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Drip irrigation – an update on use in New Zealand

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Executive summary

Drip irrigation – an update on use in New Zealand

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In 2012, Vegetables NZ and Irrigation NZ formed a working group to raise awareness of drip irrigation approaches and to identify key issues slowing wider adoption of this internationally proven technology. Understanding these barriers forms a critical component of ongoing industry efforts to increase water and nutrient use efficiency in cropping systems.

The one-year Sustainable Farming Fund (SFF, L12/109) project included two key stages: Phase 1) increase awareness of drip irrigation approaches through a series of industry workshops and document the potential barriers and issues slowing wider adoption by growers; and Phase 2) use this information to prepare an industry guide to using drip irrigation successfully in New Zealand.

This summary outlines the information collected during Phase 1 of the project. Grower feedback was arranged into three categories - those successfully using drip irrigation today, those that have used drip irrigation in the past but no longer do, and those that remain uncertain over the benefits and realities of using drip irrigation. In brief:

Growers successfully using drip irrigation today

- Growers recognized the benefits of drip irrigation, found solutions to technical challenges, and incorporated it into production systems that allow its use to be profitable.

Growers who have used drip irrigation but no longer do

- Growers recognized the benefits of drip irrigation, but in many cases were unable to find solutions to technical challenges. Given the relative setup costs, the additional 'risk' was not seen as worthwhile - certainly not when the cost and availability of water were not major issues.

Growers who are uncertain of benefits and realities of using drip irrigation

- Growers generally recognized the potential benefits of drip irrigation, but were uncertain on the economics involved or were unwilling to consider systems that have higher risk (be they perceived or real). To date there has been comparatively little pressure to move from the status quo systems.

The feedback identified during Phase 1 is now being used to prepare an industry guide, which will be built around important technical considerations that underpin a successful system, as well as the experiences of growers who are or have used drip irrigation. The guide will be available to growers in June 2013.

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1 Background to SFF project

Water allocation and efficiency of application are increasingly important issues to ensure maximum productivity per unit of water applied and to minimise potential environmental impacts. The drivers for these improvements are coming from industry itself, regulatory bodies and also from markets.

Drip irrigation has gained widespread acceptance internationally as a technology that can increase water use efficiency to about 90-95%. Additional benefits can include easy automation, reduced labour cost, better weed control and fewer foliar and root diseases. Fertigation (applying nutrients through the drip system) also offers more precise nutrient use and opportunities for increased productivity. Despite this suite of potential benefits, drip irrigation is only used on a relatively small scale in New Zealand.

In 2012, Vegetables NZ and Irrigation NZ formed a working group to raise awareness of drip irrigation approaches and to identify key issues slowing wider adoption of this internationally proven technology. Understanding the barriers and issues to drip irrigation forms a critical component of ongoing industry efforts to increase water and nutrient use efficiency in the cropping sector. The key outcome from the working group will be a guide to using drip irrigation in New Zealand, which will be built around important technical considerations that underpin a successful system as well as the experiences of growers who are using drip irrigation. The project will also prioritise knowledge gaps for consideration in future initiatives.

2 Approach

In 2012, Vegetables NZ and Irrigation NZ received funding from MAF Sustainable Farming Fund (SFF, L12-109) for this project. The project included two key components: Phase 1) increase awareness of drip irrigation approaches and document the potential barriers to wider adoption; and Phase 2) utilise this information to prepare an industry guide to using drip irrigation successfully in New Zealand. To increase awareness of drip irrigation and document key barriers to adoption, the working group included a session on the benefits of drip irrigation in the ‘Making Irrigation Pay’ workshops run by Irrigation NZ. Each session was followed by group discussion to document the experiences and/or perceptions of growers on drip irrigation technology. A number of discussions were also held with individual growers and industry representatives. The comments were largely drawn from vegetable growers, although some participants also had experiences of drip irrigation and micro-irrigation in relation to perennial crops. This combined feedback was distilled to form a series of key experiences - good and bad. These are being used by the project team to help in the preparation of the industry guide.

3 Key observations

Feedback was arranged into three groups of growers - those successfully using drip irrigation today, those that have used drip irrigation in the past but no longer do, and those that remain uncertain over the benefits and realities of using drip irrigation. In some cases, these groups had quite different experiences with drip irrigation approaches, and in others they had overlapping experiences.

