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As land becomes more expensive and rainfall more erratic, irrigation, if possible, becomes more important.

**First Priority** - Ensure there is ample permanent suitable water at a profitable price.

### The Benefits of Irrigation

1. Pastures, soils, animal health and conception rates improve. Facial Eczema decreases.
2. Cows add condition and grow bigger because of being well fed all year.
3. Young stock grow faster over summer and grow bigger.
4. 12 hour and longer sprinkler irrigation increases fusarium infection in ryegrass more than one hour or flood irrigation.
5. More cows may be needed to consume the same area of pasture, but the main benefit is more shoulder milk is produced from the same number of cows.
6. This means that while overall production will increase, peak production may not, so more Peak Shares may not be necessary.
7. Pastures last longer because they are not over-grazed and drought affected.
8. Clovers become stronger, increase and make more nitrogen per ha over the whole year.
9. Grown or bought maize green feed or silage, total costs fed are about 40 cents a kg DM.
10. Pasture grown in summer costs up to 20c/kg DM which is less than bought feed.
11. Dryland cows loose weight in dry summers, while those on irrigated pastures gain weight, saving having to increase condition scores with expensive winter feed.
12. If irrigation water runs out, the above figures change substantially. Investment costs and higher stocking rates continue with no benefits.
13. Irrigating at three day intervals in warm areas gives 30% more DM production than at 12 day intervals and gives more efficient water use.
14. Knowledge is important and Google for [http://www.waterright.com.au/water\\_wit\\_wisdom.html](http://www.waterright.com.au/water_wit_wisdom.html)

### Irrigation Systems - Small

Ecostream Irrigation System, 423 Te Rapa Road, Hamilton, New Zealand, Ph 07-849-7255, Email [help@ecostream.co.nz](mailto:help@ecostream.co.nz) travelling irrigator covers a 28 metre width and pulls 150 metres of 50 mm pipe.

1. It has an uncomplicated design with fewer moving parts than ratchet irrigators.
2. Gravity can operate Ecostream's because they require such low pressure (12 psi).
3. Ecostream is also ideal for spreading dairy effluent because their stall pressure is low, reducing the chance of stalling and polluting one place.
4. Spreading fresh effluent during milking from 200 cows saves \$3,500/year in fertiliser each year.
5. Each Ecostream irrigator operating 20 hours/day (conservative and allowing moving time) can cover one ha/day or 9 ha (23 acres) in nine days before returning.
6. Shifting to the next paddock takes about 20 minutes per irrigator with an ATV.
7. Evapotranspiration loses 4~9 mm in worst heat and wind in Australia.

### Irrigation Systems - Large

1. Pivot irrigators cost a lot more to install, but take a lot less staff to operate and give more efficient use of water and spread more evenly.
2. Running pumps at night can use cheaper electricity.
3. To irrigate requires the usual red tape, so apply to you local body for this. They charge, which is OK if from a river or lake, but you should object if it is water from your bore or source.
4. Studying the global history of irrigation shows that virtually every irrigation society, with three notable exceptions, has failed after some 200 years primarily due to salinity.
5. Irrigation is like a natural evaporation system which concentrates salts. The enduring societies have had the luck of natural rain or cyclic flooding which has flushed the salt to the sea, the rest simply failed.

6. Modern irrigation is highly managed and could easily avoid salinity but there has been generally little consideration of the need for flushing. The financial benefits of irrigation are immediate, the accumulation of salt in the soil is insidious and long term, so generally most rivers are over allocated.
7. The problems water managers face are more than technical; with water already allocated they face major political resistance in clawing back the water for the necessary flushing. This requires a paradigm shift in both technology and adoption.
8. The theme of the book is about the process of innovation, how to develop the needed technology and how to ensure its adoption. It shows how significant water can be saved without any loss of agricultural output; the problem is to persuade the irrigators to adopt these practices and reallocate the water saved for flushing.
9. One key to saving water is to ensure that no water passes the root zone for the majority of the irrigations. The water saved can then be used for periodical flushing flows, with irrigators applying extra water to flush water from their land while simultaneously extra water is flushed down the river to carry the salt to the sea.
10. The book describes how irrigators can determine exactly how much water has to be applied to reach the specified depth by using a self learning approach which determines their soil characteristics. 'Self learning' software has been developed which is both efficient and easy for the average farmer to use.
11. With this technology controlling irrigation depth is relatively easy with modern drip and sprinkler systems however it is generally impossible to control irrigation depth using flood irrigation, which used by far the bulk of water.
12. The book describes a low cost method where flood irrigation can be modified to increase efficiency and control irrigation depth.
13. While the technology exists to ensure our water use is sustainable the biggest problem is one of adoption. The book shows how to bring about the required changes in attitudes of both the traditional managers of our water system and the public.

### **Micro Flood**

Micro flood, a process which transforms flood irrigation into a highly efficient irrigation system with controlled irrigation depth

### **[For more effective use of water click here](#)**

Not enough water slows growth, so does too much. Click here to find out how to maintain the moisture in your soil which will give you the best production and make the most of your water.

