

**Continuing on-farm improvements
through good practice demonstration and
extension**

John Shannon
Vegetables WA

Project Number: VG10082

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1. Media Summary

Increasing demands on growers' time and lack of perceived value have seen patronage of events aimed at delivering extension messages on research, practice improvements and general information to improve vegetable industry businesses and production practices wane. Goodwill extended by growers to attend events gained through past experiences with the presenters only lasts so long, and without good quality, well-presented topics that are requested by growers, this situation will not improve.

'Continuing on-farm improvements through good practice demonstration and extension' provided both on-farm demonstrations and off-farm extension activities designed to encourage grower participation and create some ownership of the discussions. Growers were surveyed for topics of interest and were able to influence forum locations, times and formats. The resultant field days, farm walks, workshops and information night were well attended and received.

Surveys at the end of the project showed that 94 per cent of people who attended the event increased their understanding and knowledge of the topics presented. Most importantly, of the people who increased their knowledge, 100 per cent were able to introduce practice change to their business that they believe resulted in better outcomes for that business.

Five case studies of farms that implemented practice change that improved the farm's production and business were published and distributed to encourage other growers to make small changes on their own farms.

Additionally, an online fertiliser calculator will be developed to assist growers in applying the most economic and environmentally-friendly fertiliser rates. It is anticipated that this calculator will be released on the Department of Agriculture and Food, Western Australia's website by the end of March 2014.

2. Introduction - Continuing on-farm improvements through good practice demonstration and extension

Effectively delivering research development and extension (RD&E) has become more difficult in the busy vegetable farming industries over the past 10 years. Financial and production pressures often take priority before engagement with RD&E providers, unless providing vital information to respond to crisis situations.

While extension of emergency information has been well attended, patronage of extension events to assist the vegetable over the longer term has diminished. Building a rapport with growers and providing them with information on topics they are keen to learn more about, combined with some essential information has been one method that has resulted in more farmers attending events.

Due to the stop-start nature of research and extension activities and costs associated with building and maintaining relationships, good research outcomes are only adopted by a small number of growers. Projects that enable and encourage frequent contact with growers in an economical way help to build relationships and provide an avenue to deliver information for continual improvement aimed at achieving better financial and environmental outcomes for the vegetable industry.

The original aim of this project was to provide a longer-term focus on demonstrating good practice at five 'good practice' key industry demonstration farms that would encourage more growers to improve and remain profitable with a focus on soil health and nutrient application. As the project developed, it was clear that for industry engagement to be successful the growers preferred to have some ownership of the content.

The project became fluid and iterative, focusing on providing forums for growers to learn about important topics of their choice. These opportunities were used to extend good information that was able to be used by the growers to improve their businesses and production.

3. Technology transfer strategy and methodology/activities

3.1. Demonstration sites

Initially, demonstration farms were established with the focus of improving fertiliser and water use efficiency through using compost and other soil amendments. When it was clear that the interest in using compost at this time was limited, the project was renegotiated so that funding could still be used to provide benefit to growers.

The initial five demonstration farms included five sites each with slightly different focuses and aims depending on the grower's preference.

Site 1

The aim of this site was to assess the difference in crop and environmental performance of the use of compost in a leafy salad crop production system. Compost was applied to one area while another had none applied as a control. Several crops were monitored to measure any difference in crop performance or environmental impact. Catch can lysimeters were installed in two areas. Measurements on organic matter, carbon and biological activity were also done.

Site 2

The aim of this site was to demonstrate and case study the good practice approaches made to improve growing practices. Irrigation design and sprinkler performance were assessed. Several uniformity tests were done improvements made to the irrigation system.

Following system improvements, evaporation based scheduling, soil moisture monitoring and nutrient monitoring were explained to the grower and support given for these practices to be implemented on farm.

Site 3

Improvement of irrigation systems, irrigation scheduling and improving record keeping was a key aim for site three. This was a struggling business with deficiencies in key business practices. Demonstrating improvements to the business through good on farm management leading to better business management was identified as useful for many vegetable growing operations.

Site 4

Numerous irrigation assessments involving sprinkler uniformity testing were done on the property and a recommendation of the most appropriate sprinklers to maximise the uniformity and performance have been made. A second initiative was to improve chemical practice on this farm.

Site 5

The aim of this site was to improve irrigation practices in a highly sensitive water use area. A full irrigation assessment was done and recommendation been made on how to improve the system performance. Crops were monitored using soil moisture probes, soil testing for N and catch can lysimeters to assess practice and irrigation.

While work continued implementing changes and supporting practice change on farms over a range of subjects, the field walks, workshops and information sessions to extend knowledge became the focus.

3.2. Field days and workshops and extension articles

Work on nominated demonstration sites and additional field work on other interest farms was incorporated into a number of field days undertaken on growers properties. Other content that provided benefit to the growers was also presented at the field days by various experts and consultants engaged for the events.

More comprehensive work was limited to only the five nominated demonstration farms, and the growers at those sites supported the initiation of field days, provided locations for the events and encouraged other growers to attend. Each field day touched on the work done at the site, as well as providing an opportunity to deliver other useful knowledge through various grower experiences, expert speakers or project staff. Additional workshops were also held to review the subject matters covered and let growers discuss the usefulness of the content and the direction of the content for the next year of extension activities.

So that growers who did not attend the events could be exposed to the work, follow-up articles were published in the local industry magazine, *WA Grower* and other articles were published in the local and national irrigation industry magazines (see Appendix 1 for copies of all published articles).

A survey was run at the final project wrap-up meeting/event and also by phone for growers who could not attend (see Appendix 2 for survey given to growers). The survey would act to gauge the level of improved knowledge, understanding and adoption of principles discussed during extension activities.

To extend the practice change that occurred on the demonstration farms to a wider audience, case studies were written in a grower friendly format that were sent out with the industry magazine. As growers rarely read final reports, publishing case studies and using them as the basis of the final report seemed a logical output from the project.

Additionally, an online fertiliser calculator is in development to assist growers in applying the most economic and environmentally friendly fertiliser rates. This calculator will complement the existing Vegetable Irrigation Scheduling System (VISS) which has seen significant improvements in water use efficiency where implemented. This nationally relevant tool will allow growers to enter their own fertiliser costs and assess the unit nutrient cost of fertilisers applied via a grower's schedule.

The calculator is intended to be used by all growers as an online tool. Fertiliser companies will be approached to provide specifications of their products, and growers will be able to add their own specifications into their profiles. Growers will be able to add fertiliser costs to calculate costs of a fertiliser program for crops grown.

A simple table will be generated from a menu in which growers can select the number of applications a week and the number of weeks the crop will run. A drop-down menu with the grower's fertiliser preferences will make for easy use.

A summary in which the grower can label the crop type, bay, property and planting date can be saved or printed for future reference or audit purposes. This calculator will be released with the Department of Agriculture and Food, Western Australia's website at the end of March 2014.

3.3. Case studies

Case studies were well received in the field events and workshops, so were written up for 5 key improvements made on farms involved in the project. It was hoped that case studies showing the steps involved in an on farm change from recognition of an issue to practice change would help these become champions of these changes and help other growers relate to a similar situation on their farm.

- Good practice irrigation on gourmet and baby leaf crops addressed irrigation system improvement and scheduling resulting in better crops and potential reduction in water and power use.
- Records and comparisons key to improving vegetable production business discusses the need for business to plan, check the plan against the result and review the results to make informed decisions on both production, operational and administrative areas of the business.
- Turning theory into practice to improve scheduling of drip irrigation discusses the changes growers were supported to implement and how it affected their production following a previously successful research project into improving irrigation of tomatoes using drip irrigation
- Good practice irrigation improves vegetable production is a case study of the process a grower was supported to do to make sure that the best decision was made on the upgrade of his existing irrigation system.
- Good practice to improve chemical application and risks is a summary of the process this grower used to make necessary changes to improve his chemical practice when applying metham sodium. It looks at operation aspects of effectiveness and application method and the realisation of the risk to this business when not correctly applying this chemical.

4. Evaluation and measurement of outcomes - impact and adoption

Surveys were given out to growers towards the end of the project to assess how the events that had been held have impacted or influenced those who attended (see Appendix 2). The survey was completed by groups of growers at the final workshop or over the phone. 16 growers in total completed the survey in full to be included in the final results.

Although 16 growers was a small sample of the total number of growers who attended the workshops and field days over the project duration of three years, those who did complete the survey were from a wide range of areas and business types and so cover a good cross section of the industry as a whole. However, due to the small sample size, results cannot be overly conclusive as only limited information can be extracted from the surveys. It would be advisable in future work in this area that each grower is surveyed at each event in the form of feedback forms, to ensure all opinions are captured and included in the results of such a study.

Of the 16 growers surveyed, 15 reported to have increased their level of knowledge on the subject being presented at the workshops attended. All growers who attended the workshops were aware of the follow up article in the WA Grower magazine, emphasising the importance of the magazine as an extension tool to transfer information and to reach those who may not have been able to attend the workshops. In future surveys, it will be important to delve further into whether growers are reading and extracting information from these articles, a question that was not covered in this study.

All but two of the 16 growers surveyed reported to have actively sought out further information on the topics of the workshop/field day they had attended in order to further increase their knowledge and understanding.

Of the growers surveyed, 15 reported that they had trialled new practices as a result of attending the workshops or field days, and all 16 growers have now made changes that have become a standard way of doing things in their vegetable production operation. Every grower surveyed also agreed that these changes have resulted in lower input costs and/or a better crop.

It was difficult for some growers to confirm that the changes then led to a better return or net profit due to fluctuations in prices received for the crops and other variables involved. However, all but one grower agreed that the practice change is likely to have resulted in a better environmental outcome within their vegetable production operation.

The feedback from the growers in the surveys and from contact with growers following each event was consistently positive. Up to 35 growers were in attendance at some events and follow up communication with many growers was common to provide them with further information or contacts.

Overall, approximately 50 growers across the region would have attended at least one field day or workshop throughout the project duration. Growers have expressed interest in continuing the workshops and field days into the future as a continued source of information, as well as a valuable networking opportunity for them to make contact with other growers and industry members.

The results of the survey of the 16 growers sampled were positive and consistent across the board. However, due to limited numbers of growers completing the survey compared to the total number of growers that across the duration of the project, it is difficult to extrapolate and assume that other growers who attended the events would have had a similar experience. General feedback and discussions with growers post workshops/field days were positive, with many growers contacting the project leaders for further information, however in future it would be recommended that a more formal method of receiving feedback be established to quantify the impact the extension methods are having on growers in the field.

We know from the survey results that change has been achieved on 15 out of 50 – or 30% – of farms as a result of demonstrations and workshops held as part of the Good Practice project. There is evidence through general discussion with other growers (not officially surveyed) that this figure is likely to be greater, with growers implementing new technology and best practice methods to a range of areas within their operation.

5. Discussion

5.1. Demonstration sites

Demonstration farms established in the early stage of this project with the aim of improving fertiliser and water use efficiency using compost and other soil amendments were not as popular as anticipated. Modifying the project's focus to deliver information in different formats that resulted in good practices throughout the farm business was well received by the growers.

