

3.2.3 TRAVELLING IRRIGATORS



Rotary boom irrigators

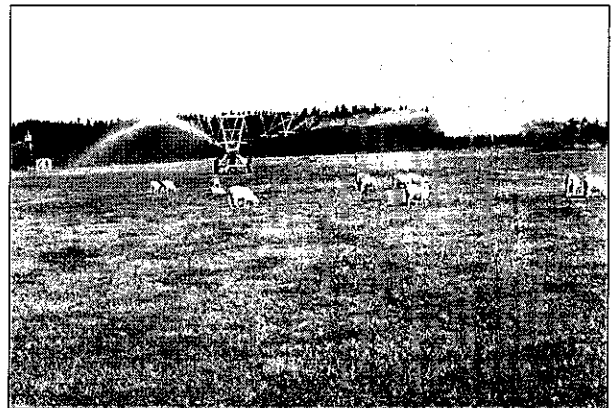
Application rate	Low-medium, high instantaneous rate, 15-25 mm/h
Application depth	Average range, depending on travel speeds, 30-70 mm
Distribution uniformity	Average-good, average in high winds
Labour requirement	Medium, 1-2 shifts per day
Hydrant pressure	Medium, 400-600 kPa
Capital investment	Medium/high
Reliability & service	Generally very good
Effective life	Very good
Enterprises	Good for most crops, especially pasture
Damage to crop	Hose drag damage in crop
Watering irregular areas	Leaves out corners – otherwise good
Effect of wind	Small, but slows down in strong winds
Acceptance	Excellent
Fencing	Needs to be planned to suit
Shifting	Difficult and unwieldy in tight areas, otherwise reasonable
Shelter	Need plenty of room to move around shelter

Rotary boom irrigators are currently the most widely used machines for irrigating pasture, particularly on dairy farms. They are simple in construction, generally very reliable, perform well, and are extremely well accepted.

Because they water a large circular area, average application rates are low, with very little ponding occurring. Uniformity is reasonably good in calm conditions, provided that machines are nozzled correctly and operated at recommended pressures. Because water is carried to the ends of the boom, the water distribution pattern is much less affected by wind than with guns.

The rotation speed of the boom and therefore the travel speed slows down in strong winds, resulting in more water being applied than perhaps needed, and the system not reaching the end of the run when expected. Independent drives can be fitted to some machines to eliminate this problem, but that option increases complexity, cost, and required hydrant pressure.

Although there is some scope for changing application depths by changing travel speeds, rotary boom irrigators are less flexible than machines with independent drives, because they will not operate at low flows and are generally not used where small depths of water are required.



They do not water into corners unless overshooting into adjacent areas is allowed, and should not be used on crops where the impact of the end jets on the ground will cause problems.

These machines take longer to shift than guns because of the need to purge and roll up a hose, and the need to manoeuvre a large boom. They also need an anchor for the wire rope. Some crop damage will occur if the hose is dragged through the crop.

