Limiting Nitrogen Losses from Blueberry Substrate Systems

Dr Sophie Parks, Research Horticulturist, NSW DPIRD

Nutrient runoff is a significant challenge for blueberry growers using substrate systems. As part of the Clean Coastal Catchments Project, NSW DPIRD is investigating how to improve the nitrogen efficiency of these systems to reduce the risk of nitrogen losses.

Nitrogen (N) pollution is a potential risk from intensive horticulture on the NSW mid north coast being located near the coast and its biodiverse marine estate. Algal blooms and their impact of limiting marine life can be exacerbated by increased N in waterways that connect to the coast. Blueberry is a major crop in this region and in this research report we highlight how reducing N inputs into substrate systems can be achieved without compromising crop performance.

In our preliminary work, we observed that for some farm samples, the N concentration in the fertigation solution being applied to blueberries in substrate can be as high as 130 mg/L (total N). To test if this nitrogen rate could be reduced without impacting the crop, we set up an experiment in 2021 at our Wollongbar research station, on the North Coast of NSW. An article update about this experiment was published in the Winter 2024 edition of this journal available at the industry Resource Library at bit.ly/BA-RL by searching 'nitrogen fertiliser guidelines'.

We grew the cultivar '11-11' of southern highbush at 5 nitrogen rates (40, 60, 80, 100 and 120 mg/L total N) in fertigation, with all other nutrients required supplied in these solutions. For N, half was supplied as nitrate and half as ammonium. The target strength or electrical conductivity (EC) was 0.9 dS/m and the pH was 5.7 for all treatments, and a control system was used to guide fertigation volumes for the environmental conditions.

One year into growing this crop, we destroyed some plants to measure the effect of the nitrogen treatments on plant growth. The plants grown at the lowest rate of N (40 mg/L total N) were small compared to the rest of the plants in the study, because at this rate, the N supply was too low for maximising growth (Figure 1). The plants from all the other treatments (60-120 mg/L total N) were all similar in size. This provided a clear indication that rates greater than 60 mg/L total N were unnecessary during the establishment of the crop.

In 2024, we were excited to harvest our first fruit from our now-mature crop, 3 years after planting. Mature berries were harvested every 2 weeks between early August and early November (Figure 2). Regardless of the N supply rate, peak production occurred in early September and declined thereafter.

Key Findings

- A trend of reduced total fruit weight for the whole season for the high N supply rates (100 and 120 mg/ total N), compared with lower N rates
- Average berry weights across the season were **not affected** by N rate
- Average Brix levels (sugars) in berries for the season were **not affected** by N rate

