Posthuma, L., O'Brien, G. K. A., and Bloomer, D. J., 2020. Liquid Fertiliser Application for Vegetable Cropping. In: *Nutrient Management in Farmed Landscapes*. (Eds. C.L. Christensen, D.J. Horne and R. Singh). http://flrc.massey.ac.nz/publications.html. Occasional Report No. 33. Farmed Landscapes Research Centre, Massey University, Palmerston North, New Zealand. 3 pages.

LIQUID FERTILISER APPLICATION FOR VEGETABLE CROPPING

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Abstract
The current practice of applying all the fertiliser to a vegetable crops at planting or soon after crop establishment allows growers little opportunity to manage climate risks. These risks affect both the crop's yield potential and the likelihood of losing nutrients. The main loss path for nitrogen is being leaching before the fertiliser is utilised by the growing crop.

The development of the "Nitrate Quick Test Mass Balance Tool" by FAR[1] helps growers measure the soil nitrogen supply with nitrate quick test strips and use the results to make an informed fertiliser decision for a crop. It can combine in-season soil testing with crop information to estimate the additional nitrogen required to finish growing the crop. Along with splitting large fertiliser applications during high risk periods for leaching, this will help farmers reduce their environmental impact by minimising the risk nitrogen leaching.

Liquid fertiliser equipment in a row cropping environment allows growers to efficiently place fertiliser close to the plants while minimising nutrient applications to non-cropping areas. The adoption of liquid nutrient application techniques in a cropping situation has the potential to allow growers to more easily split fertiliser applications based on crop demand. This can be done with minimal crop disturbance as current spray tramlines can be used for each tractor pass. The work so far has shown great potential for the adoption of liquid fertiliser application in row cropping situations.

Introduction
As part of "Future Proofing Vegetable Production" we are working with vegetable growers in Levin and Gisborne to reduce the risk of nitrate leaching from intensive production. The "Nutrient Management for Vegetable Crops in New Zealand" book (Reid & Morton, 2019) has a general recommendation to split fertiliser applications if rates are greater than 50kg N/ha, but growers have found this impractical.

When supplementary applications are made to potato mounds, dry fertilisers are observed to roll into the wheel tracks and wash away. To avoid losses, the grower incorporates all fertiliser into the bed when it is formed and planted.

In bed crops such as brassicas, fennel or lettuces, especially in winter, repeated passes with current spreading equipment which often does only single beds at a time would take considerable time while also creating major row rutting and promoting disease spread.

Seeking a solution that will enable growers to split application without the downsides, we have been testing the use of liquid fertilisers for nitrogen application. Because liquid application appears to offer benefits, alternatives including different fertiliser types, placement and application technologies are being tested.

[1] https://www.far.org.nz/articles/1231/quick-test-mass-balance-tool-user-guide Accessed 12 March 2020.

Why Liquid Fertilisers?
Many growers now maintain permanent unplanted sprayer/irrigator tramlines. This gives better trafficking especially in wet conditions and avoids poor quality produce from vehicle and mud damage. Using spray-boom equipment for nutrient placement could offer labour, equipment and nutrient savings through better efficiencies.

Vegetable growers have tended to use nitrate rather than urea-based fertilisers. We are trialling nitrate and urea based liquid fertilisers and observing marketable yields and quality. There is some evidence from overseas that biuret, a by-product contaminant of manufactured urea, can be toxic to some fresh vegetable crops. However, the levels found in New Zealand products are low, and we have not identified crops reported to be susceptible at these concentrations.

Why are they not used now?
The availability and use of liquid fertilisers are limited in New Zealand. The infrastructure and farm equipment are based around dry product distribution, storage and application; however, this supply chain is changing in some regions such as Canterbury and Pukekohe where fertiliser merchants are introducing certain liquid products.

Some vegetable growers have tried liquid fertiliser application through their crop spraying equipment, but report leaf burn that made crops unmarketable. They are understandably reluctant to repeat painful experiences. We note they had used standard flat-fan nozzles which create fine droplets intended to remain on leaves.

Fertiliser Application Equipment
We are reviewing application technologies suitable for retrofitting to existing sprayers. These technologies have large droplets which are reported to avoid crop burn and to enhance yields.

Dropper-dribbler systems such as the 360 Y-Drop are being used in the USA in row cropping situations, with results showing higher yields from applications beside the plant. We see a place for this in row crops such as sweetcorn, cabbage and broccoli and in mounded potatoes.

Fertiliser nozzles such as those from TeeJet or the Chafer Stream Bar technology are alternatives to broadcasting and typically achieve higher uniformities. Any liquid that hits the plants tends to run off avoiding leaf burn due to the large droplet size. Being used with good results by high performing cereal growers, we see a place for these technologies in vegetable bed crops including lettuce, beetroot and onions.

Our Trials
Our first trial compared liquid and dry formulations of CAN and urea applied to a broccoli crop as bands alongside plants. We found no significant yield differences even though the liquid applications were 66% of the dry rate. We assume the dry rate was supplied in excess of crop need, probably because of supply from breakdown of the preceding sweetcorn crop. Importantly, we identified no leaf or stalk damage when liquids were applied as streams or large droplets even if splashed on the leaves.

We have trials in sweetcorn and potatoes using variations of the Y-Drop system. In sweetcorn we use the standard Y-Drop soft hoses to apply streams alongside the plants. In potatoes, we are directing the streams along the top of the canopy, relying on the large droplets to roll through to the soil below.

We have planned TeeJet trials for beetroot and Stream Bar trials for other bed crops in coming months.

We acknowledge the “Future Proofing Vegetable” project funders, and the support all our farmer/grower colleagues and their industry helpers. Plant & Food Research provides peer support and review with trial work. Fernando Avendaño and Massey University are heavily involved in the potato trials.

References

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