Rice in the Ord: Opportunities and threats

Siva Sivapalan

Frank Wise Institute of Tropical Agriculture, Department of Agriculture and Food, Durack Drive, Kununurra, WA 6743.
www.agric.wa.gov.au Email siva.sivapalan@agric.wa.gov.au

Abstract
Suitable soil types, a warmer climate, and availability of irrigation water make the Ord Valley ideal for growing rice. Potential yields up to 13.6 t/ha have been demonstrated in this environment. Ten years of drought in NSW and record prices of $450/t in 2009 and $550/t in 2010 recreated interests in growing rice in the Ord Valley. Currently there are opportunities to export rice from the region, through the upgraded Wyndham Port facility, leading to a higher return for rice growers in the region. Recently, about 15,000 hectares of new lands suitable for irrigated agriculture became available in the Ord Valley. The two major soil types present in the Ord Valley have high clay content and are ideally suited to rice cultivation. However, risks such as blast disease and cold damage to commercial rice crops have been identified. Research efforts are continuing at Frank Wise Institute of Tropical Agriculture to identify suitable varieties and management practices for a profitable rice-based farming system in the Ord valley.

Key Words
Rice-based farming system, tropical environment, potential yield, rice blast disease, cold damage

Introduction

Rice was grown at commercial scale in the Ord Valley from 1973 to 1983. Production peaked in 1982, with 3500 tonnes of rice paddy at an average yield of 7.1 t/ha in the dry season and 3.7 t/ha in the wet season. However commercial rice production ceased in the Ord Valley in 1983 due to several reasons including damage to crops by ducks at the beginning of the season and magpie geese at the end of the season, cold stress in June and July and heat stress in October and November for the dry season crop, lower returns to the farmers and declining demand in local markets, high recharge rates of Cununurra clay soils under flooded systems, and unavailability of locally adapted rice varieties with good mill-out rates (Burt 2002). After 30 years, there is renewed interest in establishing a viable local rice industry in the Ord Valley. This has led to trial plantings of 240 ha in 2010 and 650 ha in 2011 in the Ord Valley with mixed results.

Opportunities

New land developments

The Ord River Irrigation Area (ORIA) is a well established and productive agricultural precinct comprising approximately 14,000 ha of prime irrigated agricultural land in Western Australia's far north. Farming commenced on the ORIA in 1963 after construction of the Diversion Dam in Kununurra. Three separate areas of land suitable for irrigated agriculture in the Ord-East Kimberley Expansion Project (Figure 1) have been released in November 2011. This includes 7,400 ha in the Goomig Farm Area, 1,700 ha in the Ord West Bank and around 6,000 in the Knox Plain area (Landcorp 2011). It has been estimated that the total irrigable land in the Ord Valley is about 58,200 ha.

Suitable soil types

The two major soil types, Cununurra clays and Aquitaine clays, present in the Ord Valley have high clay content (49-57% clay) and are ideally suited for rice cultivation. The soils of the Goomig Farm Area are 30% Cununurra clays and 70% Aquitaine clays. The Aquitaine clays have higher clay content and therefore more suitable for flooded rice systems than Cununurra clays. On the other hand, aerobic rice systems are suitable for both soil types. Raised-bed (aerobic) systems may be appropriate to overcome bird (ducks and magpie geese) problems, reduce leakage to groundwater and fit into a rotation system with other field crops (for example, chia, chickpeas, maize, sorghum, culinary beans, hay, millet, sweetcorn, sunflower, peanuts and small seeds) grown in the Ord Valley. As most of these field crops are grown in the dry season, there is an opportunity to grow rice in the wet season using the same field layout without any modification and generating a second income for farmers.

