



IRRIGATION RESEARCH & EXTENSION COMMITTEE

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FOR IRRIGATION CROPPERS

The new “V-Bay” flexible layout

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Introduction

Rice is seen by most irrigators with General Security access licences in the irrigation districts of southern NSW as their most profitable and reliable crop and 50-60% of all water delivered to these districts is used to grow rice. Contour systems constitute roughly 50% of the area laid out to irrigation in southern NSW and, to minimise deep percolation and ensure good water depth control, these systems are located on impermeable, often sodic, heavy clay soils in (very) flat terrain. Rice businesses are generally growing and viable, but returns per megalitre (ML) are relatively low for the most limiting resource: i.e. water (Cummins & Thompson 2002). Despite the low return per ML, contour systems are profitable because of their very low labour and capital requirements (Rendell McGuckian 1998). However, the low return per ML places a heavy reliance on businesses to maintain scale (ML/family) and the high per hectare (ha) water use makes production sensitive to water price and availability (Denimein LWMP Working Group 1995).

The general decline in the terms of trade for agricultural commodities and the increasing cost and decreasing availability and reliability of irrigation water is affecting irrigated farm profitability in these districts and indications are that these pressures will increase rather than decrease. Rice farmers have maintained their profitability in the past by increasing the scale of their enterprises and buying in more water and this used to be easy to achieve. However, pressures facing irrigators make it increasingly difficult for them to maintain their profitability in this way. Switching out of contour irrigation into row-cropping or more intensive industries is difficult and expensive and switching to border check systems offers little prospect for maintaining farm profitability (Rendell McGuckian 1998). There is also little incentive to switch from annual crop systems to more capital intensive industries (e.g. horticulture and dairying) because of the uncertainty and risk associated with the low reliability of supply for irrigators with General Security licences in southern NSW (Frost et al. 2003). There is thus a need to find ways to increase the profitability of rice based farming systems which retain the advantages of basin systems but which return more per ML, are better adapted to a lower and more variable irrigation supply, and do not require a large capital investment.

One way to achieve this is for irrigators to allocate water to winter crops in years when water is limiting, rather than growing rice. This strategy derives from economic theory which states that profits are maximised when net returns to the most limiting resource are maximised. Beecher et al. (1995) showed that gross margins to land, labour and capital are higher for rice than for viable alternative crops, so the most profitable strategy when water is plentiful is to use water to grow rice. When water is limiting, the most profitable strategy is to spread available irrigation water equally over a larger area and maximise the average net return per ML (Yaron & Bresler 1983). In Mediterranean climates, this is achieved most effectively by using available irrigation water to supplement winter rainfall and deficit irrigate winter crops (Stewart & Musick 1982; North 2005a).

Rice growers in southern NSW are reluctant to adopt this strategy because of the risks associated with waterlogging in winter and after spring irrigation (North 2004b; North 2005b). Thus, for this strategy to be successful, watering and drainage times in basin layouts need to be improved so higher yields of winter crops can be achieved with lower risk. Furthermore, this needs to be done in a way that improves the net returns to land, labour and capital from winter crops. If this can be done, then the shift to a more flexible cropping system will provide a viable alternative to predominantly rice based systems.

Evolution of “drive-over banks”

A system for achieving these outcomes has been developed in the Berriquin Irrigation district over the past five years. Initially, Nick and Steve Morona, “East Rostella”, Deniliquin, wanted to develop a contour system that had greater versatility than current contour designs, was quicker to water and drain, and which had better access into and within paddocks. They developed check banks along the contour that were wide and had low slope so they could be driven over. This allowed paddocks to be trafficked up and down the slope, rather than perpendicular to it, and improved machinery efficiency, weed control on banks and paddock drainage in winter.

Morona’s system, which has been described at a previous GRDC Update (Morona 2005), had a number of distinct advantages over conventional contour systems. These included:

- 6% more crop area because banks can be cropped;
- lower chemical use as banks are cropped and are no longer sources of weed seed;
- increased labour and machinery efficiency because there is less turning and headlands;
- they eliminated the need for cross-overs which concentrate traffic and cause compaction and restrict paddock drainage if not properly installed or maintained;
- better drainage was achieved by sowing with the slope;
- drainage was better for 80-100 m wide contour basins than if paddock had been converted to border check bays down the slope with 400 m long bays;
- long runs made it possible to adopt control traffic and precision farming systems, there-by reducing costs and increasing machine efficiency.

There were however a number of disadvantages to Morona’s system:

- it was hard to maintain a constant sowing depth with the air seeder over drains/banks;
- a road grader was needed to pull down/up banks if dirt is only pulled one way;
- it was necessary to drive through wet drains if sowing occurred shortly after a pre-irrigation.

