Irrigated double cropping

Best management practices for double cropping in southern irrigation areas

Irrigated double cropping

Best management practices for double cropping in southern irrigation areas

Revised and updated best management practices for southern New South Wales and northern Victoria

May 2018

The information in this publication has been developed from results, data and experience of the project *Correct Crop Sequencing for Irrigated Double Cropping* (GRDC project VIC00010).

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Irrigated Cropping Council *Promoting irrigated agriculture*

NSW GOVERNMENT Department of Primary Industries

Irrigated double cropping – Best management practices for double cropping in southern irrigation areas

GRDC project VIC00010 – *Correct Crop Sequencing for Irrigated Double Cropping*

ISBN XXXXX

Author Damian Jones, Irrigated Cropping Council

Photographs XXX, YYY, ZZZ

Editor Lucy Kealey Writing and Editing

Graphic designer Leysa Flores Design

Printer XXX, YYY, ZZZ

Contents

Introduction

Crop sequencing is the practice of growing a series of different crops in the same area in sequential seasons, or allocation of crop types to specific paddocks through time. Double cropping refers to growing two crops per year on an area of land within a crop sequence.

DOUBLE cropping has been practiced across the irrigation zones of southern New South Wales and northern Victoria for several decades but numerous issues have hampered widespread adoption. These issues include water availability, commodity prices, crop choice, variety maturity, irrigation layout, suitable machinery, herbicide residues and options, adequate labour and an individual's personal drive.

Past research and investigation of double cropping has addressed some of the issues listed above, as have new crop varieties and irrigation technologies. However the irrigation and cropping environment is constantly changing, and ideas, experience and technologies continue to evolve.

The *Correct Crop Sequencing for Irrigated Double Cropping* project was established in 2014 to investigate:

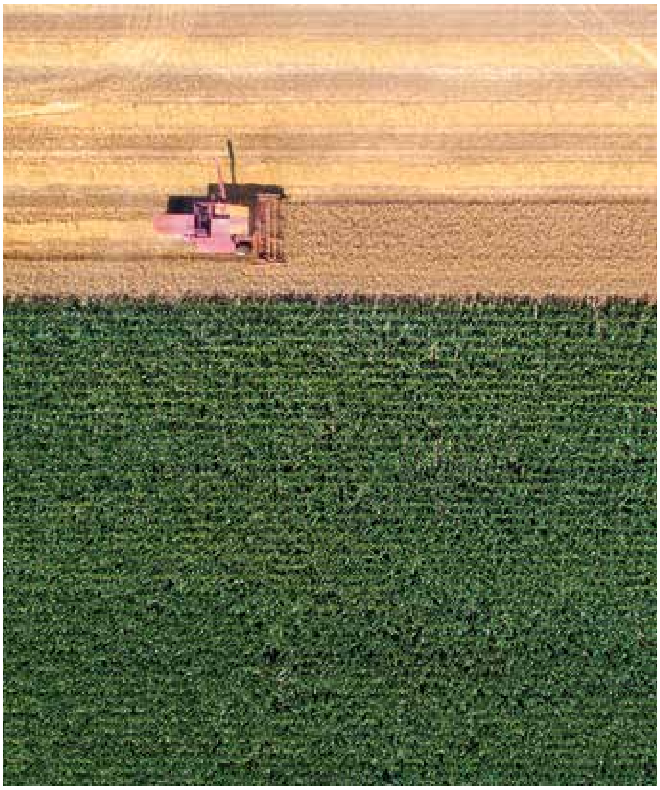
- profitability of some common double cropping sequences
- the fit of cotton — a new crop to the region — in cropping sequences
- techniques to accelerate harvest and/or sowing, enabling better timing within the crop sequence.

The first step in this project was to conduct a situation analysis of double cropping to gain an understanding of irrigators' issues and cropping intentions, farm size and infrastructure, and previous research.

Over 75% of irrigators surveyed through an online survey had an irrigation area of less than 600 hectares. These irrigators have a strong incentive to investigate crop options and sequences to increase returns from their irrigation investment, as simply increasing cropping area is not an option.

Access to on-farm efficiency programs has seen considerable investment in new on-farm irrigation infrastructure that may increase the range of crops that can be grown and/or save on labour, in addition to achieving greater returns per megalitre of water applied. It is assumed as infrastructure improves there will be an increase in double cropping and an associated increase in profitability.

Information from the situation analysis helped determine trial activities for the project at Leeton, Kerang and Numurkah. The Leeton site investigated double cropping sequences and the economic performance of crops in the trial was used to develop the Correct Crop Sequencing Decision Support Tool, explained in Section 2. The Victorian trial sites investigated agronomic aspects of double cropping, such as the effects of herbicide residues and harvest strategies.



This guide, *Irrigated double cropping — Best management practices for double cropping in southern irrigation areas*, is based on the interpretation of the trial results as well as summarised feedback from experienced double croppers. It complements a previous publication by the Irrigated Cropping Council and Victorian Department of Primary Industries, *Double Cropping in Northern Victoria and* expands on existing management practice guidelines for double cropping and provides up-to-date economic comparisons of double cropping sequences to assist decision-making.

This guide is funded by the Grains Research and Development Corporation through investment in the *Correct Crop Sequencing for Irrigated Double Cropping* project, and co-funded by the Irrigated Cropping Council and NSW Department of Primary Industries.

Summary of best management practices for double cropping

1. Layout, delivery and drainage

Design irrigation layout and plan infrastructure to supply and drain water in timeframes that minimise waterlogging of the crop but ensure re-filling of the soil profile.

Aim for *water on–water off* in 4–6 hours for border check layouts and 12 hours for siphons.

Different crops have different tolerance to waterlogging and this may influence rotation choices.

2. Weed, pest and disease control

Monitor paddocks regularly to ensure pests and diseases are identified early and appropriate action is taken for control.

Make sure plant back periods are suitable for the next crop(s) in the sequence, when considering herbicide options.

Certain Group B herbicides have long plant back periods, and pulses, especially, can be sensitive. Variety choice can overcome some of the risks associated with herbicide residues.

3. Opportunity cost of water

Ensure planned crops are profitable to grow — what looks like a profitable crop on paper can quickly become a loss during the season.

Be guided by gross margin analysis.

Water is a major input cost and its price will fluctuate from season to season, along with commodity prices.

4. Sowing time

Sow on time to maximise yield potential, as well as ensure timely harvest before the next crop in the sequence.

Manage the sowing window through the selection of shorter or longer season varieties.

Many growers start the double cropping sequence with the summer crop.

5. Soil moisture at sowing

Ensure adequate soil moisture for crop establishment and crop growth.

Determine subsoil moisture levels after harvest and pre-irrigate if required. However for summer crops, sowing into receding soil moisture is less risky than watering up with surface irrigation, so watch weather forecasts.

Sprinklers are ideal for supplying required amounts of water to ensure germination and establishment.

Stubble can trap moisture or interfere with water flow, leading to uneven wetting of the soil profile.

6. Crop establishment

Crop establishment is critical to ensure a profitable crop, particularly with summer crops.

Determine a target population, and understand the influence of seed size, target quality for the crop and growing conditions.

Have access to suitable and accurate seeding equipment.

7. Nutrition

Match nutrient supply with target yields in all cropping programs but understand that demand for soil nutrients in double cropping will be intensified.

Soil test before sowing to identify the level of nutrients present, and calculate a nutrient budget to ensure the crop is adequately fertilised.

Phosphorus levels need to be ascertained before sowing so adequate amounts of the nutrient can be supplied; and knowledge of nitrogen levels helps determine a nitrogen strategy for the whole growing season.

8. Irrigation

Efficient water application and water use is critical in all irrigated cropping programs.

Monitor soil moisture levels to ensure there is adequate moisture in the root zone.

Use crop growth stage and weather forecasts in conjunction with soil moisture information to plan irrigation schedules.

9. Timeliness of operations

The most critical factor for successful double cropping is being able to manage the transition between winter and summer (or summer and winter) crops.

Harvest of summer crops and sowing of winter crops, and vice versa, can occur at almost the same time, so having access to required labour and machinery is essential to manage competing priorities.

Timely operations also depend on stubble from the previous crop not impeding watering, germination or crop establishment.

10. Marketing

Marketing of summer grains can be more difficult than marketing of winter grains, with fewer options for receival. Prices of some commodities can fluctuate widely, so gross margin analysis can help indicate the price required for a profitable crop.