3.1 Growers successfully using drip irrigation today

- There were a comparatively small number of growers who are actively using drip approaches to irrigate their crops. Some of those are large-scale multi-crop businesses and others are small, single-crop enterprises.
- A mixture of surface and subsurface systems are being used. Subsurface systems are often being considered for longer term crops (i.e. for several seasons) or in rotations where the tape can be left in place and/or re-used for several seasons.
- In a number of cases drip irrigation systems are being used in association with other high-input management approaches such as plastic mulches and/or plastic tunnels. Drip irrigation is the only means of applying water to crops as they need it.
- Drip irrigation is often associated with higher value crops or those being grown for early season production. The investment in tape and pumping/filtration equipment is considered more economically feasible in these situations. Mobile pumping/filtration equipment is one means of ensuring flexibility of drip systems from year to year.
- Drip irrigation increases crop options in small or irregularly shaped paddocks where overhead irrigation systems are not well suited. This allows growers to grow higher value crops.
- Only a few growers currently combine drip and fertigation approaches, even though most see the potential and value of more closely matching nutrient supply with nutrient demand. This is largely related to the extra 'effort' required in integrating systems. The primary driver of fertigation is to optimise productivity, but most also see the potential environmental/compliance benefits associated with the practice (less drainage and smaller amounts of mobile nutrients being in the soil at any one time).
- Some growers fertigate so they can save fuel, labour, tractor wear and also reduce damage to soil physical structure (especially when the soil is wet). Improved soil physical characteristics may improve productivity and reduce subsequent cultivation needs (for example, less remedial cultivation to alleviate soil compaction).
- A number of growers have suggested drip irrigation can reduce weed severity by reducing the germination of surface weed seeds. Drip irrigation also reduces the incidence of foliar and root fungal disease by reducing the frequency of wet leaves, wet soil surfaces, soil splash and intermittent saturation. This may result in a reduction in agrichemical use and associated application costs.
- Most growers using drip irrigation have faced a variety of challenges in optimising its performance. These have been addressed by persistence and technical support from a range of industry groups (especially the manufacturers of drip irrigation products). Some of the key issues that are common have included lateral water movement on marginal soils, impact of water quality on emitter blockages, managing nutrients, tape repairs and maintenance, root intrusion into lines, and disposal of tape at the end of a cycle. In some cases the solutions have been relatively straightforward. In others there have been gaps

in knowledge that have been plugged with shorter term solutions (for example, closer tape spacing to address water movement issues).

- An overarching key to success for these growers is close attention to the design, installation, management and maintenance of the system. Inasmuch, the systems are typically being used in conditions where it is well suited.

Bottom line: Growers recognized the benefits of drip irrigation, found solutions to technical challenges and incorporated it into production systems that allow its use to be profitable.

3.2 Growers who have used drip irrigation but no longer do

- A number of growers recognised the potential benefits associated with drip irrigation and conducted commercial-scale trials in a single or few paddocks to test the performance of the approach. In many cases these trials revealed technical challenges that needed to be resolved. Some of these related to site selection, product performance, and/or the design, installation, management and maintenance of the systems. For practical reasons, most trials were not compared simultaneously with other irrigation systems.
- Growers often had to troubleshoot with fairly limited drip irrigation experience or on-the-ground technical support. In some cases the technical issues were not resolved for a variety of reasons. Seeing also a comparatively high setup cost, these growers chose lower capital and lower risk irrigation approaches, especially given the comparatively low cost and availability of water. While efficiency and uniformity gains were seen as desirable, they were not the highest priority.
- Some growers associated drip irrigation with a lack of flexibility, in that if a paddock had drip irrigation, a higher value crop needed to be grown to 'make the system pay'. This constrained growers looking to respond quickly to different cropping opportunities. Additionally, drip irrigation was not seen as a good option for some crop types (particularly root crops). This constrained the rotational options for a paddock, which can cause issues where land availability is limited, or where break crops are required as part of a control program for diseases, insects or weeds.
- Growers did not see drip irrigation as an appealing option on short-term lease land, certainly not when using higher quality tapes. This limited the potential uses of drip irrigation.

Bottom line: Growers recognized the benefits of drip irrigation, but in many cases were unable to find solutions to technical challenges. Given the relative setup costs, the additional 'risk' was not seen as worthwhile - certainly not when the cost and availability of water were not major issues.