Several events including field walks, workshops, information nights and meetings provided forums to extend information chosen by the growers and selected by the project team. This approach proved successful in increasing attendance and highlighted that with good content delivered at times and in

formats to suit growers, they are more responsive and more likely to be influenced by the presentations.

Assisting growers along the path of change management from attitudinal, aspirational, increased understanding and knowledge to implementation and practice change is a process that requires support. Through this fluid approach and relatively flexible project scope, staff were able to work in groups and one-on-one to help support practice change on-farm.

5.2. Field Events, Workshops and information evenings

Over the duration of project VG 10082 a number of field days, workshops and information sessions were run in order to extend good practice ideas and information to vegetable growers. Growers from a wide range of areas attended different events to hear from a number of guest speakers as well as growers sharing their experiences. Discussions and panels were held after each event to give those in attendance the opportunity to ask questions, share their views and learn more about the topics.

The following events were held as part of VG 10082 from 2011-2013:

1. Plant Pathology information night/workshop – September 2011, Wanneroo
2. All Things Soil field walk – November 2011, Gingin
3. All things Irrigation field walk – May 2012, Myalup
4. Good Practice Chemical Use information night/field walk – July 2012, Myalup & Wanneroo
5. Carbon & Nitrogen Management and IPM in vegetable production information night – August 2012, Wanneroo
6. Irrigation systems, Operation and Technology workshop – December 2012, Carabooda
7. IPM workshop with Paul Horne – May 2013, Wanneroo
8. Presentation of case studies and Wrap meeting – Aug 2013, Wanneroo

A collection of articles published in the WA Grower magazine and Irrigation Australia Overflow publication are provided in Appendix 1 of this report. These articles summarise the events held and demonstrations undertaken to share the information with all growers including those who were not able to attend the events. Many of these articles were also published in Vietnamese to ensure growers with Vietnamese as their first language could also benefit from the content.

5.3. Case studies

Writing the case studies seemed to be an effective way of summarising the work that made a difference to the grower on their farm. It allowed reflection of what had been done successfully and what had not been able to achieve. It also provided a good media format that could be used for extension during and after the project.

Often final reports are never read by growers, whereas shorter case studies that are published in or with the Grower Magazines or sent out with industry mail are more likely to be seen. Writing the case studies was not an initial task for the project, but is believed to be a valuable extension tool.

5.4. Project Recommendations

Funding to continue this extension method would allow continuing engagement with growers on the Swan Coastal Plain and may provide a template for other regions and service providers working with the vegetable industry.

Regular surveying and discussions conducted through extension events such as those reported in this project gives an opportunity for extensive feedback to funding bodies as well as peak industry bodies, making such a project a efficient and effective use of industry funds.

A more structured and rigorous feedback and evaluation approach would be recommended in future projects to gauge a more accurate understanding of the changes made and adoption of best practices/new technology by growers.

It is recommended that funds be provided for further work on the Swan Coastal Plain and similar extension projects throughout vegetable growing regions of Australia.

6. Acknowledgements

The VG10082 project team would like to acknowledge all the growers involved in demonstrations, case studies, field days and workshops for their time, commitment, involvement and cooperation in this project .

Acknowledgments must also go to the West Australian APC-VPC and to HAL for their contributions to the project, and to the team at vegetablesWA and DAFWA for their assistance with all aspects of the project from administration to communications and other support.

7. Appendix 1 – Case Studies

Case Study 1 – Good practice irrigation on gourmet and baby leaf crops

Rohan Prince from the Department of Agriculture and Food and a farmer at Pearsall, north of Perth, undertook an irrigation assessment of a property in Wanneroo. The farm produces ‘leafy’ greens, including lettuce, baby spinach and leafy herbs.

This farmer participated in the project to find ways to reduce his costs and believes it is necessary to “change practices to save money, by reducing inputs”. Considering water is the most important input, this farmer believes improving water use should be the first priority for annual horticulture enterprises.

A major issue was the difference in pressure from one end of the farm to the other, resulting in uneven watering and difficulty in scheduling irrigation reliably. Pressure dropped from 260kPa close to the shed to as low as 80kPa at the far end of the farm. After discussion, it was identified that the issue was a result of a larger volume pump being installed after the original pump stopped working.

Increasing the size of the pump was intended to increase the area irrigated, which it did, but the larger volume of water increased the speed the water moved through the pipe causing increased friction and therefore pressure loss. The pump was therefore operating at the lower end of the pump efficiency curve.

The options were downsizing the pump or upsizing the mainline. Replacing the existing 100mm mainline with a larger 150mm main would have required shutting down production, re-plumbing the valves and laterals and would have been costly and time consuming.

After speaking to a certified irrigation professional a decision was made to run a second 100mm mainline along the end of the beds, joined in several points and straight after the pump.

Adding the extra pipe effectively halved the velocity of the water and therefore significantly reduced the loss to friction. Lower friction resulted in higher flow from the pump and allowed an extra line of sprinklers to be run. Where seven lines had run, now eight were running with less pressure variation reducing pumping costs by one eighth or 12.5%.

Further reductions in pumping time were possible following improvement to sprinkler uniformity. An initial catch-can test performed on the old Raindrop butterfly sprinklers showed they were operating below the recommended standards. The distribution uniformity (DU) was only 68.5% and the Coefficient of Uniformity (CU) was 73.7% with a mean application rate (MAR) of 17.4 millimetres per hour, compared with a minimum standard of 75% DU and 85% CU.

This was caused by a combination of factors including lower than recommended operating pressures, old worn nozzles, sprinkler risers of different heights, and risers not being completely vertical.

Figure 1 shows a surface map of the irrigation testing performed with the old Raindrop sprinklers. The more areas of a similar colour to the average application, the more evenly the water has been applied. The water application within the bay tested ranged from 9 to 32mm/h.

It was decided that a new sprinkler should be sourced and tested with a more appropriate jet size to accommodate the flow of the pump and the number of lines wanting to be run at one time.

Rain Drop Sprinklers
 140 kPa DU 68.5%, CU 73.7%
 MAR 17.4mm/hr

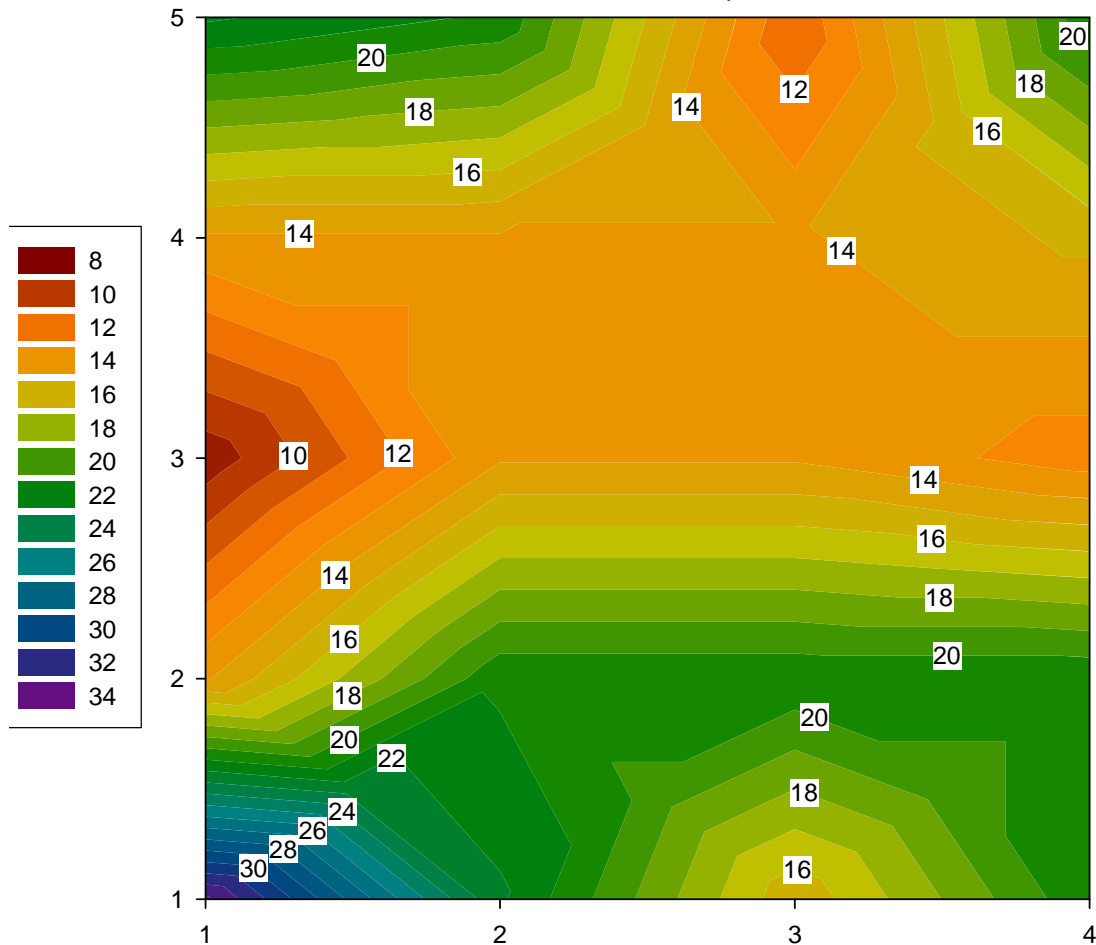


Figure 1 Surface map of mm application (legend to the left of graph) from sprinkler testing of Raindrop sprinklers operated at 140kPa

Based on the flow at the water meter and the required flow to run the desired numbers of sprinklers, two possible nozzles were considered. These were tested on separate occasions with vertical risers at similar height and both resulted in even pressure throughout the laterals to each sprinkler.

The most efficient jet was selected for installation throughout the property. Jets in this sprinkler are interchangeable, so testing different combinations was not difficult. Figure 2 displays that the application rate ranges from 14 to 20mm/h and is clearly more even than the old Raindrop sprinklers. MAR is similar but the irrigation uniformity is far better.

Over the warmer months, better uniformity of application has reduced the need to over-water the crop to compensate for a poor sprinkler pattern. The grower reports that he can now account for every minute of watering in his production. The improvement from the initial test of 73.6 to 93% DU has saved up to 27% of the water needed to achieve even irrigation. This is 16 minutes per hour less watering or 47,730L/ha/h of irrigation.

Reduction in runtime by up to 27% to account for uneven watering patterns by changing the sprinklers combined with the 12.5% from increasing the mainline size resulted in a pumping cost saving of as much as 40%.

This significant decrease in power costs helped recoup the investment in improved irrigation over the growing season. When combined with the potential for more even crops and better production the choice to improve this irrigation system on this farm was clearly a good one to make.

Not only has there been a reduction in pumping costs, but the grower has found that he is less likely to exceed his water allocation while ensuring best quality production. He has also been able to increase the area that he crops each year with that same water allocation.

