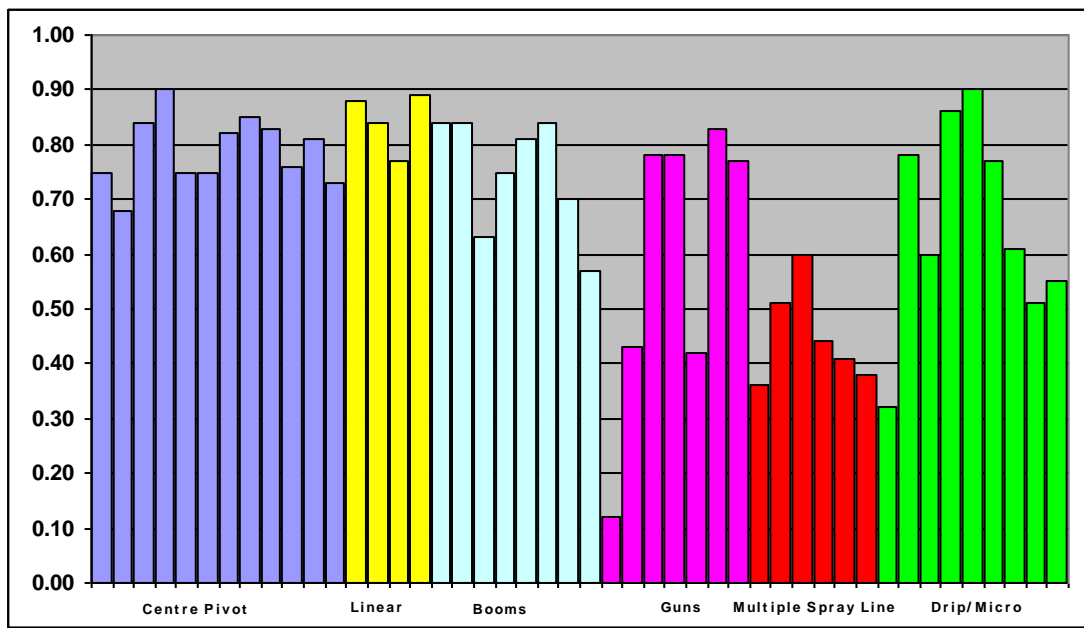


Multiple Lateral Spraylines – Are they really a low cost irrigation system?

Irrigation evaluations of multiple lateral spraylines irrigation systems have shown their been performance to be the poorest of all the irrigation systems measured. Table 1 shows a summary, per system type, of all irrigation evaluations to date. None of the multiple lateral sprayline systems assessed have achieved the 80% field uniformity benchmark.

This is an important consideration as some regional councils are allocating water based on 80% system efficiency. Systems that do not achieve this benchmark result in either a decrease the area that can be effectively irrigated or decreased production off the total area being irrigated.



	Perfect	Excellent	Good	Fair	Poor
Distribution Uniformity	1.00	0.99-0.92	0.89-0.85	0.84-0.75	0.74-less

Table 1: Summary of Irrigation evaluations by System type to date

The Hawke’s Bay Regional Council, with funding from the Sustainable Farming Fund, has undertaken a project to look at why the performance of multiple lateral sprayline systems is poor and what potential improvements can be made.

Testing

A standard “off the shelf “ sprayline pod with a NaanDan 2.8mm impact sprinkler running at 2 Bar was tested using a grid of catch cans (over 350 water collectors arranged in a 1m grid). A Nelson rotator was also tested. The results were then overlapped at different spacings to give grid uniformities.



Results from the field tests showed poor field uniformity (see table 2). Sprinkler overlap simulation software was compared with the field results. This validated the poor uniformity results from the field testing.

2 Bar	Grid Spacing				
	15m	10m	9m	8m	7m
Software Naan	0.50	0.66	0.78	0.57	0.73
Field Tested Naan	0.44	0.64	0.72	0.82	0.61
Software Nelson	0.61	0.71	0.58	0.80	0.89
Field Tested Nelson	0.44	0.61	0.71	0.77	0.67

Table 2: Summary of field test and computer overlap results

A number of overlap simulations for 2.8, 3.0, 3.2, 3.5 & 4.0mm Naan 5022 impact sprinklers, at 2, 3, & 4 Bar and for 7 - 15m spacings were also run (see table 3).

From the results, pod spacing has the greatest influence on system uniformity followed by sprinkler pressure and nozzle size.

Multiple lateral sprayline is typically installed on a 15m x 15m grid system, run at 2-3 Bar for 23 hours (applying 2-4 mm per hour) with daily shifts of the laterals. The results show this design can not achieve the 80% efficiency benchmark and also applies far more water than most soils can hold. However, if pod spacings are reduced to 10m and pressure increased the 80% benchmark can be reached. But at what cost?

