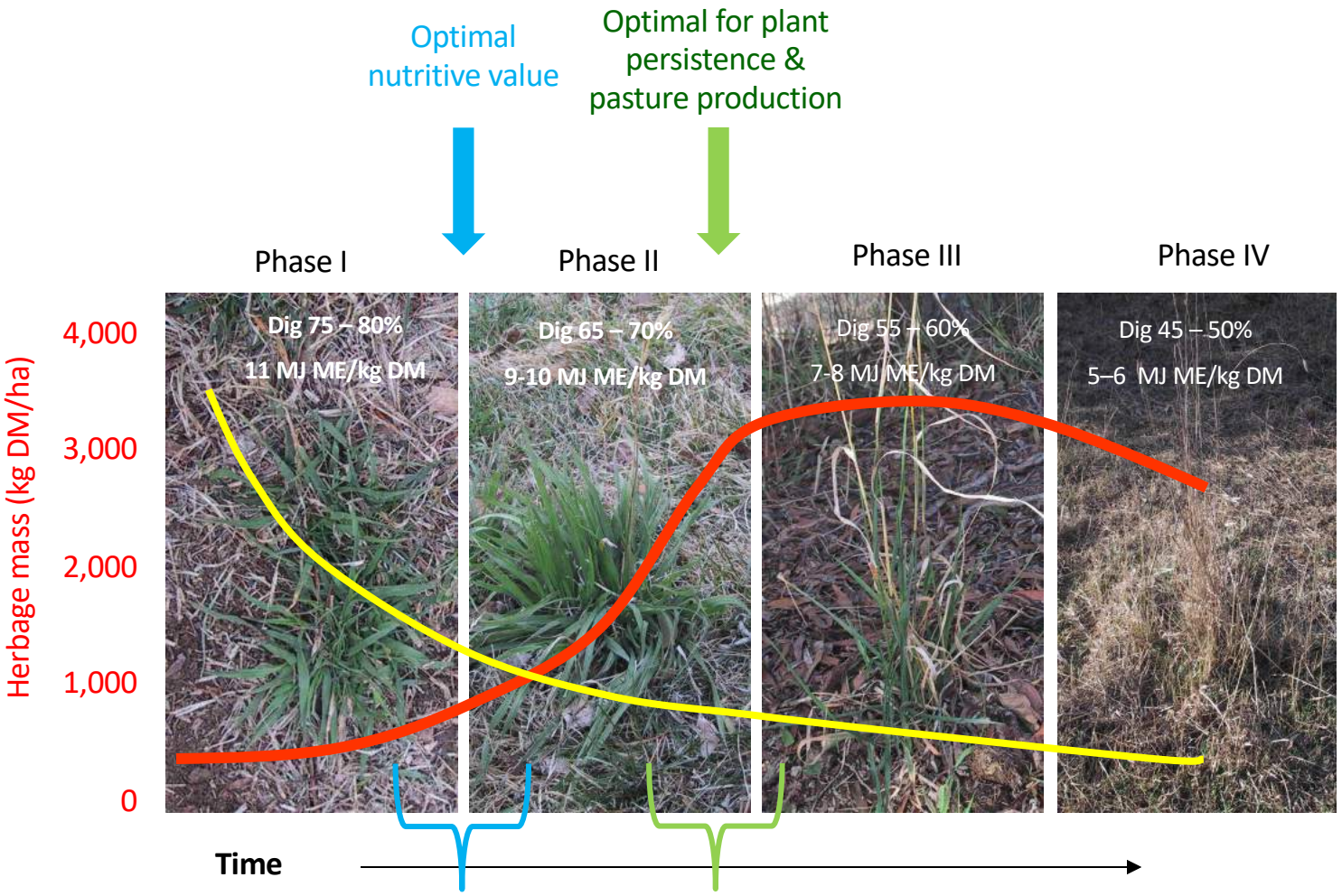
Measurement of pasture & planning the grazing

Judi Earl
11 August 2022

Website: www.aimsag.com.au
Email: judi_earl@bigpond.com
Phone: 0409 151 969

The basics of grazing management

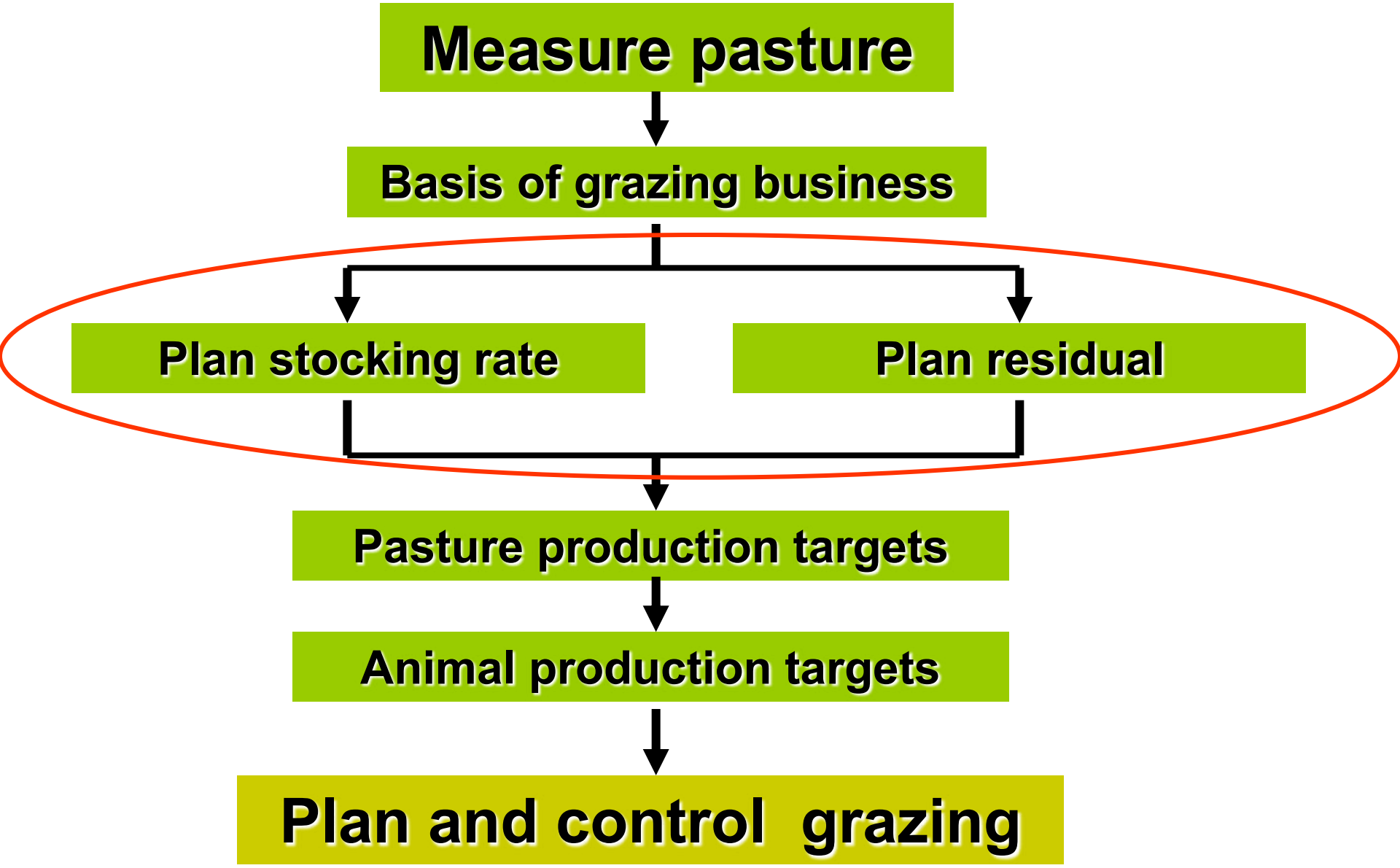
- Soils and pastures are the basis of your business
- The capture of sunlight drives pasture growth
- Grass growth & response to defoliation
- Grazing management is an important factor in controlling plant growth rate
- Importance of monitoring and planning


