Double cropping

– the northern Victorian experience

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- Research has been conducted over many years to investigate the potential of double cropping systems – however there has been little adoption of the practice in northern Victoria or southern NSW
- Issues such as stubble management, harvest and sowing conflicts between summer and winter crops, and the best combination of winter and summer options were identified as barriers to adoption
- A 'double cropping' project was instigated in 2006 to target these barriers and better understand them or resolve them through field trials
- There are also many opportunities with double cropping and the results from the project have been highlighted in a best management practice guide, which will hopefully see a greater uptake of this farming system

The double cropping project focused on opportunities to improve the profitability and water use efficiency of irrigated cropping. Double cropping systems (growing a winter and summer crop following one another) provide the opportunity for farmers to capitalise on their investment in irrigated agriculture.

Over 90% of the irrigable land in the Goulburn Murray irrigation area is laser graded to border check irrigation layouts. Irrigation developments in northern Victoria represent a significant investment by irrigators. The opportunity to take advantage of this investment with the intensive cropping and improved water efficiency practice of double cropping, is high.

As well as the focus on double cropping, the project demonstrated best management practices for the individual crops, covering issues of nutrient budgeting and irrigation scheduling. Best management practices have been identified for most crops already but not for when these crops are grown in double cropping rotation systems. This aspect has been neglected, particularly in Victoria.

Figure 1. *Double cropping systems have the potential to increase the returns on investment in irrigation developments and maximise water use efficiency.*

The project had a large natural resource management element. There is continuing pressure for irrigation to reduce its impact on the environment. Making use of water 'left over' from the previous crop has the potential to increase water use efficiency and reduce potential for accessions to the groundwater – and this is a fundamental benefit of double cropping systems.

The project, formally called *Lifting Irrigated Cropping Profitability and Water Use Efficiency*, was funded by the Grains Research and Development Corporation (GRDC), and managed by the Irrigated Cropping Forum (ICF). It complemented a project of the same name carried out in southern NSW that also investigated previous research and experience of double cropping systems, identified barriers to adoption and highlighted best practice in current irrigated cropping systems.

The 'take home messages' from this project come from the observation and results of field trials, as well as drawing on knowledge from experienced growers. Additionally, a field trial was conducted from 2006 to 2008 on a site east of Echuca in northern Victoria to further investigate double cropping. Winter crops included wheat, barley, oaten hay, faba beans, canola and shaftel clover, however some crops were salvaged for hay in the drought conditions instead of being grown for grain. Summer crops included maize, sorghum (both to silage) and soybeans.

Nutrition & irrigation

One of the key aspects in achieving maximum yielding crops is setting target yields and then feeding the crop with the required nutrients to grow this yield.

Soil testing is critical to determine what nutrients are accessible in the root zone profile and then taking into account the soil

Figure 2. The project has defined best management practice for double cropping systems, and recommends that nutrient and water applications are determined on the basis of target yield and soil measurements.

Figure 3. Reduced water allocations during the project have forced consideration of crop options such as fodder, which helped growers realise that being flexible in their farming system is a way to manage seasonal variability in weather conditions.

health status of the crop to determine mineralisation. Nutrients will be left over from a crop if inputs are set for high yields and the target yield is not achieved.

Moisture monitoring probes were installed at the trial and are critical to determine periods to refill the soil profile by scheduling an irrigation event. All crop types (winter and summer) can have this technology applied and will be critical in the future of irrigated cropping. By knowing the exact amount of moisture through the soil profile, the crop is able to grow without being exposed to moisture stress periods, which at critical growth periods can cause severe reductions in yield. By combining agronomy knowledge with measurement of moisture levels, irrigation scheduling can be planned to reduce yield limiting moisture stress.

The trials also reinforced that pre irrigation to establish both summer and winter crops follows best management practice. Moisture sensors in the ground at this period can indicate the level of moisture left over from the previous crop and determine the expected amount of water to be used per hectare.

Fodder options

Northern Victorian irrigated cropping farmers generally have a good level of understanding of how to grow winter grain crops. During the period over which this project was conducted, water allocations were low and at times water supply was not available when the crops required moisture (early spring). This was an opportunity to provide extension messages supported by trial results and gross margin matrices that provided growers with the decision making process of determining the options for crops. This has been a great benefit for the industry because growers have realised that being flexible in their farming system is the way to manage seasonal variability in weather conditions.

