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Accessory Publication: *Animal Production Science*, 2010, **50**(1), 6–16.

Wethers at Bookham

Property: Kia Ora		
Number of paddocks	1	
Total area	100 ha	
Weather: Yass (NSW)		
Weather station	Yass (NSW)	
Data period	1 Jan 1966 to 31 Dec 2007	
Paddock: Fertilised paddock		
Area	100.0 ha	
Steepness	Gentle	
Fertility	VARIABLE	
Reduce wind to	100%	
Soil: Kia Ora Soil		
Soil albedo	0.17	
Soil evaporation	3.5 mm/d ^{0.5}	
	Topsoil	Subsoil
Cumulative depth (mm)	460	1000
Field capacity (m ³ /m ²)	0.24	0.33
Wilting point (m ³ /m ²)	0.06	0.28
Bulk density (Mg/m ³)	1.36	1.7
Saturated conductivity (mm/hr)	62.31	0.01
Initial water (m ³ /m ²)	0.14	0.32
Pasture		
Legume proportion fixed at	15%	
Population	Annual Ryegrass	
Phenology	Senescent	
Live DM (kg/ha)	0	
Standing dead DM (kg/ha)	2000	
Litter DM (kg/ha)	500	
Below ground DM (kg/ha)	0	
Max. rooting depth (mm)	550	
Seed DM (kg/ha)	200	
Livestock		
Breed	Medium Merino	
Standard reference weight	47 kg	
Greasy fleece weight	5 kg	
Fibre diameter	19 microns	
Fleece yield	73 %	
Death rate: adults	3 %/year	
Death rate: weaners	3 %/year	
Management policy: Wether management		
Stocking rate	VARIABLE	
Shearing date	25-Nov	
Replacement rule	Rule	Purchase wethers on 25 Nov at age 15 months, live weight 45 kg and C.S. 2.5
	Cast for age	Sell stock aged 6 to 7 years on 25 Nov
Maintenance Feeding rule		
Main flock	Feed in paddock, applying the rules: If animal condition falls to 1.5 during 1 Jan to 31 Dec feed to maintain weight of the thinnest animals If animal condition falls to 0.5 during 1 Jan to 31 Dec feed to maintain condition of the thinnest animals	
Weaner stock	Feed in paddock, applying the rule: If animal condition falls to 1.0 during 1 Jan to 31 Dec feed to maintain weight of the thinnest animals	
Supplement	Supplement: whole barley	
	Ingredient	Barley, whole
	Proportion of mix (%)	100
	Dry matter content (%)	89
	Dry matter digestibility (%)	90
	ME:DM (MJ/kg)	13.7
Crude protein (%)	12	
	Rumen-degradable protein (%)	85
Pasture rule		
Do not reset pasture		
Costs: Sheep costs -Merino		
Wether Shearing	\$6.00 /head	
Wether Husbandry	\$2.00 /head	
Wether Replacement	\$45.00 /head	
Sheep sales commission	5 %	
Sheep sales cost	\$2.00 /head	
Pasture costs	VARIABLE	
Supplement costs (Barley, whole)	\$320.00 /t	
Prices: Merino prices -general		
Wool prices for wethers	17 micron	1462 c/kg
	18 micron	1352 c/kg
	19 micron	1057 c/kg
	21 micron	893 c/kg
	Av. Fleece Price	85 %
	Wool commission	5 %
Wether sales	Base price	185 c/kg
	Dressing percentage	43 %
	Skin price	\$4.00 /head