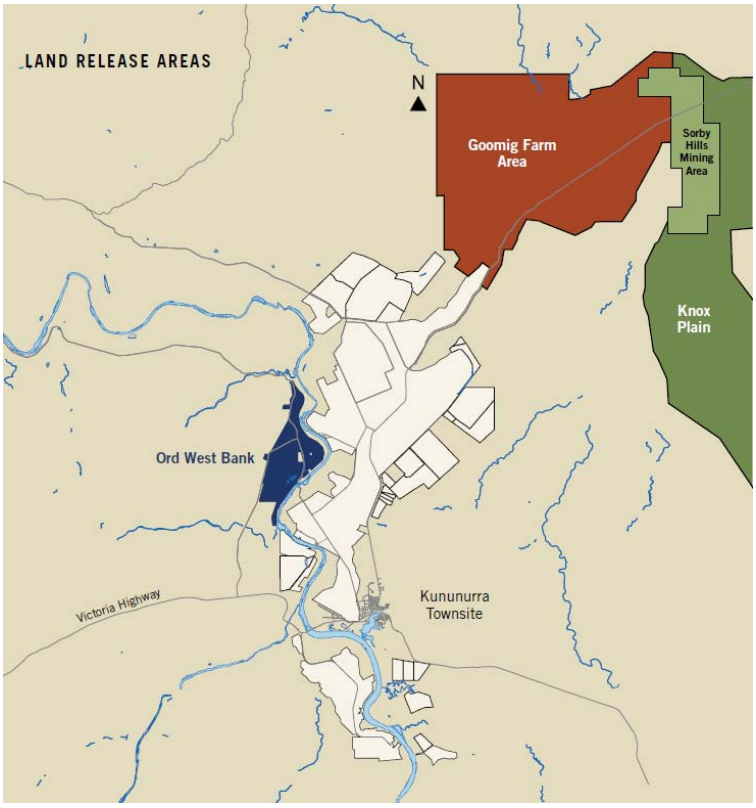

Figure 1. Ord Stage II new land developments (shown as dark areas) as part of the Ord-East Kimberley Expansion Project. Map reproduced from Landcorp (2011).

Climate

The region has a tropical monsoonal climate with most of the mean annual rainfall (around 825 mm) occuring from October to April (Table 1). The average annual maximum temperature is 35ºC. The warm climate of the region allows rice to be grown twice (wet and dry seasons) in a year. In addition, more than half of the water requirement of a wet season crop can be met by the monsoonal rains during November-March. However, cloud cover which reduces sunshine hours during the wet season (Table 1) might be an issue in achieving high yields. High humidity conditions during the wet season might also favour the occurrence of certain pests and diseases (for example, blast disease).

Table 1. Summary of monthly climate statistics for Kimberley Research Station (1981-2010). (Source: Bureau of Meteorology, www.bom.gov.au)

Month	Maximum temperature (ºC)	Minimum temperature (ºC)	Rainfall (mm)	Relative humidity (%)	Evaporation (mm)	Bright sunshine (hours)
January	36.1	24.8	213.4	69	7.3	7.6
February	35.2	24.6	215.9	72	6.3	6.2
March	35.7	23.6	155.6	63	6.4	7.6
April	35.7	21.1	37.1	45	7.0	10.2
May	33.5	18.2	5.0	37	6.7	9.6
June	30.8	15.3	4.9	35	6.3	10.1
July	31.1	14.4	1.1	32	6.6	10.3
August	33.3	15.4	0.1	32	7.6	10.8
September	36.9	19.6	1.6	37	9.1	10.5
October	39.0	23.0	17.4	41	9.9	9.8
November	39.3	24.8	59.4	49	9.6	10.1
December	37.6	25.2	167.4	60	8.4	8.5

Water

At 11,000 GL of storage capacity, Lake Argyle enables a reliable irrigation water supply of 335 GL/year and 400 GL/year to Stage I and Stage II areas, respectively. Current water allocation is 17 ML/ha/year at a cost of up to $6.50/ML together with a levy of up to $148.22/ha. It should be noted that the 2010 dry season commercial rice crops (240 ha) in the Ord Valley took just over three months to reach maturity which in turn

reduced the amount of irrigation water usage by 3.5 ML/ha. It is expected that the flooded rice system in the Ord Valley will require much less water compared to rice systems in the southern NSW environment. Better water holding capacity of soils in the Ord Valley and a shorter growing duration of rice in the tropical environment help to achieve high water use efficiencies.