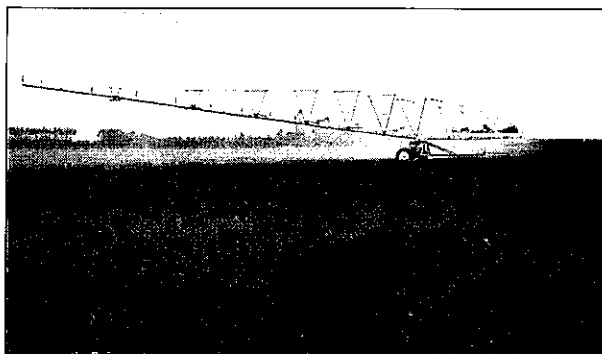
June 2001

Fixed boom irrigators

Application rate	Medium-high, depending on outlet type, typically 20-50 mm/h
Application depth	Wide range, depending on available travel speeds, 10-100 mm
Distribution uniformity	Good, but vulnerable at high pressures in windy conditions
Labour requirement	Medium, 1-2 shifts per day
Hydrant pressure	Medium (for impact sprinklers), 400-700 kPa
Capital investment	Medium/high
Reliability & service	Generally good if well maintained
Effective life	Depends on make, but generally good
Enterprises	Good for most crops and pasture
Damage to crop	Hose drag damage in crop
Watering irregular areas	Can be difficult
Effect of wind	Can be significant in strong winds
Acceptance	Good
Fencing	Needs to be planned to suit
Shifting	Difficult and unwieldy
Shelter	Can arrange shelter pattern around runs

Fixed boom travelling irrigators are common throughout New Zealand, particularly on larger properties. They are usually driven by high-speed turbines, low-speed pelton wheels, or pistons. The independent drive systems provide more flexibility in terms of the range of depths that can be applied and the range of application devices that can be used.

Older systems were fitted with either low pressure spray nozzles, which suffered from excessive application rates, or medium pressure impact sprinklers, which required higher pressures to operate. This is unlikely to be a problem with newer systems, but is worth checking.



Low pressure systems have the advantage of low operating costs, high uniformity, and less effect by wind, but experience serious problems with ponding and surface redistribution. Using higher pressure outlets, such as impact sprinklers, increases operating costs, slightly decreases uniformity, and increases the wind effects but, because of the greater wetted footprint, significantly decreases ponding and surface runoff. For this reason, Rotators and impact sprinklers are commonly seen on booms today as a compromise between performance and operating cost.

Travelling booms are ideal for irrigating rectangular paddocks, because they can irrigate into the corners. They are best suited to areas that are not constrained by shelter belts or other obstructions.

As with all soft hose machines, hose drag can damage crops, and the irrigator requires a winch anchor.

Booms can be difficult to move around intensively sheltered areas.

June 2001

Hard hose gun irrigators

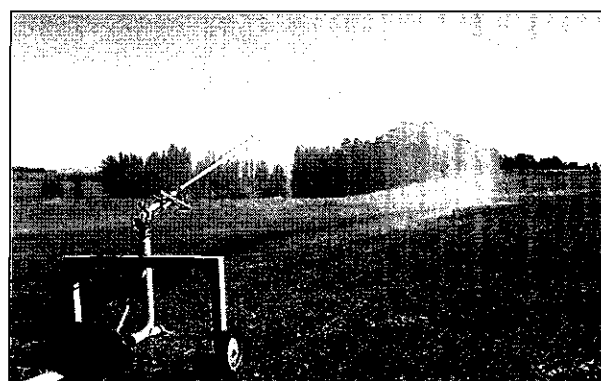
Application rate	Low-medium, 10-20 mm/h
Application depth	Wide range, 10-100 mm
Distribution uniformity	Average-good, but poor in wind
Labour requirement	Low, 1-2 shifts per day
Hydrant pressure	High, 600-1200 kPa
Capital investment	Medium/high
Reliability & service	Generally good if well maintained
Effective life	Good
Enterprises	Good for most crops and pasture
Damage to crop	At headlands, and limited in crop
Watering irregular areas	Good
Effect of wind	Can be major
Acceptance	Good
Fencing	Generally no problems
Shifting	Very good except on soft ground
Shelter	Easy to arrange intensive shelter pattern

One of the biggest advantages of hard-hose reel type machines is the ease of shifting, which takes typically 15-30 minutes, unless they have to be shifted long distances. They are also highly suitable for irrigating irregular areas. Because they apply water over a large circular area, average application rates tend to be low, which is an advantage. Crop damage tends to be small and is mainly caused by towing the gun carriage out into the crop.

The biggest disadvantages are the poor distribution uniformity in windy conditions and the high operating costs. The poor uniformity in windy areas can be overcome to some extent by designing the system to operate at closer lane spacing than is usually recommended, and by using low angle guns, which are now available. Because they water a circular pattern, they do not water into corners unless overshooting into adjacent areas is allowed.