Optimal
nutritive value
Optimal for plant
persistence &
pasture production
Phase I
Phase II
Phase III
Phase IV
Herbage mass (kg DM/ha)
4,000
3,000
2,000
1,000
0
Dig 75 – 80%
11 MJ ME/kg DM
Dig 65 – 70%
9-10 MJ ME/kg DM
Dig 55 – 60%
7-8 MJ ME/kg DM
Dig 45 – 50%
5–6 MJ ME/kg DM
Time

Influencing plant growth with management

4 key factors that are within your control

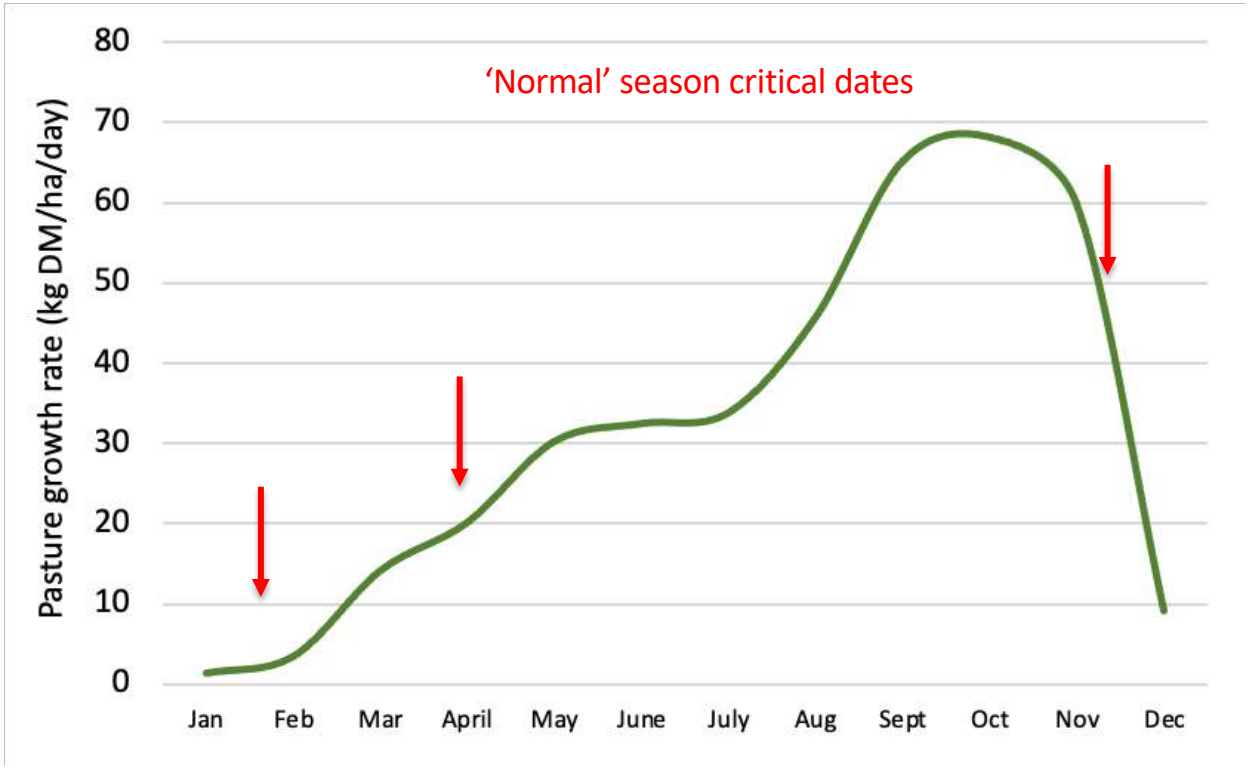
- **Recovery period** → Growing season
  → Non or slow growing season
- **Graze period**
- **Residual herbage mass**
- **Stock numbers – stocking rate**


Measure pasture
Basis of grazing business
Plan stocking rate
Plan residual
Pasture production targets
Animal production targets
Plan and control grazing

Pasture assessment – Why?

- Pasture growth determines your sustainable stocking rate
- Improve profitability and regenerate land with adaptive management
- Optimise pasture growth & production
- Needs to be a daily management activity

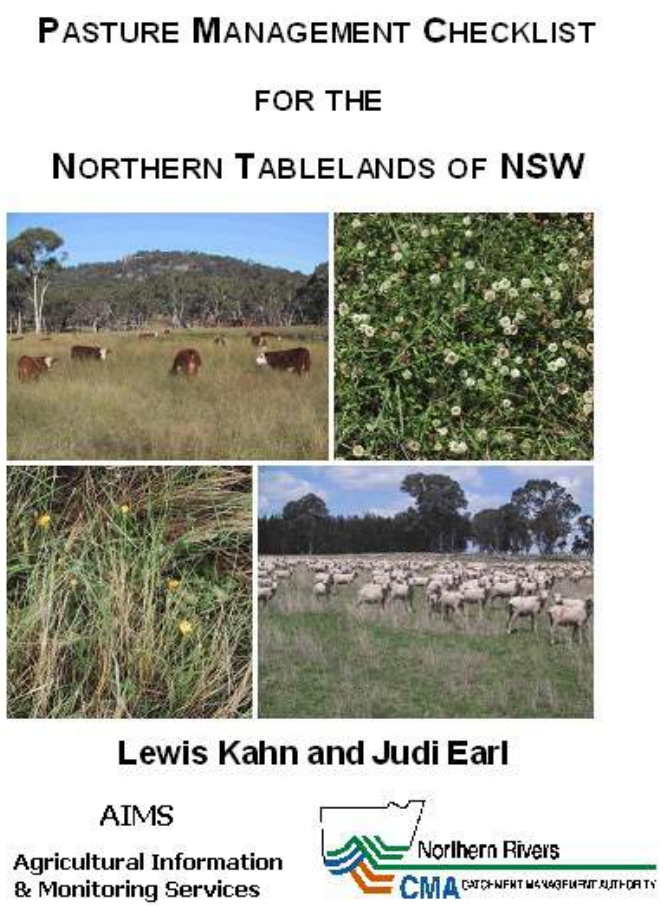
Feed year - critical dates



Pasture Assessment

How to……

Pasture Management Checklist



A 12 point checklist which enables you to quickly and effectively assess elements of the condition and productivity of your pastures.