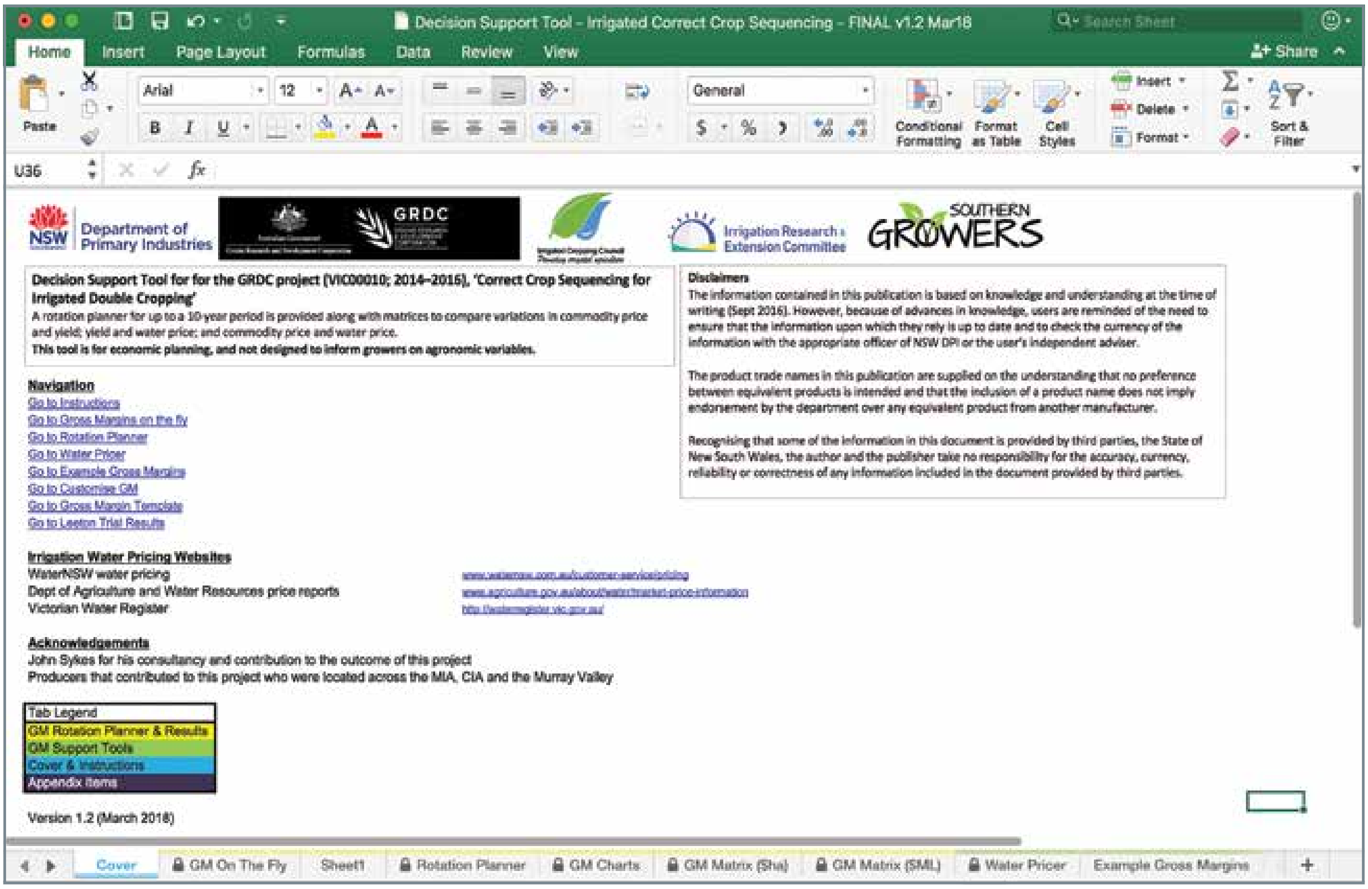
Price risk may be managed with contracts. It is essential to understand the particular characteristic of different markets, e.g. maize has hectare contracts, and soybeans may be contracted as culinary or crush. It is important to establish whether or not there will be penalties for not achieving target yield.

Marketing becomes easier as experience is gained and relationships with buyers develop.

Detailed information and production guidelines of individual crops within a double cropping program are not provided in this publication — for this information visit the website of your department of primary industries or consult your agronomist or supplier.

Making the best double cropping decisions with gross margin analysis

The Decision Support Tool for Double Cropping aims to provide an easy way for irrigators to assess the gross margins of different rotations, attribute an average water price to those rotations and customise inputs, yields and commodity prices for their own circumstances.



GROWING two crops in 52 weeks is a honed skill and for many years, southern irrigators believed it was impossible to continuously double crop.

Many growers achieve three crops in two years, and some achieve five crops in three years. However, very few claim to have mastered continuous double cropping.

The Correct Crop Sequencing — Decision Support Tool is designed to support decision making about the correct crop sequence in order to successfully double crop. The tool aims to provide an easy way to assess gross margins for different rotations, attribute an average water price to those rotations and customise the output for individual businesses.

To access the tool, follow the link above (if reading online) or go to the NSW DPI website: www.dpi.nsw.gov.au/agriculture/budgets/costs/cost-calculators/correct-crop-sequencing-decision-support-tool

The decision support tool is a series of Microsoft Excel worksheets. The first sheet provides links to the various components (presented on individual worksheets) of the tool. Most important is the *Instruction* link.

Please read the instructions before using the tool to understand how the various components of the tool interact with each other.

Gross margins on the fly

Up to five years of rotations can be entered into the *Gross Margins on the Fly* worksheet, using the drop down boxes.

Once a crop is selected in the gross margin worksheet, the decision support tool populates the table with generic income and variable costs to give the crop gross margin dollar return per hectare or per megalitre. These figures are based on the costs, prices and yields obtained from the *Correct Crop Sequencing for Double Cropping* project rotation trials at Leeton from the 2014–16 seasons.

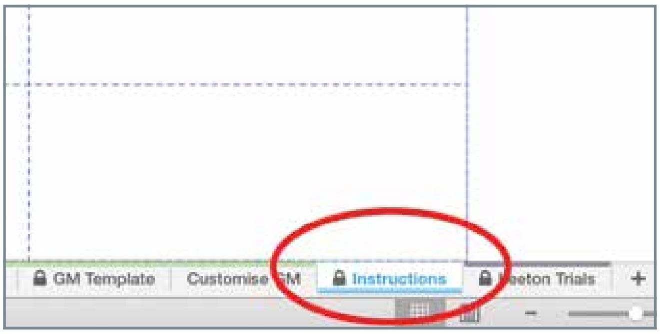
With this in mind, the 'on the fly' gross margins are only indicative of the planned rotation due to the seasonal variability in prices and yield.