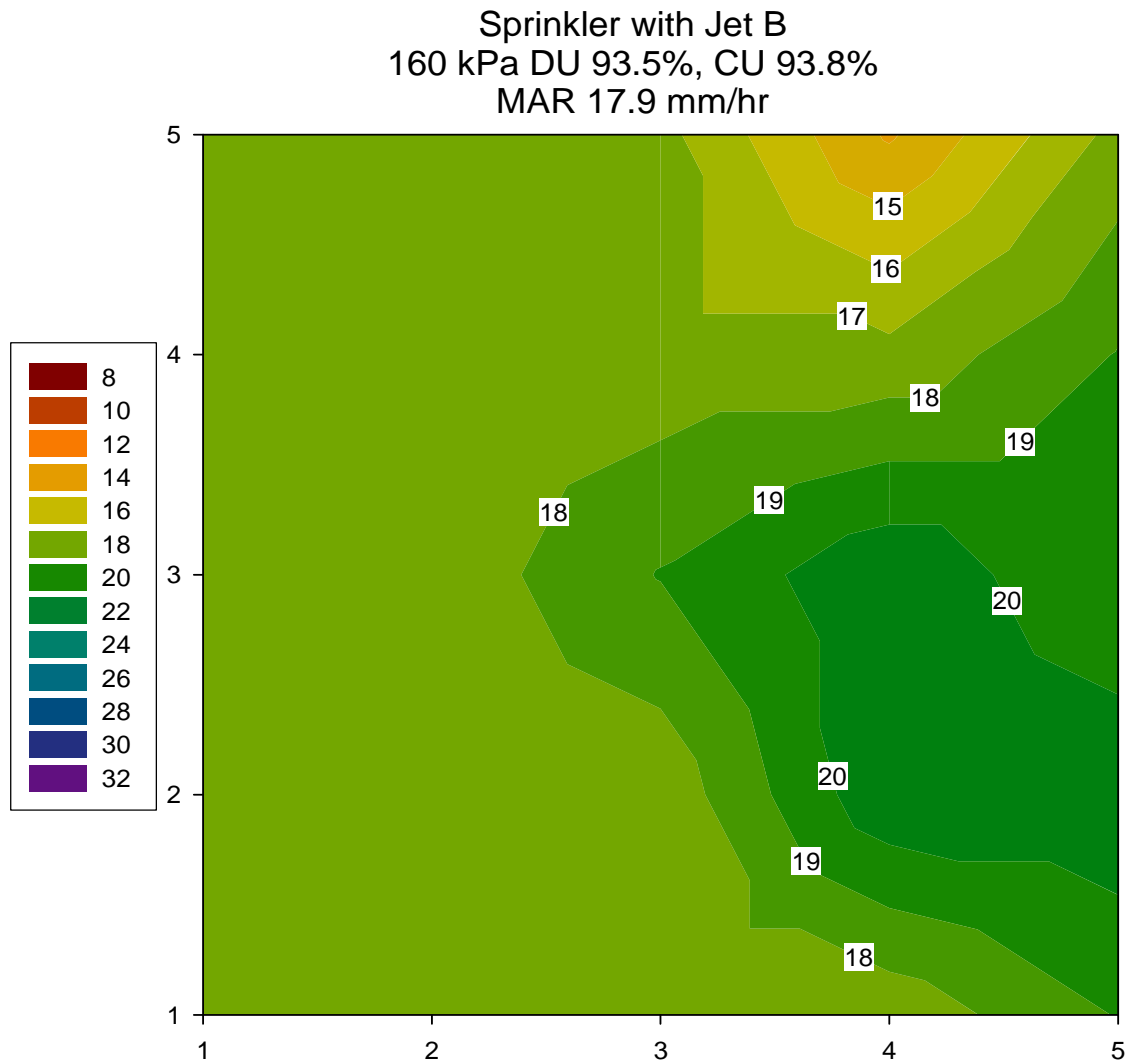


Figure 2 Surface map of water applied from sprinkler B in mm (legend to the left of graph) operated at 160kPa

Summary

Through some minor maintenance and small investment, irrigation uniformity was significantly improved on this property. Recovering the cost has come from improved crop evenness and savings in fertiliser and electricity costs from pumping. The added benefit is taking the pressure of the water licence and allowing the farmer to grow more crops with the water savings.

Case Study 2 – Records and comparisons are key to improving the businesses

Many vegetable farmers work long hours, have to move quickly to keep up and make decisions on the fly. For one farmer who was finding it hard to remain profitable, the key was to slow down.

A leafy crop grower north of Perth was struggling to produce consistent good quality produce and therefore struggling financially. After trying many different approaches including increasing the number of lines he grew, growing larger areas and working longer hours, he became involved in the Continuing on-farm Improvement activity through the Good Practice Project.

Looking at the grower's business, the first issue identified was the lack of records. While some of the information was in this grower's head, none was written down on how he grew his crops from year to year - when he had planted and harvested crops, how much it was costing him to grow a crop and how much he needed make from that crop to make a profit.

Without the records from year to year, decisions like when to decrease and increase plantings going into and coming out of winter became difficult and were risky to the business. If the wrong decision was made he might have far too much produce, or worse, no produce that could jeopardise his relationship with the company he supplied.

Following a business course arranged by the Good Practice team the grower started to realise that he needed more information to make good decisions. Vegetable farming is a lot more than just growing the produce, and more extensive records than just how to grow the crops were needed.

This grower sat down and worked out how much it was costing to grow each line and how much he made from each line.

After careful analysis and discussions with his accountant, he realised that one of his biggest lines, Chinese cabbage, was not profitable. The amount of money he was spending on crates to transport the cabbage and the other inputs such as labour, fertiliser and electricity to irrigate and then cool the crop after harvest, meant he was just breaking even for a huge amount of work.

Alternatively, he identified that one of his smaller lines that was always in demand was making good profits. He decided to inform the company he supplied that unless he could get an increased price for the Chinese cabbage he would not be able to supply it. The supplier raised the price, but lowered the volume, which suited the grower as it meant the line became profitable.

In the same analysis of his business he realised the amount of money he was spending on labour was an issue. Many of his lines were harvested by hand and required many hours of labour to pick, bunch and pack.

Some of his lines were already mechanically harvested and seeded which reduced the labour component considerably. By concentrating on increasing the markets of his mechanically-managed crops he could reduce his labour and become more profitable.

At the same time the grower was improving his business decisions we realised his growing decisions had to improve. He asked for help to improve the nutrition and irrigation of his crops. A systematic approach to improving his practices was worked through to improve his efficiency and therefore his profitability.

The first steps involved improving his irrigation to a standard that meant he could schedule it. Irrigation uniformity testing was done and by changing nozzle sizes a more uniform wetter pattern was achieved.

The second step involved keeping records of evaporation, irrigation and monitoring soil moisture to see what worked best on the crops on his farms. Fine-tuning for crops that had irrigation recommendations and working out requirements for crops that had little or no information.

Next was recording the fertiliser applications and soil nitrogen and the growth that resulted. With this information the grower was better able to match his fertiliser application to the plant requirements. This was one of the most important records for this grower to keep. By knowing how much fertiliser he was applying for different plantings throughout the year he could clearly see how crops sped up and slowed down with the day length and weather and was better able to forecast when he needed to increase or lower his application rates.

He was able to develop fertiliser programs for several periods for several crops throughout the year. Additionally, what proved useful to this grower was gaining a better understanding of unit rates of individual elements.

The project team developed a spreadsheet that he would enter in his program and the prices he would pay per tonne or kilogram of product. The spreadsheet would show the units of nitrogen, potassium, phosphorus, sulphur and several other elements within the fertilisers, the price spent on each fertiliser and the total program.

Working out the units of each nutrient proved important. With so many products on the market and problems with sourcing the same one all the time, the spreadsheet allowed him to find suitable substitutes or alter his program while maintaining the same rates of weekly units of nutrient.

The spreadsheet was popular with others also and will be developed into an online tool. In conversations the grower commented that since he has been involved in the project he keeps records of everything and as a result his business is on the up and up. He has become more profitable and is farming in a more sustainable way.

Summary

With the rapid pace of the vegetable industry, people often forget that keeping good records and reflecting on what has been done can help plan a better path for the future. By slowing down enough to have a look at his business as well as how the crops were being grown this grower realised he was working hard for very little reward.

With some minor changes to his operations and major changes to how he kept and used records, he is now a more profitable sustainable grower.

Case Study 3 – Turning theory into practice to improve scheduling of drip irrigation

Turning theory into practice change often takes many years with incremental steps along the way from knowledge and attitude to actual practice. This case study describes the adoption of evaporation-based scheduling using drip irrigation, the support needed and the result for the farmers involved.

Following HAL project VT10001 to develop good practice irrigation for drip irrigation, four growers were keen to try implementing the methods developed but requested some support. The Continuing Good practice through on-farm demonstration seemed the perfect fit.

Changing the way the growers irrigated their crops, although shown to work in the previous project, was still a huge leap of faith and would need to be refined to work on commercial scale farms with multiple crops and varying irrigation systems.

Most of the growers were familiar with the vegetablesWA evaporation SMS that provides daily evaporation and forecasting, but were unsure of how to use the information. Another resource available was the Vegetable Irrigation Scheduling Service (VISS), a web-based irrigation calculator that once set up had the capacity to email the irrigation requirements for your farm to you.

The theory being extended to growers was that using the previous 24 hours evaporation and looking at the forecast for the day, you could replace the water used by the crop to minimise excess drainage of water and leaching of nutrients and still produce good crops. Support in the form of irrigation assessments, advice and soil moisture monitoring service was provided to reassure the growers the new practice was not causing stress and crop losses.

Two of the growers preferred to work with the SMS being sent to their phone and a table that showed the stage of the crop down one side and the amount of evaporation to replace along the other. It was as simple as looking where the two columns intersected and that was the water requirement for the day.

The other two were interested in trying the VISS that required the application rate of the drip tape and the planting date to be entered online, after which they would be emailed the daily run times and water requirement based again on the crop growth stage and evaporation.

Through the previous project, all the growers learnt the importance of providing even irrigation to the crop to avoid excess watering in some areas and under-watering in others.

Application uniformity of the drip tape was tested and when necessary some adjustments were made. Two of the systems were quite uniform with variation of flow rates less than 10%. These growers did not have to make changes to their irrigation setups to be able to schedule efficiently.

Due to slopes and long drip lines some modifications to the other growers' properties were necessary. One of the irrigation systems took 12 minutes to charge the drip lines from the bottom to the top of the shift. When the required irrigation was as short as 20 minutes and the number of shifts was as many as seven per day, then a large amount of water over the season was being wasted. This was due to the water being able to drain from the sub-main after the valve through the drip tape once the shift had finished.

A solution was found that reduced the time required to charge the lines to 2 minutes. Pressure check drain valves on each take-off from the sub main, set at the operating pressure of the drip line would only open once the mainline pressure had built up and would shut down once the shift changed, preventing the water draining out of the sub main.

This immediately reduced the run times required to irrigate evenly on this property. Over a 20 week crop with an average of four shifts a day this immediately saved 90 hours pumping time and over 4.5 ML of water per hectare of crop.

The change in irrigation timing was significant with all growers. One grower was previously applying three to four 1.5 hour shifts changed to applying five to six 30 minute shifts. Another who was applying a maximum of six to seven 1 hour shifts reduced them to a maximum of 35 minutes.

The soil moisture monitoring from before and after the practice change was evidence that the growers had changed the way they were applying water and clearly showed a reduction of deep drainage.

