SoilsForLife
AN OUTCOMES AUSTRALIA PROJECT

Case Study

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FFL WINLATON CASE STUDY: ECONOMIC REPORT

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Kilter Rural has quickly become an international leader in processing tomato production with its large operational scale, and focus on yields and quality. A strong focus on water use efficiency and soils will continue to drive productivity and soil improvement.

Background:

Kilter Rural's returns in excess of 8% on capital invested a year is achieved by returns generated from the blending of multiple business units – agricultural produce, irrigation water services and environmental markets (to the extent that they are available), and the operational returns generated as capital appreciation of the land. This is regularly assessed by independent valuation.

When both Operational Returns and Capital Valuations are added, Kilter Rural is aiming to *exceed* a target of 8% a year.

This report focuses on the agricultural produce enterprise.

Production Focus: Soil and Water

Since 2014 Kilter Rural has transformed its agricultural production systems by focussing on both water use efficiency and soil health. This dual focus underpins the improving levels of production that have been measured over the last four years.

In order to create a more regenerative production system, the most suitable irrigation soil types are identified through detailed soil tests for nutrient status and chemical properties. Soil pits are used to examine physical soil structure and applications of organic matter at rates up to 10 t/ha are commonly applied as compost in order to assist the soil biological processes in the first years of production. Compost is currently transported from other parts of Victoria. Agricultural production is focussed on the black and grey cracking clays (Vertosols) on the lower floodplain as well as loamier clays (Sodosols) on the gentle rises where these meet irrigation suitability criteria.

Sub-surface irrigation, centre pivots and laser levelled paddocks for gravity irrigation have been installed on the most productive soils, currently nearing 3,000 ha. A further 1,300 ha is in the process of being developed for irrigated production.

Over time various summer and winter irrigated crops have been trialled. These include dryland cereals where there is the ability to irrigate at key growth stages to supplement increasingly unreliable rainfall. The business is currently operating on two distinct streams of cropping rotations:

1. Irrigated summer crops rotating around lucerne, processing tomatoes and cotton; and
2. Winter organic cereals in combination with a short rotation organic summer crop (e.g. soybean)

A sheep enterprise is run on the dryland areas and opportunistically on crop feed/residue, and small areas of new crops are actively trialled to determine future viability.

The summer irrigated cropping provides the bulk of the net income from the enterprise. A focus on lucerne, processing tomatoes and cotton creates a balanced cropping rotation as well as strong predictability in market prices through the ability to sell forward. However this is now being increasingly supported by the elevated margins associated with a broadacre organic enterprise. All cropping enterprises have well developed agronomic programs with linkages to leading industry partners and R&D organisations.

Regenerative practices:

When purchased by the company, much of the original aggregation consisted of low nutrient status soils with a long history of past cultivation and unsustainable irrigation practices. Soils were also significantly affected by salt, brought about by a century of inadequate irrigation and drainage management.

Farm productivity was low, and the farms had effectively become a stranded asset at the turn of the 21st century. Natural regrowth on stranded irrigation land was typically of low quality and dominated by a few early colonisers (often by halophytes on salt affected ground).

A number of innovations have brought soils back into production. These include:

- The strategic use of compost, gypsum and fertilisers.
- The introduction of (deep rooted) lucerne and careful management of irrigation
- Irrigation combined with the natural cracking properties of the soils, assists with flushing of accumulated surface salts deeper into the profile.
- Large quantities of compost are used to support improvement in soil structure, organic matter levels and biological activity.
- Compost is a key element of a broader strategy to regenerate these soils.
- Over 1000 ha of managed lands are under organic certification.

Kilter Rural is particularly innovative in developing production efficiencies in its cropping enterprise including;

1. Soil management: integration of crop residue; introducing organic matter through composting; strategic crop rotations; irrigation to mimic natural wet-dry cycles to develop soil structure and permeability in cracking clays,
2. Water use efficiency: optimising water applications to the plant in the right amount at the right times; and

3. Fertiliser management: improving soil biological processes; crop rotation; targeting applied nutrients to meet plant requirements; enhancing soil nutrient availability through improvements in soil structure; sub-surface delivery of nutrients in-crop.

The Kilter management team is able to access a strong technical team within and outside the business and has taken a detailed measurement based style to their management. This provides a good platform for their innovation.

Kilter is building a strong data driven learning style to managing its land, which will allow them to refine a locally adapted management approach.

Cropping Rotation:

After re-development of land for irrigation (either through subsurface, spray or laser levelling for gravity irrigation), lucerne typically starts the rotation and plays an important role in soil conditioning. Its deep roots open pathways for air and water to permeate through the soil profile. As a legume, the ability to add nitrogen to assist subsequent crops that have high nitrogen requirements, is important. Processing tomatoes are currently the highest value cropping enterprise and follow lucerne in the rotation. Generally, after two harvests, tomatoes are rotated with cotton for up to two years. The actual sequencing of crops within a rotation is dependent upon the needs and capability (soil and irrigation) of the particular paddock.