Self-replacing Merinos at Bookham

Property: Kia Ora		
Number of paddocks	1	
Total area	100 ha	
Weather: Yass (NSW)		
Weather station	Yass (NSW)	
Data period	1 Jan 1966 to 31 Dec 2007	
Paddock: Fertilised paddock		
Area	100.0 ha	
Steepness	Gentle	
Fertility	VARIABLE	
Reduce wind to	100%	
Soil: Kia Ora Soil		
Soil albedo	0.17	
Soil evaporation	3.5 mm/d ^{0.5}	
	Topsoil	Subsoil
Cumulative depth (mm)	460	1000
Field capacity (m ³ /m ³)	0.24	0.33
Wilting point (m ³ /m ³)	0.06	0.28
Bulk density (Mg/m ³)	1.36	1.7
Saturated conductivity (mm/hr)	62.31	0.01
Initial water (m ³ /m ³)	0.14	0.32
Pasture		
Legume proportion fixed at	15%	
Population	Annual Ryegrass	
Phenology	Senescent	
Live DM (kg/ha)	0	
Standing dead DM (kg/ha)	2000	
Litter DM (kg/ha)	500	
Below ground DM (kg/ha)	0	
Max. rooting depth (mm)	550	
Seed DM (kg/ha)	200	
Livestock		
Breed	Medium Merino	
Standard reference weight	47 kg	
Greasy fleece weight	4.5 kg	
Fibre diameter	19 microns	
Fleece yield	73 %	
Ram breed	Medium Merino (Mature ram: 65.8 kg)	
Death rate: adults	3 %/year	
Death rate: weaners	7 %/year	
Management policy: Meriono ewe management		
Stocking rate	VARIABLE	
Shearing date	25-Nov	
Replacement rule	Rule	Self-replacing each 1 Jan
	Cast for age	Self stock aged 5 to 6 years on 31 Dec
Reproduction rule		
First join at	1 years	
Birth date	11-Aug	
Conception at CS 3	(singles) 64% (twins) 30%	
Weaning date	24-Nov	
One ram per	100 ewes	
Keep rams for	4.0 years	
Sell young stock	Sell 0 year old animals on 31 Dec	
Maintenance Feeding rule		
Main flock	Feed in paddock, applying the rules: If animal condition falls to 2.5 during 1 Jan to 31 Dec feed to maintain weight of average animals If animal condition falls to 2.0 during 1 Jan to 31 Dec feed to maintain condition of the thinnest animals	
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Supplement	Supplement: whole barley	
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Pasture rule		
Do not reset pasture		
Costs: Sheep costs -Merino		
Ewe Shearing	\$6.00 /head	
Shearing Lambs	\$2.50 /head	
Ewe Husbandry	\$2.50 /head	
Lamb Husbandry	\$2.00 /head	
Ewe Replacement	\$60.00 /head	
Rams	\$800.00 /head	
Sheep sales commission	5 %	
Sheep sales cost	\$2.00 /head	
Pasture costs	VARIABLE	
Supplement costs (Barley, whole)	\$320.00 /t	
Prices: Merino prices -general		
Wool prices for ewes	18 micron	1352 c/kg
	19 micron	1057 c/kg
	21 micron	893 c/kg
	Av. Fleece Price	85 %
	Wool commission	5 %
Ewe sales	Base price	175 c/kg
	Dressing percentage	42 %
	Skin price	\$3.00 /head
Lamb sales	Base price	300 c/kg
	Dressing percentage	40 %
	Skin price	\$5.00 /head

Crossbred ewes at Bookham

Property: Kia Ora																							
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Weather: Yass (NSW)																							
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Management policy: XB ewe management																							
Stocking rate	VARIABLE																						
Shearing date	25-Nov																						
Replacement rule	Rule	Purchase ewes on 1 Dec at age 18 months, live weight 50 kg and C.S. 2.5																					
	Cast for age	Sell stock aged 5 to 6 years on 30 Nov																					
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Wethers at Hamilton

Property: Hamilton

Number of paddocks	1
Total area	100 ha

Weather: Hamilton (VIC)

Weather station	Hamilton (VIC)
Data period	1 Jan 1966 to 31 Dec 2007

Paddock: Fertilised paddock

Area	100.0 ha
Steepness	Level
Fertility	VARIABLE
Reduce wind to	100%

Soil: Brown duplex soil

Soil albedo	0.17
Soil evaporation	3.3 mm/d ^{0.5}

	Topsoil	Subsoil
Cumulative depth (mm)	300	1000
Field capacity (m ³ /m ³)	0.31	0.42
Wilting point (m ³ /m ³)	0.13	0.29
Bulk density (Mg/m ³)	1.33	1.35
Saturated conductivity (mm/hr)	6.9	0.8
Initial water (m ³ /m ³)	0.22	0.31

