LANDSCAPE LOGIC
LINKING LAND AND WATER MANAGEMENT TO RESOURCE CONDITION TARGETS

Fact sheet for managers and policy-makers #3
February 2010

Managing nutrient loss under intensive cropping in north-west Tasmania

What we found

With a favourable climate, productive soils and ready access to processing and port facilities, the north-west of Tasmania supports some of the most intensively cropped land in Australia. However high rates of irrigation and fertiliser combined with high annual rainfall and free draining soils means there is a high risk of nitrogen leaching below the root zone and potential contamination of waterways.

A study of 7 farms in the Panatana catchment in NW Tasmania found potatoes were the 'leakiest' crop, with an average of 29 kgN/ha leached below the root zone each year, 4 times more than other crops (Figure 2). Using climate data from 1980-2005 and the irrigation and fertiliser practices used on each farm, crop production was modelled over 25 years to examine likely nitrogen losses over typical rotations (Figure 3). Results varied greatly depending on the management strategies employed, with mean nitrogen losses ranging from 1 to 16 kg/ha and seasonal peaks from 4 to 36 kg/ha (Figure 3). The positive aspect of the high variability is that the low end results tell us that strategies for managing leaching are already in place on some farms.

The strategies that produced the lowest rates of leaching without compromising crop yield were deficit irrigation (applying just enough water to make up for crop use plus evaporation), scheduling small irrigation applications at short intervals, and using lower rates of nitrogen fertiliser.

Implications for natural resource managers and policy-makers

As we have no control over rainfall, total crop water supply (effective rainfall plus effective irrigation) will often exceed crop water use (soil evaporation plus transpiration). The surplus supply over demand means that significant drainage can be expected in this region, in the order of 100 mm per season and greater, and this needs to be factored into cropping strategies.

Figure 1. Intensive cropping in the Panatana catchment, north-west Tasmania.

By progressively introducing the three effective strategies to a simulated potato crop on a farm with one of the higher rates of leaching, we could identify their relative contribution to low impact, high yield cropping. This is illustrated in Table 1 where the impacts of deficit-based irrigation scheduling (less irrigation applied more often, matched to demand) had the greatest impact on drainage and nitrogen loss, while lower applications of nitrogen had a smaller impact on nitrogen loss but represented significant cost savings.

These results suggest that nitrogen loss can be reduced to a negligible 3 kgN/ha without any reduction in potato yield. These relatively simple changes have the potential to reduce the risk of off-site nitrogen pollution and produce significant cost savings, while maintaining current levels of productivity. Despite the significant cost savings, experience suggests that adoption of these strategies are unlikely to occur without significant extension effort, such as demonstration and mentoring, as many growers will need more direct evidence that

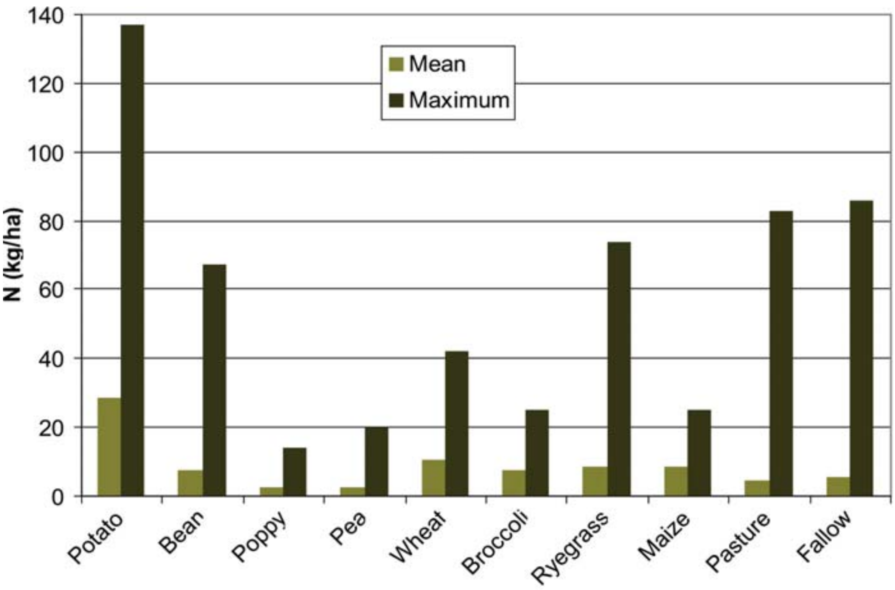

Figure 2. Mean and maximum nitrogen loss below the root zone for each crop used in this study over the 25 year simulation period (1980–2005).

these results can be achieved in their particular situation before changing their practices.