Care must be taken when operating large machines on soft wet ground, as they can become bogged and difficult to move.

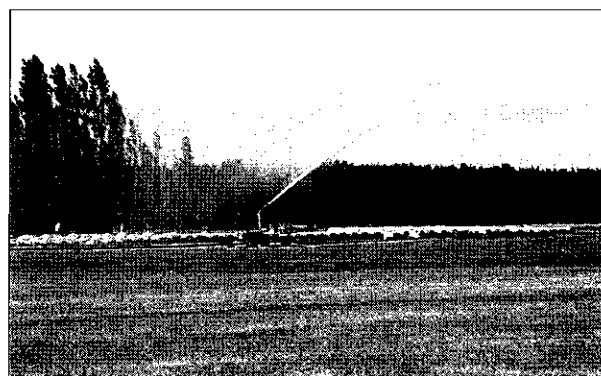
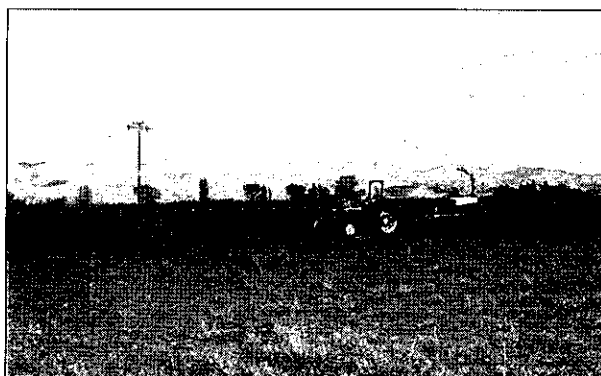
A more recent innovation with these machines is to replace the gun with a collapsible boom, which can be folded up during transportation. The boom can be operated at lower pressures, is less affected by wind, and can irrigate into corners. It does, however, decrease flexibility when irrigating irregular paddocks.



June 2001

Drag hose gun irrigators

Application rate	Low-medium, 10-15 mm/h
Application depth	Wide range, 10-100 mm
Distribution uniformity	Average, but poor in wind
Labour requirement	Medium, 1-2 shifts per day
Hydrant pressure	Medium-high, 500-900 kPa
Capital investment	Medium/high
Reliability & service	Generally good if well maintained
Effective life	Good
Enterprises	Good for most crops and pasture
Damage to crop	Hose drag in crops
Watering irregular areas	Adequate
Effect of wind	Can be major
Acceptance	Good
Fencing	Generally no problems
Shifting	Generally good
Shelter	Easy to arrange intensive shelter pattern around runs



These types of machines have been widely used for many years. The two main drive systems are piston drive and turbine drive. Where pressure is at a premium, a piston drive machine is better, because it requires less pressure to operate. These machines take longer to shift than the hard hose reel machines because of the need to purge and roll up a hose. But because they are relatively small, they are easy to manoeuvre. They also need an anchor for the wire rope, and some crop damage will occur if the hose is dragged through the crop.

As with all guns, they suffer from poor distribution in windy conditions, but tend to have low application rates. They should be operated as much as possible in calm or low-wind conditions and at appropriate lane spacings for the conditions. More modern machines with variable trajectory guns may help reduce wind effects. The biggest problems with these irrigators are that they are often operated on lane spacings that are too wide or at inappropriate gun pressures.

