## FERTILISER OPTIONS:

# PRODUCTIVE AND PROFITABLE GRAZING SYSTEMS IN WESTERN VICTORIA

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**Abstract.** Productive and profitable grazing systems do not just happen, but are the result of careful planning to ensure that all components which make up the system dovetail together. Attention must be paid to all aspects of the system (soils, pastures, animals and markets) to make progress. It is not good enough to have the best sheep in the district and hope that this will make up for poor quality pastures. Grazing projects conducted in western Victoria have shown that sheep productivity can be doubled (wool 59 vs 32 kg/ha) when a "Productive Pasture Package" is adopted. Gross margins have been lifted by $50-150/ha depending on commodity prices and the degree of improvement in the pasture. The Australian Wool Research and Promotion Organisation is funding the "Grassland's Productivity Program" conducted by the Grasslands Society of Victoria and the Department of Agriculture, Victoria. This program is encouraging the adoption of Productive Pastures in the over 550 mm rainfall regions of southern Australia by helping producers monitor productivity of paddocks on their farms.

Grazing systems are made up of many components, some of the most important of which are shown in Table 1. Those shown in italics are discussed in this paper but it is vital that all are considered if profitability and productivity are to be optimised.

## Putting the grazing system under the microscope

### *Soils*

**Fertility:** Soil fertility is a major determinant of the productivity of a farm, has been studied in many trials and major projects, is something which farmers have a large amount of control over, yet is often the most limiting factor in the grazing system. Results from the 16 year old Phosphate Trial at Hamilton are shown in Table 2. These clearly show the importance of P inputs to maintain pasture composition. This trial was established on an area with a low fertiliser history (Olsen P 4-5 ppm). Reduced fertiliser use on many farms over recent years makes the results applicable to many properties.

**Table 2.** The effect of P fertiliser on pasture composition at Hamilton (percent green material of each species in mid spring).

| Fertiliser rate (kg P/ha/year) | 1 | 3 | 7 | 14 | 21 | 33 |
|---|---|---|---|---|---|---|
| Onion grass | 35 | 31 | 9 | 2 | 1 | 0 |
| Subclover | 6 | 11 | 14 | 27 | 28 | 24 |
| Perennial Ryegrass | 12 | 15 | 32 | 34 | 39 | 37 |

In contrast, stocking rate had no effect on Onion grass content. There were small effects on the amount of perennial ryegrass (27%, 34%, 23%) and subclover (15%, 18%, 23%), for low, medium and high stocking rates respectively.

Animal productivity results for 1991-92 in the Hamilton Trial are shown in Table 3. Plots are stocked with September lambing, 19-20 merino ewes. Ewes are shorn in June and pregnant ewes are reallocated to the plots which are maintained with 100% lambs.

**Table 1.** Important components of grazing systems.

| **Soils** | **Pastures** | **Animals** | **Marketing** |
|---|---|---|---|
| *Fertility* | *Legumes* | *Stocking rate* | Customer needs |
| Biological activity | *Perennial grasses* | *Efficient stock* | Alternative markets |
| Trace elements | Management | *Pasture utilisation* | Product value |
| Soil pH | Hay/silage | *Animal health* | |
| Drainage | Alternative species | Reproductive rate | |

**Table 3.** Fertiliser and stocking rate effects on sheep production at Hamilton.

| Stocking rate | Parameters | Average fertiliser applied (kg P/ha/year) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 3 | 7 | 14 | 21 | 32 |
| Low | Weight (kg) (June) | 46.6 | 51.6 | 52.7 | 54.7 | 55.3 | 53.0 |
| | Fleece (kg) | 4.4 | 4.5 | 5.4 | 5.4 | 5.0 | 5.6 |
| | Stocking Rate (ewes/ha) | 5.0[1] | 6.3 | 8.3 | 10.0 | 11.3 | 12.5 |
| Medium | Weight (kg) (June) | 47.7 | 47.9 | 49.8 | 52.6 | 52.3 | 52.2 |
| | Fleece (kg) | 4.2 | 4.4 | 4.7 | 5.0 | 4.9 | 5.0 |
| | Stocking Rate (ewes/ha) | 7.0[1] | 8.8[1] | 12.3 | 14.0 | 15.3 | 17.5[1] |
| High | Weight (kg) (June) | 43.1 | 43.1 | 45.1 | 49.4 | 48.6 | 45.6 |
| | Fleece (kg) | 3.6 | 4.1 | 4.1 | 4.2 | 4.6 | 4.2 |
| | Stocking Rate (ewes/ha) | 9.0[1] | 11.3[1] | 15.8[1] | 18.0[1] | 20.3[1] | 22.5[1] |