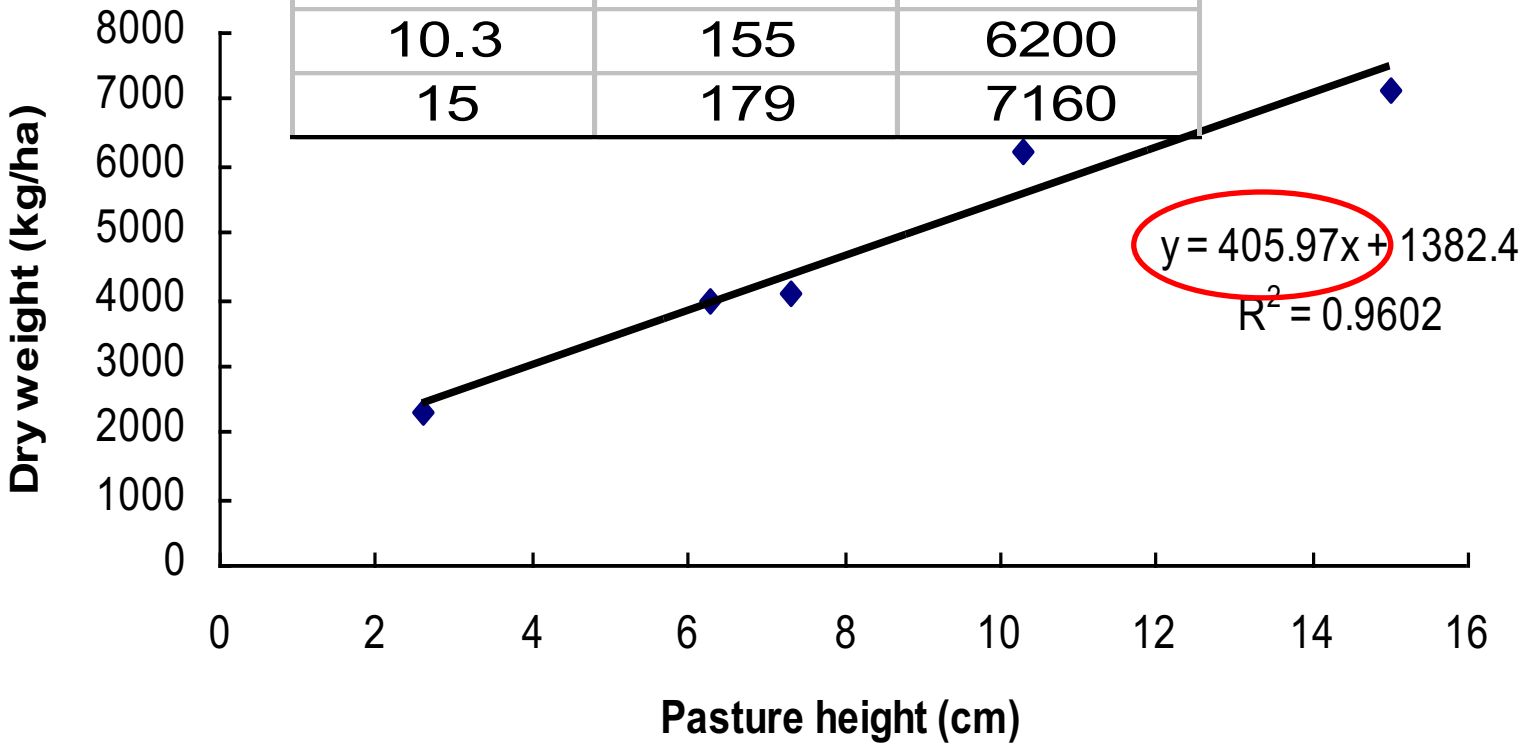
www.aimsag.com.au/software

Pasture height:weight relationship

Measure average height of material in each of a number of quadrats, cut, dry and weigh material to establish the height:weight relationship for that pasture

Pasture height:weight relationship

Ht	Wt (g)	Kg DM/ha
2.6	58	2320
6.3	100	4000
7.3	102	4080
10.3	155	6200
15	179	7160



Selecting a site

- An area that is representative of the paddock
  - Small uniform paddocks 1 measure is enough
  - Larger more variable, 2 or 3 may be needed
- Select a 10 x 10 m area or a transect
- Take at least 10 measurements of pasture height
- Record results

17/06/2022

Paddock name: .....

Grazable area (ha)	Date	Date	Date	Date
Herbage mass (kg DM/ha) **A**				
Herbage mass - % *edible* (%) **B**				
Percentage green (%) **C**				
Ground cover (%) **D**				
Broadleaf plant component (% of herbage mass) **E**				
Legume component (% of herbage mass) **F**				
Annual grass component (% of herbage mass) **G**				
Perennial grass component (% of herbage mass) **H**				
Diversity of perennial grasses (number) **I**				
Pasture growth rate (kg DM/ha/day) **J**				
Water use efficiency (kg DM/ha/mm) **K**				
Pasture utilisation rate (%) **L**				
What factors are low				
What factors are ideal				

How to estimate herbage mass

Measure pasture height in centimetres

Pasture height = 10 cm

Estimate pasture density

Very low **Density =** **200 kg DM/ha/cm**
Ground seen through sparse pasture

Low **Density =** **250 kg DM/ha/cm**
Ground occasionally seen through average pasture

Average **Density =** **300 kg DM/ha/cm**
Ground not visible through average pasture

High **Density = 400 kg DM/ha/cm**

How to estimate herbage mass

Multiply pasture height x density

Pasture height = 10 cm

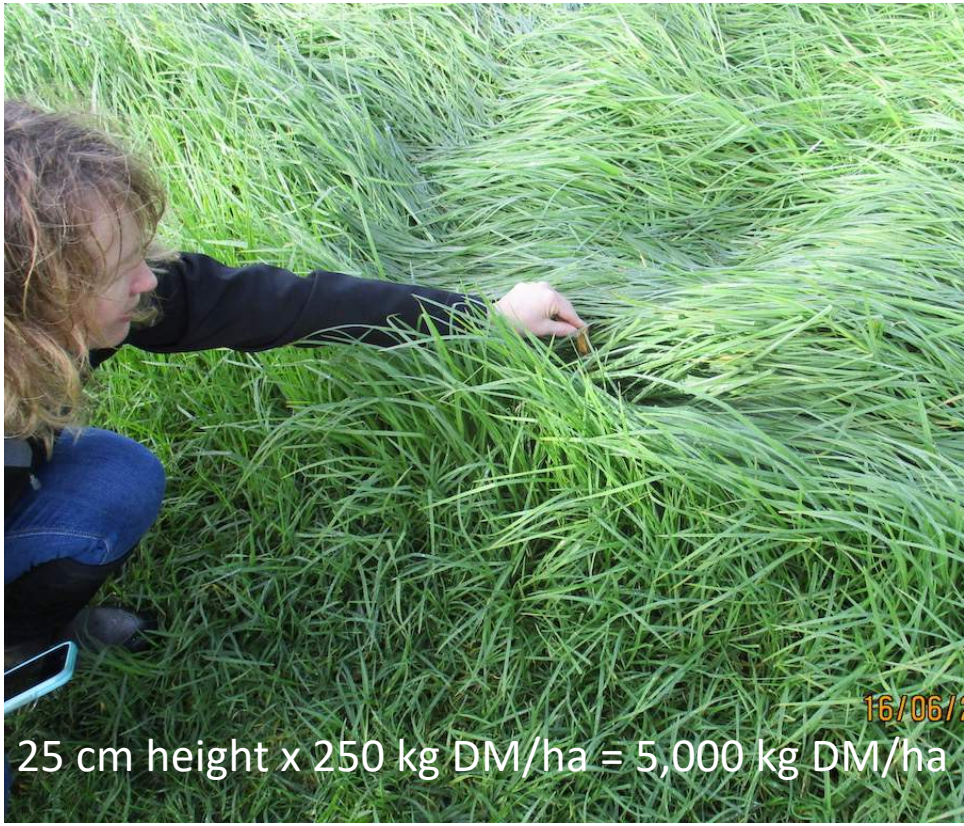
Density = 300 kg DM/ha/cm

Herbage mass = 10 x 300 = 3,000 kg DM/ha

Table: Guide to the estimation of pasture density (kg DM/ha/cm)