The setup of the soil moisture sensors was three probes, one measuring the top 15cm, one the next 15 to 30cm and one below the root zone at 30 to 60cm.

The rise and fall and the slope of the lines of graph from the soil moisture probes is an indication of the amount of the drainage from one profile to the next.

The time between movements of the different lines shows the time water takes to drain from one profile to the next. By understanding these graphs the growers were able to tailor their irrigation to achieve little drainage and retain nutrients within the root zone, or alternatively confirm a leaching event to remove salts from the root zone of the crop.

Examples of these graphs are shown in Figure 1 old practice and Figure 2 new good practices. The vertical gridlines represent 9am each day and the horizontal gridlines the percentage soil moisture. The blue line is measurements taken in the top 15cm, the green line taken from 15 to 30cm and the orange line is measurements from 30 to 60cm.

In sand, it is not unexpected to see large rises in the top 15cm (blue line), with smaller movements in the 15 to 30cm profile indicating some water is being used by the crop or held in the zone above.

If the rise and fall in each profile was at a similar time and intensity as in Figure 1, this would indicate significant drainage past the first zone. The individual movements of the orange profile indicated a significant amount of water from each irrigation event was passing the root zone and leading to drainage. In Figure 2, the very small movement on the 30 to 60cm zone (orange line) indicates that only a very small amount of water has made it past the first and second depths as a result of the combined irrigation over the day, not individual events. This pattern indicates low drainage and efficient use of water.

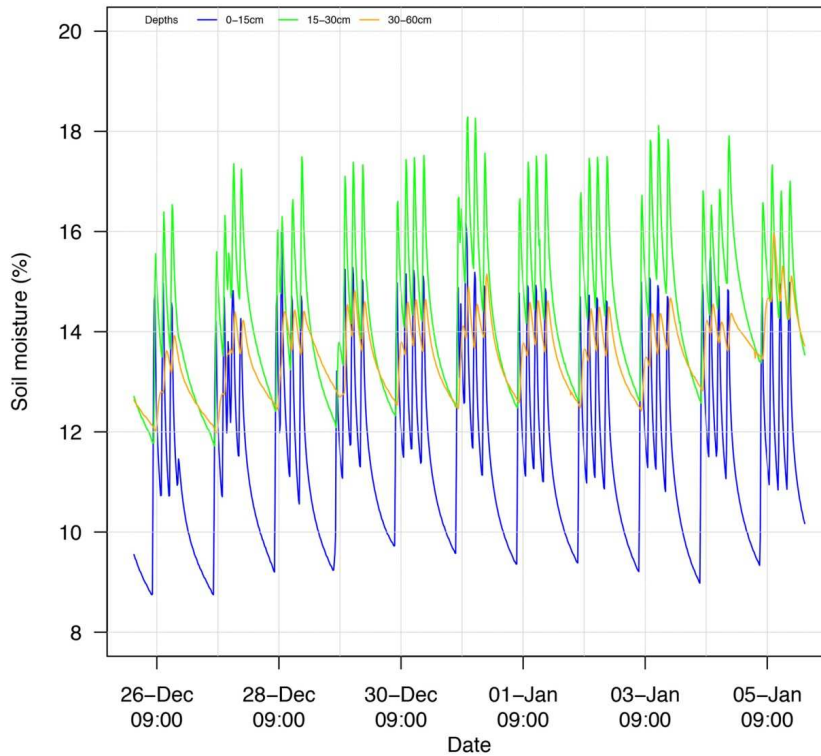


Figure 1. **Soil moisture graph showing original pattern of irrigation. Movements can be seen in each profile, 0-15, 15-30cm and 30-60cm indicating water is passing each profile with each irrigation event beyond.**

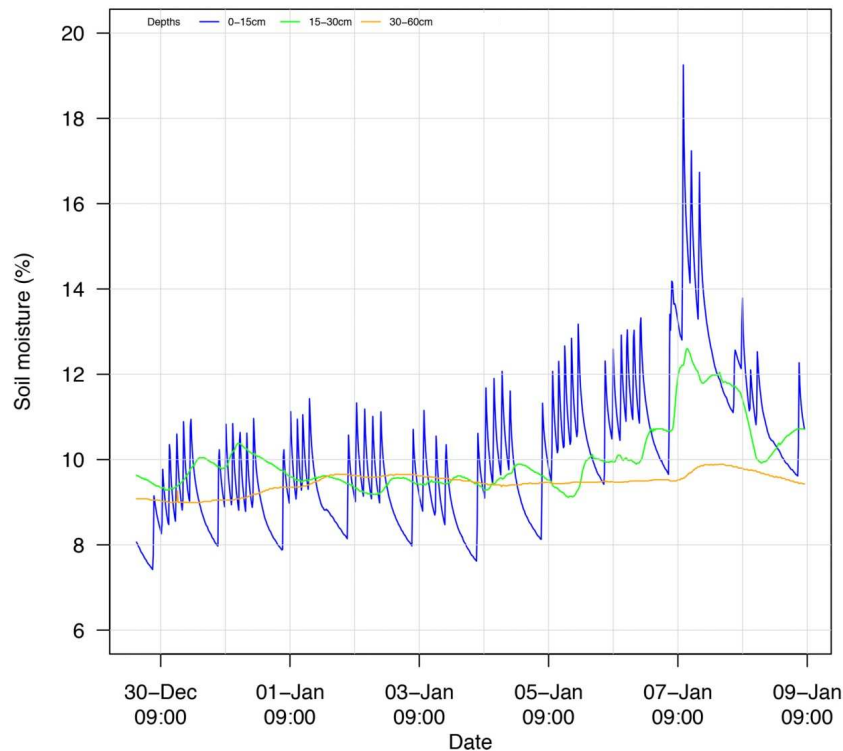


Figure 2. **Soil moisture graph showing more controlled irrigation with little movement of water in the deeper profile of the soil, using evaporation-based scheduling and soil moisture sensors to fine-tune irrigation**

On following up with each grower who had tested the new scheduling, they were asked if the crop had been any better or worse and if they believed they had used any more or less water.

The first grower, who generally had slightly lower yields than the others, commented that he had definitely used less water and had his best crop in a long time. The second and third growers who had both been under pressure for exceeding their water licences commented that they had not lost any yield and that they had used 30 to 40% less water, which had eased the pressure from the water license regulator.

The fourth grower said that he had used less water, but what he had noticed most was he needed to reduce his fertiliser use to account for the lower levels of drainage and leaching of nutrients from the root zone.

Another tool that was used to demonstrate the lower levels of drainage was dye. Blue dye was put on to about 10 drippers and the grower was asked to run his irrigation as he would normally run it for the next 24 hour period. After 24 hours a trench would be dug along the drip line where the dye had been placed. The dye was carried to the depth the water had reached as the combined effect of irrigations over the day. Previously, only a single irrigation event was tested with the dye. By running the test for 24 hours, monitoring the soil moisture with logging soil moisture sensors then comparing the depth of the dye to the soil moisture sensors, the growers learned two things.

Not all water from each irrigation was being used by the plants and some had drained past the depth the crop could use it easily.

Water movement could be clearly seen on the soil moisture graphs. This increased confidence in the scheduling method and the use of soil moisture probes to fine-tune irrigation.

For practice change to continue economic benefit would need to be shown. Based on the electricity saving from reduced pumping time and fertiliser saving, the increase in profit was as much as much \$3000 a hectare per season. If the water saving meant more crop could be grown, an additional 30 to 40% of area grown may result in an extra \$30,000 per hectare per season.

This benefit most growers acknowledged was that they had reduced the pressure from the water regulators and had more water to grow other crops throughout the year, meaning they could make more profit.

Summary

The early adopters who had been willing to try a different crop management technique required support to implement the practice change and to understand the concept. Each grower had small issues to work through to be able to incorporate this new practice into their existing business. After the first season all saw benefits to their business.

Case Study 4 – Good practice irrigation improving production

This farmer produces summer carrots and winter potatoes on about 60 hectares of land 50 kilometres south of Perth. The owners recently saw the need to improve irrigation performance as they increase their reliance on applying fertiliser through the irrigation system.

With the farm established over 30 years ago when water was not seen as such a scarce resource, irrigation system layout was generally based on pipe length or machinery wheel spacings. This resulted in lateral spacing of between 15 and 16 metres and sprinkler spacing of between 13 and 14 metres.

Moving laterals and sprinklers is a costly and time consuming exercise, and for a farm with little down time between crops was not a realistic option to improve sprinkler uniformity. With that in mind, a series of catch-can testing sessions of sprinklers was done to match performance characteristics to the existing spacing.

Four different brands of sprinkler with different nozzles were tested under regular operation in a range of wind conditions. Forty catch-cans in each of the four test areas were placed evenly between two laterals and the width of one sprinkler. Tests were run for a minimum of 30 minutes and the volume received in the catch-can recorded. Performance was assessed by calculating the distribution uniformity (DU) and co-efficient of uniformity (CU).

An acceptable level of efficiency is considered to be greater than 75% DU and 85% CU. Results ranged from 63% to 79% DU and 75% to 88% CU.

Using DU to calculate the scheduling coefficient (SC) showed an improvement from 1.58 to 1.26. Improving DU from 63% to 79% therefore has the potential to reduce the need for extra watering by up to 55%, or total water saving of more than 20%.

The difference in evenness of water application can be seen by looking at the surface map from the catch-can testing. The green colour shows the average application rate on the map, therefore the greater area of green the more even the application. Orange and red indicate lower water than average and the blue-purple indicates higher than average irrigation.

The time taken by the growers to do the testing really shows the value they place on irrigation.

“Irrigation for delivering water and fertiliser to the plants as evenly as possible is essential when you want to grow a good even crop,” the grower commented. “And now that we fertigate most of our nutrients, the irrigation is even more important.”

The decision to change the farm’s 2000 sprinklers was an informed decision made through testing which not only showed the best sprinkler, but also highlighted differences in in-field performance of different brands of sprinklers.

It is important to test sprinklers in field conditions before a large purchase is made. In this case, not only was the retailer happy to be involved in the testing, but an irrigation company representative also helped with the testing and measurement of the catch-cans.

The second improvement was the use of pressure regulators. Another issue on some parts of the farm was the difference in pressure in laterals within irrigation shifts and drainage of the laterals, therefore air in the system was causing damage to the sprinklers on start up. This was due to additions to sections of irrigation over the years, elevation changes, and incorrect initial irrigation design.

To improve this without major site works, pressure regulators with built-in check valves were used. The framers first mapped the pressure of each lateral in the problem area of the farm to make sure the pressure regulators should work at the desired pressure. Once the flow and desired pressure and sprinkler type were known, the regulators were selected and installed on a shift.

“The difference was immediate,” the grower said. “The water now starts up and shuts off immediately once the shift changes. There are no more leaking sprinklers and the pressure is even from end to end.”

With thousands of litres contained within the lateral lines on farm, a significant amount of water is being saved on a daily basis through reducing the losses on start-up and shut down.

These modifications have come at significant cost, but the growers believe that these improvements to their farm are an investment which will be repaid over a couple of years through reduced pumping time and fertiliser, combined with a more even crop and improved yields.