Cereal hay is now determined to be a valuable fodder crop sought after by the intensive industries that share the Murray Valley. Farmers have the option after assessing crops for the grain potential with irrigation and non irrigation scenarios to:

- stop irrigating and cut for hay and trade water/retain for summer crop or
- continue to irrigate and harvest for grain and use subsoil moisture, if available, to grow a short season summer crop.

Gaining the advantage of a hay decision depends on farmers being aware of the correct times of cutting to manipulate quality and quantity, which can place added value to the farm gate price, but also ensuring timely removal of dry matter for a summer crop to be sown in the correct window to achieve maximum yields and significantly contribute to the gross margin of the paddock.

Crop types & variety selection

Victoria has a slightly shorter summer season than NSW (cooler starts to summer and a mild autumn, which limits the growing season of summer crops). Historically this has meant that two crops that ideally require 13 months to grow, mature and harvest were being forced to grow in 12 months. The general result was a part sacrifice to one crop's maximum potential yield in order for the following to be sown on time.

Genetic improvement to varieties in all crop types now allows a range of optimum sowing windows with the choice of short, mid and long season types generally being available with slight differences in yield potentials.

According to the sowing date, the crop harvest date can be manipulated with the use of different varieties. The rotation is still an issue in the irrigated varieties with the pulse crops of soybeans in the summer and faba beans in the winter being inconsistent with yields. Price variations will also affect gross margins, so although the obvious benefits of a pulse crop with herbicide rotation for weed control and positive soil health benefits, these crop types can lower gross margins. Major gains for the grains industry will continue with focused research and development of winter varieties suited to irrigated conditions.

Harvesting & sowing

The conflict of harvesting and sowing times is a major barrier to the adoption of double cropping because the two operations are required to be done in a short space of time. If the farm has limited labour units, then long hours of work or the assistance of casual work is required. Time management needs to be administered at high level. Contractors can be engaged if specialised equipment (harvesting and/or sowing) is required and these tasks can be performed efficiently.

When stubble is correctly managed and the soil moisture condition promotes good germination, then sowing with a direct drill machine is possible and timely. The project investigated the practice of handling heavy stubble loads from the previous crop, however all stubbles were treated prior to sowing, ie mulching, rolling (maize).

Straw spreaders are currently available which can chop up stubble and spread the straw residues evenly. Straw can be value-added by baling-up dense irrigated-crop stubbles and assist machinery at sowing time and promoting good seed/soil contact. Advancements in sowing machinery have a number of ways to enable successful direct drilling of crops, allowing for one pass sowing and improving timeliness.

Harvesting/sowing conflicts will collide in double cropping but direct drilling allows for the successful establishment of crops in close time sequence after harvesting the previous crop. At times, stubble will need to be treated but if you follow the rule that sowing starts with the harvest of the previous crop, then the correct preparation should be performed.

Knowing the nutrient status of soils is essential to match the crop requirement to maximum potential yield. Starter fertiliser placement can be accurately performed at sowing, without germination percentage reductions. With high yielding/high input summer crops, a large proportion of fertiliser and be placed well below the seed to be efficiently taken up by the crop during the season. The contractor used in the trial was able to use a modified machine to place the nitrogen (upfront) with minimal soil disturbance. This was a specialised piece of equipment and it shows that deep ripping with precision to place fertiliser in the correct placement for root uptake, and with disturbance that would suit a direct drilling systems.

Flexible system to maximise water efficiency

Victorian irrigators operate under a different environment to NSW irrigators. Victoria has a greater reliability of supply and traditionally only one type of irrigation layout that is generally well suited to soil type and able to support many crop types. These factors all work together to support the idea of using irrigation water intensively and gaining the maximum water use efficiency from each ML/ha. With recent dry seasons influencing water allocation, the project has demonstrated more than ever the importance of having a system that is flexible and capable of adjusting according to risk and profit in a complete business decision making process. The promotion of soil health farming techniques cannot be under estimated and should be the aim of all farmers, which will leave the land in a better state than when they started.

Detailed results of the double cropping trial will be available in the publication….*Best management practice guide – double cropping in Northern Victoria.*

Further information

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