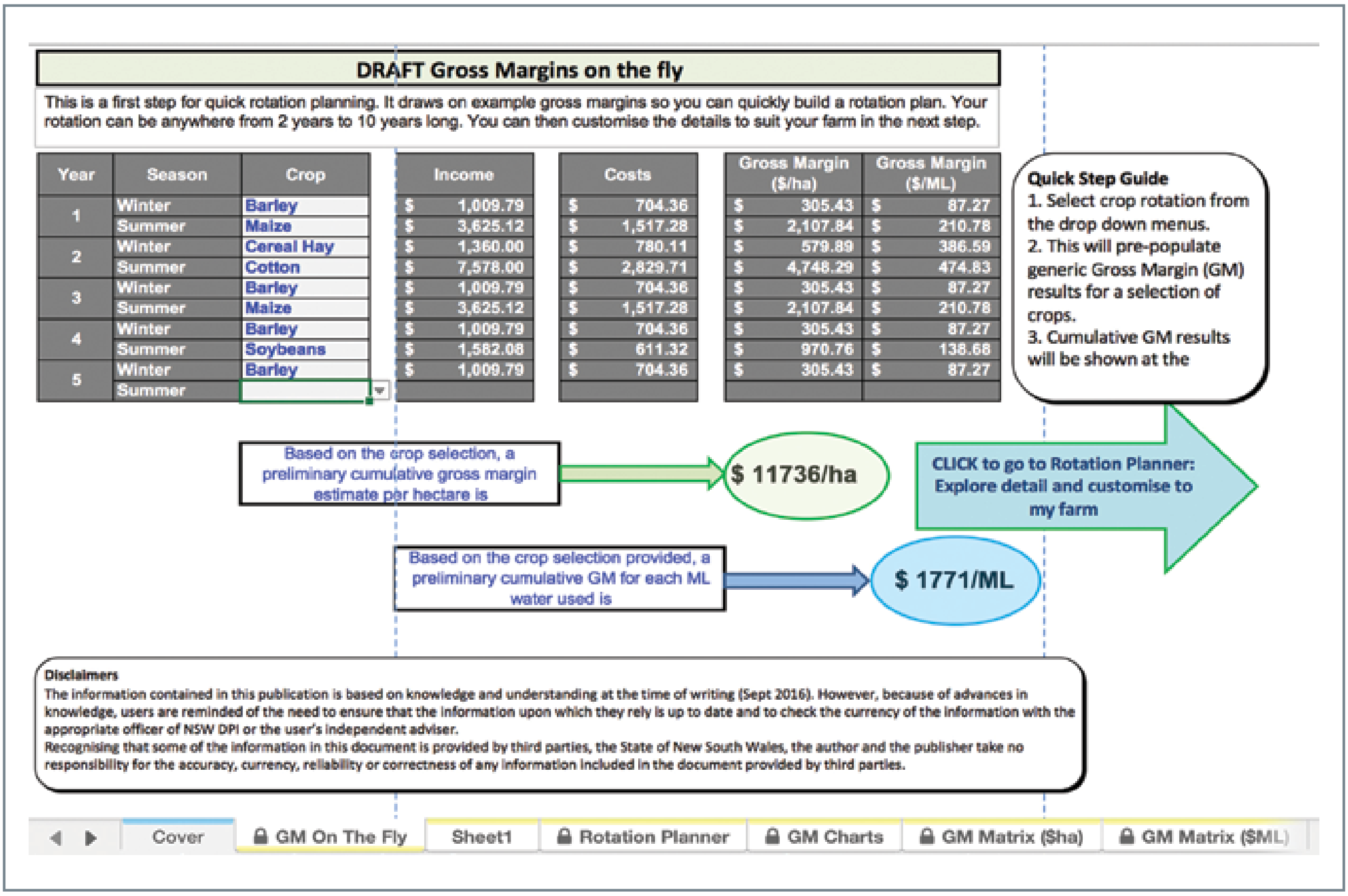
It is important to understand that any combination of crop choices can be selected in the gross margin worksheet, and that the gross margin worksheet does not consider the practicality or workability of the rotational fit.

Forward planning is essential when analysing the gross margins of crop options for double cropping, and selection of crops must take into account future crop or variety choices.

IT IS important to understand that any combination of crop choices can be selected in the gross margin worksheet but these may not be practical or workable in a rotation. For example, the worksheet will let you choose a late maturing winter crop that is ready for harvest in November and a summer crop option that needs to be sown in October. Also, the worksheet will not take into account the impact of herbicide choices.

After analysing the gross margin results, the agronomic implications of the rotations selected must be considered.





Year	Season	Crop	Income	Costs	Gross Margin ($/ha)	Gross Margin ($/ML)
1	Winter	Barley	$ 1,009.79	$ 704.36	$ 305.43	$ 87.27
	Summer	Maize	$ 3,625.12	$ 1,517.28	$ 2,107.84	$ 210.78
2	Winter	Cereal Hay	$ 1,360.00	$ 780.11	$ 579.89	$ 386.59
	Summer	Cotton	$ 7,578.00	$ 2,829.71	$ 4,748.29	$ 474.83
3	Winter	Barley	$ 1,009.79	$ 704.36	$ 305.43	$ 87.27
	Summer	Maize	$ 3,625.12	$ 1,517.28	$ 2,107.84	$ 210.78
4	Winter	Barley	$ 1,009.79	$ 704.36	$ 305.43	$ 87.27
	Summer	Soybeans	$ 1,582.08	$ 611.32	$ 970.76	$ 138.68
5	Winter	Barley	$ 1,009.79	$ 704.36	$ 305.43	$ 87.27
	Summer					

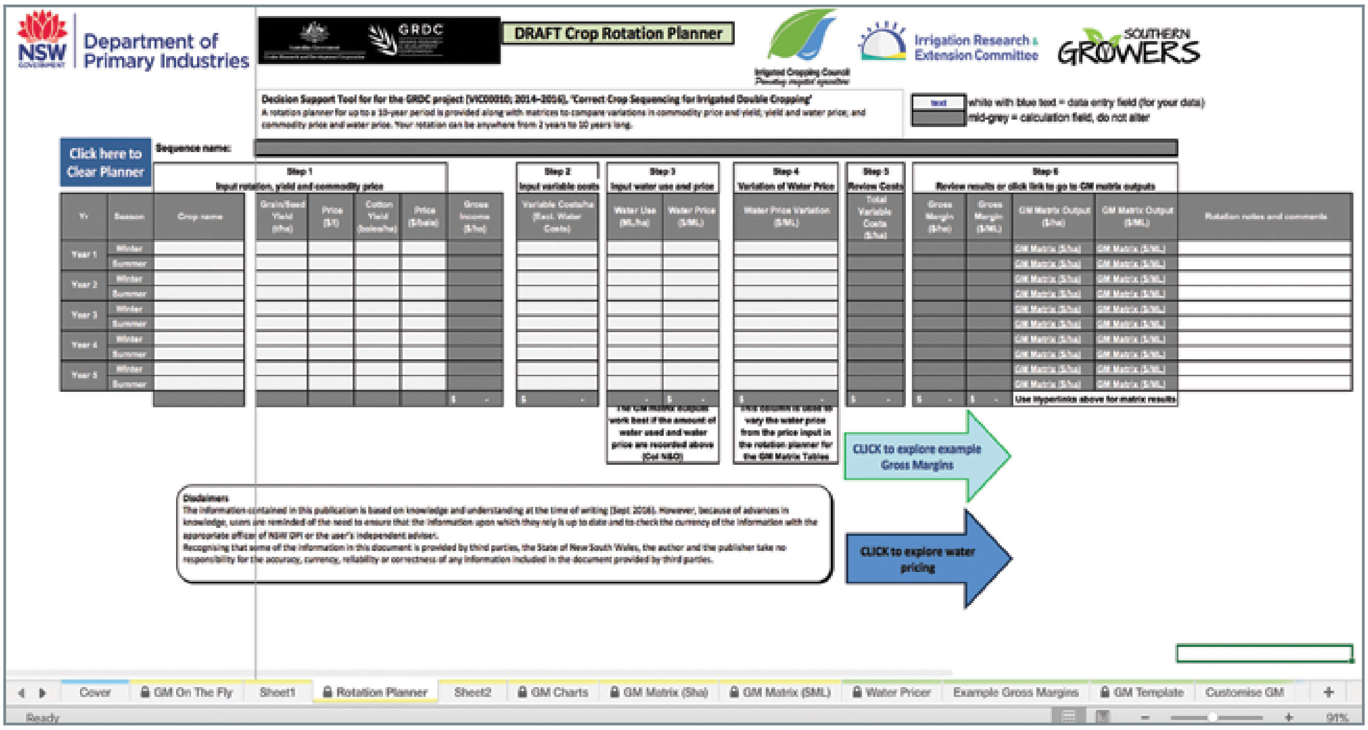
Rotation planner

For more accurate gross margins reflecting the current season prices, the *Rotation Planner* worksheet allows crop-specific gross margins to be calculated. New rotations can be added to the planner. The worksheets *Example Gross Margins, Gross Margin Template* and *Customise Gross Margins* provide a guide and prompt for irrigated cropping inputs and operations and the costs involved. Remember that the price of water is a separate input cost in the *Rotation Planner*.

Once the estimated yield, commodity price, water requirement to grow the crop and water price are added into the tables, the decision support tool will calculate the return per hectare or return per megalitre for that crop; as well as calculate the accumulated gross margins for the planned double cropping rotation.

An additional element in the *Rotation Planner* is the ability to look at the influence of commodity price, water cost or yield. The range in water pricing is added into the worksheet, in the *Variation of Water Price* column.

The decision support tool automatically calculates a matrix of gross margins based on the commodity price up to +/- $40/t, as well as +/- 25% of the estimated yield. By clicking on the links on the right hand side of the table, you will be taken to the *GM Matrix* worksheets ($/ha and $/ML) where the effect of changes in prices and yield and their effect on gross margin can be seen.