3.3 Growers who are uncertain of the benefits and realities of using drip irrigation

- Many growers appear uncertain or unconvinced about the economics of using drip irrigation on a large scale. They generally associate drip irrigation with higher costs than guns, laterals or pivots. However, some growers see drip irrigation as a way of developing smaller areas without a large investment in fixed irrigation infrastructure. This offers the flexibility to respond to cash cropping opportunities, particularly on otherwise marginal ground. A mobile pumping/filtration system allows for greater season-to-season flexibility in these situations.
- Many growers acknowledge the potential benefits of drip irrigation but also associate the approach with a greater number of technical considerations and challenges. To address these risks requires in-house capability or on-call support from suppliers. Historically, there have been a relatively small number of agronomists that have a strong background in drip irrigation compared with a much larger support network for overhead irrigation systems. Where major technical difficulties are encountered, expertise may need to be brought in from overseas, delaying the implementation of a solution. There is also no central resource for drip irrigation-related materials for growers looking to adopt this technology.
- Comparatively few growers appear to place an emphasis on differences in irrigation efficiency or uniformity between drip and overhead irrigation approaches. In part this reflects the comparatively low cost of water in New Zealand compared with other countries, and the fact that limited water availability is only slowly become a significant issue. It also reflects claims that many overhead irrigation systems can also achieve good efficiency and uniformity. Whether they actually do so depends on the design, installation, management and maintenance of the system. There can be a large disparity between what a system can do and what it does, irrespective of the type of system used.
- Overhead irrigation systems have evolved considerably over the years. For example, new pivots can apply water at variable amounts across a paddock to match soil characteristics better. It is difficult to achieve variable rate spatially with drip irrigation. However, drip emitter technologies have also improved, giving more precise control of flow rates to match soil characteristics.
- Growers typically did not consider yield, nutrient or sediment loses associated with poor irrigation management when making irrigation investment decisions. Over-application or slow water infiltration often lead to runoff, which either ponds in low points of a paddock or is lost to surface drains or streams. Ponding in low points can be associated with varying degrees of yield loss as well as nutrient hot spots (potentially increasing loses or contributing to within paddock soil variability). Soil and nutrient movement off the site can influence subsequent productivity and damage the environment. The true financial cost associated with these combined factors is generally poorly quantified.
- Some growers believe that the most profitable use of drip irrigation is linked to a production system that uses tape for several seasons. This often requires other technologies and management approaches, such as GPS to position/locate tape, permanent beds so tape can remain in use for several years, and minimal cultivation to avoid damaging tape and soil physical structure. Adopting all factors simultaneously is seen as risky, and some growers do not have the scale to justify it. Others that do have the scale are still cautious.
- In some regions there is normally sufficient seasonal rainfall to grow crops. The ‘payoff’ from a drip irrigation system that may not be used on a regular basis is therefore unclear.

While average seasonal rainfall may be sufficient in many years, there are often periods of intermittent water stress, especially on shallow, stoney soil types or soils with low water-holding characteristics. Intermittent water stress can have a large effect on yield, especially if the stress occurs at critical growth points.

Bottom line: Growers generally recognized the potential benefits of drip irrigation, but were uncertain on the economics involved or were unwilling to consider systems that have higher risk (be they perceived or real). To date there has been comparatively little pressure to move from the status quo systems.

4 Next steps

The key output of the project is a guide to using drip irrigation successfully in New Zealand. We recommend that this is built around important technical considerations that underpin a successful system, as well as the experiences of growers who are or have used drip irrigation. In consultation with several project team members, a draft guide format has been proposed for further discussion within the broader project team.

Suggested timeline:

Date: 2013	*Key contact:*	*Description of activity:*
Early February	Paul Johnstone	Summary report provided to Andrew Curtis and John Seymour.
Late February	Andrew Curtis, John Seymour	Final guide content agreed and authors tasked with preparing relevant sections. An overall editor is appointed. Final delivery format and costs are confirmed. Remaining project funding ($19K) is allocated accordingly.
Early April	All, coordinated by editor	Draft material is submitted to the editor by section authors.
Early May	Editor/All	Editor reviews material and re-circulates a formatted version for final comment by the contributing authors.
Late May	Editor	Final changes are made to the guide.
June	Andrew Curtis, Paul Johnstone	A final grower article is prepared. Guide is available through agreed dissemination channels.
June	All	A list of outstanding priorities is documented, including a suggested plan for addressing these through targeted industry projects.

5 Acknowledgements

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