[1] Ewes which required supplementary feeding.

Note that despite the higher stocking rates in the high P treatments, wool cut and liveweights are higher than the low fertility plots. Decreasing stocking rate has not been able to make up for poor pasture composition and quality.

Changes to fertiliser policy take time to show the full effects. In a trial near Dunkeld on a paddock with a history of 2.75 t/ha superphosphate (Olsen P 8-9 ppm), the differences between the nil and 25 kg P/ha treatments increased each year over a 6 year period. By the last year of the trial, equivalent wool cuts per head (5.5 kg/head) occurred at 12, 15 and 18 wethers/ha for the nil, 10 kg P and 25 kg P treatments, respectively.

### *Pastures*

**Legumes:** The clover content of many pastures is too low. We should be aiming at 30-50% legume in late winter and spring. Clover content can be increased by:

- grazing paddocks bare before the autumn break;
- increasing soil fertility, rectifying trace element deficiencies;
- introducing more productive, disease-resistant cultivars. Improved subterranean clover should have been put in every paddock by now! and,
- keeping stocking rates up throughout the year.

**Insects:** Red-Legged Earth Mite are always a problem in under-stocked, poor quality onion grass/silver grass paddocks, but appear to do little damage in well-grazed, upgraded paddocks. It seems the close grazing over summer destroys many of the eggs. In contrast, cockchafers can do a lot of damage in the years that they occur in heavily grazed paddocks, and patches or paddocks should be treated immediately they are seen.

**Perennial grasses:** Improved perennial grasses significantly boost the carrying capacity, sustainability and productivity compared to annual grasses. They respond well to increased fertility, maintain quality over summer and hold the ground together in late summer and autumn. When choosing between different grass species and cultivars, there seems to be a trade off between persistence and productivity; *ie.* Australian *vs* Sirosa phalaris, Victorian *vs* Ellett ryegrass, Currie *vs* Porto cocksfoot, the first species listed being more persistent but less productive. Lack of persistence of the perennial grass component is the weakest link in the "Productive Pasture Package".

We are slowly learning about the management requirements of the newer species. There are indications that rotational grazing and spelling will improve persistence, particularly in marginal areas. The length of spells, when they should occur and differences between species are still unclear, but the MRC Pasture Sustainability Key Program may provide some answers. Lifting soil pH and improving fertility also greatly improve persistence.

Intensive mob stocking techniques have not been widely adopted in Australia. There is a place for these systems to be used to improve degraded pastures. Many paddocks in western Victoria are undergrazed, with a large carry-over of dry feed, and are dominated by rank phalaris, fog grass, sweet vernal, *etc.* It is difficult for many farmers to assemble enough sheep or cattle to graze these paddocks down over a 1-2 week period and, if stock are forced to graze this type of pasture for long periods, their liveweight and production will suffer. There is potential to split paddocks like this up into areas of 2-5 ha which can be stocked with 300-500 DSE/ha to graze the area bare within a few days. This practice, combined with heavy fertiliser application and spraytopping, might be a cheap way of restoring many degraded pastures.