Year 1 Winter: Gross Margin ($/ha) — Commodity Price/Unit

Yield V Price	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0

Yield/ha

Table requires minimum of yield and commodity price to create output.

Year 1 Winter: Gross Margin ($/ha) — Water Price/ML

Yield V $/ML	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0

Yield/ha

Table requires Table 1 parameters + water price/ML + ML /ha applied

Year 1 Winter: Gross Margin ($/ha) — Commodity Price/Unit

$/ML V Price	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0

Water Price/ML

Table requires Table 1 parameters + water price/ML + ML /ha applied

Year 1 Summer: Gross Margin ($/ha) — Commodity Price/Unit

Yield V Price	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0

Yield/ha

Table requires minimum of yield and commodity price to create output.

Year 1 Summer: Gross Margin ($/ha) — Water Price/ML

Yield V $/ML	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0
0.0	$0	$0	$0	$0	$0

Yield/ha

Table requires Table 1 parameters + water price/ML + ML /ha applied

Year 1 Summer: Gross Margin ($/ha) — Commodity Price/Unit

$/ML V Price	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0

Water Price/ML

Table requires Table 1 parameters + water price/ML + ML /ha applied

Water pricer

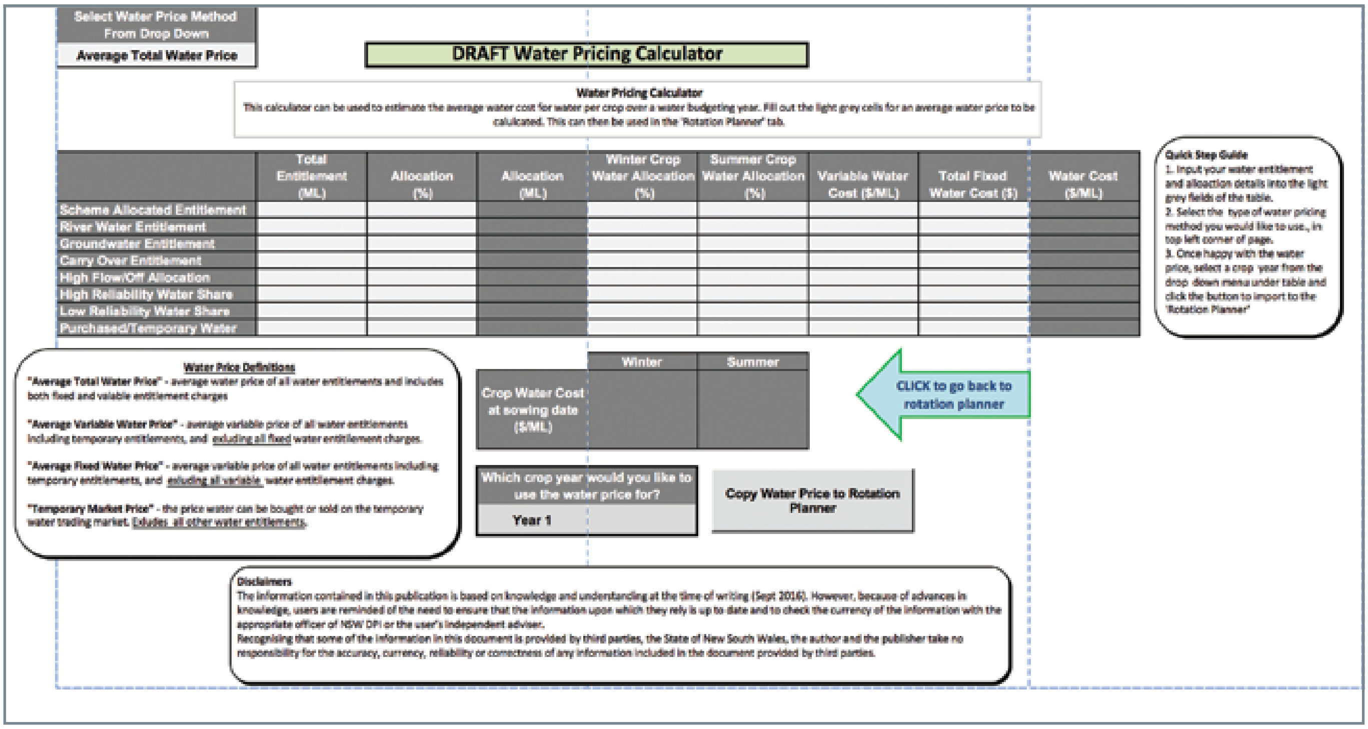
The final part of the double cropping planning jigsaw is the cost of water. The Correct Crop Sequencing Decision Support Tool allows all sources of water to be included into the final average price of water used in the gross margin calculations. Each source of water can be entered into the table and its price, as well as the proportion to be used on the winter or summer crop.

Keep in mind that the strict interpretation of a gross margin is to only include variable costs, so fixed water costs or charges are not used in the calculations.

The *Water Pricer* worksheet also calculates the *Average Variable Water Price, Average Fixed Water Price* and the *Temporary Market Price* by selecting the drop down tab in the top left hand side of the worksheet.

YOU MAY choose to use the full cost of water in your gross margin — just enter the full cost value in the "variable" column.

Similarly, irrigators calculate the price of water in their gross margins in many ways — from the actual cost through the wheel to opportunity cost on the temporary water market. Whatever your choice, just be consistent.



Rotation choices and implications for double cropping

In order to grow two crops under irrigation in 52 weeks or less, there are a number of issues that growers and their advisers need to consider to understand correct crop sequencing and double cropping.

THE field trial component of the *Correct Crop Sequencing for Irrigated Double Cropping* project investigated a range of rotation options and agronomic challenges encountered in double cropping. Field trials were conducted at Leeton Field Station, operated by the NSW Department of Primary Industries.

After consultation with irrigators, a series of rotations was designed and planned for the trial, as outlined in Table 1. Gross margin returns for all rotations are also shown in Table 1. Gross margin returns for individual crops, as well as price and yield, are shown in Table 2.

In the trials, cotton proved to be the most profitable crop. From a gross margin perspective, it returned $4766/ha or $477/ML as an individual crop, and $6233/ha as part of Rotation 3.

Cotton was considerably more profitable than other crops when considered individually. Maize returned $1692/ha or $176/ML and soybeans returned $933/ha or $125/ML.

Winter cropping gross margins were competitive with summer crops on a $/ML basis. In the trials, faba beans had the highest gross margin of $1491/ha or $481/ML, with wheat gross margin of $723/ha or $222/ML in second place.

The gross margins presented in this publication are a 'snap-shot' in time, reflecting the prices and yields obtained in the trial, for that season; therefore gross margins are a guide only.

Commodity prices and the cost of water are constantly changing, so when planning to grow a crop ensure gross margin analysis uses current prices. Also use a conservative yield estimate based on personal experience with the crop and local yields. The Correct Crop Sequencing Decision Support Tool developed by this project aims to make gross margin analysis and crop comparison more streamlined (see Section 2).

While individual crops may be very profitable, crop diversity is important for the health of the farming system, risk management and medium–long term business profitability.

Table 1. Seven double cropping rotations investigated over five cropping seasons at Leeton, with gross margin returns

Rotation	Year 1		Year 2		Year 3	Gross margin	
	Winter	Summer	Winter	Summer	Winter	$/ha	$/ML
1	Fallow	Soybeans	Fallow	Maize	Fallow	3014	167
2	Fallow	Soybeans	Fallow	Soybeans	Fallow	1971	131
3	Fallow	Cotton	Faba beans	Fallow	Wheat	6233	476
4	Wheat	Soybeans	Wheat	Soybeans	Wheat	3037	147
5	Wheat	Fallow	Wheat	Fallow	Wheat	1565	237
6	Barley	Soybeans	Barley	Soybeans	Barley	2977	141
7	Canola	Canola	Faba beans	Fallow	Canola	3356	222

Table 2. Price, yield and gross margin returns for individual crops, averaged across rotations

Crop	Price	Average yield	Gross margin	
	$/t	t/ha	$/ha	$/ML
Barley	241	5.2	542	202
Canola	449	3.4	566	189
Faba beans	450	4.6	1491	481
Wheat	258	6.2	690	180
Cotton	500*	13.9	4766	477
Maize	287	11.4	1693	176
Soybeans	512	3.1	933	125

* per bale

Cotton

Cotton is a long season crop (about 180 days) and seldom used in a double cropping program. With such a long growing season, cotton is not suitable for true double cropping rotations (two crops in one year) however cotton was included in the *Correct Crop Sequencing for Irrigated Double Cropping* field trials at Leeton to compare double cropping rotations with a range of potential crops.