	15m	14m	13m	12m	11m	10m	9m	8m	7m
2 Bar 2.8mm	0.50	0.48	0.56	0.59	0.55	0.66	0.78	0.57	0.73
3 Bar 2.8mm	0.54	0.54	0.61	0.69	0.68	0.76	0.89	0.72	0.84
4 Bar 2.8mm	0.67	0.63	0.65	0.70	0.76	0.82	0.92	0.88	0.91
2 Bar 3.0mm	0.42	0.45	0.55	0.60	0.56	0.73	0.76	0.58	0.84
3 Bar 3.0mm	0.56	0.58	0.66	0.73	0.75	0.86	0.91	0.80	0.93
4 Bar 3.0mm	0.67	0.64	0.66	0.70	0.77	0.84	0.95	0.92	0.97
2 Bar 3.2mm	0.40	0.51	0.62	0.65	0.62	0.80	0.78	0.64	0.88
3 Bar 3.2mm	0.52	0.53	0.60	0.70	0.74	0.83	0.93	0.79	0.90
4 Bar 3.2mm	0.64	0.63	0.66	0.71	0.78	0.86	0.96	0.92	0.96
2 Bar 3.5mm	0.48	0.45	0.54	0.64	0.64	0.73	0.86	0.67	0.82
3 Bar 3.5mm	0.57	0.60	0.66	0.73	0.79	0.89	0.90	0.84	0.96
4 Bar 3.5mm	0.67	0.76	0.79	0.81	0.80	0.91	0.95	0.96	0.91
2 Bar 4.0mm	0.49	0.54	0.65	0.68	0.69	0.84	0.79	0.72	0.92
3 Bar 4.0mm	0.68	0.73	0.76	0.81	0.88	0.95	0.86	0.92	0.95
4 Bar 4.0mm	0.49	0.72	0.73	0.77	0.82	0.84	0.79	0.72	0.92

Table 3: Sprinkler overlap computer simulation

Costed Example

Ten hectares of silt loam pasture with an irrigation return period of 8 days (40mm readily available water using peak PET of 5mm/day).

1) Typical design 15m x 15m (poor uniformity 0.62)

One 8 pod lateral irrigates 0.18ha per shift and applies 2.8mm/hr. Therefore, seven laterals are required to cover the 10 hectares using one shift per day (maximum 14 hours irrigating per shift). Approximate system capital and running costs (mainline cost not included as assumed to be identical for each option) are shown below.

Item	Price	Number	Cost
Pods	\$100 each	56	\$5,600
LDPE 32mm	\$700 (500m)	7	\$4,900
Fittings	\$150	7	\$1,050
Pump		11l/s @ 4 Bar	\$3,000
Capital cost			\$14,550
Seasonal labour cost	Man & bike \$40/hr	0.5hr x 90days	\$1,800

2) A 10m x 10m design that achieve 80% uniformity benchmark (0.82)

One 8 pod lateral irrigates 0.08ha per shift and applies 6.3mm/hr. There are two options for covering the 10 hectares –

- a) 16 laterals using one shift per day (maximum 7 hours irrigating per day). Approximate system capital and running costs (mainline cost not included as assumed to be identical for each option) are shown below.

<i>Item</i>	<i>Price</i>	<i>Number</i>	<i>Cost</i>
Pods	\$100 each	128	\$12,800
LDPE 32mm	\$700 (500m)	16	\$11,200
Fittings	\$150	16	\$2,400
Pump		21 l/s @ 4 Bar	\$4,500
Capital Cost			\$30,900
Seasonal labour cost	Man & bike \$40/hr	1hr x 90days	\$3,600

- b) 8 laterals using two shifts per day (maximum 7 hours irrigating per shift). Approximate system capital and running costs (mainline cost not included as assumed to be identical for each option) are shown below.

<i>Item</i>	<i>Price</i>	<i>Number</i>	<i>Cost</i>
Pods	\$100 each	64	\$6,400
LDPE 32mm	\$700 (500m)	8	\$5,600
Fittings	\$150	8	\$1,200
Pump		11l/s @ 4 Bar	\$3,000
Capital cost			\$16,200
Seasonal labour cost	Man & bike \$40/hr	1hr x 90days	\$3,600

Summary

Field tests and computer simulations confirm a standard 15 x 15m multiple lateral sprayline system will never reach the required 80% performance benchmark. However, if pod spacing and pressure are optimised (closed up and increased) through better design, it is possible to achieve this benchmark by either –

- If the capital cost is to remain relative, doubling the seasonal labour input, i.e. twice a day shifting.
- Doubling the capital cost of the system. Weigh up your options if you decide to choose this approach, you may be better off spending a few more dollars and investing in a higher quality irrigation system.

Whichever approach you take, it is essential to have a suitably qualified irrigation consultant design your multiple lateral sprayline irrigation system. Otherwise your 'low cost' investment is likely result in an inefficient and ineffective multiple lateral sprayline irrigation system.