Pasture description	Pasture height		
	0–10 cm	10–25 cm	More than 25 cm
Sparse pasture with ground readily visible	200	150	100
Pasture with ground only occasionally visible	250	200	150
Pasture with ground not visible	300	250	200

10 cm x 300 kg DM/cm = 3,000 kg DM/ha



25 cm height x 250 kg DM/ha = 5,000 kg DM/ha

Additional considerations

- Herbage mass – percentage edible
- Percentage green
- Groundcover
- Contribution of plant types to herbage mass
  - Perennial grasses - Annual grasses
  - Legumes - Forbs
- Diversity of desirable perennial grasses


Percentage edible
17/06/2022

25% ground cover

50% ground cover

75% ground cover

Pasture density = 200 kg DM/ha/cm

100% ground cover

Pasture density = 300 kg DM/ha/cm


Broadleaf component 10 - 15%
Legume component 15 - 25%
Annual grass component 10 - 15%
Perennial grass component 60 – 80%

Calculate KPIs

- Pasture growth rate
  - Measure pasture production over time
  - Measured as kg DM/ha/day
- Water use efficiency
  - The amount of pasture grown per mm rainfall
- Utilisation %
  - The proportion of pasture grown eaten by stock
  - A key factor in potential pasture production

Calculation of pasture growth rate

Example:

1 March 2022	Herbage Mass Day 1	1000 (kg DM/ha)
31 May 2022	Herbage Mass Day 92	2000 (kg DM/ha)
	Stock intake (kg DM/ha)	1300 (kg DM/ha)
	PGR = $\frac{(2000 - 1000) + 1300}{92 \text{ days}}$	kg DM/ha
	= 25 kg DM/ha/day	

Calculation of water use efficiency

Rainfall in the period (mm)	225
Start of period (date)	1 March 2022
End of period (date)	31 May 2022
Length of period (days)	92
Pasture growth rate (kg DM/ha/d)	25
Water use efficiency (kg DM/ha/mm)	**10.2**

Water use efficiency = (pasture growth rate x length of period) ÷ rainfall

(25 kg DM/ha x 92 days) ÷ 225mm

Calculation of pasture utilisation %

Stocking rate in the period (DSE/ha)	14.1
Start of period (date)	1 March 2022
End of period (date)	31 May 2022
Length of period (days)	92
Pasture growth rate (kg DM/ha/d)	25
Pasture utilisation (%)	**56.5**

Pasture utilisation = (stocking rate ÷ pasture growth rate) x 100

(14.1 DSE/ha ÷ 25 kg DM/ha/day) x 100

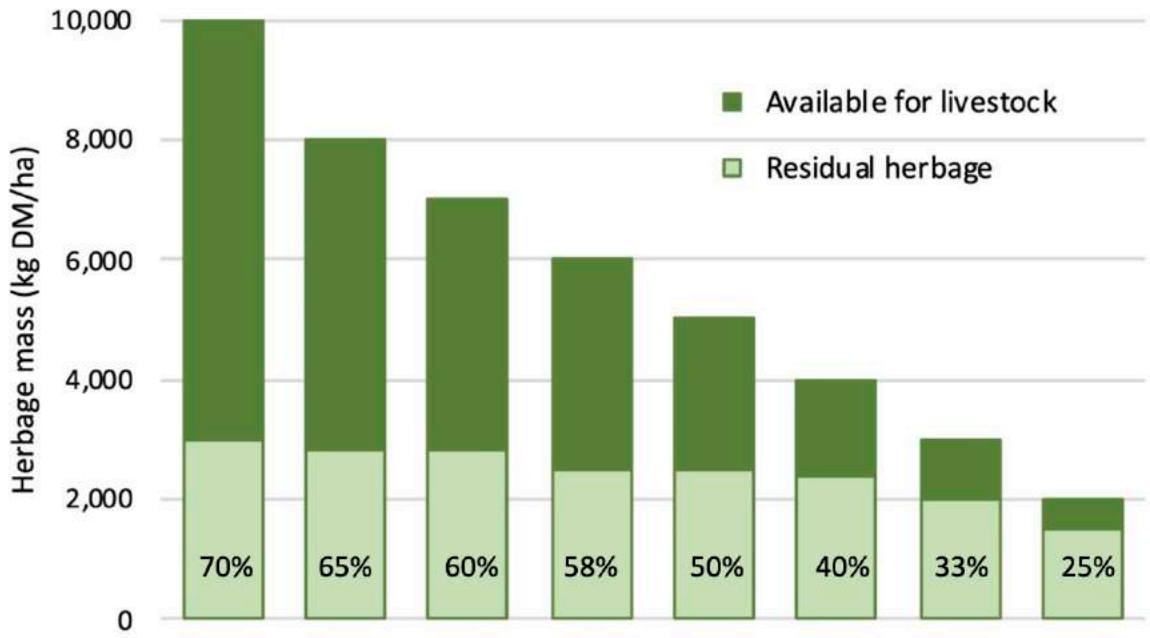
Pasture utilisation

Range of seasonal pasture utilisation rates (%)

Season	Low	Marginal	Ideal
Autumn	35 - 40	45 -50	55 - 60
Winter	25 - 30	35 - 40	45 - 50
Spring	15 - 20	25 -30	35 - 40
Summer	100 - 110	120 - 130	140 - 150