Cotton is usually sown as a back to back crop or in rotation with a winter cereal. Given the high gross margins possible with cotton, it would not make financial sense to do anything that would compromise yield. When cotton is included in a rotation, it is always sown first without a winter crop immediately preceding it.

In a back to back sequence, the winter period after cotton picking is used for pupae busting, bed renovation and nitrogen application for the next cotton crop. When sown in rotation with a cereal, cotton is always sown first. A cereal is included in the rotation every few years when looking to renovate beds, enable rotation of herbicides, provide a disease break and improve soil structure.

Establishment

The sowing window for cotton is based on soil temperature and starts when soil temperature reaches 15 °C at a depth of 10 cm. Most growers aim to have the majority of their crop sown in the first two weeks of October. Deep furrows can be used to keep beds high (and maintain higher soil temperatures) as well as quickly drain water beneath the plants.

Timely establishment is the key to a successful cotton crop. The further south you are, the more critical is timing. The timing of harvest of a winter crop and the need to cultivate the stubble, makes it almost impossible for timely sowing of a cotton crop in true double cropping programs.

Plant growth regulation

A plant growth regulator is required to 'stop' the plant continuing to flower, allowing the flowers to develop in time to form mature bolls before the season finishes.

Harvest

Harvest date will be influenced by sowing date and the relative warmth of the season. Cotton grown in northern Victoria has struggled to mature in some seasons and harvest has been delayed well past the optimum date for sowing a winter crop.

In developing cotton areas, accessing harvest machinery is proving to be difficult, which potentially delays harvest and the sowing of the following crop.

Stubble and pupae busting

After the cotton is picked, the stubble is mulched (with a flail mulcher) leaving trash on top and plant stalks about 150 mm long. Root cutters (disc types) are used to cut out the remaining plant stalks and to disturb the top 10 cm of soil. A tyned implement is then used to cultivate and pupae bust.

If all of this works to plan, the cereal crop is sown with a disc seeder by June and harvested by mid-December, leaving a nine month break until the next cotton crop.

Faba beans have also been successfully grown after cotton but it does not give a disease break and care needs to be taken as disease problems may increase in the subsequent cotton crop.

In some seasons, the operations that occur after picking cotton may not be completed until about mid-July, which prevents the opportunity for direct drilling a winter crop.

Maize

Marketing

It is essential to understand markets for maize (grits, feed or speciality types) and establish if contracts are available before committing to growing a maize crop.

Maturity and sowing

The sowing window for maize ranges from early October through to early December, depending on region and variety. Establishment is the key to a successful crop so ensure adequate preparation time, fertiliser placement and suitable equipment to handle the sowing conditions (crop residues, soil tilth).

As a general rule, longer season varieties have greater yield potential. But if maize is part of a double cropping rotation, a lesser yield from a shorter maturity variety may be acceptable to assist with timely winter crop sowing.

The Correct Crop Sequencing — Decision Support Tool (Section 2) can provide a useful analysis of the gross margins in these scenarios. Is it better to have a higher maize yield and gross margin and forgo the winter crop than less maize yield but added income from the winter crop? The results from the comparison will vary from year to year as commodity prices and water availability fluctuate.

Availability of sowing contractors (if necessary) is an important consideration when planning a maize crop, as most crops are established by sowing into moisture and having the contractor on site at the correct time is critical. Some growers do have success watering up but this tends to be later in the sowing window and layouts need to be quickly watered and drained.

The later that sowing occurs, the more likely that grain drying will be required. This can add up to $30/t in costs when drying and freight are included.

Herbicide tolerance

Imidazolinone tolerant (IT) maize can be used if Group B herbicide residues from the previous crop are suspected — either through the growing of Clearfield® winter crops or application of Spinnaker® to faba beans. Unfortunately for double croppers, IT maize varieties are longer season varieties.

Plant back options

Ensure there are no plant back restrictions for maize when determining herbicide applications for crops preceding maize. It is important that there are no herbicide residue levels to reduce crop performance when committing to a high-input maize crop.

Desiccation and harvest

Desiccation of maize at the black layer stage of grain will improve timing, quality and efficiency of harvesting and ensure even grain drying throughout the paddock. The crop can be harvested within two weeks and paddocks pre-irrigated to provide sowing moisture for the next crop.

Stubble

Modern sowing equipment can handle maize stubbles, however if access to such equipment is not possible, maize stubble may compromise sowing and establishment of the next crop. An effective way to manage maize stubble (where possible) is to mulch the stubble to near ground level to dry the green sap and when burning permits are available, burn the residue.

Experience indicates that a crop sequence needs to be initiated around a summer crop — cotton, maize or soybeans.

Soybeans

Benefits of soybeans

Soybeans do not require specialised equipment, and they use less water and have a shorter season than many other summer crop options.

Sowing

The sowing window for soybeans is from early November through to late December in the MIA and CIA and from the first week of November until the end of the first week of December in the Murray Valley and northern Victoria — there is no compromise on sowing date.

Timely sowing enables the plant to accumulate enough biomass before the plant begins to flower. Harvest is then expected to be in late March to mid-April harvest, which reduces the risk of autumn rain and pod shedding.

The ideal situation is to pre-irrigate and sow into receding moisture. Dry sowing and watering up is highly risky, particularly where the soil surface crusts.

Stubble

Stubble after a soybean crop is generally light enough for most seeders to cope with. If the stubble load is going to cause a problem, it can be mulched or chopped after harvest.

Wheat

Maturity and sowing

Similar to barley, there is a wide range of varieties available with differing characteristics and different maturities. Varieties suitable for double cropping are assumed to be those with a shorter season length such as Axe⟨PBR⟩ or Dart⟨PBR⟩. These early maturing wheats have less ability to tiller than the later maturing wheats, which seem to have a yield ceiling of 5–6 t/ha. The sowing window for early to mid-late maturing varieties is the first two weeks of May.

Straw strength

When considering a variety, as well as the maturity, think about straw strength. Some wheat varieties are prone to lodging, which makes harvest more difficult. Severely lodged crops may re-tiller and delay harvest while these new tillers mature sufficiently. In this situation, windrowing or desiccation of the crop should be considered and has been proven to be quite successful.

Crop height

Crop height is an important factor as part of the double cropping planning process. Consider the conditions needed by the next summer crop when planting the winter crop. Choosing a shorter variety may be the best choice for harvesting low and being able to sow the next crop directly into the wheat stubble. If the plan is to rake and bale post-harvest to reduce stubble issues, then a taller crop will not be an issue.

Watering up

Generally, the preferred method of establishment for wheat is pre-irrigation and sowing into receding moisture. The drawback of this approach is a delay of up to three weeks between irrigation and sowing, assuming there is no rain in the meantime.

Watering up can work but is far more risky, particularly if the subsoil is already moist and there is an opportunity for ponding on the soil surface. Rain after watering up can be disastrous if the seedlings have not emerged and weeds can be more difficult to control and will require post-emergent herbicides.

Harvest

For crops sown in the first two weeks of May, harvest would be expected from mid-November for early maturing varieties through to early December for mid–late varieties.

Stubble

Wheat stubble generally handles well and should not hinder sowing of the following summer crop if wheat varieties are chosen with stubble management in mind, in terms of straw strength and crop height. As well as direct sowing into the wheat stubble other management options may be burning, slashing, mulching or baling.

Barley

Maturity and sowing

Barley is suited to double cropping rotations due to the availability of early maturing varieties. These varieties can yield as well as some of the later maturing lines, as demonstrated in the *Southern Irrigated Cereal and Canola Varieties Achieving Target Yields* project. However these varieties need to be sown on time — the first week of May is a good target date.

Barley can cope better with later sowing than other cereals if the summer crop harvest is delayed but yield potential is reduced and the advantage of early maturity is lost in the spring.

Straw strength

When considering a variety, as well as the maturity, think about straw strength. Some barley varieties are prone to lodging, which makes harvest more difficult.

Severely lodged crops may re-tiller and delay harvest due to extra time for the new tillers to mature sufficiently. In this situation, windrowing or desiccation of the crop should be considered and has been proven to be quite successful.