High potential yields

The average yield potential of paddy rice at the ORIA is around 7.5 to 8.0 t/ha (Burt 2002). It may be possible that higher yields, of more than 9 t/ha, could be achieved under optimum conditions. For example, trials at Frank Wise Institute of Tropical Agriculture in 2009 using temperate rice varieties demonstrated that rice yields up to 13.6 t/ha are possible in this environment. Trial planting of 240 ha of commercial crop in the region in 2010 using temperate varieties achieved an average yield of 7.5 t/ha. At a farm gate price of $550/t, gross margin analysis indicated that this crop generated gross margins of $2,442/ha which was very competitive compared with many other field crops grown in this region. Further trials conducted at Frank Wise Institute of Tropical Agriculture attempted to identify suitable locally adapted (temperate or tropical) rice varieties for both flooded and aerobic systems (Sivapalan *et al.* 2011, 2012b). The results suggest that many varieties have potential for high and/or economical yield in the Ord Valley. There is also high interest in evaluating the potential of hybrid rice production, possibility of an economical ratoon crop after the main crop harvest and feasibility of producing fragrant rice for specialty markets.

Market

Prior to 1983, rice produced in the ORIA was only sold on Western Australian markets and therefore the returns to the farmers were low. Currently there are opportunities to export rice from the region. Under the Australian Government Nation Building Economic Stimulus Plan, $10 Million has been allocated for the upgrade of Wyndham Port facility for import and export of a range of commodities. This will allow exporting paddy rice to a rice processing facility in a neighbouring country such as Papua New Guinea (for example, Trukai Industries Ltd in Papua New Guinea which is a subsidiary of the Australian SunRice company). This might lead to a higher return for rice growers in the region. The major market to be targeted is export to neighbouring countries such as Papua New Guinea. There is also opportunity for the domestic market – ideally for higher value human consumption (fragrant rice). Rice also provides another grain source for intensive livestock feed in the region possibly at $200 to $300/t. In addition, an opportunity has arisen for baling rice stubble as cattle feed which brings extra dollars to growers in the Ord Valley. Rice produces about 12 t/ha of hay and prices up to $150/t were offered in 2011. There is a market for rice stubble as stockfeed in the region which results in less stubble burning and reduced environmental pollution, at the expense of possible depletion of soil organic matter.

Threats

Diseases

In 2011, the commercial crop in the region suffered a serious setback from the infection of rice blast disease (Sivapalan *et al.* 2012a). Three growers established up to 650 ha of rice in May 2011 using a temperate variety Quest under the flooded (paddy) system. For the first time in Australia at this scale, a rice grower in the Ord Valley discovered symptoms similar to blast disease in his crop on August 3, 2011 when the crop was 10 days after panicle initiation stage. Tests identified the disease as rice blast caused by the fungus *Magnaporthe grisea*. The pathogen infected all the above-ground parts of the rice plant. Cool night temperatures, high nitrogen supply, and leaf wetness by dew were the factors that favoured the occurrence of the disease. Rice blast is very destructive causing significant losses in yield. The disease had spread to other rice crop areas in the Valley. The cause of the initial infection is not known but migratory birds or wind could be an agent of spread. After the detection of the disease, the three growers took different approaches (such as cutting for hay, spraying fungicide, and no treatment) to their crops. The blast disease caused serious economic and social impacts on the emerging rice industry in the Ord Valley (Sivapalan *et al.* 2012a). Hence, identification of a blast tolerant variety is a priority research need for the emerging Ord rice industry.

