Irrigation Management Series

When is it time to Stop Irrigation?

"When is it time to stop irrigation?", is a question being asked a lot at present, especially now that the frequent rains of the past few months seem to have given way to relatively fine weather. People who had put their irrigators away have had to rethink the decision and are now actively irrigating again. Going back to the question though, the answer has to be when you will no longer gain an economic return from the applications of irrigation.

Figure 1 shows recent rainfall and potential evapotranspiration (ET) data for Lincoln and while ET rates are falling, significant water is still being used and the longer we go without irrigation the greater the soil moisture deficits will be. So far those who turned off for a number of weeks can well be expected to be irrigating once again.

When the daily average soil temperature at 10 cm depth is below 10 deg C, grass growth really starts to slow down. Therefore there is not a lot of point irrigating when soil temperatures are really low. Driving back from Cromwell late last week I ran out of fingers to count the number of irrigators pumping water onto frost covered paddocks. While quite spectacular watching ice patterns form around K-Line pods, one has to come back to the question, would there be an economic return from applying this water? The potential is to actually suppress growth further as temperatures drop even more in the coming days.

You often hear people talking about late irrigation cooling the soil, and this can be very true, especially if the temperature of the water, due to its source, is cold, but what people often neglect to consider is that adding water to the soil changes the thermal regime in a different way. Drier soils warm more quickly than wetter soils. When soil temperature is becoming a potentially limiting factor for pasture production this fact is important. But why?

The specific heat of water is 4.18kJ of energy per gram while the specific heat of soil is about 0.83 kJ per gram. This means it takes nearly five times more energy to raise the water temperature 1 deg C than the soil temperature. Or, with the same energy input, the soil temperature will increase five times more than the water temperature. This is the reason you walk on wet sand at the beach in the summer and farmers in continental climates often use cultivation to dry and warm soils in the early spring so they can plant earlier and benefit from a longer growing season.

Its all about energy and the sun is what drives the planet. With the end of daylight saving and the prospect of limited hours of light outside working hours we are all acutely aware of the rapid shortening in day length, but it is the reduction in receipt of energy from the sun that is most critical for pasture production. If soil moisture is not limiting then the solar energy receipt and soil temperature are major controlling factors. With the daily receipt of energy from the sun falling (Figure 2) the pressure will be downwards on soil temperatures and in the autumn shoulder irrigation management must be focused on not over watering the soil.

Recent research conducted at Lincoln University showed response to irrigation through tothe first week of May in the 2005/2006 season. No analysis of the cost benefit was done to see if it was economic, but the key point here is that the “Stress Point” is lower, later in the season when the ET rates are not as high. The “Stress Point” or as it is often referred “Refill Point” defines the soil moisture deficit that pasture production will be limited if exceeded (all other variables being non-limiting). Being able to maintain lower soil moisture levels later in the season without risking production, potentially increases growth as soil temperatures may be maintained above non limiting levels for longer. Ms Leers, a student of Wageningen University undertaking research at Lincoln found the critical deficit in a Templeton soil during April was as large as 66mm before potential pasture production was limited. This is a lot larger than we would normally be happy with during the peak of the growing season.

So what should you being doing with your irrigation? There is no fixed answer to this questions, as it is dependent on local conditions, current soil temperature and soil moisture status. The thing I can recommend is try avoiding irrigation that take your soil up to field capacity. Easier to do with Centre Pivots than a Rota-Rainer, but if you need to do a last Rota-Rainer round, try and run it as fast as possible to reduce the depth of application. In most situations you will not need 50 mm to get you through to the end of the season. At the time of writing the last 7 day average ET was 2 mm/day at Lincoln. Soil temperatures (Figure 3 upper trace) are falling and 20 mm is likely to get you through, even without rain, into late April.

At this time leaving a soil moisture deficit after irrigation allows the soil the capacity to absorb and retain any rainfall that does fall. If you irrigate the soil up to its Field Capacity when it is not needed any rain is wasted in essence and this is an economic loss to you in terms of wasted energy, both electrical (or diesel) and energy from the sun heating surplus water rather than the soil. Therefore, keep measuring both your soil moisture and soil temperature to allow you to make better irrigation decisions. The example from LUDF (Figure 3) shows how manager Peter Hancox has allowed the soil moisture to drift down during the last few weeks and has only applied light irrigation towards the end of the graph to arrest the rate of moisture decline. This is a perfect example of good management of soil moisture to aid in maximising production while reducing costs.

AQUAFLEX NZ are available to assist you with developing an irrigation management system for your operation, please feel free to contact them on 03 3848900 or visit www.aquaflex.co.nz.