Crop height

Crop height is an important factor when selecting a variety for double cropping planning. Consider the conditions needed by the next summer crop when planting the winter crop. Choosing a shorter variety may be the best choice for harvesting low and being able to sow the next crop directly into the barley stubble. If the plan is to rake and bale the stubble, then a taller crop will not be an issue.

Drainage

Paddock choice is important for barley, as it can be more susceptible to waterlogging than other cereals. The preferred method of establishment is pre-irrigation and sowing into receding moisture. Watering up can work but is far more risky, particularly if the subsoil is already moist and there is ponding on the soil surface. Subsequent rain can be disastrous if the seedlings haven't emerged and weeds will be more difficult to control, and post-emergent herbicides will be required.

Harvest

Depending on the sowing date, variety and the season, harvest could be planned for mid-November.

Stubble

Barley stubble generally handles well and should not hinder sowing of the summer crop if varieties are chosen with stubble management in mind, in terms of straw strength and crop height. As well as direct sowing into the barley stubble, other management options may be burning, slashing, mulching or baling.

For the winter phase to commence on time, it is essential that moisture availability, winter seedbed preparation and sowing are correctly managed. If summer harvest is delayed, consider fallow and/or bed remediation rather than sowing a winter crop too late.

Canola

Maturity and sowing

As a general statement, the maturity of canola fits well with many summer crops, however to maximise yield potential, sowing should be targeted from mid to late April. Due to the small seed size, canola establishment is slightly more difficult in stubbles but can be achieved with suitable seeders. Many growers have success in sowing dry and watering up. There are many varieties to choose from with a range of herbicide tolerances, plant heights and maturities. The early-mid to mid maturity varieties offer the best yield potential based on the results of the *Southern Irrigated Cereal and Canola Varieties Achieving Target Yields* project.

Herbicide tolerance

Herbicide tolerant varieties are useful when controlling weeds in canola but keep in mind the yield penalty that comes with triazine tolerant varieties; the potential for herbicide residues in Clearfield® varieties (although evidence suggests that plant back recommendations for maize are very conservative); and limited delivery options and market discounts for Roundup® Ready varieties.

Windrowing

Windrowing has a range of benefits for all canola crops but especially so when double cropping. Apart from avoiding shattering losses, it also evens out ripening and brings forward harvest. Windrowing is recommended when 40–60% of seeds have changed colour. Typically windrowing takes place in late October–early November and the crop is harvested two weeks later. Desiccation is an alternative to windrowing, especially if weeds are present in the crop.

Harvest

In double cropping, canola should be managed so harvest occurs mid to late November.

Stubble

Canola stubbles are generally light enough for most seeders to cope with the stubble load. However, there may be problems when windrowed crops are harvested with headers that have poor or no chopper/spreader, leaving a dense mat of pods below the chaff trail. Baling may be an option to remove the chaff trails and then a multidisc cultivation can be carried out to distribute the pods.

Faba beans

Crop benefits

Faba beans have numerous advantages in the rotation — they have been quite profitable for several years and contribute significant amounts of nitrogen to the following crops. Tolerant of mild waterlogging, they are well suited to surface irrigation layouts. The days of 'failure beans' are behind growers, with improved disease resistance in varieties and adoption of proactive fungicide strategies.

Maturity and sowing

With improved disease management, sowing dates have become progressively earlier and many crops are now sown in late April. This has seen yield potential increase but the risk of lodging has increased as well. Crops sown in late May are slow to emerge and have lower yield potential and delayed harvest.

Harvest

Most faba crops are direct harvested in late November but they can be windrowed when the hilum is black to bring forward harvest slightly, make ripening of the crop more even and aid harvest if weeds such as prickly lettuce are an issue.

Stubble

Faba bean stubble is generally easily handled if the plant material is dry but it can 'ball up' if damp.

Hay

Maturity and sowing

A hay crop can be particularly useful in a double cropping rotation as there is a lot of flexibility with sowing and harvest times that can allow a 'catch up' and get the rotation plan back on schedule. Hay crops are typically oaten hay but do not ignore other cereal options,

There is a broad range of maturities amongst the varieties, resulting in a sowing window from April through to June. Choose a variety where the sowing and maturity dates match the timing of other crop. For example there is no point in sowing early if the hay crop will be ready to cut in early September. In this situation, a silage crop may be more suited to the rotation if a market is available. Late sowing can work if a short season variety is selected but yield potential is reduced and sowing rates need to be increased to compensate for lower tillering.

Straw strength

When considering what variety to grow for hay, as well as the maturity, think about straw strength. Some oaten varieties are tall and prone to lodging under irrigated conditions, which makes mowing more difficult.

Crop height

Crop height is an important factor when selecting a variety for double cropping. Consider the conditions needed by the next summer crop when planting the winter crop. A shorter variety may be the best choice for harvesting low and being able to sow directly into the stubble. If the plan is to rake and bale the stubble, then a taller crop will not be an issue.

Drainage

Oats tend to more tolerant of waterlogging than other cereals. The preferred method of establishment is pre-irrigation and sowing into receding moisture. Watering up can work quite well but will rely on post-emergent weed control, and the range of herbicides available for the control of weeds in oats is not as great as for the other cereals.

Mowing

Depending on the sowing date, variety and the end market, mowing could be planned for late August through to early November.

Stubble

One of the valuable characteristics of growing a hay crop is the lack of stubble following harvest. As soon as the bales are off the paddock, preparation or sowing for the summer crop can commence.

While this section of the book has focused on the crops grown in the Leeton trial, niche crops and seed crops may also be suitable for double cropping, depending on the opportunities available to the irrigator.

Rice — as an option for double cropping?

THE extensive crop sequencing experiment conducted for the *Correct Crop Sequencing for Irrigated Double Cropping* project was conducted at Leeton Field Station in a field where water could not be ponded. Therefore it was not possible to include rice in the rotations investigated, in addition to the scope of the project being primarily GRDC-levied crops.

With improved irrigation layouts and shorter season varieties, rice is increasingly being considered as an option for double cropping programs. In particular, new irrigation layouts with raised beds in bankless channels layouts provide flexibility to move from rice to other crops in consecutive seasons. The availability of shorter season rice varieties provides rice growers with options for sowing in late November with no yield penalty. With the right combination of layouts and variety, it would be possible to sow rice after the winter crop harvest, and then complete rice harvest in time for sowing a winter crop the following year.

Management considerations for double cropping

While economics point to the crops that return the most profit, irrigators and farmers know that crop choice is not that simple. And especially so, when double cropping.

THE ideal rotation or crop sequence depends not just on the profitability of a single crop but the overall profitability of a sequence of crops. Further, to achieve a profitable sequence, timing of planting and harvest must be complementary from one crop to the next, as well as crop management practices, particularly crop residue management and plant back periods for herbicides used.

Trial results, as well as previous experience of irrigators, has enabled the following information to be collated about considerations for decision making and management requirements in double cropping.

Soil type

Ensure crops planned for the rotation are matched to soil type, e.g. only grow soybeans on free draining red loam soils. Maize is adaptable to heavy clay soil types where waterlogging may occur and the establishment of other crops on receding pre-irrigation moisture is difficult.

If soils are difficult to drain, bed farming with bankless channels may be a better option than other irrigation layouts, such as border check.

Irrigation layout

Border check layouts are suitable for double cropping when there is sufficient channel supply to achieve the *water on–water off* time of 4–6 hours. This assists drainage for quicker paddock drying. Irrigation timing on a 4–5 day cycle will be needed in summer when heatwave conditions occur.

Fast flow technology to increase channel supply is important for any irrigated cropping but particularly double cropping where there is not time to delay crop growth. An irrigation system that allows water delivery to bays of 15–30 ML per day offers the flexibility of quicker times for *water on*, however the soil must have sufficient infiltration to allow full replenishment of the root zone.

Drainage is particularly important. While there is a range of ways to reduce water on times, any advantage is lost if bays take too long to drain. Similarly, high flows can mean high water losses if bay changeover timings are incorrect. A re-use system will help manage over-irrigation. All paddocks should be drained and water recycled.

Bankless channel layouts with beds or pontoon systems are proving to be effective for a wide range of crops, giving irrigators flexibility with crop choices as well as improved crop production conditions. Terraced bays may be better suited to steeper red soils. However on flatter grey clay slopes, if there is excess stubble in bankless channel layouts, water can stall and be pushed over the tops of furrows.