Cold damage

Cold night temperatures from May to August also had devastating effect on the crop in 2011 (Sivapalan *et al.* 2012b). Yield potential of five temperate and 15 tropical rice varieties grown on raised-bed (aerobic) and flooded (paddy) conditions was evaluated at Frank Wise Institute of Tropical Agriculture during April to September 2011. Cold night temperatures during the season had a severe effect on grain yield of most

varieties. Ponded water also failed to provide complete protection against low temperatures. However, these trials enabled the identification of those varieties which are tolerant to cold. In terms of cold tolerance under aerobic conditions, the best performing varieties were Yunlu 29 (11.75 t/ha), B6144F-MR-6 (7.16 t/ha) and Tachiminori (5.05 t/ha). The highest yielding varieties in the flooded systems were NTR 426 (7.79 t/ha), Yunlu 29 (7.25 t/ha) and ULP R17 (7.08 t/ha). Further trials are continuing at Frank Wise Institute of Tropical Agriculture to assess blast disease tolerance of suitable varieties.

Other

Rice trials conducted at Frank Wise Institute of Tropical Agriculture in 2009 highlighted the effect of extreme hot weather conditions in late-September and October on grain quality (for example, millout percentage, chalk, amylose and protein content) for a crop planted in May. Therefore, planting the crop early in March or April is necessary for the crop to reach maturity and be harvested under mild weather conditions probably in August. However, late finish of the wet season rains (as seen in 2011, for example) might hinder planting in March or April due to ground conditions being too wet for sowing. In addition, maximum temperatures during December-February greater than 35ºC (Table 1), might impact the successful establishment of a wet season crop (as seen in 2011-12 wet season, for example). Cloud cover reducing the bright sunshine hours may also be an issue for the wet season crop. Bird problems and high insect pressure may also be expected in the region.

Conclusion

Among the new crops trialled in the ORIA, rice has been demonstrated as a potentially high-return crop suitable for this region. A rotation system based on rice appears highly suitable and profitable for the soil types in this region. Permanent raised-beds may provide a viable production system. Grain from specialty rice varieties can supply niche markets and attract premium prices. Even with average yields, these can be highly profitable. High yielding good quality rice could significantly increase farm gross margins and viability. However, there are many issues regarding suitable varieties (tropical versus temperate, cold tolerance, disease resistance), planting date, sowing rate, and fertiliser and irrigation requirements remain to be resolved. A rotation system based on rice and a legume crop on a permanent raised-bed system appears highly suitable and profitable for the soil types in this region. The emerging rice industry has new challenges to increase production over the next few years. In order to establish a viable industry based on production of high quality exportable produce, a suitable rice-based farming system needs to be developed. More research is needed to identify a suitable variety for the local tropical environment, ideal planting time for maximum yield, sowing rate for optimum plant density and nitrogen fertiliser requirements. Research is continuing at Frank Wise Institute of Tropical Agriculture to address these issues.

References

Burt J (2002). Review of the potential for growing rice at the Ord River Irrigation Area in Kununurra Western Australia. Trade and Development Technical Report, August 2002, Department of Agriculture Western Australia.

Landcorp (2011). Land release information for prospective buyers. The Ord-East Kimberley Expansion Project, www.landcorp.com.au/ordlandrelease.

Sivapalan S, Bright F and Wilson N (2012a). Economic and social impact of rice blast disease occurrence on the emerging ORIA rice industry. Proceedings of the Agribusiness Crop Updates Conference, Perth, WA, Australia, 28-29 February 2012, pages 277-280.

Sivapalan S, Goldsmith P and Plunkett G (2011). Yield performance of temperate and tropical rice varieties in the Ord River Irrigation Area. Proceedings of the Agribusiness Crop Updates Conference, Perth, WA, Australia, 23-24 February 2011, pages 28-31.

Sivapalan S, Goldsmith P, Warmington M, Snell P and Ford R (2012b). Effect of low night temperatures on growth and grain yield of 20 rice varieties grown in the Ord Valley. Proceedings of the Agribusiness Crop Updates Conference, Perth, WA, Australia, 28-29 February 2012, pages 271-276.