The time that the farmers invested into the improvements, although small, was one of the most valuable contributions. For them to see the difference in the catch-cans and the pressure of different laterals really hit home the benefits that could be made by improving things on their farm.

The other important factor was the irrigation industry’s willingness to assist in the testing process and obtain the correct sprinklers and fittings required to do the testing correctly.

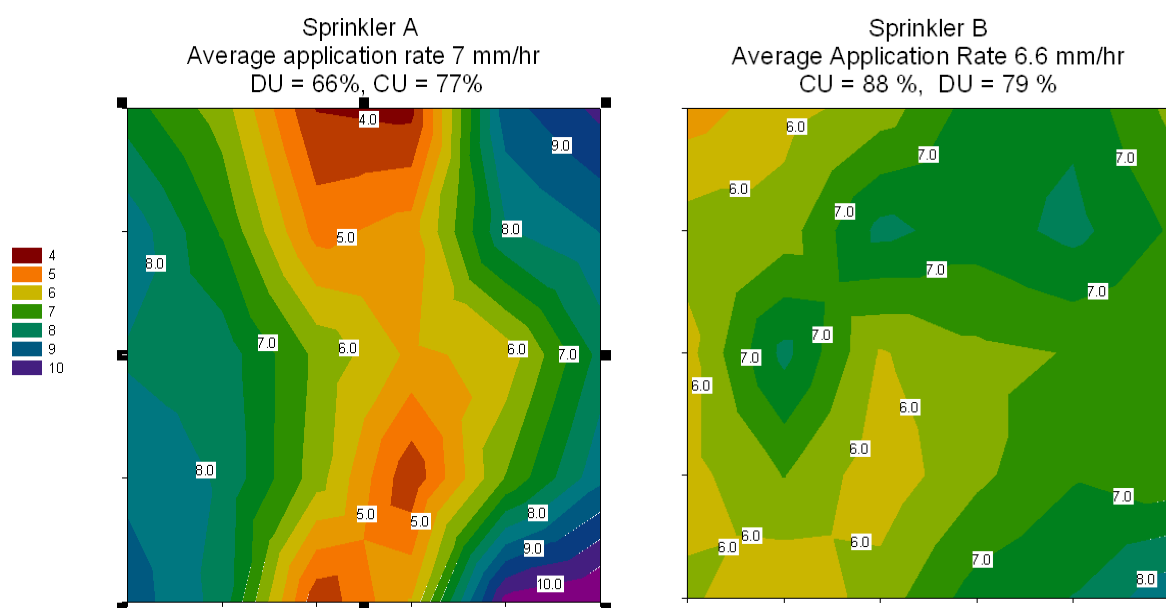


Figure 1 Surface maps from catch-can irrigation testing showing below-standard DU and CU (left) and acceptable levels (right). Mm application shown in legend to the left of sprinkler A graph.



Figure 2 **Catch can layout of during the sprinkler testing.**

Summary

Through a small investment of time, the growers have improved irrigation performance and practice on their farm. While the investment for 2000 sprinklers and pressure regulators was significant, the return on that investment can be seen through reduced pumping cost, less wear and tear on the system from air, and more even crops resulting in better pack-outs. Good practice is considering the most basic inputs and making sure they are working as intended.

Case Study 5 – Good practice to improve chemical application and risks

The soil fumigant Metham sodium is used on many vegetable farms in Western Australia. Several changes in the conditions in its registration over the years had seen some growers not applying the chemical as now directed on the product label.

While the vast majority of vegetable farmers are very diligent in their operations, several incidents have raised concerns that farmers are putting themselves at risk of fines under environmental and safety laws.

The label on chemical products registered by the Australian Pesticides and Veterinary Medicines Authority is not only intended to minimise waste and cost through providing correct instruction of the rates and application chemicals, but also to protect users and the environment from harm.

It is a legally-binding document that the purchaser and user agree to follow through the purchase and use of the product.

When identified that Metham sodium was not being used correctly, a workshop was held to inform growers through continuing on-farm improvements through good practice.

One farmer, unaware he was applying the chemical incorrectly, realised that not following the label was a huge risk to his business that might result in crop not being accepted by his markets and danger to his workers. An incident with the chemical would be sure to result in financial stress and the possibility of the grower leaving the industry.

Identifying safety of his staff, produce, and business as the highest priority, he also saw that he might be able to improve the effectiveness of the chemical by changing to the recommended method of application.

When the grower looked he found no available off-the-shelf solution appropriate for his farm. Through discussions with the manufacturer and looking at reference papers on the use of the product, he and his business partner set about designing a purpose-built fumigation rig.

Through the design period the grower identified all the possible issues using a new method and tried to overcome these. One criticism of applying Metham as suggested on the label was the speed of application. Previously allowed methods were much quicker, although not as safe. The new method would take slightly longer but was acceptable because it was considered more effective.

Other concerns were that when applying Metham sodium under the ground, it was hard to tell if it was working, if the nozzles were being blocked, and that the correct rate was being applied to the soil.

To test the effectiveness of the chemical the grower did two tests. Oats were sown prior to the Metham being applied in strips along the test area. Where Metham had been applied the oats did not emerge from the soil. This showed that the Metham gas still moved up through the profile when applied at about 20cm using tynes with sprays nozzles behind them.

To test the spread of the sprays, a channel was dug across the field and the tynes moved through the soil until in the channel. The spray pattern was assessed using water to see if the spread was adequate from behind the tyne.

Through careful examination of the label, the grower also noticed that the volume of water used to apply the chemical could be increased, meaning larger spray nozzles could be used behind the tynes which resulted in less risk of blockage.

The grower also identified decanting the Metham as a safety hazard. He designed his rig to minimise any risk of spillage of the chemical making it safer for the operator of the machinery. An onboard water tank allowed any flushing of the rig to be done in the field not around the shed. This again minimised the risk of accidental exposure of other staff not wearing personal protection equipment.

Following development of the equipment the grower agreed to do a video to help educate other growers to the risk, not only to workers' safety and environmental responsibility, but all the issues surrounding food safety and the potential financial risks of not applying chemicals as per label requirements. The video was shown at a follow-up workshop and was by far the most popular topic that night.

The good practice was not only using the chemical as per the label instructions, but identifying all the potential effectiveness issues, safety issues and business issues and addressing them prior to full development of the machinery.

The operator of the rig commented that he felt a lot safer being able to apply Metham using this rig and that it had expanded the hours he could apply Metham. He continues to say that the weather did not matter as everything was underground and no fumes released.

An additional benefit was the reduction in water required to apply the chemical. With a roller sealing damp ground there was no longer need to maintain irrigation for long periods of time to prevent gas from travelling off-site.

Summary

Through good practice the farm reduced their business risks, increased the effectiveness of a chemical being used, reduced unnecessary water use, and increased the hours of operation and the safety to all staff on the farm. These are all good outcomes for the business.

For the farm to agree to make the video that showed that they had not been using the chemical appropriately and the steps involved to work out how to use the chemical correctly was brave. He challenged other growers to make the right choice when it comes to chemical use and documents his attitudes and thought process that would lead to better use of the chemical and remove the risks of misuse from his farm. Through documenting his challenge he has become a champion for good chemical practice.



Figure 1 Custom built Metham sodium application rig



Figure 2 Behind the buried tynes that create space for the spray nozzles to apply the chemical, a flat bar levels the soil before the heavy roller seals the soil to prevent loss of gasses.



Figure 3 The closely spaced tynes, spraying water, in a demonstration of how the chemical is evenly sprayed into the soil

8. Appendix 2 – Published Articles

- Paulin, B. (2011) Poultry manure banned from September 1, 2011. WA Grower v.46 no.3 pp.40
- Prince, R. (2011) Growers driving good practice agenda. WA Grower v.46 no.3 pp.61
- Prince, R. (2011) Good practice talks a walk. WA Grower v.46 no.4 pp.63
- Prince, R. (2012) Myalup talks about all things irrigation. WA Grower v. 47 no. 2. pp 14-15.
- Prince, R. (2012) Myalup talks about all things irrigation The Overflow. Autumn edition no. 29 pp. 8-9.
- Prince, R. (2012) Irrigation systems – underrated farm assets. WA Grower v. 27 no. 1 pp. 20-21
- Prince, R. (2012) Irrigation systems – underrated farm assets. The Overflow. Summer edition no. 28. pp. 10-11.
- Prince, R. (2012) Good Practice meetings deliver important messages to growers. WA Grower v.47 no 4. Pp 33-35 (Chemical Workshops, Carbon and Sustainability Workshops and Review and Planning for 2013).
- Houston, S. (2013) Industry projects support good practice and efficiency in WA vegetable production. WA Grower v.48 no.3 pp. 52

Poultry manure banned from September 1, 2011



BY BOB PAULIN

SENIOR DEVELOPMENT OFFICER
DEPARTMENT OF AGRICULTURE AND
FOOD WESTERN AUSTRALIA

Regulations which allowed vegetable growers to apply raw poultry manure to land in the winter months of July, August and September have been amended, extending the ban to a full 12 months per year from 1 September 2011.


This means that under the 2001 Health Regulations it will be illegal to apply raw poultry manure to your farms even if it is incorporated with other materials.

This change will apply in all local government areas covered by the current regulations. These are the Cities of Armadale, Cockburn, Joondalup, Serpentine-Jarrahdale, Rockingham, Swan and Wanneroo; the Town of Kwinana; and the Shires of Chittering, Gingin, Harvey, Kalamunda and part of the Shire of Murray, described as the Peel-Harvey Coastal Plain.

Organic soil amendments such as compost are an alternative that is currently available, and growers should consider either changing their fertiliser programs to use chemical fertilisers or use acceptable alternatives, such as compost.

Growers concerned at the increased cost of such materials should note that they are effective at lower rates than poultry manure and have better ability to build soil organic matter levels and soil performance.

In changing to these materials, greater attention is needed to supplying nitrogen during crop establishment. This requires small frequent applications that usually result in lower fertiliser use, considerably less leaching to groundwater, and in many instances, improved crops.

Demonstration of the benefits of compost-amended soil will be held in November as part of the APC/VPC HAL-funded project to continue good practice through on-farm demonstrations, so keep any eye out for the flyer. 

MORE INFORMATION ►

For further reading on how to move away from poultry manure see the series of DAFWA Farmnotes on growing vegetables using the 3Phase method on sandy soils: Farmnote 375 for lettuce, 377 for broccoli, 451 for cabbage and 452 for growing celery which can be downloaded from the website. For a better understanding about the benefits of compost see DAFWA *Bulletin* 4746 Compost production and use in horticulture.



New opportunity for farm businesses

A new drought reform program through which farm businesses can access funding of up to \$30,000 to build more resilience into their operations, is open for business.

In May the Australian Government announced that an existing pilot scheme in Western Australia was being extended by 12 months to 30 June 2012. It will now cover a broad range of farming businesses over the entire South West Region as far north as Exmouth.

The measures are designed to move from a crisis management approach to risk management to better support farmers and rural communities in preparing for future challenges such as climate change, rather than waiting until they are in crisis.

The Department of Agriculture and Food, WA (DAFWA) is funding and delivering aspects of the program to enable farmers to develop or update a strategic plan for their business.