### **Schedule**

Irrigation scheduling based on site measurement of crop factor and water holding capacity

New irrigation scheduling technique saves water, improves quality, using evaporation and plant and soil moisture data. Plant water usage (crop factor) and water holding capacity of the soil are calculated from soil and plant sensors and combined with evaporation data.

### **[Salinity, how to manage and its effect on water policy just updated](#)**

During dry weather farmers frequently investigate the viability of irrigation.

Before spending money on irrigation, ensure that there are no better ways of getting more out of your land without over-capitalising it. Perfect drainage, adequate fencing for controlled grazing and high fertility will all help grow more pasture. Forage crops can fill deficiency gaps.

Investments must always be directed towards getting the highest long-term profit. For example drought effects can be worse when grazing run out poor pastures, through under liming and under fertilising. If your pastures are not well fed and not top quality, then put money and effort into improving them. Observations when consulting and recent research show that well fertilised pastures grow much more and for longer into dry, hot and cold periods than under-fertilised ones.

There are also pasture species which not only grow more in dry weather, but also more in both cold and hot weather - without irrigation. Seek out the best species and varieties (there are variations within

species) for your farm, and don't just rely on the first seed supplier you ask. Check with them all and with neighbours and successful farmers in the area. Even some research trials on some species have been unfair because of biased and unreasonable trial protocol allowing a fast growing grass to grow too long before grazing, just to comply with the trial conditions which may have aimed at grazing every three weeks, when some species in good conditions need grazing every ten days.

Irrigating good pastures has given more profit than irrigating some crops.

In some cases, irrigation has allowed better species to be grown and more stock to be carried, but remember that most pasture grown off the same area will require more fertiliser and/or lime. You can't expect to grow more pasture under irrigation indefinitely without feeding the land to make up for what goes off, except in a very few cases of highly fertile alluvial soils, but even these will have some deficiencies.

Yields of pasture and animal products under irrigation can increase from double to tens times in arid areas. These areas then become high rainfall areas which means that a lot more minerals are being exported off the irrigated area. The trend is to apply nitrogen to get added benefits from irrigation. This shortens the time that imbalances occur after which many minerals may have to be replaced.

Analyse the herbage and act before problems arise which can include a lack of animal appetite from one or more of the following being low; cobalt, calcium, phosphate, copper, selenium and/or sodium. Animals have broken out of irrigated pastures to eat dryland grasses with their higher mineral (and dry matter) content. Poor clover nodulation can occur through low cobalt, calcium, potassium and/or phosphate reducing yields.

### **Use irrigated pasture to the best advantage**

If you are in a dry area you may be able to increase your profit by milking cows or goats, fattening lambs or other animals and/or charging more for contract grazing.

In these eBooks I've mentioned the importance of analysing minerals in pastures to improve their growth and quality and how profitable it is to feed minerals because pastures can't take up enough of them all and I'm going to repeat one thing again - lambs won't fatten or finish on soils deficient in Cobalt. All animals can grow slowly if even one mineral is lacking.

More pasture will be grown. To make a profit it must be turned into income which will mean more animals. Allow for this.

### **Additional benefits from regular irrigation**

- Pastures in areas which suffer dry periods last longer with less over-sowing, drilling or renewal. The high producing and more palatable annual, short rotation and hybrid ryegrasses last longer under irrigation and can out-produce perennial ryegrasses.
- Fewer weeds grow.
- Keeping soils moist in dry weather keeps earthworms and soil microbes working which can help improve soils, but only if other aspects are optimum.
- Soils which dry out, then repel water and become hard to wet are much better under irrigation.
- Soil organic matter increases.
- Cows gain weight over summer instead of losing it and young stock do better.
- Dairy cows get bigger and carry more condition.
- Stress through no feed decreases, but workload increases.
- Improved animal feeding improves conception rates and reduces foetus losses.
- Surplus spring pasture made into silage or hay may not be needed in summer, so can be fed in winter which may mean that to obtain the ultimate from the increased pasture growth, more animals may have to be farmed.
- Facial eczema is reduced. This is uncommon in North America, but does occur.
- As land prices increase irrigation becomes more cost effective.

### **Which System?**

In some cases water rights and/or irrigation licences have to be applied for and paid for, so check with all local authorities. Also ensure that the water supply won't decrease with increased usage by others. If the supply of water is, or might be, a limiting factor in the future, spray irrigation might be the best.

Most irrigation vendors have literature and figures promoting their systems. Compare them with

others against your requirements. Check all their figures to match your conditions, costs and likely income.

Modern irrigation is not the labour intensive operation it was a few decades ago, in fact the border dyke flood systems are almost free of labour, other than to walk the dyke and set the controls.

If flood irrigation is possible it can be a good choice because of the lack of running costs, but capital costs can be higher if extensive paddock shaping has to be done.