Pasture	11 kg/superphosphate/ha/yr	45 kg/superphosphate/ha/yr	90-375 kg/superphosphate/ha/yr
Legume proportion fixed at	10%	20%	30%
Population	Annual Ryegrass	Annual Ryegrass	Perennial Ryegrass
Phenology	Senescent	Senescent	S. Dormant (0)
Live DM (kg/ha)	0	0	0
Standing dead DM (kg/ha)	1000	1000	1000
Litter DM (kg/ha)	200	200	200
Below ground DM (kg/ha)	0	0	1500
Max. rooting depth (mm)	400	400	500
Seed DM (kg/ha)	200	200	

Livestock

Breed	Medium Merino
Standard reference weight	47 kg
Greasy fleece weight	5 kg
Fibre diameter	19 microns
Fleece yield	73 %
Death rate: adults	3 %/year
Death rate: weaners	3 %/year

Management policy: Wether management

Stocking rate	VARIABLE
Shearing date	30-Jun
Replacement rule	Rule
	Purchase wethers on 25 Nov at age 15 months, live weight 45 kg and C.S. 2.5
	Cast for age
	Sell stock aged 6 to 7 years on 25 Nov

Maintenance Feeding rule

Main flock	Feed in paddock, applying the rules: If animal condition falls to 1.5 during 1 Jan to 31 Dec feed to maintain weight of the thinnest animals If animal condition falls to 0.5 during 1 Jan to 31 Dec feed to maintain condition of the thinnest animals																
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Pasture rule

Do not reset pasture

Costs: Sheep costs -Merino

Wether Shearing	\$6.00 /head
Wether Husbandry	\$2.00 /head
Wether Replacement	\$45.00 /head
Sheep sales commission	5 %
Sheep sales cost	\$2.00 /head
Pasture costs	VARIABLE
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Prices: Merino prices -general

Wool prices for wethers	17 micron	1462 c/kg
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	19 micron	1057 c/kg
	21 micron	893 c/kg
	Av. Fleece Price	85 %
	Wool commission	5 %
Wether sales	Base price	185 c/kg
	Dressing percentage	43 %
	Skin price	\$4.00 /head