Siphon irrigation is worth considering for flatter slopes (1:1500 to 1:2000) where the paddocks are landformed well. Siphon irrigation may also be used in terraced bays on steeper grades. Siphons are best changed every 12 hours but labour needs to be organised and efficient.

Beds in irrigation layouts must be well formed with deep furrows — no water must go over the top.

If the integrity of beds is damaged (e.g. from a wet harvest) do not compromise future crops — withdraw from double cropping and renovate the beds. Soil compaction issues will penalise the following crops until damage is repaired. Sometimes "pulling the pin" and not double cropping is the best option.

Herbicide management

Planning and management of herbicides for double cropping takes into consideration all factors that are important in conventional cropping programs, such as crop tolerance, drift management and resistance management. However, herbicide residue management is particularly important in double cropping programs due to the rapid turnaround between cropping phases.

Growers must be very aware of the plant back periods for the herbicides used. Sometimes crop choice and the resulting herbicide program may mean that crop sequences need to be altered.

For example, legumes such as soybeans cannot tolerate residues of Group B or sulfonurea herbicides; and non-IT (imidazolinone-tolerant) maize and canola cannot tolerate residues of Spinnaker®.

Crop establishment

Consistent with any cropping program, plant establishment must be uniform. Correct sowing equipment, such as precision disc seeders, is particularly important with double cropping where stubble is retained. Precision sowing enables even germination, leading to even growth and ripening of the maturing crop.

The use of a lateral/pivot sprinkler for crop establishment is ideal to assist uniform establishment.

Effect of herbicide residues on maize

THE effect of herbicide residues from canola production was investigated on a maize crop, as part of trials conducted during the *Correct Crop Sequencing for Irrigated Double Cropping* project.

For the 2015–16 season, three maize varieties were was sown into the residue of the 2015 Clearfield® canola crop, which had been treated with Intervix® at 750 mL/ha in July. The canola crop received two spring irrigations (1.5 ML/ha) throughout the season. There was little yield difference between the imidazolinone-tolerant variety Pac607IT and the conventional variety Pac624, which had similar maturity (see table).

The trial was repeated in 2016–17, with an additional treatment of sowing maize into faba bean residue, where the faba crop had been treated with Spinnaker® (active ingredient imazethapyr) at 100 g/ha pre-sowing in early May. Once again, conventional maize was not affected by the system where Intervix® was applied, but the Spinnaker treated system did create some establishment issues — populations were down by 26% in P0021 and 34% in PAC624 (see table below) but the faster maturing P0021 did recover to yield reasonably well despite the poor establishment (some plants became multi-stemmed).

Note: Intervix® contains the active ingredients imazamox and imazapyr and is an early post-emergence herbicide for the control of certain annual grass and broadleaf weeds as part of the Clearfield® Production System for Clearfield Plus wheat, Clearfield barley, and Clearfield canola.

Yield (t/ha) of the three maize varieties when sown inside the recommended plant back period for systems treated with Intervix® and Spinnaker®.

Variety	Maturity	Intervix®		Spinnaker®
		Yield 2015–16	Yield 2016–17	Yield 2016–17
PAC607IT	118 CRM*	14.2	10.3	10.2
PAC624	118 CRM	14.7	10.5	4.6
P0021	100 CRM	12.2	9.4	9.2
p		*0.03*	*0.357*	*0.005*
lsd		*1.3*	*NS*	*2.7*
cv%		*2.2*	*8.7*	*17*

* Comparative relative maturity

Irrigation can affect the breakdown of herbicide residues. Some plant back recommendations on labels may be too conservative when double cropping.

Nutrient management

The demand for soil nutrients will be intensified in a double cropping program so it is important to develop a fertiliser program to match crop requirements. Correct nitrogen and phosphorus rates, determined via soil testing and crop usage, are required.

Before initiating a cropping rotation, it may be necessary to renovate paddocks to improve soil fertility and structure (particularly when the soil is hard). Topdressing with manure (5 t/ha) and gypsum (2.5 t/ha) will be beneficial.

'Strip tilling' or a heavy duty disc rig can be used to apply large fertiliser volumes below seed level within a month (September) of sowing maize (October) while leaving a small cultivated strip in a hill to improve crop establishment.

Irrigation management

Irrigation requirements can be assessed accurately using evapotranspiration (ETo) or soil moisture monitoring equipment. Capacitance probes or water potential probes (gypsum blocks) provide a convenient way to measure soil moisture with sensors located at representative sites and soil depths. More attention is then paid to frequency — often irrigating more frequently but using no more water.

Using capacitance tubes to 1 m depth (10 cm intervals) can enable irrigation frequency to be varied early in the season (2–3 leaf stage) and increased from tillering or when roots are showing greater depth.

With sprinkler irrigation, it is important to check sprinkler capacity — older sprinklers are renowned for being under-sized and have difficulty keeping up with summer demand. Calibration, maintenance and even distribution of sprinkler heads are required to ensure the crop receives adequate moisture.

Windrowing

Successful double cropping relies on seamless transition between summer and winter phases. One aspect of bringing about this smooth transition is to harvest the previous crop as soon as possible and then sow the next. Windrowing or desiccation of the crop is an option to ensure that a crop matures evenly and can be harvested in a timely manner, in relation to preparation and sowing of the next crop. Windrowing also is an option to even up the ripening of lodged crops.

Stubble

The management of stubble from one crop to the next is a critical component of double cropping. Too much stubble from the previous crop can impede sowing operations and reduce establishment success. The presence of stubble in furrows can cause water to bank and flow over beds.

Depending on the crop, stubble management may be an important issue when planning crop rotations, as well as ensuring a smooth transition from one crop to the next, when the rotation is underway.

There are many factors at play when considering the stubble management options. These need to be considered before harvest and will include available time, harvester options, sowing equipment, fire restrictions, contractor equipment and impacts on herbicides. All options should be considered — and sometimes burning may be the right choice. Some research work has shown that the impact of occasional stubble burning is minimal.

The *Correct Crop Sequencing for Irrigated Double Cropping* project managed stubble with direct drilling, mulching, baling header trails, chopping and shallow incorporation by multi-discing, harvesting with a header fitted with a chopper and spreader followed by suitable sowing equipment for both summer and winter crops.

All techniques will be successful when used in the appropriate situation and with the knowledge of what sowing equipment is to be used to sow the next crop and the capability of that equipment to handle stubble. Seasons and situations may affect some management decisions, and flexibility is required. For example, circumstances may change, affecting plans for pre-drilling fertiliser or herbicide applications.

For a detailed discussion on how to approach stubble management, read the *Managing Stubble* guide, available on the GRDC website (see *Useful resources* at the end of this guide for links).

The management of stubble varies from crop to crop. See Section 3 *Rotation choices and implications* for discussion on stubble management for individual crops.

Effectiveness of windrowing

WINDROWING of winter crops as an aid to bring forward harvest was investigated by the project.

The first windrowing experiment was with lodged barley in 2015. When lodging occurred prior to flowering, the crop began to re-shoot.

By windrowing when the crop was at medium dough stage (the grain is hard but can be dented with your thumbnail) the crop was ready for harvest approximately two weeks before the untreated crop.

The windrowing demonstration was repeated in 2016 with faba beans and wheat, purely to promote rapid maturity. In both crops, harvest was brought forward by approximately one week, compared with two weeks in 2015.

After harvest of the winter crops, a rapid turnaround was required for timely sowing of maize. This was achieved by using the correct machinery for the job — a header with a chopper that spread straw the full width of the front and a maize disc planter that could sow through the stubble.

Results of windrowing demonstrations, 2015

Barley	Treatment	Harvest date	Yield t/ha	Retention %	Protein %	Test weight kg/hL
	Windrow	29 Oct	6.23	61.0	15.1	71.0
	Direct head	3 Dec	6.28	63.1	14.4	66.3

Results of windrowing demonstrations, 2016

Wheat	Treatment	Harvest date	Yield t/ha	Screenings[a] %
	Windrow 1	24 Nov	6.06	0.2
	Windrow 2	28 Nov	5.97	0.2
	Direct head[b]	12 Dec	5.57	0.5

Notes
Windrow 1 occurred at medium/hard dough, thumbnail leaves a large dent.
Windrow 2 occurred at hard dough, thumbnail leaves a small dent.
[a]Windrowed wheat crop samples were threshed by hand, which may explain the low screenings.
[b]The crop was harvested on 12 December due to availability of machinery, however it was ready for harvest around 7 December.