### *Animals*

**Stocking rate:** Stocking rate, like fertiliser policy, is directly under the farmer's control and has a major effect on productivity and profitability. If pasture growth or quality is increased, stocking rate must also

be increased in order to effectively use the feed grown. Increased production per head from the existing animals will not recoup additional costs. With wool sheep, increased production per head also increases fibre diameter, leading to lower prices per kg of wool. Many farmers fail to take full advantage of the potential to carry more stock. A survey by Peter Schroder in the Hamilton district found that whereas 83% of farmers improved pastures so that they could run more stock, only 30% of farmers *had actually increased their stocking rate over the last 5 years.* There are many reasons why stocking rates might not have increased (*eg.* disease, risk, price, availability, *etc.*), but there is no point spending money improving pastures unless it is recouped by higher returns from more animals.

**Efficient and productive stock:** Just as poor pastures limit the profitability of productive sheep, unproductive sheep may greatly reduce the benefit of productive pastures. It costs as much to feed, drench, shear and maintain a 55 kg ewe cutting 4.5 kg of 23$\mu$ wool as one cutting 5.5 kg of 22$\mu$! As a rule of thumb, ewes should cut at least 1 kg wool per 10 kg liveweight, wethers more.

**Pasture utilisation:** Good pasture utilisation means using a high proportion of the feed produced during the growing season without high supplementary feed inputs. In practice, this means making sure lambing, weaning and shearing times fit in with pasture growth. These factors have the greatest influence on the feed requirements of sheep flocks.

Changing from autumn to late winter/spring lambing allows an increase of about 30% in carrying capacity. Some farmers argue that lower lambing percentage and additional feed requirements of weaners reduce this advantage. Over 4 years at 5 farm sites, we have averaged 80% lambs weaned. Important issues when considering spring lambing are:

- watch ewe condition at joining (March) as they will have slipped since the spring peak;
- Yarloop subclover is common in some areas and can dramatically affect lambing;
- keep the mating period short. Late lambs increase management problems;
- train lambs to eat grain while on the ewes; and,
- fodder crops, lucerne or other higher quality species can provide a safety net.

## Putting it all together

The South-west Sheep Pasture Productivity Project, jointly funded by Pivot Fertilizers and the Victorian Department of Agriculture started in southwest Victoria in 1988. The aim of the project is to demonstrate the economic and productivity benefits of using better quality pastures. During 1988, paddocks were selected on farms at Ararat, Edenhope, Lismore, Vasey and at the Pasture and Veterinary Institute, Hamilton, representing typical poor quality pastures (low soil fertility, low clover content, few improved perennial grasses). The five paddocks were each split into four blocks and in spring 1988-autumn 1989, two blocks at each site were resown by direct drilling to perennial rye grass, phalaris and subterranean clovers (Upgraded Pastures). Fertilisers are applied to these pastures each autumn, based on soil test results. The remaining two blocks (Typical Pastures) have received a maintenance fertiliser application only (4 kg P/ha/year) and no other pasture treatment.

Upgraded paddocks were initially stocked with about 15% (1.5 ewes/ha) more ewes than the Typical pastures. Original sheep have remained on the particular treatment for at least 2 years and up to 4 years so that differences showing in one year flow through into following seasons. Ewes are weighed regularly and, as consistent differences in liveweight develop between the two treatments, stocking rates of sheep grazing Upgraded pastures are adjusted, with the aim of maintaining ewes at a liveweight similar to those grazing the Typical pastures.

### *Fertiliser applications and soil tests*

Phosphorus (P) is the main element required at all sites. 15-25 kg P/ha/year has been applied to the Upgraded paddocks with potassium and sulphur added if necessary. Olsen P in the Upgraded paddocks has increased (mean 1988 7; 1993 11) while Typical paddocks have remained at 7. In 1993-94, fertiliser applications have been reduced to 15-18 kg P/ha/year on Upgraded paddocks where Olsen P is greater than 11 ppm.

### *Effects of fertiliser on pasture growth and composition*

Fertiliser test strips were established to study the effect of different rates of fertiliser on pasture growth and composition. Rates of 0-60 kg P/ha/year (0-700 kg single super/ha/year) have been applied each autumn over the last 4 years. The effect of the fertiliser on pasture growth for June and August 1992 is shown in Figure 1. Upgraded pastures which contained much more clover and perennial grasses responded well to fertiliser. The Typical pastures did not respond to fertiliser. Both pastures responded in October to fertiliser, but again the response was greater in Upgraded pastures.

