Seasonal water allocations inevitable

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Seasonal allocations are going to be a fact of life and farmers will have to use water efficiently if they are to avoid running out.

This message was made loud and clear by Aqualinc engineer Ian McIndoe when he addressed field days throughout Canterbury on making irrigation water go further. He says a seasonal allocation will be put on all irrigation takes to enable the regulatory authority to manage both volumetric (stored) water and groundwater systems.

While in most cases the allocation numbers have yet to be finalised, this allocation will be enough to meet full demand if used efficiently, but in dry years there may be a shortfall. Environment Canterbury is proposing an allocation that would meet demand in four out of five years.

"On that fifth year you would have to manage water very efficiently to avoid production losses," McIndoe says.

As farmers don't know when a dry season is going to occur, they have to manage their irrigation systems as if it is going to be dry year every year. Running out of water at the end of February will quickly impact on the bottom line.

Farmers will have to strive for an irrigation efficiency of 80% in order to make their seasonal allocation last the irrigation season.

The allocation will be based on an assumption that they are running their irrigation system at 80% efficiency. Farmers running a system with greater than 80% efficiency will find it easy, while those with less efficient systems will struggle. The most important factor in determining efficiency is design. If that isn't right it will be impossible to run an efficient system; if its correct, efficiency can be improved in several ways.

This season, simply by installing automatic cut-offs on their two Rotorainers, Bankside dairy farmers Stu and Gayle Litchfield saved themselves water and 130,000 units of electricity worth $19,000 – more than paying for the automatic cut-offs which cost $3000/machine.

"They are real benefits," Stu says. "I never expected to make the savings we have seen.

Having the cut-offs has the potential to save the couple 140,000 cubic metres of water a season. This is sufficient to irrigate a further 80ha.

Other refinements they have made include getting all the data from Aquaflexes sent to a computer in the house every hour, rather than using a palm-pilot in the paddock.

As part of a Sustainable Farming Fund trial on making irrigation water go further, McIndoe says they looked at the irrigation systems (Rotorainer, linear boom and centre-pivot) on three farms in the Rakaia Selwyn irrigation zone to see how much water of their theoretical allocation they had used by the end of February. Bearing in mind it was an "average" year with some rainfall, the Rotorainer farm had used 83%, the linear boom had used 80% and the centre-pivot 90%.

Since the end of February, dry weather had meant at least one of the farmers in the trial had exceeded the theoretical allocation.

McIndoe acknowledges that the amount of water used varies each season and the key to making the best use of the allocation is to use rainfall as effectively as possible. To do this farmers need to run below field capacity most of the time without losing production.

The shoulders of the season are the best time to conserve water as evapotranspiration (ET) rates are low and there is more chance of rain than in the middle of summer. ET rates tend to follow day length and start climbing in October to 2.5-3.5mm/day and peak in midsummer where they can average 4mm-5mm/day.

Long pivots reduce pasture production

table 1: expected per-grazing production for centre-pivots of various lengths

Pivot Length (m)	Area (ha)	Total Cover (kg DM/ha)	Pasture Grown (kg DM/ha)	Pasture Grown (kg DM)
300	28	2608	1108	31,336
400	50	2566	1066	53,578
500	79	2511	1011	79,438
600	113	2452	952	107,696
700	154	2391	891	137,137
800	201	2328	828	166,543
900	254	2265	765	194,697
1000	314	2209	709	222,650

Notes: Assumes 1500kg DM/ha residual after each grazing.
All pasture growth values are based on measured pasture data from Farm 1.

table 2: is it worth it to put in smaller pivots?

Pivot / Production Details			
- Pivot Length (m)	1000	700	500
- Number of pivots	1	2	4
- Area (ha)	314	314	314
- Production per Grazing (kg DM/ha)	2200	2400	2500
- Total Production (kg DM/ha/yr)	7000	9000	10,000
- Total Production ($/ha/yr)	**$2567**	**$3300**	**$3667**
Capital Costs			
- Pivot	$500,000	$700,000	$1,000,000
- Mainline	$100,000	$90,000	$76,800
- Pump Station	$80,000	$95,000	$110,000
- Misc.	$5000	$10,000	$20,000
- Total Capital Cost ($)	**$685,000**	**$895,000**	**$1,206,800**
- Total Capital Cost ($/ha)	**$2182**	**$2906**	**$3838**
Operating Costs			
- Electricity	$94,000	$90,000	$86,000
- R&M	$3000	$4000	$6000
- Total Operating Costs ($/yr)	**$97,000**	**$94,000**	**$92,000**
- Total Operating Costs($/ha/yr)	**$309**	**$305**	**$293**
TOTALS			
- Total Production ($/ha/yr)	$2567	$3300	$3667
- Annualised Capital (10yr, 10%) ($/ha/yr)	-$335	-$446	-$589
- Total Operating Costs ($/ha/yr)	-$309	-$305	-$293
- Net Value ($/ha/yr)	**$1923**	**$2549**	**$2785**

The bigger the better. That has been the mentality of many farmers installing centre-pivots, but research is showing there can be significant pasture production losses in pivots over 500m long.

Until recently there had been anecdotal evidence of production losses under the ends of long pivots, particularly in dry seasons. Aqualinc engineer Ian McIndoe says they have found these production losses are happening and are quite severe.

Aqualinc trials on two farms showed a definite reduction in pasture production away from the middle of the pivot (see table 1). On a 900m pivot drymatter production towards the ends of the pivot was found to be 500kg DM/ha less than what was growing under the middle.

McIndoe pointed out that the end of the pivot was watering a lot more land than the middle sprinklers and on a 1000m pivot, the last 100m is watering 60ha. This represents a significant loss in pasture production under long pivots.

The production loss is caused by the application rate, that is, the rate at which the water falls on to the soil. In the middle of the pivot this is around 20mm/hour (which is the optimum rate) but towards the end the application rate gets up to 80-100mm/hour which McIndoe describes as similar to a torrential downpour. Through sheer force, the water redistributes on the surface and ponding occurs before it makes its way down macro-pores in the soil and is lost out the bottom of the soil profile.

While McIndoe acknowledges the scientific evidence they have is from only two trials, he believes there is enough evidence to warn people off installing pivots that are longer than 500m. Obviously farmers with long pivots are not going to pull them out; some modifications help reduce the application rate and will help minimise production losses.

Boom-backs will increase the wetted width which will help decrease the application rate and McIndoe strongly recommends farmers with long pivots install these on the outer sprinklers. Other methods to reduce the application rate include clipping the hoses over the truss rods and changing the type of sprinkler.

Changing the speed at which the pivot is run will not change the application rate.

Overseas there are few pivots over 500m long, but for some reason New Zealanders decided to install long pivots without realising the disadvantages. More work needs to be done in examining the problem but McIndoe says the message is clear: Don't install long pivots.

On a 900m pivot drymatter production towards the ends of the pivot was found to be 500kg DM/ha less than what was growing under the middle.