Salvaging lodged crops

AS part of the *Correct Crop Sequencing for Double Cropping* project, the treatments for 2014–15 trial in northern Victoria focused on the use and residue degradation of Group B herbicides under irrigated conditions. The site at Numurkah was sown to Clearfield® barley and canola, as the winter phase of the double cropping rotation.

The only barley variety at that time with Clearfield herbicide technology was Scope CL. Variety trials had shown it to be prone to lodging in high yielding situations. The Numurkah trial site was pasture for several years and had a high nitrogen status. Combined with early sowing, this resulted in excessive vegetative growth and the barley crop began to lodge in late August.

Inspection in late October showed that while the majority of the barley was approaching maturity, a fresh crop of new tillers had sprung up where the crop was badly lodged. As timely harvest is essential for successful double cropping (so that the following summer crop can be planted on time), methods of accelerating the barley ripening were tested, namely desiccation and windrowing.

Windrowing timing is dependent on the crop being ripe enough. The Western Australian Department of Agriculture and Food publication Barley harvest and grain quality was used as the guide for when to windrow (or swath). An excerpt on timing from the publication follows.

When to swath

SWATHING can begin when grain moisture content is below 35% and when the grain is at the medium dough stage and is hard but can still be dented with the thumbnail. It is better to swath early to prevent losses from shedding and lodging, but do not swath when the ground is wet after rain.

Grain filling studies have shown that barley reaches maximum grain weight when all of the green tissue has gone from the flag leaf sheath and the peduncle (stem immediately below the head). Avoid swathing too early as the grain is not fully developed and this will give small pinched grain. Whilst it is often easier to swath later than earlier, the swaths of a ripe crop may not interlock well enough to withstand disturbance from a strong wind.

High yielding crops are likely to gain more from swathing than low yielding crops. Generally, crops that are likely to yield less than 2 t/ha should not be swathed.

The crop was windrowed using a canola windrower with enclosed knife guards. Even though the crop was quite lodged, the windrower missed less than 1% of heads.

An inspection of the windrow one week after windrowing showed the underside was drying quite well. The windrows were quite large but did not collapse prior to harvest. The windrow dried quite well and could have been harvested two weeks after windrowing.

The other treatment was desiccation using Roundup® Attack™. This product is registered for wheat but not barley. The instructions for use on wheat are to apply when the grain is at the late dough stage (28% moisture) onwards, and the grain will not be used for seed or sprouting, which automatically excludes the product's application on malting barley. The herbicide was applied at 1.5 L/ha with 100 L/ha of water. Again, the desiccated crop was ready to harvest two weeks after application.

Actual harvest occurred on 3 December 2014, partly due to waiting for the untreated crop to ripen but also waiting for a contractor to harvest the paddock.

The appearance of the desiccated and untreated crop was similar prior to harvest, with no noticeable loss of grain. The lower yield from the desiccation treatment was probably more due to paddock variability than a negative effect from desiccation.

The windrows were uniformly gold on top but the green shoots underneath had dried and remained green in colour. All grain moisture levels were similar at harvest (approximately 9%).

Harvested grain contained some dirt in the sample, with the canola front picking up some dirt attempting to lift the windrow up and the fingers flicking dirt up into the windrow. Dirt also was in the untreated sample due to the header front being very close to the ground and the plants, lying sideways, sometimes jamming in the knife guard and being pulled up rather than cut off by the knife.

Overall the experiment was a success, with the canola windrower (in the hands of a skilled operator) quite successfully windrowing the crop and harvest being brought forward by two weeks. Grain yield or quality did not suffer as a result of windrowing, but careful assessment of the maturity of the crop needs to be made as there is the potential for early windrowing having a negative effect on grain quality.

Crop results for desiccated, windrowed and direct headed barley

Treatment	Date	Yield t/ha	Retention %	Protein %	Test weight kg/hL
Desiccated	29 Oct	5.31	67.0	14.3	69.7
Windrowed	29 Oct	3.23	61.0	15.1	71.0
Direct headed	3 Dec	6.28	63.1	14.4	66.3

Machinery and labour

There is a huge range of machinery with differing capabilities in terms handling stubble. Having specialised equipment for the situation, e.g. for sowing into maize stubble, cuts the preparation time and ensures timely sowing. The alternative is to cut, rake, bale and multidisc, which is not ideal, especially in double cropping where every day counts.

As well as using the *right equipment*, having access to the equipment at the *right time* is critical. Owning the machinery certainly makes life easier (but maybe not for the financial adviser or bank manager!). However, the economic option may be to find a reliable contractor who understands the need for timely operations.

The harvest of one season's crop will almost certainly coincide with the sowing time of the next season's crop. Murphy's Law! Having access to required labour to manage the competing priorities is essential. A reliable contractor is worth their weight in gold at this point.

Ensure you have access to the right equipment — you must be able to harvest and sow a new crop on time. It all happens at the same time and you have to be well resourced.

Financial assessment

Gross margin calculations are essential both before and after each cropping phase. While there are standard spreadsheets available to determine gross margins, it is also very beneficial to retrospectively develop individual crop gross margins, as soon as possible after harvest. These will be customised for a particular situation, location and management style. The retrospective gross margin provides an up-to date base document to review variable costs and compare current pricing when there are new purchasing and selling opportunities, e.g. water, fertiliser and commodity prices for current or upcoming crops.

Double cropping needs to be profitable and reflect the additional labour and effort required over conventional rotations. For example, barley may be the best crop option in terms of maturity but there is a price differential between barley and wheat. Additionally, if the crop becomes stressed, barley screenings will increase whereas wheat can be more closely managed for yield and protein.

Water use needs to be factored into overall planning. Winter crops are more water efficient at 2.5–3.2 ML/ha; and border check may use less water than other layouts.

Compare buying water within a gross margin — it is an option and will be undertaken as insurance or to finish crops in dry years or lower allocation.

Conclusion

Double cropping takes planning, personal drive and access to the right equipment and infrastructure to ensure everything occurs in a timely manner. While it is not for every irrigator, for those with the inclination and resources, double cropping can maximise returns per hectare and per megalitre.

The major output of this project, the Correct Crop Sequencing — Decision Support Tool, helps irrigators consider and plan crop sequences and the best use of water in light of varying returns, water prices and seasonal conditions.

Useful resources

Trial results summaries

www.irrigatedcroppingcouncil.com.au

Correct Crop Sequencing Decision Support Tool

http://www.dpi.nsw.gov.au/agriculture/budgets/costs/cost-calculators/correct-crop-sequencing-decision-support-tool

Situation analysis for double cropping in the GRDC southern region

Project report for VIC000010 published in 2014

/// add link when available

Double Cropping in Northern Victoria

A best management practice guide published in 2009

/// add link when available

~~Project reports/details~~ from canola and wheat achieving higher yields

~~/// add link when available~~

~~Project reports for *Southern Irrigated Cereal and Canola Varieties Achieving Target Yields* (DAN00198)~~

Stubble management

https://grdc.com.au/resources-and-publications/all-publications/publications/2012/05/managing-stubble

Acknowledgement

This guide was produced for the GRDC-funded project *Correct Crop Sequencing for Irrigated Double Cropping* (VIC00010), with co-funding from the Irrigated Cropping Council Inc and NSW Department of Primary Industries. The project was led by the Irrigated Cropping Council. ICC managed on-farm trial sites at Kerang and Numurkah in northern Victoria and the NSW Department of Primary Industries managed the trial site at Leeton Field Station in NSW.

The author acknowledges Rob Fisher and Tony Napier for their contribution to this document.

Further information

Damian Jones

Trial Manager

Irrigated Cropping Council, Kerang, Victoria

Mobile: 0409 181 099

Email: damian.jones@irrigatedcroppingcouncil.com.au

Web: www.irrigatedcroppingcouncil.com.au

Twitter: @Canola_Boy

Tony Napier

Research & Development Agronomist – Southern Cropping Systems

Yanco Agricultural Institute,
NSW Department of Primary Industries

Telephone: 02 6951 2796

Mobile: 0427 201 839

Email: tony.napier@dpi.nsw.gov.au

Web: www.dpi.nsw.gov.au

Should I double crop?

1. You need to have the personal drive and enthusiasm to double crop.
2. You need excellent agronomic skills (or a good advisor).
3. Determine the most profitable crop sequence for your farm using the ***Correct Crop Sequencing Decision Support Tool***.