WISPAS

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Coppiced Poplars and Willows Show Potential for Use in Effluent Irrigated Systems

Environmental Concerns

Many aspects of dairy farming have come under increasing environmental scrutiny and in recent years the effect of farm dairy effluent has been of particular concern to the industry, public and Regional Councils. These concerns are heightened where farms are established along waterways that flow into significant catchments or where tile drainage systems can quickly move drainage water from paddocks to waterways.

Practice

Farm dairy effluent is often irrigated onto pasture, a practice that is either encouraged or required by Regional Councils. Irrigation onto pasture provides a source of nutrients for the pasture and renovates the effluent by removing nitrogen and other nutrients and allowing sufficient passage of time that pathogens are killed. Effective renovation depends on correct application of effluent at rates appropriate for the local soil, climate and pasture growth.

Dangers

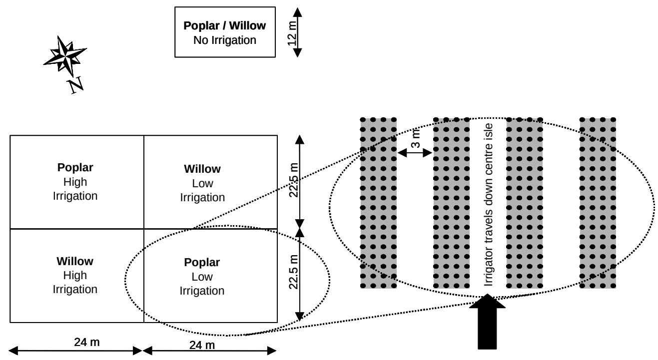
If effluent is applied incorrectly, ponding and surface runoff can occur, nitrate concentration in the drainage can reach unacceptable levels, and groundwater or surface water can become contaminated.

Poplars and willows are used extensively in New Zealand for soil conservation and riverbank plantings because of their ability to grow quickly in wet areas, establish extensive root systems and remove large amounts of water.

Their ability to coppice repeatedly makes them promising candidates for use in effluent irrigated systems; either as vegetation to be directly irrigated by the effluent, or as riparian buffer zone plantings to capture nitrogen from seepage or re-irrigated tile drainage. A further advantage of the trees is that the foliage can be cut and fed to stock, either milking or dried-off cows, or other livestock systems

Three blocks each of Argyle poplars and Tangoio willows were planted as 1.2 m stakes on a dairy farm in Southern Wairarapa in September 2001. One block of each species was irrigated with fresh farm dairy effluent at a high rate, about 5 mm per week, the second irrigated at a low rate of about 2.5 mm per week, and the third block of each species was left unirrigated.

The trial was continued for three growing seasons finishing in May, 2004. The trees were coppiced once per growing season (Feb-Mar). There was some growth following coppicing but not enough to warrant a second harvest.



The harvested biomass in tonnes of dry matter per hectare is shown in Figure 1.

Poplar yields in 2001/02 were depressed by rust infection, all yields were reduced in 2002/03 by an unusual number of frosts in October followed by a dry summer.

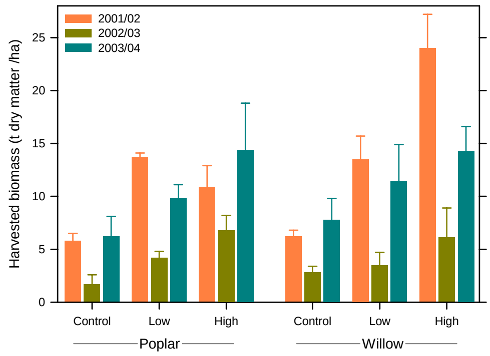


Figure 1. Harvested biomass (average and maximum) in the poplars and willows for the three years of the trial.

Nitrogen stored in the harvested biomass was measured (Figure 2). Overall N removal in the trees per hectare was greater than would be expected from grazed pasture.

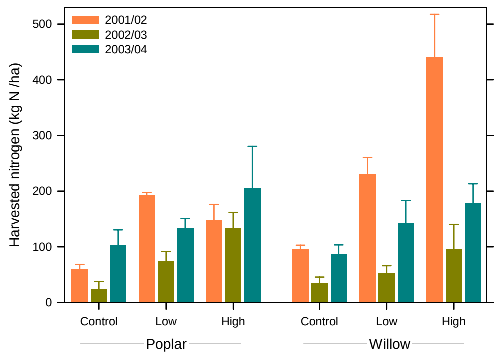


Figure 2. Harvested nitrogen (average and maximum) in the poplars and willows for the three years of the trial.