Allowing crop residues to be returned to the soil and minimising soil disturbance are important processes to ensure soil structure is maintained. Compost is embedded in the management cycle and is applied at rates up to 10 t/ha.

This crop combination is designed for sustained long-term returns. Over a four year period *gross margins* are currently averaging between $1000-$1500/ha/year.

Measurable soil structural and health improvements over time demonstrate the success of the summer crop rotation strategy. Through the use of regular and detailed soil testing, and use of an experienced Soils Consultant, soil improvement is planned and then monitored on a paddock by paddock basis.

Crop yields and quality are also closely monitored on a paddock by paddock basis and, together with soil data, inform future management decisions.

The future:

Kilter Rural has quickly become an international leader in processing tomato production with its large operational scale, and focus on yields and quality. A continuing focus on water use efficiency and soils will continue to drive productivity and soil improvement.

Detailed paddock, soil and crop records allow for a yearly cycle of review and adaptive learning. This creates a continuous improvement culture within the organisation.

Within the irrigation enterprise, the cotton rotation is an evolving area of knowledge. Growing cotton in a southern (short season) climate on a sub-surface irrigation zone is innovative, but increasingly possible given a changing northern Victorian climate.

A continual focus on agronomics, water use efficiency and soil profile improvements will help drive further growth in yields and Gross Margins, and lift average Gross Margins to the top of the target range.

While continually improving year on year production from each individual crop is important, Kilter Rural remains focused on the overall Gross Margin return over the full rotation cycle. This philosophy also somewhat removes the distraction of year to year commodity pricing that can be managed but not controlled.

Crop yield and efficiency information:

Crop type: Processing Tomato

The following table shows the area, average yield (t/ha and t/ha/100mm rain) and water use (ML/ha) for the tomato crop from 2014-17 financial year's crop. Note this crop has been grown on Sub Surface Drip Irrigation

TABLE 1: CROP YIELD AND EFFICIENCY MEASURES: KILTER TOMATO CROP

Sub surface Drip Irrigation

Financial Year End:	Area grown (ha)	Yield (t/ha)	Irrigation Water Use (ML/ha)	Water use efficiency for irrigation and rainfall (t/ha/100mm)
FY14	65	92	7.7	11.2
FY15	165	135	7.4	16.9
FY16	275	152	8.5	16.7
FY17	268	119	6.3	16.3

Note: Rainfall contribution to total crop water is that accumulated over Oct-Jan growing season

The Kilter management team focuses on water use efficiency as a driver of both production and Gross Margin. Their target is to exceed 16 t/ha/100mm and this is considered a high benchmark in the industry.

Individual seasonal influences such as within crop temperature variations (particularly cold temperatures early in the season) and changing crop paddocks (new irrigation fields) have led to the small fluctuations in water use efficiency around the target.

After the first cropping year, the internal benchmark has been exceeded in all years. The management team believes that with further experience and learning there is an opportunity for additional improvement in both overall yield and efficiency.

We were unable to locate published benchmark water use efficiency figures for processing tomatoes in Northern Victoria. However, the SFL team has verified in discussions with independent industry experts that the water use efficiencies measured at the Kilter farms are very high by industry standards.

Crop type: Lucerne

Sub surface drip irrigated lucerne:

The following table shows the area, average yield (t/ha and t/ha/100mm rain) and water use (ML/ha) for the lucerne crop from 2014-17 financial year's crop. Note the crop characterised here has been grown on Sub Surface Drip Irrigation.

TABLE 2: CROP YIELD AND EFFICIENCY MEASURES: LUCERNE CROP

Sub surface Drip Irrigation

Financial Year End:	**Area grown (ha)**	**Hay Yield (t/ha)**	**Irrigation Water Use (ML/ha)**	**Water use efficiency for irrigation and rainfall (t/ha/100mm)**
FY15	100	10.7	8.3	0.99
FY16	212	12.5	8.7	1.19
FY17	312	11.9	7.1	1.16
3 yr AVERAGE				**1.13**
COMPARATIVE				*1.10*

Notes:

1. Lucerne yields are for the season following establishment
2. Rainfall contribution to total crop water was accumulated over Jul-Mar growing season
3. Comparative: see footnote for reference citation

As for tomatoes, seasonal variations in temperatures, the pattern of rainfall (particularly after hay is cut) and the length of growing season all impact on the numbers of hay cuts possible in a season and yield. In some years grazing with sheep has been preferred to an inferior final cut.

The Comparative line is taken from a paper published in the Journal of Crop and Pasture Science examining lucerne yield, water productivity and persistence under a range of irrigation strategies. The research was undertaken over a five year period in Northern Victoria.[1] The water use efficiencies

[1] *Lucerne yields, water productivity and persistence under variable and restricted irrigation strategies. ME Rogers, AR Lawson and KB Kelly. Crop and Pasture Science, 2016, 67 563-573.*

being achieved using Sub Surface Irrigation are comparable with those found in the research trial, which suggests a good level of water use efficiency is being achieved.