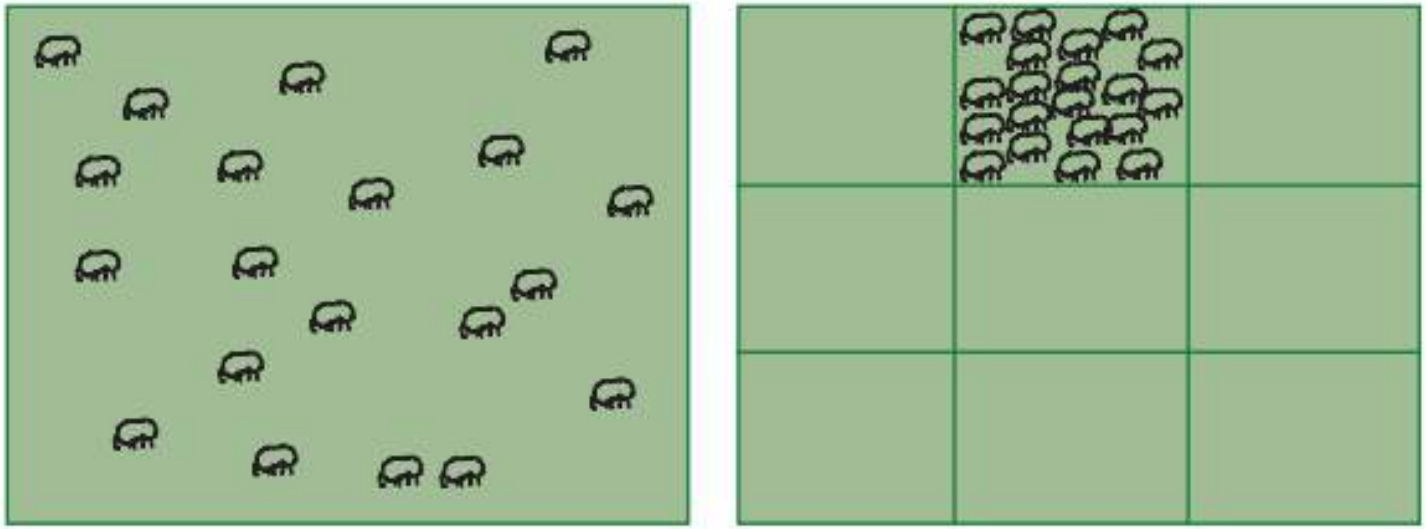
Values are highly dependent on pasture growth rates

Grow more - use more - leave more



Stocking rate & stock density

Uncontrolled grazing vs Controlled grazing

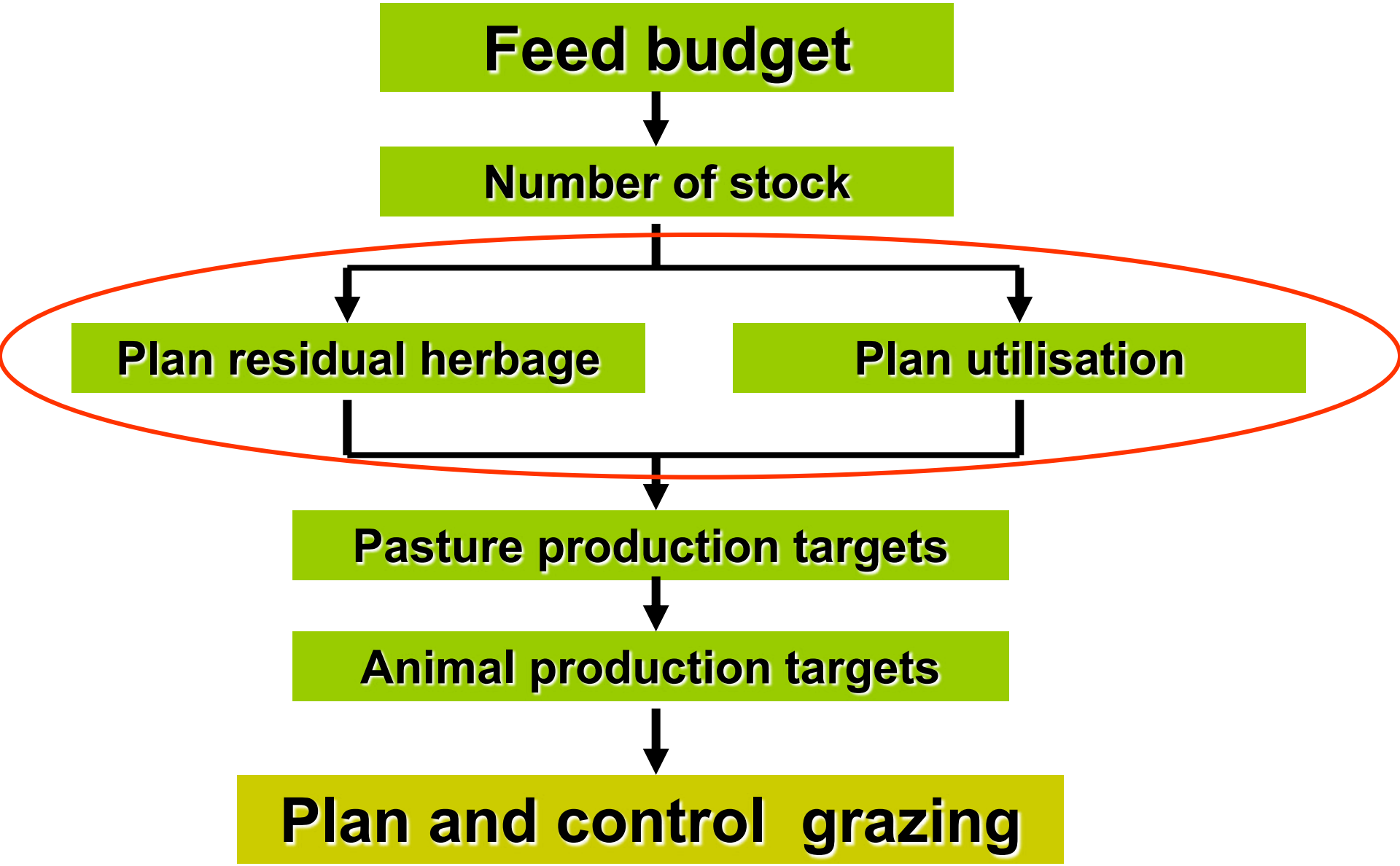


Same grazing area same number of stock

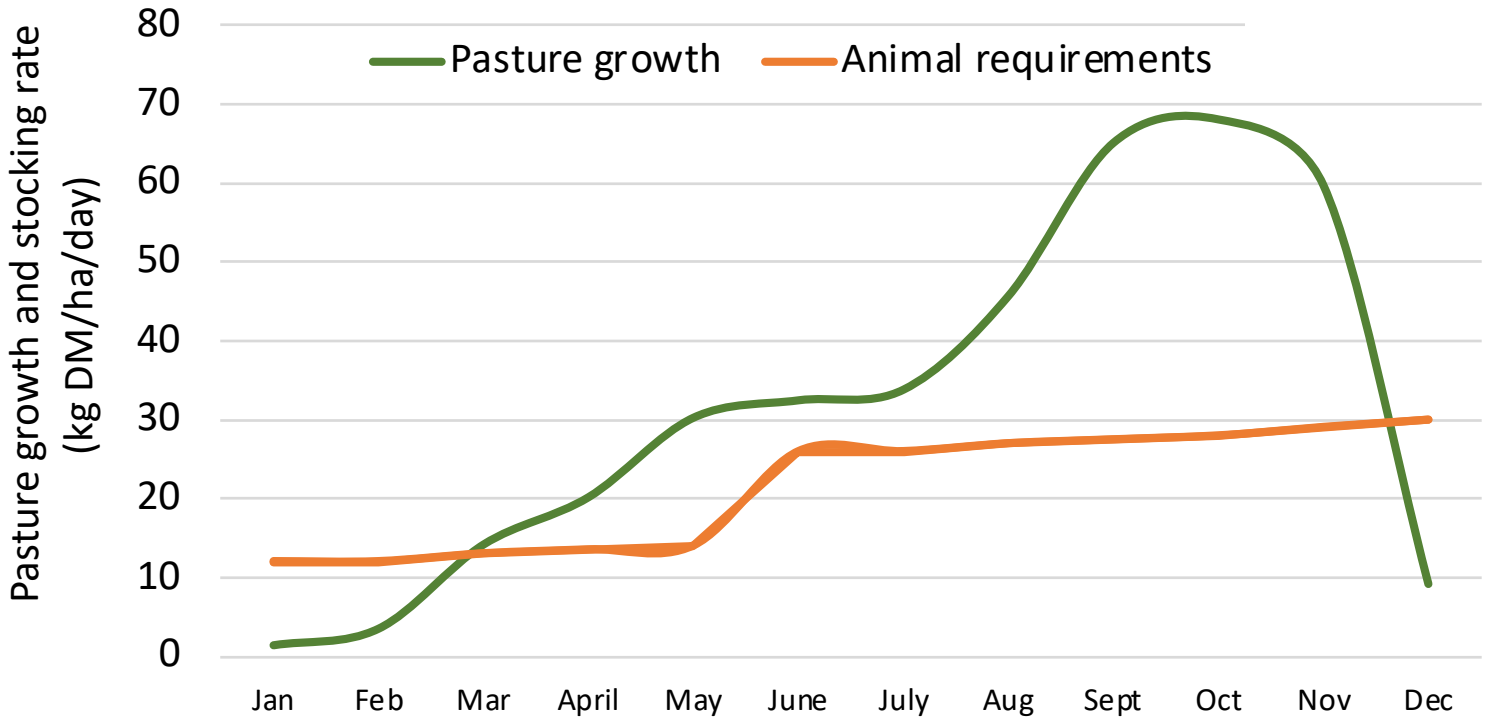
Any questions ?