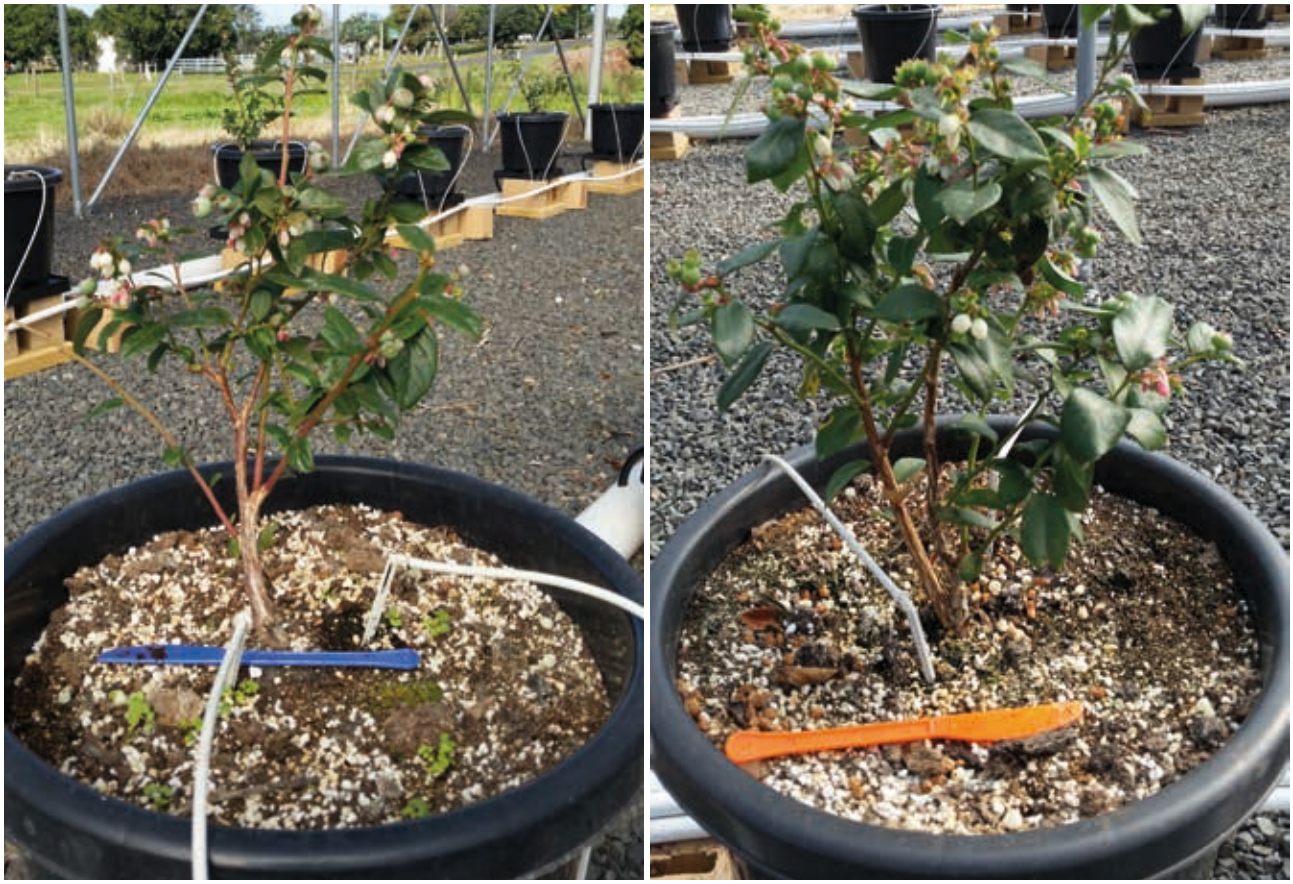

Figure 1. One year into the experiment, the plant on the left received 40 mg/L total N in fertigation and the one on the right 80 mg/L total N. Those plants receiving 60-120 mg/L total N were of a similar size.

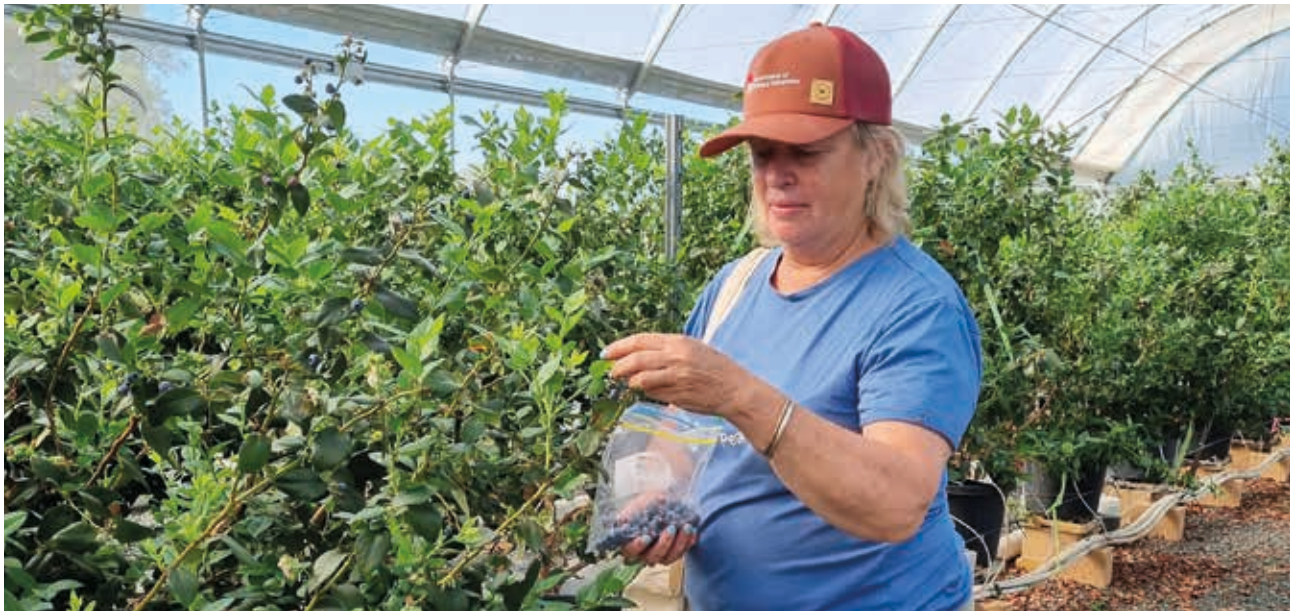

Figure 2. Technical Officer, Diana Unsworth picking blueberries from the experiment to record fruit numbers and weights

All photos credit: NSW DPIRD

Based on these results, we showed that during establishment, plants did not need more than 60 mg/L total N, since there was no growth advantage of applying higher rates.

It is likely that the optimum rate is below this, between the 40 and 60 mg/L total N treatment rates, around 50-55 mg/L. We are currently setting up a new experiment that will determine this optimum rate. This will be critical to reducing N losses in pot drainage because the greatest losses of nutrients occur for establishing crops. This is because their roots occupy only a small volume of the substrate being fertigated and do not intercept much of the nutrition being supplied. Our results also highlighted that more established plants may need up to 80 mg/L total N in fertigation, and that greater concentrations risk reduced yield.

Selecting N rates in fertigation, appropriate for the stage of blueberry growth helps to address nitrogen in runoff but our work continues because the presence of N in drainage remains a challenge. We have already demonstrated significant reductions in drainage N when the drainage is channelled through and treated by a bioreactor, using the one installed at our research facility.

Also, the Clean Coastal Catchment team is close to releasing an online fertigation calculator that streamlines the task of working out fertiliser amounts for nutrient stocks according to the recipe and solution concentration that you select.

NSW GOVERNMENT

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