Department coordinator James Dee said it was a new opportunity for horticultural businesses, not just broadacre farmers, and owners should register as soon as possible to ensure they were kept informed about what was happening.

"Irrigated horticultural businesses haven't been able to access this type of funding before," he said.

"It is an opportunity for these businesses to critically analyse what they are doing and potentially fund the key activities that will build resilience into their businesses.

"When we know how many are interested, we will form groups that are as industry-specific as possible," Mr Dee said.

"They will then need to attend a series of five workshops to build their skills in business planning."

Groups of 12 to 15 businesses, about 30 participants, will allow members to learn from each other as well as the facilitators.

From this training, the businesses will need to produce a strategic plan, indicating the key activities planned. These might include new bores or dams, soil moisture monitoring, changes in production systems, succession planning or better accounting systems.

"This is a great opportunity to take a fresh look at your business plan," Mr Dee said.

"Once drawn up, the plans will be evaluated independently and may become eligible for the grant of up to \$30,000 to put them into practice."

Both training and grant applications need to be completed by May 2012, but payments could continue until 2014. Details are on the DAFWA website at www.agric.wa.gov.au.

MORE INFORMATION ►

For further information, contact James Dee on (08) 9780 6285 or 0429 687 050.

Growers driving Good Practice agenda



ROHAN PRINCE
DEVELOPMENT OFFICER,
DEPARTMENT OF
AGRICULTURE AND FOOD,
WESTERN AUSTRALIA


The Wanneroo Tavern attracted a large crowd of growers in July to develop priorities in the APC/VPC and HAL-funded *Good Practice Demonstration* project.

Growers participated in activities to identify important issues and highlighted the ones that they would like to learn more about in a combination of field days or evening workshops.

A raft of issues was identified that could be broken down into Production, Operational and Market Access. The two most topical were the impending ban on fowl manure and water availability.

Growers were also keen to have more information on pest and disease management, basic soil science and nutrient interactions, chemical use permits and the potential impact of the Carbon Tax.

We will try to address these issues. That may include sourcing expertise from within the State or interstate to present to growers. It is intended to have at least three field events a year with additional meetings and workshops when required.

So please support this grower-funded project in which the directions have been set by the growers. 

MORE INFORMATION ►

The next topic will be one of the big ones concerning water, or the ban on using fowl manure. So keep your ears and eyes open for the invites and come along to access the resources being made available by the Department of Agriculture and Food and by vegetablesWA.

Good Practice talks a walk



ROHAN PRINCE
DEVELOPMENT OFFICER,
DEPARTMENT OF
AGRICULTURE AND FOOD,
WESTERN AUSTRALIA



Field walk in Gingin looking at *All Things Soil*.



Two events of this APC/VPC and HAL-funded Good Practice Demonstration project have been run since the planning meeting in July. Both events were well received with good numbers of growers attending.

The first, held again at Wanneroo Tavern in September, was a night of all things pathology with special interstate guest speakers, Barbara Hall, Manager of Horticulture Diagnostic Service, Manager Post Entry Plant Quarantine at SARDI, and Len Tesoriero who has 20 years' experience with NSW Agriculture specialising in diagnostic plant pathology.

DAFWA virologist Brenda Coutts, diagnostic pathologist Dominie Wright, nematologist Sarah Collins, horticulturists Allan McKay and Aileen Reid, plus Len and Barbara, were on hand for healthy discussions of on-farm issues and how to diagnose and deal with the problems.

Problems with spring onions, bacterial canker in tomatoes, black rot in brassicas and the difference in powdery and downy mildew and their control were covered. The

important take-home message was that to treat an issue effectively you must know the cause and the pathogen you are dealing with. This is where diagnostic testing may help.

Dominie Wright handed out kits with information of how and what to sample. She emphasised the importance of filling in the forms with the crop history, soil type and chemicals applied, to help correctly diagnose a problem.

"It is very difficult to diagnose problems on plants that are almost dead, but with a sample of a plant just showing symptoms and a good history of the site you are more likely to be able to isolate the pathogen causing the symptoms," Dominie advised.

The November event was a field walk in Gingin looking at *All Things Soil* with Katrina Walton from the Chemistry Centre WA helping growers to understand soil chemistry and how it can influence availability of plant nutrients. Bob Paulin, Dominie Wright and Aileen Reid also fielded questions on soil health and how this can influence crop performance and disease susceptibility.

Bob, retired since then and moving to Canada, explained the potential benefits of compost to soil health and fertility. He made it clear that the compost industry needs to work with growers to understand their needs to ensure that their products meet the needs of the vegetable industry. The vegetable industry in turn needs to move on from poultry manure's nitrogen blast and focus on managing soil for better productivity and reduced



Specialist presenters, Aileen Reid, Len Tesoriero, Barbara Hall, Brenda Coutts and Dominie Wright at the plant pathology night for the Good Practice project.

Good Practice meetings deliver important messages to growers



BY ROHAN PRINCE
DEVELOPMENT OFFICER,
DEPARTMENT OF
AGRICULTURE AND FOOD,
WA

Good Chemical Practice

Discussions held in Wanneroo and Myalup delivered the message that appropriate chemical use is good agricultural practice, good business practice and a duty of care not only for growers and their employees, but also the general public and consumers of their produce.

Through the APC/VPC and HAL-funded project *Continuing Good Practice through on-farm demonstration*, growers were presented messages about how on farm practice could potentially impact their business and consumers away from the paddock.

Growers in Wanneroo heard presentations from the Department of Health, AusChem Training, DAFWA specialists and Woolworths about the importance of abiding by chemical labels for their own safety, the implications to supply, consequences of a product recall and the financial implication to their businesses.

Department of Health speaker Bill Calder highlighted important sections of the *Food Act 2008* that aims to ensure food for sale is both safe and suitable for human consumption. Ready-to-eat vegetable

produce is included in the Act while most primary producers are exempt.

This is very important with the rise of leafy salad lines packed on farms and direct sales at farmers markets. The penalties able to be applied under the *Food Act* reflect the seriousness of the offence and range from \$40,000 to \$100,000 and potential imprisonment for an individual, and \$200,000–500,000 for a body corporate.

Geoff Harcombe also from Department of Health spoke about chemical safety aspects of food production from an environmental health perspective.

He reminded growers that applying chemicals as per label instruction is a legal responsibility and intended to reduce the likelihood of neighbours, either farmers or others, and the environment being impacted. The vital link between following chemical label instructions and provisions in the *Food Act* were again referenced in this talk.

Woolworths Produce Operations Manager, Paul Turner, spoke about the company's desire to deliver safe and healthy locally-grown produce to WA consumers. Paul stressed that effective quality assurance programs that detect food safety issues before the public are affected are vital to maintain consumer trust in fresh produce. Ultimately



Paul Turner from Woolworths addressing growers at the Good Practice Workshop.

Myalup talks — all things irrigation





ROHAN PRINCE
DEVELOPMENT OFFICER,
DEPARTMENT OF
AGRICULTURE AND FOOD,
WESTERN AUSTRALIA

'All things irrigation' were discussed in Myalup at the latest in a series of field walks and workshops that are part of the APC/VPC and HAL-funded Continuing on-farm improvement through Good Practice Demonstration project.

Held at Joe and Sonia Castro's Rigg Road property on 3 May, two case studies of good irrigation practice were discussed and guest speaker, Colin Campbell, a certified irrigation designer and board member of Irrigation Australia also spoke. Tracy Martin from the IAL also provided details of services provided by Irrigation Australia and irrigation suppliers Nelson, Netafim and Toro each had tables of products for growers to look at and feel as an extra point of interest.

The first case study involved Baldivis Market Garden (BMG), and the recent sprinkler upgrade. Several sprinkler uniformity tests with the existing sprinklers and a variety of potential replacements were run with Sam Calameri at BMG over a two-week period.

Several wind conditions and pressures were assessed before Sam decided which was the most suited to his situation based on the sprinkler testing performance, sprinkler quality and economics. With over 1,000 sprinklers on his property Sam knows the importance of making the right decision when investing in new equipment.

"The testing did not take that long and gives me peace of mind that the money is being well spent on the most suitable sprinklers for my spacing and pressure within my budget," Sam commented.

Sam also found his local irrigation supplier to be helpful and the some suppliers will provide sprinklers to test for no or little cost which also encouraged him to test as many sprinklers as feasible.

The good practice at BMG not only comes from the testing done to make the right decision about sprinklers, but the fact Sam also used evaporation as a reference to schedule his irrigation. Through these two practical methods BMG is ensuring they are using water efficiently on the farm.

Colin Campbell talked about the importance of knowing the right questions to ask and providing the right information to ensure that what you get from your irrigation service provider meets the needs and specifications required to do the job.

By having a little knowledge about the velocity of water in pipes and the minimum acceptable figures for pump efficiency, pressure variation and distribution uniformity, growers are able to ensure they are getting the right equipment for the job. Colin also suggested that a brief of system specifications required and performance criteria expected is written up so that comparisons between different suppliers' quotes are possible and you can measure if what has been requested is performing as it should. This makes a lot of sense as it is often difficult to compare the cost of systems without knowing what components are being supplied.

The second case study covered irrigation and nutrient practice on Castro Farms' Rigg

Road property. Irrigation was monitored using manual and automated tipping bucket rain gauges, soil moisture probes and catch can lysimeters. Over the season Joe used the SMS weather service from the nearby Myalup weather station combined with personal experience to schedule the irrigation of his crop.

Results showed that there was very little drainage and nutrient leaching from the site with only 18 per cent of water applied passing 1 metre and 40kg/ha of nitrogen leached over the entire crop.

These figures are excellent for WA's sandy soils and Joe was happy with his carrot crop from the monitoring area.

Joe also compared figures emailed from the Vegetable Irrigation Scheduling Service (VISS) and believes some fine-tuning can be made to the recommendations to better suit his property. Fortunately this is easily done by creating your own custom crop in the VISS system in the crop stages page. For help with this, contact Rohan Prince, DAFWA, or Sarah Houston, vegetablesWA.

Healthy discussion was followed by a sundowner BBQ with refreshments, hamburgers with of course salad, and sausages with plenty of onions. The event was well received and plans for the next one are coming together. 🍷🍔

MORE INFORMATION ►

If you wish to know more about the day or be notified of the next event to be held north or south of Perth, please contact Rohan Prince, phone: 0429 680 069 or email rohan.prince@agric.wa.gov.au.

Myalup talks about all things irrigation

By Rohan Prince, Development Officer, DAFWA



Department of
Agriculture and Food



Attendees of the All things Irrigation Field Walk held at Joe Castro's Rigg Road Property in Myalup

'All things Irrigation' were discussed in Myalup at the latest in a series of field walks and workshops that are part of the vegetablesWA Continuing on-farm improvement through Good Practice Demonstration project, run by DAFWA and funded by the APC-VPC and HAL.

Held at Joe and Sonia Castro's Rigg Road property on 3 May, two case studies of good irrigation practice were discussed and guest speaker, Colin Campbell, a certified irrigation designer and board member of Irrigation Australia also spoke. Tracy Martin from the IAL also provided details of services provided by Irrigation Australia and irrigation suppliers Nelson, Netafim and Toro each had tables of products for growers to look at and feel as an extra point of interest.