Pasture Checklist
Pasture Checklist Calculator
Graze Plan Calculator & Guidelines

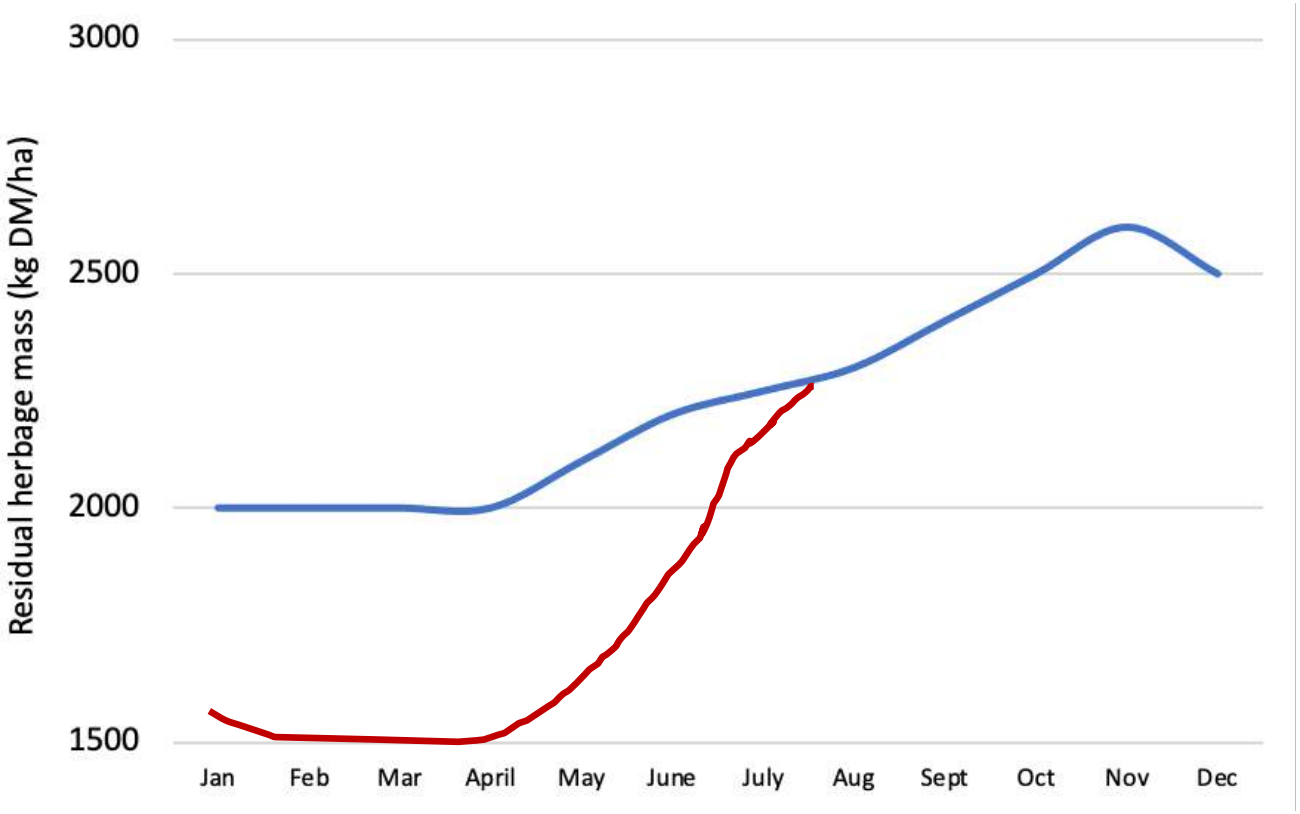
www.aimsag.com.au/software


Feed budget
Number of stock
Plan residual herbage
Plan utilisation
Pasture production targets
Animal production targets
Plan and control grazing

Feed budget


Pasture growth and stocking rate (kg DM/ha/day)
80
70
60
50
40
30
20
10
0
Pasture growth
Animal requirements
Jan
Feb
Mar
April
May
June
July
Aug
Sept
Oct
Nov
Dec

Residual herbage mass should be managed to vary throughout the year



Residual herbage mass is the amount of feed in the paddock at the end of a graze event.

Things needed for a feed budget

Estimate

- Grazeable area
- Herbage mass
- DSE values – stock requirements
- Pasture growth rate

Set

- Minimum herbage mass – residual targets

DSE values

Dry Sheep Equivalent *1 DSE eats 1 kg of pasture each day*

DSE ratings for cattle

Weight of steer	Growth Rate (kg/hd/day)	DSE
200	0	**3.5**
250	0	**4.5**
300	0	**5**
350	0	**6**
400	0	**7**
450	0	**8**
500	0	**9**
200	1	**8.5**
250	1	**9.5**
300	1	**10**
350	1	**11**
400	1	**12**
450	1	**13**
500	1	**14**

DSE values

Dry Sheep Equivalent *1 DSE eats 1 kg of pasture each day*

DSE ratings for cattle

Weight of cow (kg)	Pregancy/ lactation	DSE rating
400	dry	7.5
400	pregnant early	8.0
400	pregnant late	9.5
400	lactating early	14.0
400	lactating late	17.0
500	dry	9.5
500	pregnant early	10.0
500	pregnant late	11.5
500	lactating early	16.0
500	lactating late	19.0

