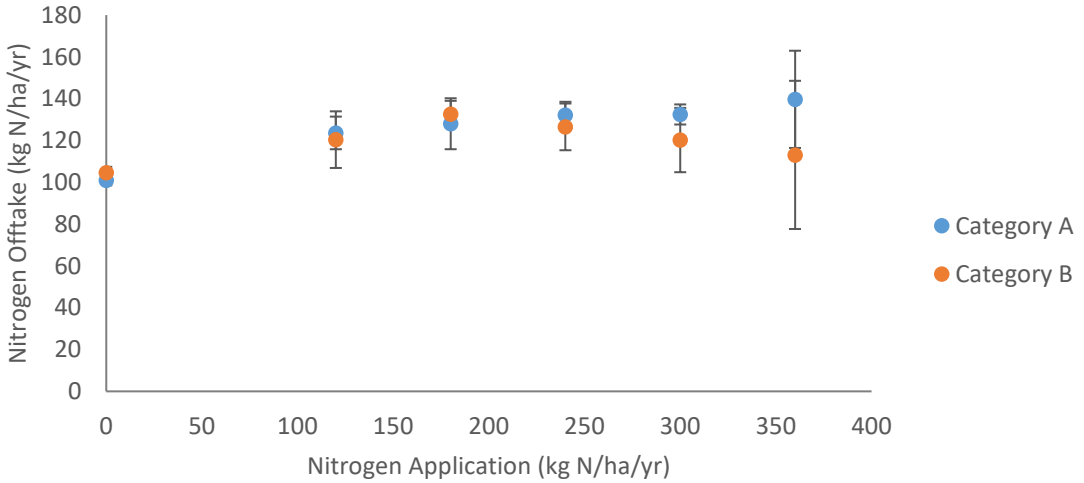

Figure 4. Total crop N offtake - site 2.

1.6 Updating RB209 Guidance for Rhubarb

A key theme emerging from the 2021 trials is the continued support for a significant crown contribution to early season N requirements of the developing plants. It is likely that nitrogen will be taken up in the summer months, stored in the crown (along with starches) and the utilised in the early spring for growth. The uptake and conversion of inorganic nitrogen is an energy-intensive process, so it would be most efficient for the crowns to utilise existing sources before taking up additional N from the soil. Crowns which have sufficient reserves are likely to see strong productivity in the spring, whilst those with less optimum reserves (either as a result of poor growth or through limited N in the previous season) may see reduced growth or heightened need for N in the following spring.

This aspect creates two additional complexities. Firstly, it means that the identification of optimum N requirements based on a single season of results is difficult given that the impact of the crown reserves cannot be separated from the new uptake from the soil. Therefore, it will be necessary to further appraise the impact of varied N treatment on the same crop at the start of the 2022 season to track inter-seasonal effects. Secondly, it means that determining optimum timings of N application (including evaluating the benefit of pre-emergence and post-harvest splits) is further complicated due the presence of internal reserves. However, given that a wide range of factors are liable to impact the timing of crown depletion, it may be advisable for growers to ensure that a minimal amount of N is applied earlier in the season to ensure this does not become limiting for subsequent growth.

1.7 Key Findings & Recommendations

- The rhubarb crown will contribute a significant amount of nutrients and resources to the first crop of the season using reserves built up in the previous summer. Act to maintain productivity and weed control to ensure strong full season growth boosts these reserves.
- While the crown will provide for early N requirements, small pre-emergence applications may be beneficial by ensuring that all N requirements are met when the crowns transition from internal to external N sources for later growth.
- Whilst further replication and testing is required to fully valid total N requirements, these results so far indicate the optimum N applications around 180 – 240 kg N/ha may maximise yields whilst preventing excessive applications.