Colin Campbell delivering a talk to growers on systems design and system requirements.

The first case study involved Baldivis Market Garden (BMG), and the recent sprinkler upgrade. Several sprinkler uniformity tests with the existing sprinklers and a variety of potential replacements were run with Sam Calameri at BMG over a two-week period.

Several wind conditions and pressures were assessed before Sam decided which was the most suited to his situation based on the sprinkler testing performance, sprinkler quality and economics. With over 1000 sprinklers on his property Sam knows the importance of making the right

decision when investing in new equipment. "The testing did not take that long and gives me peace of mind that the money is being well spent on the most suitable sprinklers for my spacing and pressure within my budget," Sam commented.

Sam also found his local irrigation supplier to be helpful and that some suppliers will provide sprinklers to test for no or little cost which also encouraged him to test as many sprinklers as feasible.

The good practice at BMG not only comes from the testing done to make the right decision about sprinklers, but the fact Sam also used evaporation as a reference to schedule his irrigation. Through these two practical methods BMG is ensuring they are using water efficiently on the farm.

Colin Campbell talked about the importance of knowing the right questions to ask and providing the right information to ensure that what you get from your irrigation service provider meets the needs and specifications required to do the job.

By having a little knowledge about the velocity of water in pipes and the minimum acceptable figures for pump efficiency, pressure variation and distribution uniformity, growers are able to ensure they are getting the right equipment for the job. Colin also suggested that a brief of system specifications required and performance criteria expected is written up so that comparisons between different suppliers' quotes are possible and you can measure if what has been requested is performing as it should. This makes a lot of sense as it is often difficult to compare the cost of systems without knowing what components are being supplied.

The second case study covered irrigation and nutrient practice on Castro Farms'

Rigg Road property. Irrigation was monitored using manual and automated tipping bucket rain gauges, soil moisture probes and catch can lysimeters. Over the season Joe used the SMS weather service from the nearby Myalup weather station combined with personal experience to schedule the irrigation of his crop.

Results showed that there was very little drainage and nutrient leaching from the site with only 18 per cent of water applied passing 1 metre and 40 kg/ha of nitrogen leached over the entire crop. These figures are excellent for WA's sandy soils and Joe was happy with his carrot crop from the monitoring area.



Development Officer Rohan Prince, describing the monitoring tools to measure irrigation effectiveness

Joe also compared figures emailed from the Vegetable Irrigation Scheduling Service (VISS) and believes some fine-tuning can be made to the recommendations to better suit his property. Fortunately this is easily done by creating your own custom crop in the VISS system in the crop stages page. For help with this, contact Rohan Prince, DAFWA, or Sarah Houston, vegetablesWA.

Healthy discussion was followed by a sundowner BBQ with refreshments hamburgers with of course salad, and sausages with plenty of onions. The event was well received and plans for the next one are coming together.

If you wish to know more about the day or be notified of the next event to be held north or south of Perth, please contact Rohan Prince, phone: 0429 680 069 or email rohan.prince@agric.wa.gov.au.

Good practice and irrigation systems an under-valued farm asset



ROHAN PRINCE
DEVELOPMENT OFFICER,
DEPARTMENT OF
AGRICULTURE AND FOOD,
WESTERN AUSTRALIA

Poor irrigation performance and incorrectly designed or installed irrigation systems not only cost you in terms of production, but also in higher input cost, especially power. This has been revealed by recent testing on properties from Carabooda to Myalup through the Good Practice project funded through the APC/VPC and Horticulture Australia Limited.

To grow an even crop using water efficiently, the pressure within your irrigation system must be uniform and correct for your sprinkler types. This is very important to remember when you are installing or maintaining an irrigation system.

Matching your sprinklers to their recommended pressure and checking to make sure you have even pressure in your lines is the least that should be done to make sure your irrigation system is contributing to efficient irrigation.

A catch-can test is the next step in making sure your irrigation is performing well and providing water uniformly to the crop. The sprinkler uniformity can be described mathematically by simple terms known as the coefficient of uniformity (CU) and the distribution uniformity (DU).

The uniformity of your irrigation system can be measured using catch containers placed in a grid pattern between sprinklers and laterals to measure application rates (Figure 1). The measurements are then used to calculate



Figure 1 Catch cans provide a useful way of checking whether irrigation water delivery is even.

the CU and DU and can also be graphed to show a surface map of water applied (Figure 2). The green colour represents the average application of water; the orange to red shows areas that receive less water and the blue colours show areas that are receiving more water than the average.

Often there can be two to three times difference in application from the driest to the wettest area.

It is preferable to have more areas receiving the same amount or very close to the average (Figure 3). The higher the DU and CU the more likely this is to occur, reducing the need to compensate for dry areas by overwatering.

Application efficiency, while very useful, is not the only indication of irrigation efficiency. A more detailed system assessment will also look at pressure losses through the system. Large pressure losses result in extra pumping time and therefore higher running costs. There is also an optimal area within a pump's operation to maximise efficiency. Most large losses can

be overcome through correctly designing and installing systems.

A way of checking the losses in your system is to read the pressure gauge at the pump and then at the first and last valves in the system. Elevation will contribute to losses, but these are easily accounted for. A one metre increase in height will result in about 10kPa loss. If on a level site and the pumps are operating at 600kPa but the first sprinkler after the valve is only receiving 280kPa, the pressure loss through the system is 320kPa, which is excessive. Generally, no more than 20 per cent loss should be accepted. If losses are greater, then a full assessment should be performed to diagnose the cause of the problem.

An irrigation system is a large investment and can be one of the most long-lived pieces of equipment on a farm. Without it, growing horticultural crops relying on rain would not be economical. If poorly designed, installed and operated, irrigation systems will have a shorter life and will cost you more than necessary. This



Myalup growers attend a session at Ivankovich Farms.

it is demand for local fresh produce that will help ensure the local vegetable industry has long-term sustainability.

In a similar meeting in Myalup, Syngenta's Technical Lead from South Australia, Scott Mathews, presented the finer points of effective spray applications focusing on spray equipment setup, environmental conditions and the target problem, and how they are all important factors when making spraying decisions.

Some of his key points included knowing the following important information:

- Environmental conditions and how they can affect the efficacy of sprays. This includes how temperature and humidity affect contact time and therefore effectiveness of the chemical based on its mode of action
- How often nozzles should be tested and what chemicals affect the performance of nozzles more than others
- The most appropriate nozzles for different cropping scenarios based on the canopy cover, the target problem and the chemical being used
- The action of common chemicals and how this affects the spray method that you use for a problem.

Scott's talk was very well received and discussion continued during the following barbecue and sundowner.

Carbon and Sustainability Workshops

The Carbon & Sustainability Workshops held around WA in late August saw three interstate guests present a range of topics including nutrient benchmarking and soil health, carbon farming and where it fits with horticulture, and integrated disease management (IPM) on brassica crops. The workshops were held in Carnarvon, Manjimup and Wanneroo.

Peter Melville (Horticulture Australia Limited) presented insight into how the Carbon Tax and Carbon Farming initiatives may impact or benefit vegetable production and what it means for the farm and supply chain. The talk highlighted the extra indirect costs associated with production and transport that will impact on growers.

Peter also looked at the vegetable industry's ability to take advantage of the federal government's carbon farming initiative. He concluded there was limited opportunity to take advantage of carbon farming as the regular inputs such as compost, manures and mulches are consumed and used up too quickly by the crops. Biochar was one option mentioned, however the benefits to production are still unclear. The talk concluded by suggesting options to reduce the impact of a carbon price by increasing production efficiency through efficient use of fertiliser, water and other inputs to offset

price increases. This tailed in nicely to the next talk by Dr Ian Porter.

Ian, a Principle Research Scientist at DPI Victoria, presented results from a federally-funded project on nutrient benchmarking (carbon and nitrogen) and its importance to soil health and sustainability of the national vegetable Industry. Data highlighted the benefits of adding composted organic mulch, or composted fowl manure, fumifert, a biofumigant crop and nitrification inhibitors with fertilisers, compared to no fumigation or methyl bromide. Research showed that trying to increase soil carbon in intense vegetable production using compost was difficult, but also revealed that yields were improved when compost was used.

Similarly, using nitrification inhibitors increased fertiliser efficiency leading to higher yields than unfumigated farmer practice and produced better economic returns.

A change in subject to IPM on brassicas saw Dr Paul Horne from IPM Technologies in Victoria speak about controlling diamond back moth (DBM) using a wasp (*Diadegma*) that parasitises DBM caterpillars in combination with specific sprays for other pests that will not affect the *Diadegma* parasitic wasp. The plan for a typical crop included the following strategy:

Week 1	Seedlings planted out
Weeks 2 & 3	Release Diadegma wasps
Week 4 or 5	Spray Dipel and Movento if aphids are present
At buttoning	Spraying Belt
Near harvest	Spray XenTari for cabbage white butterfly.

The above chemical products were used as they have a lower impact on the wasp than others.

It is important to note that chemical groups should always be rotated to avoid resistance, even when using the 'softer' chemicals mentioned here.

When trialled in Werribee they resulted in \$300–500/ha less insecticide used than other farms in the area for the same period on a cauliflower crop.


For further details on Paul Horne's talk on IPM or to view Peter Meville's or Ian Porter's talks visit the vegetablesWA website (www.vegetableswa.com.au) or contact Sarah Houston 0427 373 037 or Rohan Prince on 0429 680 069.

Review and planning for 2013

Following the presentations from the interstate guests at the Wanneroo workshop, a review of the last year's demonstration sites, field days and workshops was run by Rohan Prince and Sarah Houston. Six workshops/field days were run between Myalup and Gingin on topics including pathology, soil health and performance, irrigation, chemical use and the most recent.

An interactive planning session revealed that growers wanted to hear more on market access following the bans of dimethoate and fenthion, and have more information on the requirements for minor use permits including how the APVMA assesses the data.

The loss of fowl manure was a hot topic and how the industry may be able to utilise this product again through composting may be investigated. A workshop was requested on balancing nutrients to maximise the benefit of application, as well as giving information on cover crops, green manures and bio-fumigant crops.

It is intended that four more workshops or field walks be run prior to the project winding up in August 2013. Keep an eye out for a booklet summarising all the Good Practice sites and the work done so far to demonstrate on-farm improvements. 

MORE INFORMATION ►

For any further information on field days and workshops, including if you have any thoughts or suggestions to pass on in relation to this project, please don't hesitate to contact Rohan Prince at DAFWA or Sarah Houston at vegetablesWA.

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Irrigation Systems - underrated farm assets

By Rohan Prince, Development Officer, DAFWA



Figure 1.

To grow an even crop using water efficiently, the pressure within your irrigation system must be uniform and correct for your sprinkler types. This is very important to remember when you are installing or maintaining an irrigation system.

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mathematically by simple terms known as the coefficient of uniformity (CU) and the distribution uniformity (DU).