Self-replacing Merino ewes at Hamilton

Property: Hamilton				
Number of paddocks	1			
Total area	100 ha			
Weather: Hamilton (VIC)				
Weather station	Hamilton (VIC)			
Data period	1 Jan 1966 to 31 Dec 2007			
Paddock: Fertilised paddock				
Area	100.0 ha			
Steepness	Level			
Fertility	VARIABLE			
Reduce wind to	100%			
Soil: Brown duplex soil				
Soil albedo	0.17			
Soil evaporation	3.3 mm/d ^{0.5}			
	Topsoil	Subsoil		
Cumulative depth (mm)	300	1000		
Field capacity (m ³ /m ³)	0.31	0.42		
Wilting point (m ³ /m ³)	0.13	0.29		
Bulk density (Mg/m ³)	1.33	1.35		
Saturated conductivity (mm/hr)	6.9	0.8		
Initial water (m ³ /m ³)	0.22	0.31		
Pasture		11 kg/superphosphate/ha/yr	45 kg/superphosphate/ha/yr	90-375 kg/superphosphate/ha/yr
Legume proportion fixed at		10%	20%	30%
Population	Annual Ryegrass	Annual Ryegrass	Perennial Ryegrass	
Phenology	Senescent	Senescent	S. Dormant (0)	
Live DM (kg/ha)	0	0	0	
Standing dead DM (kg/ha)	1000	1000	1000	
Litter DM (kg/ha)	200	200	200	
Below ground DM (kg/ha)	0	0	1500	
Max. rooting depth (mm)	400	400	500	
Seed DM (kg/ha)	200	200		
Livestock				
Breed	Medium Merino			
Standard reference weight	50 kg			
Greasy fleece weight	5 kg			
Fibre diameter	20 microns			
Fleece yield	70 %			
Ram breed	Medium Merino (Mature ram: 70.0 kg)			
Death rate: adults	2 %/year			
Death rate: weaners	2 %/year			
Management policy: Meriono ewe management				
Stocking rate	VARIABLE			
Shearing date	25-Nov			
Replacement rule	Rule	Self-replacing each 1 Jan		
	Cast for age	Sell stock aged 5 to 6 years on 31 Dec		
Reproduction rule				
First join at	1 years			
Birth date	13-Sep			
Conception at CS 3	(singles) 90% (twins) 10%			
Weaning date	30-Nov			
One ram per	50 ewes			
Keep rams for	5.0 years			
Sell young stock	Sell 0 year old animals on 1 Feb			
Maintenance Feeding rule				
Main flock	Feed in paddock, applying the rules: If animal condition falls to 2.5 during 1 Jan to 31 Dec feed to maintain condition of average animals If animal condition falls to 2.0 during 1 Jan to 31 Dec feed to maintain condition of the thinnest animals			
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Pasture rule				
Do not reset pasture				
Costs: Sheep costs -Merino				
Ewe Shearing	\$6.00 /head			
Shearing Lambs	\$2.50 /head			
Ewe Husbandry	\$2.50 /head			
Lamb Husbandry	\$2.00 /head			
Ewe Replacement	\$60.00 /head			
Rams	\$800.00 /head			
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	21 micron	893 c/kg		
	Av. Fleece Price	85 %		
	Wool commission	5 %		
Ewe sales	Base price	175 c/kg		
	Dressing percentage	45 %		
	Skin price	\$3.00 /head		
Lamb sales	Base price	300 c/kg		
	Dressing percentage	45 %		
	Skin price	\$5.00 /head		

Crossbred ewes at Hamilton

Property: Hamilton				
Number of paddocks	1			
Total area	100 ha			
Weather: Hamilton (VIC)				
Weather station	Hamilton (VIC)			
Data period	1 Jan 1966 to 31 Dec 2007			
Paddock: Fertilised paddock				
Area	100.0 ha			
Steepness	Level			
Fertility	VARIABLE			
Reduce wind to	100%			
Soil: Brown duplex soil				
Soil albedo	0.17			
Soil evaporation	3.3 mm/d ²			
	Topsoil	Subsoil		
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Bulk density (Mg/m ³)	1.33	1.35		
Saturated conductivity (mm/hr)	6.9	0.8		
Initial water (m ³ /m ³)	0.22	0.31		
Pasture		11 kg/superphosphate/ha/yr	45 kg/superphosphate/ha/yr	90-375 kg/superphosphate/ha/yr
Legume proportion fixed at		10%	20%	30%
Population	Annual Ryegrass	Annual Ryegrass	Perennial Ryegrass	
Phenology	Senescent	Senescent	S. Dormant (0)	
Live DM (kg/ha)	0	0	0	
Standing dead DM (kg/ha)	1000	1000	1000	
Litter DM (kg/ha)	200	200	200	
Below ground DM (kg/ha)	0	0	1500	
Max. rooting depth (mm)	400	400	500	
Seed DM (kg/ha)	200	200		
Livestock				
Breed	Border Leicester x Merino			
Standard reference weight	60 kg			
Greasy fleece weight	3.8 kg			
Fibre diameter	26 microns			
Fleece yield	68 %			
Ram breed	Dorset (Mature ram: 110.0 kg)			
Death rate: adults	3 %/year			
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Management policy: XB ewe management				
Stocking rate	VARIABLE			
Shearing date	25-Nov			
Replacement rule	Rule	Self-replacing each 1 Jan		
	Cast for age	Sell stock aged 5 to 6 years on 31 Dec		
Reproduction rule				
First join at	1 years			
Birth date	13-Sep			
Conception at CS 3	(singles) 49% (twins) 45%			
Weaning date	30-Nov			
One ram per	100 ewes			
Keep rams for	4.0 years			
Sell young stock	Sell 0 year old animals on 1 Feb			
Maintenance Feeding rule				
Main flock	Feed in paddock, applying the rules: If animal condition falls to 2.5 during 1 Jan to 31 Dec feed to maintain weight of average animals If animal condition falls to 2.0 during 1 Jan to 31 Dec feed to maintain condition of the thinnest animals			
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Ewe sales	Base price	175 c/kg		
	Dressing percentage	45 %		
	Skin price	\$3.00 /head		
Lamb sales	Base price	320 c/kg		
	Dressing percentage	42 %		
	Skin price	\$5.00 /head		