If resowing of pastures is needed and can be combined with shaping, the costs will be less, but where topsoil is shallow, some areas will grow a lot less until the topsoil and fertility have built up again, which takes a decade or more.

Water applied is less even, being more at the inlet and less at the end. A good slope is necessary to reduce this effect. A flood system which gives more even spread is one whereby an engine driven travelling dam moves down the water race blocking it with a plastic sheet causing the water to run over the bank as it goes. Flood irrigation hastens the toxicity problems when water has toxic minerals.

Low pressure (as low as 10 psi) continuous drive travelling irrigators that winch themselves along a cable and pull up to 150 metres of 50 mm hose behind them are becoming popular. They are easy to move to the next paddock in 20 minutes with a small ATV. The best can water a diameter of 30 metres (100 ft) and travel up to 300 metres (1,000 ft) before having to be moved after the 150 metre drag-hose is looped (irrigator has travelled both ways in a paddock). This system is fed by hydrants from underground pipes. An irrigator operating 20 hours/day can cover one ha/day or 9 ha (23 acres) in nine days before returning.

Alternatively many stationery sprinklers each attached to about 60 m (200 ft) of 25 mm (1") flexible piping can be used. They are easily moved with a small ATV. However, installation of all the underground pipes and many valves is costly.

When deciding which system to install, consider everything, including your time. Moving pipes several times a day and watching the grass grow is fun in the beginning, but not long term. You may be able to get labour to operate the irrigation as and when required. In your budget allow for labour costs at local rates. You may become ill and have to pay for it to be done.

The best pumped system can depend on the location of the water supply. Where possible pumps are best positioned in the centre of the area to be irrigated to allow smaller diameter pipes, less friction and lower pumping costs. Sometimes the water can be led in a canal or ditch to a suitable central point or to the electricity source.

Centre pivots and large traveling irrigators are labour saving initially, but can need fencing changes to allow drive-over systems and new lanes to be laid out and are expensive to buy and operate. After a few years they become costly to maintain filling ruts and keeping the controls operating smoothly. If they break down during hot dry weather pastures and grazing animals can suffer.

Large high pressure travelling irrigators usually apply larger amounts over longer periods and have large drops which is little problem on pasture, but can be on newly sown paddocks. They also lose a lot of the water in wind and hot dry conditions.

Small travelling irrigators have to be moved more frequently, but this can be done easily with a farm bike or ATV while the cows are walking to the dairy. They are growing in popularity because of their lower initial cost and versatility, especially for spreading animal effluent.

The New Zealand low-capital cost K-Line systems require only 30 to 50 psi and are becoming more and more popular and are replacing pivots in some areas. They can cover irregular shaped paddocks and uneven rolling land without shaping and can be extended, however, the pods take a lot of moving and ATVs can wear out after a few years. Allow for this and the labour.

## **Budget**

Irrigation in hot weather is best applied weekly at about 25 mm (1") per application rather than larger amounts less often, but achieving this depends on the labour and equipment. Variations to this optimum occur depending on the degree of heat and soil types.

With most high pressure irrigation larger amounts have to be applied each time.

In hot tropical areas the type of pastures possible may not give a return, while in freezing areas a shortage of winter feed may be a higher priority. In both cases, and where grain is cheap, buying it and/or crop wastes may be more profitable than installing an irrigation system.

Try and use night irrigation because it has less evaporation and can utilise cheaper electricity. Wind and heat during the middle of a hot day on high pressure systems can lose up to 40% of water sprayed.

Growing forage crops can be more profitable than installing irrigation, especially the new improved crop species such as Pasja with an annual grass like Nutrifeed or Shirohie millet. See Forage Crops.

In all systems remember to budget for maintenance and replacement.

### **Precautions**

Irrigation water must not have toxic minerals, salts or pollutants which will increase in soils over time and make soils toxic and unproductive causing irreversible problems. This is greater when irrigating crops where evaporation is higher than from pastures, especially in hot areas where evaporation is high and leaching is minimal. Before installing irrigation check the water by analysing it to counter problems if possible, or to at least forecast and monitor them.

Stem nematodes, liver fluke and similar problems can be transported, especially by flood irrigation, so check the sources of water.

Avoid heavy irrigating for three days after animals leave a paddock to reduce nitrogen leaching from urine patches. Keeping soils moist with light irrigation helps the urine spread through the soil so reduces leaching and its loss and grows more pasture.

### **When to Irrigate**

There are formulae to help decide when to irrigate, but none will allow exactly for your soil type, contour, aspect (north or south slope), the heat, wind, pasture density or pasture cover.

As when milking cows, if you get short of pasture and production drops you dry off the low producers, so if you get short of irrigation water, stop irrigating the low producing paddocks. If you continue to irrigate all paddocks with less water they will all stay green but won't grow much pasture.

Irrigating at night is more efficient with less wind, less evaporation and in some cases cheaper power. Sprinklers throw slightly further at night, but farmers are not sure why.

Time the grazing and irrigation so that you apply water after grazing, not just before which can increase pugging.

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