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(Continued next page)

DU 63.7%, CU 72.1%
Winds SW 5 to 10 km/hr
Mean application rate = 7 mm/hr

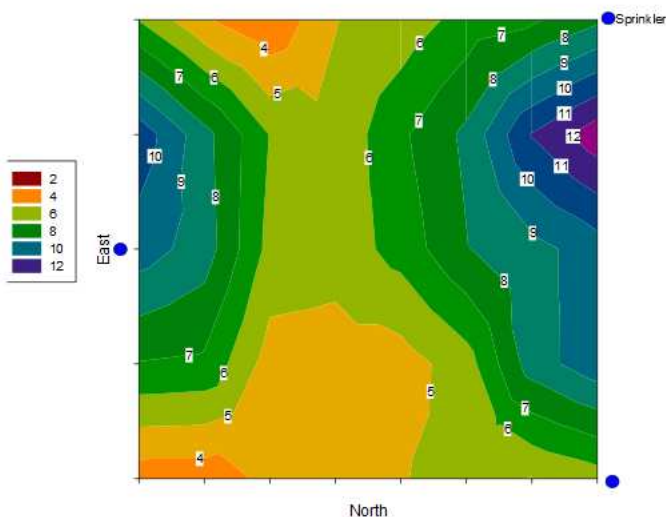


Figure 2.

CU = 90.3% DU = 84.2%
Winds SW 5 to 10 km/hr
Mean Application rate 7mm/hr

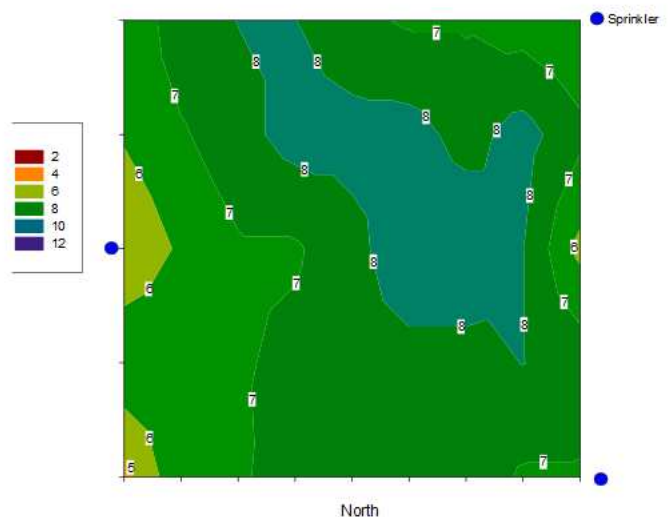


Figure 3.

Figure 2 Map of sprinkler uniformity testing with poor efficiency

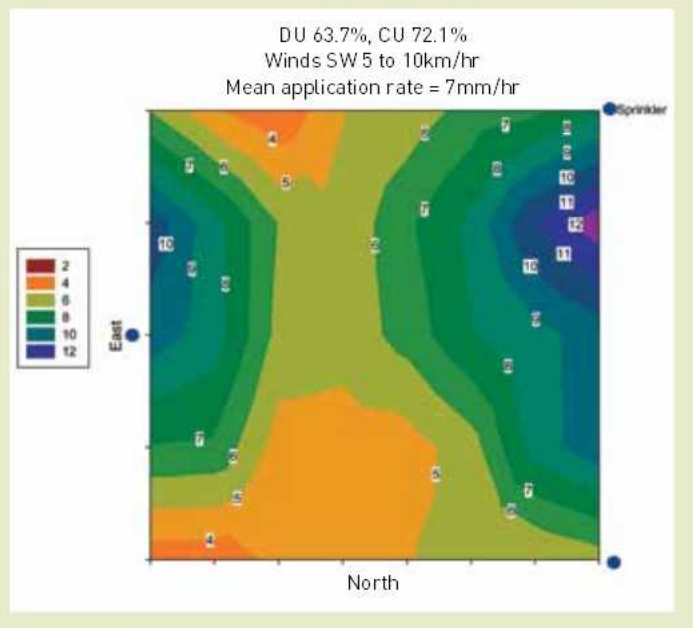
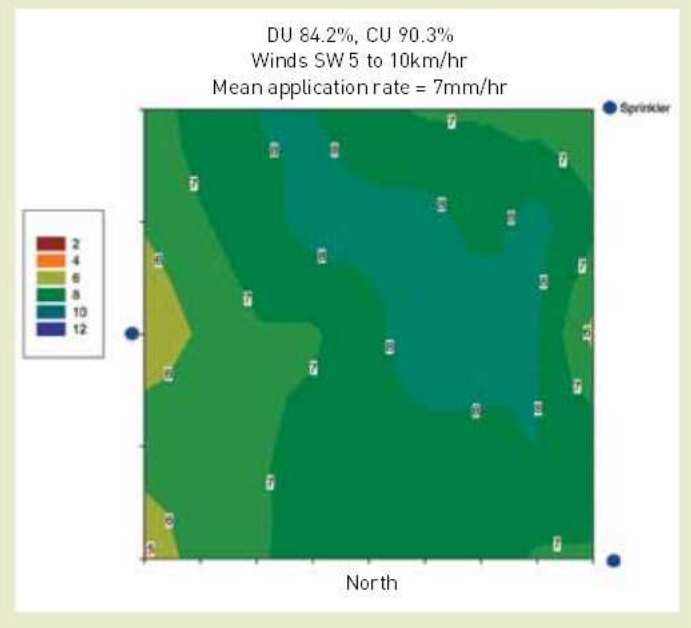



Figure 3 Map of sprinkler uniformity testing with good efficiency



reduces profit and will more than likely result in higher water use and lower water use efficiency.

The choice of irrigation system should be made carefully, similar to purchases of farm machinery.

You need to buy the correct equipment to do the correct job. One size does not fit all and often just repeating what has been done previously or what has been installed next door does not deliver the best value for money or best performing system. 

MORE INFORMATION ►

For further information contact Rohan Prince at the Department of Agriculture and Food, email rohan.prince@agric.wa.gov.au or mobile 0429 680 069.



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Industry projects support good practice and efficiency in WA vegetable production



BY SARAH HOUSTON
FIELD EXTENSION OFFICER,
VEGETABLESWA

Field days, workshops and information sessions for vegetable growers around WA have long been an essential form of communication and extension within the vegetable industry.

A number of exciting projects and initiatives have been running over the past few years to bring regular workshops to growers on essential topics such as pests and diseases, chemical use, soil health, water issues, irrigation, technology and more. 2013 has been busy with a number of workshops being run across the vegetable growing regions of WA.

Caring for our Country Project, Manjimup

The Manjimup IPM workshop was run through the Caring for our Country project and held at the DAFWA Research station. The CfoC project continues to focus on sustainable vegetable production practices such as precision irrigation, irrigation efficiency, IPM practices and nutrient management.

If growers have any questions or would like further information about this workshop or any of the ongoing trials under the CfoC project, please contact Alison on alison.mathews@agric.wa.gov.au or phone 0427 388 567, or Sarah Houston: sarah.houston@vegetableswa.com.au or 0427 373 037.



The workshops held in Wanneroo caught growers attention on a number of topics including IPM, chemical application and best irrigation practice.

Good Practice Project, Swan Coastal Plains

The Perth IPM workshop was also run in May through the Good Practice Demonstration project. This project has been bringing workshops and field days to growers in the Swan Coastal Plains region over the past three years. These have included workshops on soil health, irrigation, plant diseases, carbon and sustainability, IPM and safe chemical practice.

The final workshop/grower meeting as part of the Good Practice project was then held in August 2013 at the Wanneroo Villa where a number of growers gave an overview of the improvements and changes they have made during the project. George Kyme from WesGrowers spoke about the use of soil moisture monitoring equipment to keep irrigation and nutrients within the root zone of his tomato crop.

Damien Rigali of Gourmet Fresh Farms presented on the increase in water use efficiency he gained by increasing the uniformity of his irrigation system and scheduling for evaporation and crop factors.

Sam Calameri and the team at Baldvis Market Gardens featured in a video presentation produced by DAFWA and vegetablesWA focusing on the correct application of Metham Sodium as a soil fumigant. The team have designed and developed a piece of equipment which quickly and effectively applies the chemical under the soil, then rolls the surface to seal it underneath. The guys explained the thought process and challenges involved in the development of the equipment, as well as the importance of making sure you use chemicals in the correct way and according to the label.

The wrap up meeting for the Good Practice project was also an opportunity for growers to give feedback on the past few years work, and to have input into ideas for future projects.

For further information about the Good Practice project or any of the field days held over the past few years, please contact Rohan Prince on rohan.prince@agric.wa.gov.au or 0429 680 069, or Sarah Houston on sarah.houston@vegetableswa.com.au or 0427 373 037.

Swan Coastal Plain Project Survey and Evaluation

1 For each grower at your table, please write down the approximate area for each Grower's Farm in acres or Ha . **Note, each grower is allocated a letter of the alphabet which will be used for all questions. Providing your name is optional**

Grower A, Name

Grower B, Name

Grower C, Name

Grower D, Name

Grower E, Name

Grower F, Name

please circle

ac / ha

ac / ha

ac / ha

ac / ha

ac / ha

ac / ha

please circle

2 In addition to this meeting, have you attended another good practice event?

If Yes, please write your Grower letter (A,B,C,D,E,F) next to the events you attended

Yes / No

September 2011, Pathology night , Wanneroo Tavern

November 2011, All things Soil - Field Walk Gin Gin

May 2012, All things Irrigation- Field Walk Myalup

July 2012, Good Practice Chemical Use Myalup or Waneroo

Aug 2012, Workshop on carbon & nitrogen management in vegetable production & IPM Control for Brassica Cropping

Dec 2012, Irrigation Systems, Operation & Technology, Carabooda

May 2013, Implementing IPM for vegetable Cropping

Please write your Grower letter (A,B,C,D,E,F)

3 Who noticed the followup article in the WAGrower magazine following the event.

4 Which of these events present information that changed your level of knowledge on the subject presented

Please write down your Grower letter for each event that changed your knowledge about the subject presented

September 2011, Pathology night , Wanneroo Tavern

November 2011, All things Soil - Field Walk Gin Gin

May 2012, All things Irrigation- Field Walk Myalup

July 2012, Good Practice Chemical Use Myalup or Waneroo

Aug 2012, Workshop on carbon & nitrogen management in vegetable production & IPM Control for Brassica Cropping

Dec 2012, Irrigation Systems, Operation & Technology, Carabooda

May 2013, Implementing IPM for vegetable Cropping

The next three questions try to gauge the level of change that each grower experienced

Please write your Grower letter (A,B,C,D,E,F)

5 Who looked for more **knowledge** on a topic from the field after the field days/workshops and information sessions. Please list grower letter

Please write your Grower letter (A,B,C,D,E,F)

6 Who **tried changing** the way they did some practices on farm as a result of the field days/workshops and information sessions

Please write your Grower letter (A,B,C,D,E,F)

7 Who **made changes** that have now become the standard way of doing things

Please write your Grower letter (A,B,C,D,E,F)

8 Which grower believes the practice changed resulted in lower input cost or a better crop.

Please write your Grower letter (A,B,C,D,E,F)

9 Who thought the lower cost or better crop resulted in a better return or net profit?

Please write your Grower letter (A,B,C,D,E,F)

10 Which growers thought the practice resulted in a better environmental outcome. Please write down grower letter

11 For the group please write down some subjects that you would like some help to understand better or want to learn more about.