### *Pasture quality and growth*

A mixture of Trikkala, Larisa, Karridale and Enfield subterranean clover was sown at 10 kg/ha, the proportion of each cultivar varying depending on site characteristics. Clover content of the two pastures is

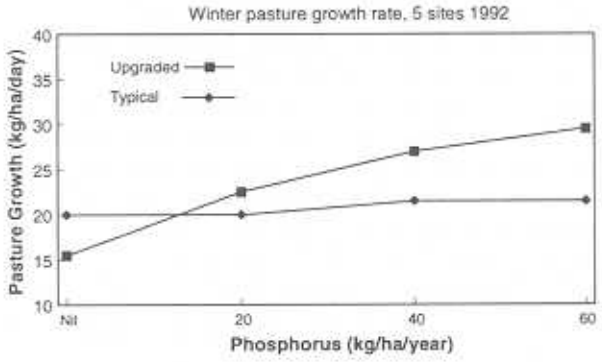


**Figure 1.** Upgraded pastures respond to fertiliser.

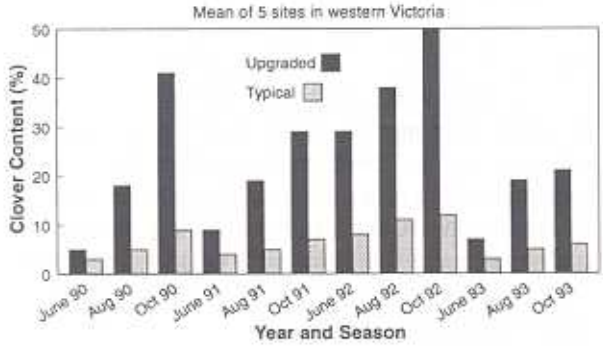


**Figure 2.** Upgraded pastures contain more clover.

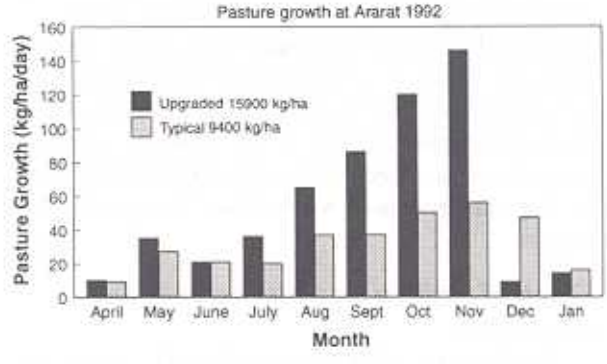


**Figure 3.** Upgraded pastures produce more herbage.

shown in Figure 2. The Upgraded pastures always contained more clover than the Typical pastures. Pasture quality was assessed by taking random samples of the herbage on offer each season. Digestibility of the Upgraded pasture on offer was also higher, 64 *vs* 60% DOM.

The pattern of pasture growth has been similar at all sites in most years. Pasture production for Ararat in 1992 is shown in Figure 3. There is relatively little difference in growth between the pastures in autumn/early-winter with the greatest advantage of the Upgraded pastures occurring in August-November. This change in pattern of pasture production is due to several factors. A combination of the higher stocking rate and higher palatability of the Upgraded pastures means that they are grazed shorter over winter, and so have a lower growth rate. It takes 8-12 weeks from the autumn break for the subterranean clover to make a major contribution. Also, the annual grasses which are dominant in the Typical pasture get away quickly. Grazing strategies are needed for these high quality Upgraded pastures to enhance their productivity in autumn.

### *Perennial grass persistence*

Ellett and Kangaroo Valley perennial ryegrasses were sown at all sites, and Australian or Sirosa phalaris depending on site characteristics. The density of phalaris has been maintained or increased at all sites whereas the density of the perennial ryegrass has declined. However, Victorian perennial ryegrass was successfully incorporated into the Hamilton and Lismore sites in 1992 without further spraying or removing the sheep from grazing. The poor ryegrass persistence highlights the need to sow persistent and productive perennial grasses which are managed to enhance persistence. New species should be trialled in small areas on your farm regularly to build up knowledge on the cultivars that will persist under your particular farming conditions.