Gravity irrigated lucerne (flood irrigation):

Lucerne had been opportunistically grown for some years. However it was 2014 when Kilter saw a strategic role for lucerne as a genuine long term rotation crop with tomatoes and cotton. The soil conditioning properties of lucerne were able to be closely monitored in the subsequent high value crops and were reflected in improvements in yield and quality.

This has created a focus on the overall Gross Margin *of the rotation*, rather than on an individual crop.

TABLE 3: CROP YIELD AND EFFICIENCY MEASURES: LUCERNE CROP

Gravity Irrigation (Efficient Flood)

Financial Year End:	**Area grown (ha)**	**Hay Yield (t/ha)**	**Irrigation Water Use (ML/ha)**	**Water use efficiency for irrigation and rainfall (t/ha/100mm)**
FY16	140	9.5	8.5	0.92
FY17	320	9.4	6.7	0.95
AVERAGE:				*0.94*
COMPARATIVE TRIAL				*1.02*[2]
COMPARATIVE LUCERNE HANDBOOK				*0.73*[3]

Notes:

1. Lucerne yields are for the season following establishment
2. Rainfall contribution to total crop water was accumulated over the Jul-Mar growing season
3. Comparative: see footnote for reference citations

[2] *Lucerne yields, water productivity and persistence under variable and restricted irrigation strategies. ME Rogers, AR Lawson and KB Kelly. Crop and Pasture Science, 2016, 67 563-573.*
[3] *Bullen, K 2002 Lucerne Management Handbook 4th edition DPI Publishing*

The water use efficiency for the laser levelled gravity irrigated paddocks is below that achieved through sub surface drip irrigation, which is to be expected. The yields achieved are slightly lower than those achieved in the five year comparative research trials, however they are greater than those achieved under commercial conditions as cited in the Lucerne Management Handbook.

Water use efficiency: Overall Lucerne crop

Water use efficiency is a key management focus at Kilter. Table 4 below shows the irrigation efficiency comparisons between gravity irrigation and sub surface Irrigation for the lucerne rotation over a three year period.

While the capital costs of sub surface irrigation are substantially more than laser levelled gravity irrigation, the irrigation efficiency gains range from 22% to 29%.

TABLE 4: IRRIGATION EFFICIENCY MEASURES: LUCERNE CROP

Gravity Irrigation (Flood) compared to Sub Surface irrigation

Financial Year End:	**Gravity (Flood irrigation)** **Water use efficiency for irrigation and rainfall (t/ha/100mm)**	**Sub surface irrigation** **Water use efficiency for irrigation and rainfall (t/ha/100mm)**	**Efficiency difference** **(sub surface over gravity)** **%**
FY16	0.92	1.19	29
FY17	0.95	1.16	22

Water use efficiency: Paddock example

Below is an example of the yields achieved from Paddock DBRA3 which was sown in spring 2014. This crop was rotated out of lucerne into tomatoes in 2017, and the yields cut short by the need to prepare the soil for the subsequent summer crop.

	Table 5: Sub Surface irrigation Lucerne Water-Yield Efficiency: DBRA3				
Financial Year end	**Ha grown**	**Ave. t/ha** **Crop Yield**	**Ave. ML/ha** **Irrigation water applied**	**Ave t/ha/100mm** **Water use efficiency for irrigation and rainfall (t/ha/100mm)**	**Comment**
FY14	100	5.2	6.4	0.5	Establishment: Lucerne sown in spring
FY15	100	10.5	8.3	1.1	
FY16	100	13.5	8.6	1.3	
FY17	100	11.4	7.4	1.1	Consistently wet winter/spring , crop rotated out in autumn

The case study above shows the above lucerne paddock DBRA3 consistently achieving in excess of 1.1 t/ha/100mm of applied water (rain and irrigation).

Lucerne is currently harvested with a combination of small and large bales and marketing is targeting the higher value racehorse industry.

Gross Margins:

Kilter has a strong financial management focus to its activities. A key financial metric with a strong focus is Gross Margin/Megalitre of water applied ($GM/ML.) for each of their crops. This helps ensure that the most profitable use of their irrigation water is made.

Below is a Gross Margin range that has been achieved for the current range of crops, some being fully established and some for newer crops.

Table 6: Gross Margin per ha ($GM/ha) and Gross Margin per ML applied water ($GM/ML) for a range of crops.

Crop	$GM/ha range	GM $/ML range	Comment
Tomatoes	1500-2500	175-300	Demonstrated
*Cotton	800-1200	95-140	Work in progress
Lucerne	300-500	35-60	Demonstrated
Organic Cereals	500-700	200-280	Demonstrated
Organic Stone fruit	8000-12000	650-950	Demonstrated