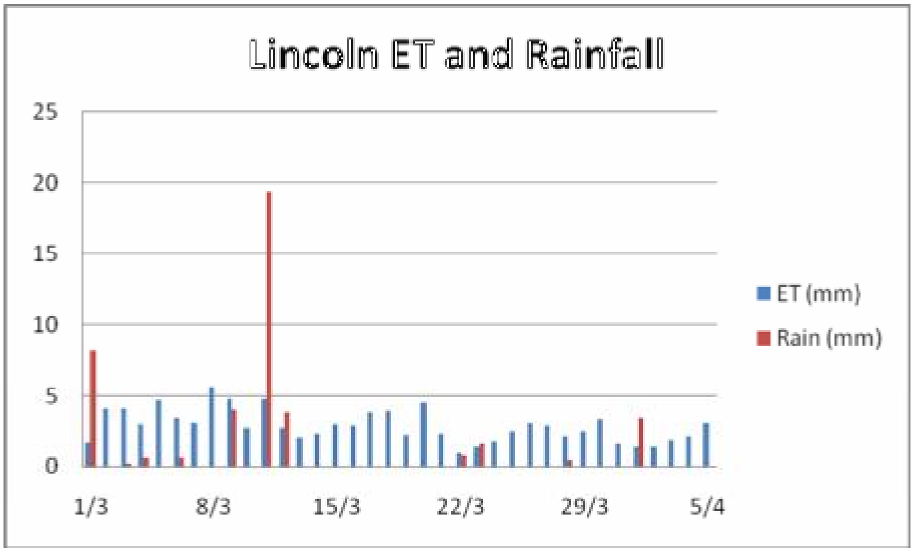

Figure 1: Lincoln Evapotranspiration and Rainfall data (source NIWA climate database)

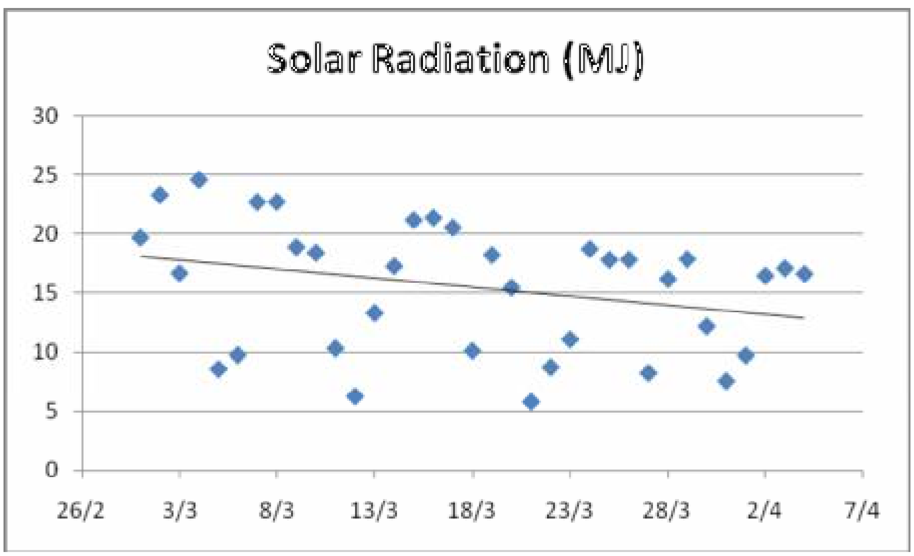

Figure 2 Daily Total Solar Radiation (MJ) with trend line (Source NIWA climate database)

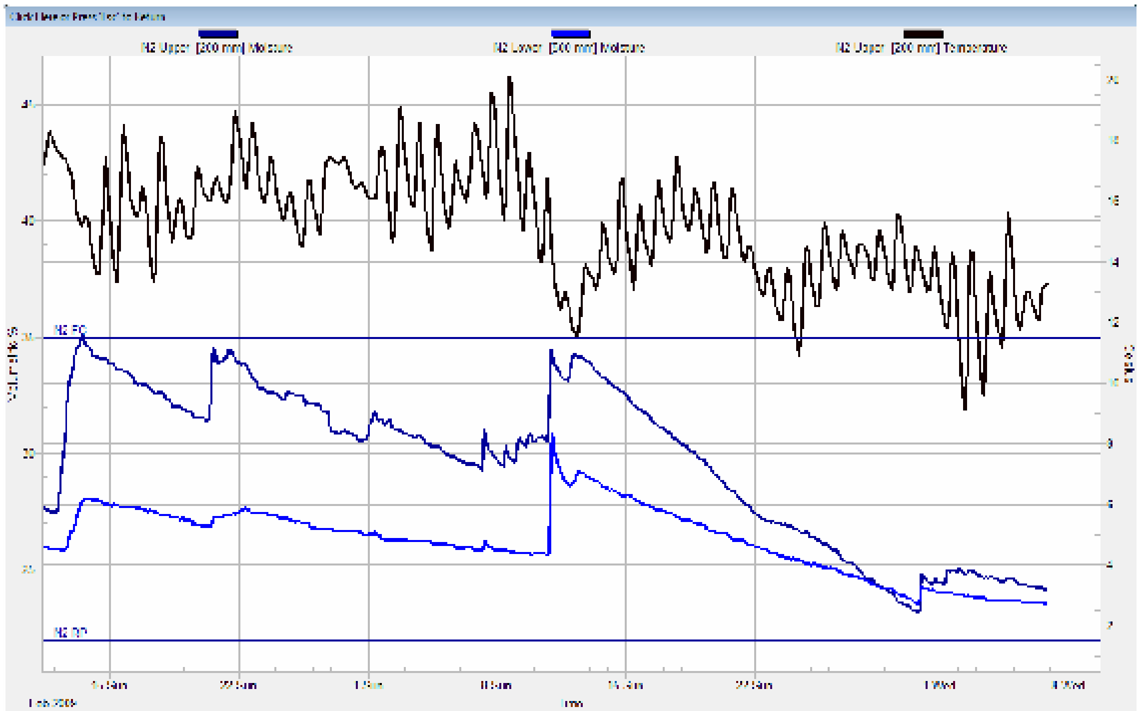

Figure 3. Soil Moisture and Soil Temperature data from the Lincoln University Dairy Farm North Pivot.