### *Sheep productivity*

Key productivity results are shown in Table 4. An example of stocking rates and liveweights is shown in Figure 4. Stocking rates on the Upgraded pastures have increased from 9.9 ewes/ha to 12.6 ewes/ha over the last 4 years. Despite this increase, the sheep are heavier, cut more wool per head and wean heavier lambs. This suggests that the Upgraded pastures have placed the ewes under *less* pressure than those in the Typical paddocks despite the higher stocking rate. After 4 years, the wool cut/ha and lambs weaned/ha have doubled on the Upgraded compared to the Typical pastures.

### *Animal health*

Worms are the major animal health issue in sheep, and it is widely held that higher stocking rates increase worm burdens. In September-October 1993, the faecal egg count was determined in ewes at 4 farm sites. Ewes grazing Upgraded pastures at up to twice the stocking rate of the ewes on the Typical pastures had the lowest counts (190 compared to 500 eggs/g). Despite running more ewes/ha, the Upgraded pastures maintained the stock in better condition and at higher liveweights and this may have reduced egg output. Upgraded pastures are grazed short over summer and autumn which may result in desiccation of larvae.

### *Does it pay?*

Productivity and profitability for a number of sites are shown in Tables 5-7. In calculating the returns, the following assumptions have been made:

**Table 4.** Productivity of Upgraded and Typical pastures, 1990-1993[1]

| Year | Pasture system | Liveweight (kg) | Stocking rate (ewes/ha) | Fleece weight (kg) | Wool/ha (kg) | Weaning (%) | Weaning weight (kg) | Feed /ewe ($) |
|---|---|---|---|---|---|---|---|---|
| 1990-91 | Upgraded | 47.5 | 9.9 | 4.7 | 47 | 81 | 21 | 1.95 |
| | Typical | 46.2 | 7.3 | 4.4 | 32 | 77 | 20 | 2.02 |
| 1991-92 | Upgraded | 50.1 | 11.2 | 4.7 | 52 | 86 | 22 | 3.68 |
| | Typical | 48.8 | 7.2 | 4.6 | 33 | 81 | 22 | 3.25 |
| 1992-93 | Upgraded | 54.6 | 11.5 | 5.3 | 60 | 79 | 27 | 1.77 |
| | Typical | 50.7 | 6.9 | 4.9 | 34 | 79 | 25 | 2.19 |
| 1993-94 | Upgraded | 53.2 | 12.6 | 4.7 | 57 | 85 | 25 | 1.28 |
| | Typical | 49.8 | 7.0 | 4.3 | 30 | 87 | 24 | 0.84 |

[1] Average of sites at Ararat, Edenhope, Hamilton, Lismore and Vasey.

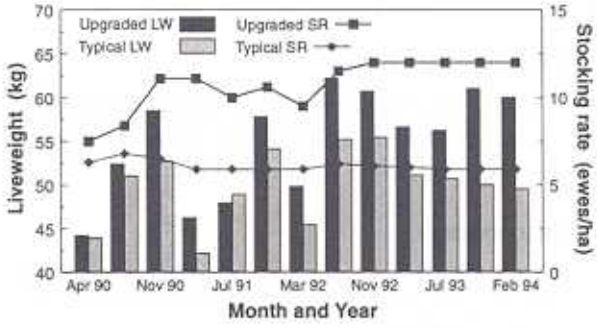


**Figure 4.** Liveweight and stocking rate, Ararat.

- Net on-farm greasy wool prices based on Market Indicator April 1994, 8% Tax, 25 c/kg selling costs, 73% yield.
- Weaner lambs and cast merino ewes valued at $12/head.
- For prime lamb systems, depreciation at $4/ewe/year is charged
- Supplementary feeding, fertilizer costs and weaning percentages have been averaged over a three year period.
- Interest at 8.5% is charged against the extra stock on the Upgraded pastures.
- Overhead costs are averages from the Hamilton Farm Monitor Project.
- Upgraded Pasture costs include a proportion of initial resowing costs (*ie.* $20/ha/year for 10 years).