June 2001

Linear move irrigators

Application rate	Medium, 25-40 mm/hr
Application depth	Wide range, depending on travel speeds, 5-100 mm
Distribution uniformity	Usually very high
Labour requirement	Low, except between blocks, 1-2 shifts/day
Hydrant pressure	Low, 200-400 kPa
Capital investment	Medium on large systems. High on small systems
Reliability & service	Generally good if well maintained
Effective life	Generally good
Enterprises	Good for intensive cropping
Damage to crop	Minor from wheel tracks in crop
Watering irregular areas	Poor
Contour	Best for flat land only, (recommended less than 3% side slope)
Affect by wind	Not significant except in strong winds
Acceptance	Good
Fencing	Needs to be planned to suit
Shifting	Easy if properly planned, difficult if not
Shelter	Can arrange shelter pattern to suit

These irrigators are also known as linears, laterals or lateral move irrigators. They are very similar in construction to centre-pivots and are usually manufactured by the same companies using the same components. Unlike centre-pivots, which rotate about a central point, linear irrigators travel down a field in a linear fashion. Linear irrigators are increasing in popularity, particularly for large cropping farms because of their high distribution uniformity and the ability to apply a wide range of depths.

Long rectangular farms without obstacles are well suited for linear machines. They are not suitable for small irregular areas or farms with obstacles such as trees or buildings.

They are hose-fed from one end, requiring mainline or hydrants to supply water to the hose. As an alternative, water can be supplied from an open channel and pumped directly into the machine.

Linear machines require a guidance system to keep them moving in the correct direction. Running a tracking wheel in a furrow, using a guidance wire above ground, or in some cases, using a buried guidance wire usually keeps the machine on the right track.

They are suited to relatively flat ground. Recommendations are for no more than 5% run slope and 3% side slope.

Damage to crops is minor and limited to wheel tracks every 50 metres or so. Labour requirements are low because shifting only requires moving the hose. At the end of a run, the machine is either rotated 180 degrees or end-towed to set up for the reverse runs. Drive systems are usually independent, with diesel motors mounted on the machines.

A wide range of sprinkler types can be fitted to them ranging from LEPA (low energy precision applicators), low-pressure spray jets through to large impact sprinklers. The preferred choices of sprinklers are low-pressure plastic or medium-pressure impact sprinklers. The low-pressure sprinklers tend to be quite closely spaced, which minimises the effect of wind.

December 2001

Fixed centre-pivot

Application rate	Medium-high, particularly at ends, 15-75 mm/h
Application depth	Wide range, depending on travel speeds, 5-100 mm
Distribution uniformity	Excellent in all but strong windy conditions
Labour requirement	Extremely low
Hydrant pressure	Low-medium, 200-300 kPa
Capital investment	Medium on large systems, high on small systems
Reliability & service	Excellent if well maintained
Effective life	Depends on make, but generally very good
Enterprises	Good for most crops and pasture
Damage to crop	Very limited wheel track damage
Watering irregular areas	Needs basic circular or square areas, some land unwatered
Effect of wind	Not significant except in strong winds
Acceptance	Very good
Fencing	Needs to be planned to suit, electric internal fencing used
Shifting	Not required
Shelter	Can arrange shelter pattern around circular areas

Increased emphasis on irrigation uniformity and the need to apply variable applications has increased the popularity of centre-pivots (as is also the case with lateral move irrigators). The control systems of centre-pivots allow enormous flexibility, such as changing application depths over the full circle or in different sectors, simply by programming in requirements.

Fixed centre-pivots have another major attraction: a very low labour requirement. Most of the operational time is spent on routine maintenance, as operation is very simple.

On larger systems, the cost per hectare irrigated is low, making them extremely cost-effective.

Centre-pivots generally have very high application uniformity and the ability to apply a wide range of depths. Application rates are very low at the centre of the pivot, and increase with distance from the centre. On very long systems, sprinkler flow rates and therefore application rates at the ends can be very high, because of the large area watered by the end spans. This can create problems

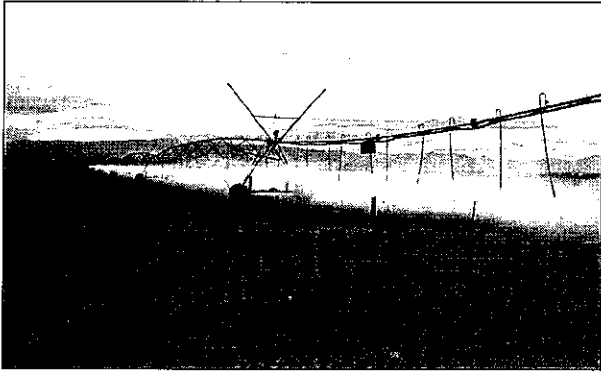
with ponding and surface redistribution, which can be minimised by applying small depths of water more often.