The Kooloos’ “V-Bay”

Harry Kooloos, “Amarran” Mayrung, saw Morona’s system and felt he could improve upon it. After some consideration and discussion with his earthmoving contractor, the Kooloos “V-bay” was born. In this system, paddocks that were originally landformed on a single plane (slope 1:2000) were re-graded within each bay to a double slope of 1:1500 which drained to the centre (see Figure 1). A drain, 5 cm deep and one scraper blade in width, is cut down the centre of this V along the middle of each bay and, to further improve drainage, a spinner cut is made down the centre of the centre drain. Paddocks have a side-ditch along both ends of the bays. Channel stops are placed in the head supply/drainage side-ditch and 300 mm pipes in the side-ditch at the opposite end of the bay in order to speed drainage. Bays do not have slope along their long axis and check banks are constructed so that they can be driven over, allowing the paddock to be trafficked with the slope.

The “V-bay” has all the advantages of Morona’s system and overcomes its principal disadvantages:

- the check banks are on the high side of each bay so they don’t need to be as high, making them easier to drive over, less likely to crack through and leak, and amenable to being pulled down/up with non-specialised machinery (see Figure 2);
- trafficability down the paddock is improved by placing drains down the centre of the bay and at some distance from the check banks;
- the double slope in each bay means that only half the volume of water is needed to fill the bay and get complete coverage, resulting in quicker watering and drainage times and reducing the likelihood of water backing up in drains. (This creates the option to increase the bay size and reduce the number of structures).

The “V-bay” system may still have some disadvantages, principally in the additional cost associated with moving larger volumes of earth and potentially if top-soiling is not done and heavy cuts expose unfavourable sub-soils. There may also be a minor problem with trafficking through the centre drain in wet years, but this should be easy to overcome. However, in theory, this system has the potential to markedly improve the

irrigation efficiency of contour systems, reduce the risk of waterlogging and so improve winter crop yields, and improve machine and operational efficiency. All these aspects will be assessed this coming irrigation season and compared to the performance of conventional contour designs in a project funded by the Murray LWMP's and conducted by NSW DPI staff at Deniliquin.

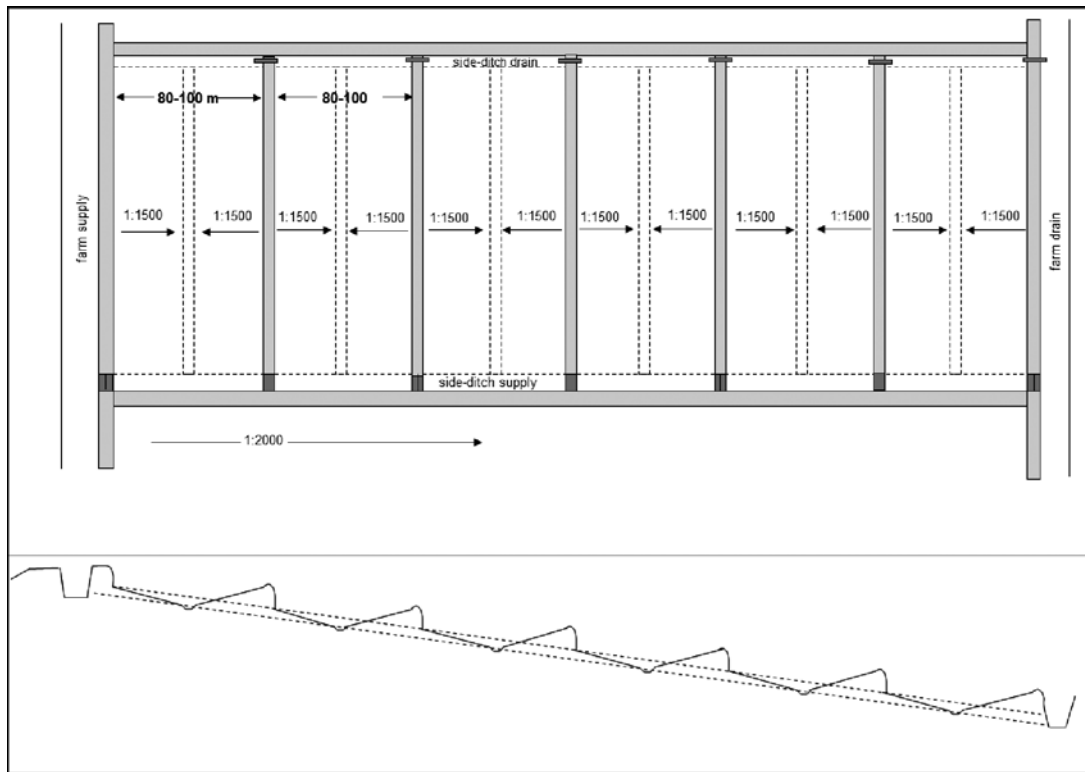


Figure 1. Vertical (top) and side-view (bottom) plan representation of Kooloos' "V-bay" basin system.



Figure 2. The Kooloos "V-bay" drive over bank seen in profile