### *Edenhope 1991-92 (Table 5)*

There are several reasons for the poor productivity at this site. The perennial grasses in the Upgraded pastures are below expectations due to inappropriate species selection. Also, ewes lamb in autumn, need additional supplementary feed and are below the bench mark for productivity per head.

### *Lismore 1992-93 (Table 6)*

Typical pastures at this site are dominated by barley grass, silver grass, *Danthonia* and fog grass and have declined during the trial. In contrast, the Upgraded pastures are an excellent stand of clover, phalaris and perennial ryegrass. The ewes lamb to fit the pasture growth and, being a prime lamb flock, have high demands during lactation. Carrying capacity has been increased by over 100% and profitability increased 3-fold.

### *Ararat 1992-94 (Table 7)*

Typical pastures at this sites are dominated by Onion grass and *Danthonia* and are very unproductive,

**Table 5.** Productivity and Profitability, Edenhope, 1991-92[1].

| Parameters | Pasture type: Typical | | Pasture type: Upgraded | |
|---|---|---|---|---|
| Stocking rate (ewes/ha) | 6.2 | | 9.0 | |
| *Returns* | | *($/ha)* | | *($/ha)* |
| Wool kg/ewe[2] | 4.3 | | 4.4 | |
| $/kg (net on farm) | 3.44 | 92 | 3.32 | 131 |
| Lambs weaned (%) | 86 | | 88 | |
| $/weaned lamb | 12 | 64 | 12 | 95 |
| | | 156 | | 226 |
| *Costs* | *($/ewe)* | | *($/ewe)* | |
| Health & shearing | 4.00 | 25 | 4.00 | 36 |
| Supplementary feed | 2.99 | 19 | 4.78 | 43 |
| Rams & other costs | 2.50 | 16 | 2.50 | 23 |
| Fertiliser | | 8 | | 43 |
| Pasture sowing | | 0 | | 20 |
| Interest on extra stock | | 0 | | 3 |
| *Total enterprise costs* ($) | | 68 | | 168 |
| *Gross margin* $/ha | | 88 | | 58 |
| *Gross margin $/ewe* | 14 | | 6 | |
| *Less Overhead costs @ $90/ha* | | | | |
| *Net Profit/Loss ($/ha)* | | $-2 | | $-32 |

[1] May lambing, Merino ewes, 23 micron; [2] 22.5 micron wool for typical pasture, 23.5 micron wool for upgraded pastures.

**Table 6.** Productivity and Profitability, Lismore, 1992-93[1].

| Parameters | Pasture type | | | |
|---|---|---|---|---|
| | Typical | | Upgraded | |
| Stocking rate (ewes/ha) | 5.0 | | 9.5 | |
| *Returns* | | *($/ha)* | | *($/ha)* |
| Wool kg/ewe[2] | 4.7 | | 4.9 | |
| $/kg (net on farm) | 3.19 | 75 | 3.19 | 148 |
| Lambs weaned (%) | 90 | | 95 | |
| Lamb liveweight (kg) | 37 | | 41 | |
| $/lamb | 35 | 158 | 38 | 343 |
| | | 233 | | 491 |
| *Costs* | *($/ewe)* | | *($/ewe)* | |
| Health & shearing | 4.00 | 20 | 4.00 | 38 |
| Supplementary feed | 2.75 | 14 | 2.36 | 22 |
| Rams & other costs | 2.50 | 13 | 2.50 | 24 |
| Replacement ewes | 4.00 | 20 | 4.00 | 38 |
| Fertiliser | | 8 | | 36 |
| Pasture sowing | | 0 | | 20 |
| Interest on extra stock | | 0 | | 5 |
| *Total enterprise costs* ($) | | 75 | | 183 |
| *Gross margin* $/ha | | 158 | | 308 |
| *Gross margin $/ewe* | 32 | | 32 | |
| *Less Overhead costs @ $90/ha* | | | | |
| *Net Profit/Loss ($/ha)* | | $68 | | $218 |

[1] August lambing, Bond ewes, mated to South Hampshire rams for prime lamb production; [2] 25 micron wool for typical pasture, 26 micron wool for upgraded pastures.