Potential Advantages and Challenges

The prospects for using coppiced blocks of willow and poplar for effluent control on dairy farms will depend on the capacity of the coppiced trees to remove more N than would grazed pasture. The capacity will depend on the long-term average growth of the coppice block. Growth rates varied widely during the three years of the study (see Figure 1). Table 1 shows the range of N removed measured for the coppiced trees compared to a typical grazed pasture.

Over the three years of the trial the coppiced trees, particularly willows, removed more N than would a typical grazed pasture. This would reduce the amount of land needed for the irrigation of effluent (see table 1).

	Typical (grazed) pasture	Coppice block (cut and carry)	
		Low Range	High Range
Harvestable biomass (t DM /ha /yr)	12-18	7	24
N in biomass (kg N /ha /yr)	500	100	440
Returned to site (kg N /ha /yr)	350	10	44
Removed from site (kg N /ha /yr)	150	90	400
Area need per 100 cows (ha)	4.0	6.7	1.5

Table 1 Calculations comparing the area needed per 100 cows for a typical grazed pasture and the likely range of cut and carry coppice blocks.

The trees accumulate a large amount of fodder with qualities similar to maize silage, which is available in late summer when many farms experience feed gaps. Some willow and poplar species have high levels of condensed tannins that are considered to be effective in deworming stock. There are challenges associated with disease and pest management of coppiced willow and poplar blocks as well as with harvesting and feeding out. There may be need for rust and sawfly control, and the cut stools can be susceptible to silverleaf fungus attack.

The coppice blocks may be more useful as a wet weather safety valve, particularly in unproductive areas of the farm. Another potential use is in retreating tile drainage to reduce N movement to surface water

Figure 3. Comparison in early spring growth of stools coppiced at different times (see text).

Time of harvesting is important. The photograph in figure 3 was taken in October 2003. The larger trees in the background were harvested in the previous February while the smaller trees were harvested later, in April. Early harvesting allows some regrowth, formation of buds, and allocation of carbohydrate to roots before winter leading to faster growth in spring and summer. This grows more fodder and suppresses weeds better than late harvesting.

Ian McIvor, Steve Green, Sarah Hurst, Brett Robinson, Carlo van den Dijssel (*HortResearch*)
Val Snow (*AgResearch*)
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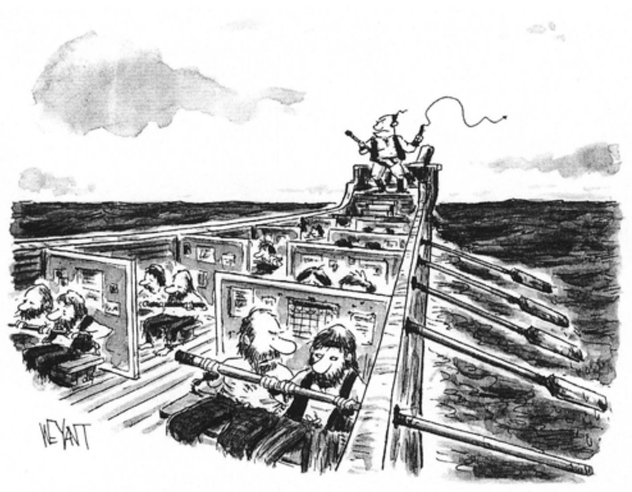
John Arnold (*Armagh Farms*)
Jim Barnett (*Fonterra Research Centre*)

The Lab Designer

This *WISPAS* we honour as our Professional – the designer of laboratories with cubicles.



"I don't mind the whip. It's the cubicles I find demoralizing."

Lab Inspiration I

A first-rate laboratory is one in which mediocre scientists can produce outstanding work.

P M S Blackett, 1897-1974

Lab Inspiration II

Laboratorium est oratorium.

(The place where we do our scientific work is a place of prayer.)

Joseph Needham

Lab Design

The reason for architecture is to encourage people to behave mentally and physically in ways they had previously thought impossible.

Cedric Price

Lab Teams

What I like about scientists is that they are a team, so that one need not know their names.

Lord Wilmot, 1895-1964
British Minister of Supply (1945-1947)

Hard Work

They say that hard work never hurt anybody, but I figure why take the chance.

Ronald Reagan (attrib.)
US President

Plus ça change …

The latest issue of ***Nature***, the world's most widely-read scientific journal, says 25 scientists have resigned from New Zealand Government laboratories or university science departments in the past three years to accept overseas posts, mainly in Australia.

Nature has written New Zealand off as a worthwhile field for scientists seeking employment. The effect of its factual review of conditions of employment in this country is expected by the London office of the DSIR to be devastating.

Auckland Star, 6 November 1959