How we did it

The 7 farms were selected to represent the typical range of soils, crops and management practices in the Panatana catchment, part of the greater Rubicon catchment in Northwest Tasmania. The APSIM model (Agricultural Production Systems Simulator) was used to simulate crop growth and development in response to climate, soil and different management strategies.

Interviews were conducted with each farmer so that their particular crop management practices could be represented in the model, including crop rotations, cultivar selection, crop establishment, nutrient management, irrigation practices and tillage and residue management. One soil on each farm was fully described and characterised to a depth of 120cm to enable the model to simulate growing conditions, water balance and nutrient movement. Farmers were also asked to provide estimates of crop yields to provide a comparison with simulated values. Long-term local daily climate data was then used over a 25-year period to enable us to factor in the long-term impacts of seasonal climate variability. Return visits were made to each farm to confirm the management information used in the model and check that the first run simulated yields and water usage were in line with their experience.

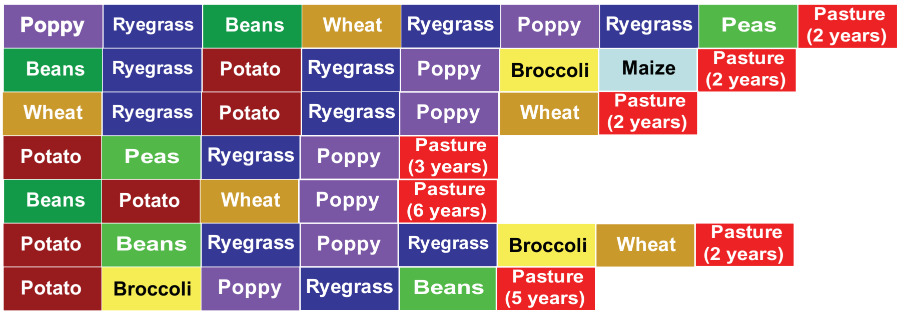

Figure 3. (above) the crop rotation patterns on the seven farms.

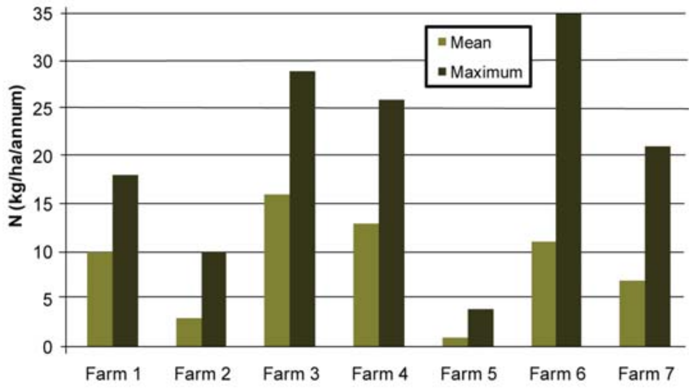

Figure 4. (right) Mean and maximum nitrogen losses for each farm in the study, reflecting variation in management practices and crop rotations. Note: farm 5 does not include potatoes in its rotation.

It is worth noting that mean nitrogen loss per farm from this study (17 kgN/ha/yr) is in close agreement with the results of another Landscape Logic study by Shane Broad and Bill Cotching which used end of catchment gauging station data and river flows to estimate catchment scale nutrient loads for intensive cropping, providing some confidence in the paddock scale estimates of nitrogen loss in this study.

The authors wish to acknowledge the generosity of the participating farmers in sharing their data and experience with the research team.

[See also Lanscape Logic Technical Report X, www.landscapelogic.org.au/publications]

Table 1. Changes in nitrogen leaching and potato yield in response to changes in irrigation scheduling and fertiliser application, simulated for a farm in the Panatana catchment, Tasmania. (Note: this data is for potato production only, and is therefore not comparable with data in Figure 3 for all crops).

	Farm 3			Farm 1
Scenario	*Current management*	*+ Deficit-based irrigation scheduling*	*+Deficit-based irrigation + reduced N*	*Current management (includes deficit-based irrigation scheduling)*
Basal N (kg/ha)	215	215	100	154
Topdressing (kg/ha)	5 X 115 urea	5 X 115 urea	5 X 80 urea	5 X 125 urea
Irrigation (mm)	260	174	172	198
Irrigation interval (days)	11	5	5	5 (deficit based)
Amount per event (mm)	26	13	13	13
Drainage (mm)	135	52	51	57
N leached (kgN/ha)	53	6	3	1
Tuber yield (T/ha)	56	56	56	63

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