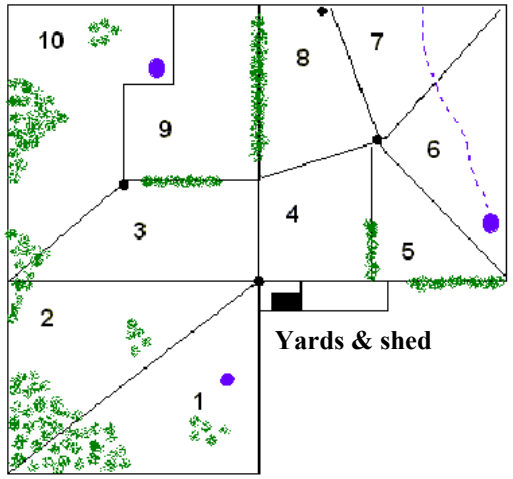
Feed budget

- Feed budgeting process aids decision making about selling, keeping or feeding livestock
  - how much pasture is available
  - how much pasture needs to remain
  - what's the likely pasture growth

- Calculate feed budgets using this information
  - how many animals can I carry and for how long

Feed budgeting exercise

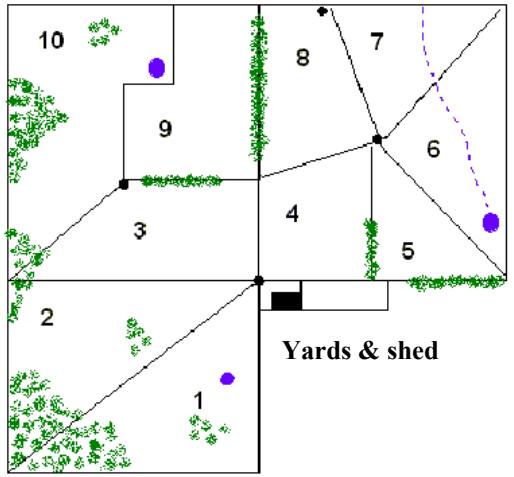
Ashfield is a Lower Blackwood beef cattle breeding enterprise
Total Area 100 ha - 10 paddocks of varying size and quality
25 ha of non-productive area leaves a <u>total grazing area of 75 ha</u>



Feed budgeting & planning exercise

Ashfield is a beef cattle grazing enterprise
Total Area 100 ha - of 10 paddocks of varying size and quality
25 ha of non-productive area leaves a total grazing area of 75 ha

- Aim is to have an average residual herbage mass of 1,500 kg DM/ha when stock leave any paddock or by the end of summer.
- Herbage mass was assessed on 1 December in each paddock and was, on average, 2,600 kg DM/ha.



Task 1 Calculate a feed budget to determine the number of 500 kg breeding cows that can be run over summer (1 Dec – 30 April).
Task 2 Complete the graze plan for Ashfield which determines how long stock graze each paddock.

Feed budget

A	Grazable area (ha)	75 ha
	Start of period (date)	1 December 2021
	End of period (date)	30 April 2022
B	Length of period (days)	150 days
C	Type of stock	500 kg preg cow
D	DSE rating (DSE/stock unit)	12 DSE/head
E	Start herbage mass (kg DM/ha)	2,600
F	Desired end herbage mass (kg DM/ha)	1,500
G	Pasture growth rate (kg DM/ha/d)	0 kg DM/ha/day
1	**Available feed (kg DM/ha/d)**	**7.3 kg DM/ha/day**
2	Number of stock units/ha	
3	Number of stock units	

1. Available feed = $\frac{\text{(start herbage 'E' – end herbage 'F')}}{\text{length of period 'B'}}$ + PGR 'G'

= $\frac{(2{,}600 - 1{,}500)}{150 \text{ days}}$ + 0 = **7.3 kg DM/ha/day**

Feed budget

A	Grazable area (ha)	75 ha
	Start of period (date)	1 December 2021
	End of period (date)	30 April 2022
B	Length of period (days)	150 days
C	Type of stock	500 kg preg cow
D	DSE rating (DSE/stock unit)	12 DSE/head
E	Start herbage mass (kg DM/ha)	2,600
F	Desired end herbage mass (kg DM/ha)	1,500
G	Pasture growth rate (kg DM/ha/d)	0 kg DM/ha/day
1	**Available feed (kg DM/ha/d)**	**7.3 kg DM/ha/day**
2	**Number of stock units/ha**	**0.6 head/ha**
3	Number of stock units	

2. Number of stock units/ha = $\frac{\text{available feed}}{\text{DSE rating 'D'}} = \frac{7.3}{12} =$ **0.6 / ha**

Feed budget

A	Grazable area (ha)	75 ha
	Start of period (date)	1 December 2021
	End of period (date)	30 April 2021
B	Length of period (days)	150 days
C	Type of stock	500 kg preg cow
D	DSE rating (DSE/stock unit)	12 DSE/head
E	Start herbage mass (kg DM/ha)	2,600
F	Desired end herbage mass (kg DM/ha)	1,500
G	Pasture growth rate (kg DM/ha/d)	0 kg DM/ha/day
1	**Available feed (kg DM/ha/d)**	**7.3 kg DM/ha/day**
2	**Number of stock units/ha**	**0.6 head/ha**
3	**Number of stock units**	**46**

3. Number of stock units = number of stock units/ha x grazable area '**A**'
   = 0.6 / ha x 75 ha = **46 head**

Graze plan for Ashfield

	A	B	A÷B	C	D	C-D	E
Paddock	**Total DSE in mob**	**Grazeable Area (ha)**	**Stocking density**	**Herbage mass**	**Residual herbage mass**	**Available herbage mass**	**Days grazing**
			DSE/ha/day	**kg DM/ha**	**kg DM/ha**	**kg DM/ha**	
1	550 ÷	9 =	61				
2	550	9	61				
3	550	8	69				
4	550	7	79				
5	550	5	110				
6	550	8	69				
7	550	6	92				
8	550	6	92				
9	550	6	92				
10	550 ÷	11 =	50				

Total days =

Step 1: Record the total DSE in the mob (A) = number of animals x DSE rating for each animal
(e.g. 46 cows x 12 DSE/cow = 550 total DSE)

Step 2: Record the grazable area of each paddock (B)

Step 3: Calculate the stocking density (A÷B) for each paddock = total DSE in mob (A) ÷ grazeable area (B) and is the herbage eaten by the mob expressed per hectare and per day

Graze plan for Ashfield

	A		B	A÷B	C	D	C-D	E
Paddock	**Total DSE in mob**		**Grazeable Area (ha)**	**Stocking density**	**Herbage mass**	**Residual herbage mass**	**Available herbage mass**	**Days grazing**
				DSE/ha/day	**kg DM/ha**	**kg DM/ha**	**kg DM/ha**	
1	550	÷	9	= 61	3300	1500		
2	550		9	61	2600	1500		
3	550		8	69	3600	1500		
4	550		7	79	3300	1500		
5	550		5	110	2600	1500		
6	550		8	69	1300	1500		
7	550		6	92	2600	1500		
8	550		6	92	2500	1500		
9	550		6	92	1500	1500		
10	550	÷	11	= 50	2700	1500		

Total days =

Step 1: Record the total DSE in the mob (A) = number of animals x DSE rating for each animal (e.g. 46 cows x 12 DSE/cow = 550 total DSE)

Step 2: Record the grazable area of each paddock (B)

Step 3: Calculate the stocking density (A÷B) for each paddock = total DSE in mob (A) ÷ grazeable area (B) and is the herbage eaten by the mob expressed per hectare and per day