Interpolating a medium fertility level for Hamilton

We derived a model relating annual pasture production to fertiliser application rate at Hamilton using data published by Quigley *et al.* (2003) (Table 1, Fig. 6). The equation applied was:

$$P = a + \frac{b}{1 + e^{-(F-c)/d}}$$

where P is annual pasture production ($\text{kg}\cdot\text{ha}^{-1}\cdot\text{yr}^{-1}$), F is the fertiliser application rate (kg single superphosphate. $\text{ha}^{-1}\cdot\text{yr}^{-1}$), and the relevant constants are: $a = 5733.5$ ($\text{kg}\cdot\text{ha}^{-1}\cdot\text{yr}^{-1}$), $b = 6920.8$ ($\text{kg}\cdot\text{ha}^{-1}\cdot\text{yr}^{-1}$), $c = 89.880$, and $d = 24.608$.

Table 1. Data from Quigley *et al.* (2003) for mean annual pasture production at different fertiliser application rates, modelled data for the same fertiliser application rates, and the relevant GrassGro fertility scalar applied for each fertiliser application rate.

Fertiliser applied (kg superphosphate/ha/yr)	Mean annual pasture production (kg/ha) (Quigley et al. 2003)	Modelled annual pasture production (kg/ha)	GrassGro fertility scalar
11	6000	6003	0.43
45	6700	6695	0.47
90	9200	9202	0.62
130		11521	0.78
170	12400	12397	0.84
260	12700	12647	0.86
375	12600	12654	0.86

We used the fitted model to derive a value for annual pasture production at a fertiliser application rate of 130 kg superphosphate. $\text{ha}^{-1}\cdot\text{yr}^{-1}$ (Table 1, Fig. 6). The relevant GrassGro fertility scalar value for each fertiliser application rate (Table 1.) was set by matching the simulated pasture production in GrassGro with measured pasture production data (or the modelled value for the 130 kg superphosphate. $\text{ha}^{-1}\cdot\text{yr}^{-1}$ application rate).

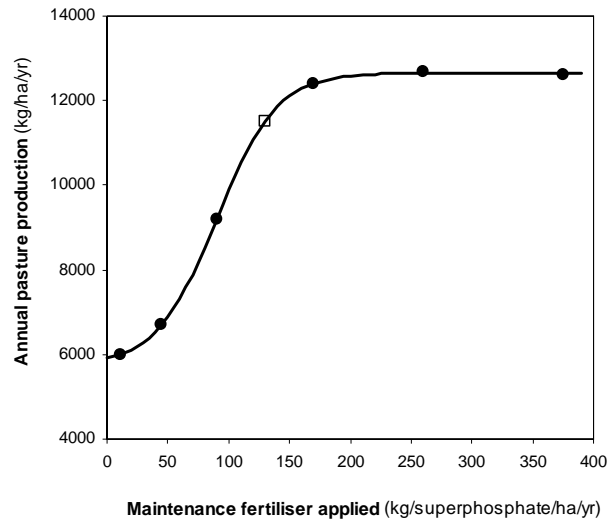


Figure 6. The relationship between annual pasture production and fertiliser application rate for Hamilton. Data from Quigley *et al.* (2003) are black circles, the line depicts the fitted model, and the square shows the interpolated pasture production value for a fertiliser application rate of 130 kg superphosphate.ha⁻¹.yr⁻¹.