**Table 7.** Productivity and Profitability, Ararat, 1992-94[1].

| Parameters | Pasture type | | | |
|---|---|---|---|---|
| | Typical | | Upgraded | |
| Stocking rate (ewes/ha) | 6.2 | | 12.0 | |
| *Returns* | | *($/ha)* | | *($/ha)* |
| Wool kg/ewe | 4.8 | | 5.0 | |
| $/kg (net on farm) | 3.53 | 105 | 3.53 | 212 |
| Lambs weaned (%) | 81 | | 84 | |
| $/weaned lamb | 12 | 60 | 12 | 121 |
| | | 165 | | 333 |
| *Costs* | *($/ewe)* | | *($/ewe)* | |
| Health & shearing | 4.00 | 25 | 4.00 | 48 |
| Supplementary feed | 3.30 | 20 | 2.49 | 30 |
| Rams & other costs | 2.50 | 16 | 2.50 | 30 |
| Replacement ewes | 4.00 | 20 | 4.00 | 38 |
| Fertiliser | | 8 | | 40 |
| Pasture sowing | | 0 | | 20 |
| Interest on extra stock | | 0 | | 5 |
| *Total enterprise costs* ($) | | 69 | | 173 |
| *Gross margin* $/ha | | 96 | | 160 |
| *Gross margin $/ewe* | 15 | | 13 | |
| *Less Overhead costs @ $90/ha* | | | | |
| *Net Profit/Loss ($/ha)* | | $6 | | $70 |

[1] August lambing, Merino ewes, 22 microns.

whereas the Upgraded pastures are an excellent stand of perennial grasses and clover. Carrying capacity has been doubled from a low base with a large increase in profitability.

## Conclusions

The results show that the Upgraded pastures returned more than the Typical pastures, provided all aspects of the grazing system were harmonious (*eg.* Lismore 1992-93, Ararat 1992-94). However, if part of the grazing system is not performing, then the increased profitability of the Upgraded pasture will be completely eroded (*eg.* Edenhope 1991-92). To achieve the full potential for sheep production in Western Victoria, the benchmarks shown in the Appendix should be adopted.

## Acknowledgment

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## Appendix

### *Suggested benchmarks for sheep production in Western Victoria*

**Soil fertility:** minimum Olsen P 12-14 ppm, 15 kg P/ha applied every year.

**Carrying capacity:** target of 1 DSE/25 mm average annual rainfall in excess of 250 mm (*ie.* 500 mm average rainfall, 10 dse/ha; 700 mm average rainfall 18 DSE/ha).

**Pastures:**

*July:* green pasture 1-2 cm, less than 20% carryover dead herbage, 10-20% clover.

*September-October:* pasture 3-5 cm, no obvious dead material, 30-50% clover.

*December:* pasture should not exceed 15 cm.

Onion grass, fog grass, annuals, bent, sweet vernal and *Danthonia* should not exceed 20% of the pasture.

Sown perennial grasses should be 30-50% of the pasture.
By the autumn break, pastures should be grazed down to 1-3 cm average height.

**Animals:**
Sheep to lamb in July-October depending on area, over a 5 week period.
Minimum weaning percentage Merino's 80%, XB ewes 120%.
Minimum weaning weight Merino's, 20 kg at 12 weeks after commencement of lambing.
Lambing ewes should cut at least 1 kg wool per 10 kg liveweight.
Target ewe condition scores: prelambing 2.5, lactating 2.0, December 3.5.
Less than $2/ewe spent on supplementary feed.
Only 2 summer drenches and no winter drenching in most years.