A wide range of sprinkler types can be fitted, including LEPA systems, low pressure spray jets and large impact sprinklers. The preferred choice of sprinkler is now rotators or similar low pressure plastic sprinklers, which have excellent uniformity and reliability and an acceptable application rate.

Because sprinklers tend to be quite closely spaced, fixed centre-pivots are not greatly affected by wind.

Farm shape must suit these machines to obtain good overall coverage. Square or circular areas with no obstacles are best. Centre-pivots can be used on flat or rolling country, at slopes where most other irrigation systems cannot operate, but they are not suitable for small irregular areas. Although corners are not watered, sector operated end-guns or controllable corner towers can be used to cover most of the corners. Centre-pivots are usually fed directly

from the centre, so damage to crops is limited to wheel tracks every 50 metres or so. Drive systems are usually independent, with underground electric cable or diesel motors the most common.



June 2001

Towable centre-pivot

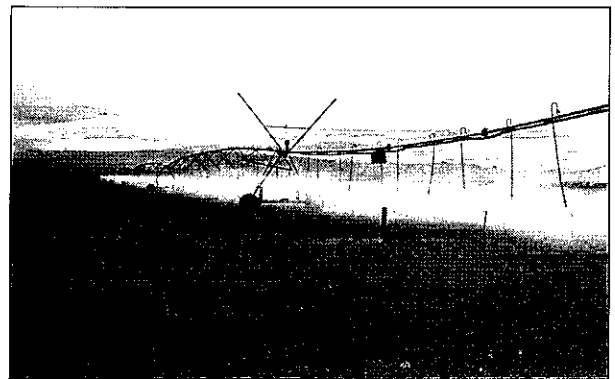
Application rate	Medium-high, depending on flow rate, 15-50 mm/h
Application depth	Wide range, depending on travel speeds, 5-100 mm
Distribution uniformity	Excellent in all but strong windy conditions
Labour requirement	Medium
Hydrant pressure	Low-medium, 200-300 kPa
Capital investment	Low on large systems, medium on small systems
Reliability & service	Excellent, but frequent towing can increase maintenance
Effective life	Depends on make, but generally very good
Enterprises	Good for most crops and pasture
Damage to crop	Limited wheel track damage
Watering irregular areas	Needs basic circular or square areas, some land unwatered
Effect of wind	Not significant except in strong winds
Acceptance	Very good
Fencing	Needs to be planned to suit, electric internal fencing used
Shifting	Generally only possible in straight lines
Shelter	Can arrange shelter pattern around circular areas

These systems have most of the advantages and disadvantages of fixed centre-pivots.

They are often more cost-effective than fixed centre-pivots, because the same machine is used to cover a number of positions. Because they are moved, they tend to be smaller than fixed units. Hydrants are usually placed at centre positions, so very short flexible hoses are used. Moving is achieved by jacking up and rotating the wheels to allow end-towing.

Farm shape is less critical than with fixed pivots, but square or circular areas with no obstacles are still best. Sector operated end-guns are used to extend watering into the corners. They are usually fed directly from the centre, so damage to crops is limited to wheel tracks every 50 metres or so. Drive systems are usually independent, with diesel motors being most common. Some systems have permanently installed underground electric cable, which is the most convenient.

Because they are moved, maintenance tends to be higher. Purchasers of these systems must ensure that they are designed for regular towing.



June 2001