Step 4: Record herbage mass (C) for each paddock

Step 5: Record the residual herbage mass (D) desired at end of period

Graze plan for Ashfield

	A	B	A÷B	C	D	C-D	E
Paddock	**Total DSE in mob**	**Grazeable Area (ha)**	**Stocking density**	**Herbage mass**	**Residual herbage mass**	**Available herbage mass**	**Days grazing**
			DSE/ha/day	**kg DM/ha**	**kg DM/ha**	**kg DM/ha**	
1	550 ÷	9 =	61	3300 -	1500 =	1800	29
2	550	9	61	2600	1500	1100	18
3	550	8	69	3600	1500	2100	30
4	550	7	79	3300	1500	1800	23
5	550	5	110	2600	1500	1100	10
6	550	8	69	1300	1500	0	0
7	550	6	92	2600	1500	1100	12
8	550	6	92	2500	1500	1000	11
9	550	6	92	1500	1500	0	0
10	550 ÷	11 =	50	2700	1500	1200	24
						Total days =	**157**

Step 1: Record the total DSE in the mob (A) = number of animals x DSE rating for each animal (e.g. 46 cows x 12 DSE/cow = 550 total DSE)

Step 2: Record the grazable area of each paddock (B)

Step 3: Calculate the stocking density (A÷B) for each paddock = total DSE in mob (A) ÷ grazeable area (B) and is the herbage eaten by the mob expressed per hectare and per day

Step 4: Record herbage mass (C) for each paddock

Step 5: Record the residual herbage mass (D) desired at end of period

Step 6: Calculate available herbage mass (C-D) = herbage mass (C) - residual herbage mass (D) and is feed that you are making available to stock in the feed budget

Step 7: Calculate the number of days available for grazing (E) = Available herbage mass (C-D) ÷ stocking density (A÷B) and is the number of days that stock will graze each paddock

Notes from our ‘Ashfield’ grazing plan

1. We have 157 days grazing days available based on this plan – 7 more than our budget.
2. This plan doesn’t include any pasture growth. Any growth during the period will be a bonus and enhance landscape health and production.
3. The plan calculates the *appropriate grazing days* for each paddock based on (i) the total DSE in the mob (demand), (ii) the area of each paddock and available herbage mass (supply).
4. Note the different grazing days for paddocks of same area due to differences in **Available Herbage Mass** and paddock area.
5. Two paddocks start the period below the residual target and are therefore unavailable for grazing, assuming no growth during the planning period.
6. On 1 December we can have confidence that we can run 46 pregnant cows across the property and maintain a minimum residual herbage mass target which will optimise the condition of the pastures coming into autumn, enhance subsequent growth and maintain the health of the landscape.

Additional notes

a. If we were to apply a *time based rotation* the average graze period across the 10 paddocks would be = 150 days / 10 paddocks = 15 days. In this example paddock number 2 would be grazed for a few days over the correct period, paddocks 1, 3, 4 and 10 would be *under-utilised* and the remaining paddocks number 5 – 9 would be *over-utilised* and any perennial plants will be over grazed.

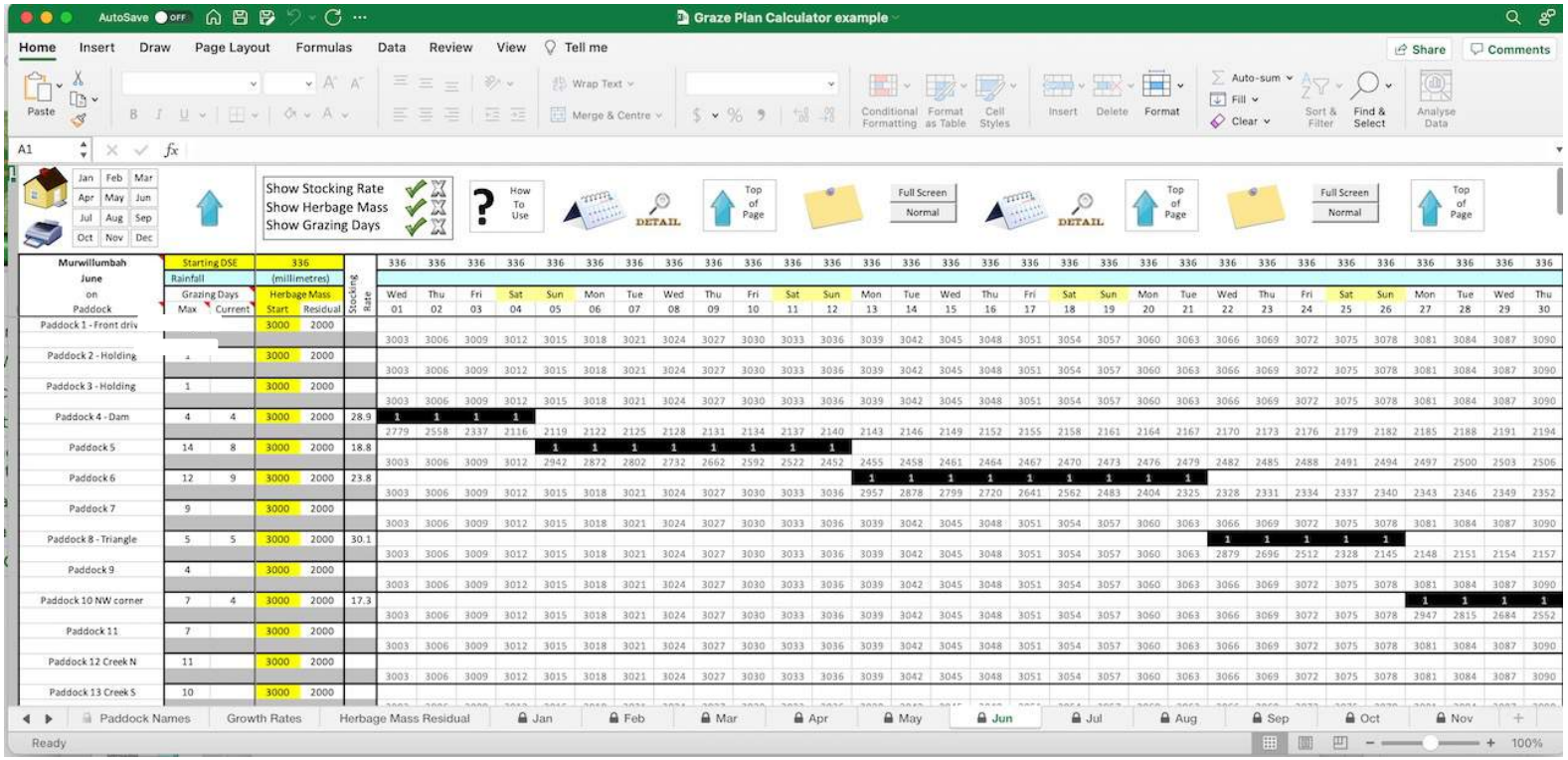
b. The long graze periods indicated in paddocks 1 and 3 particularly would suggest that these would be priority candidates for subdivision to improve utilisation of available feed and animal production. But all would benefit.

c. Most importantly, you know on 1 December you have enough herbage mass on hand to sustain 46 pregnant cows for at least 150 days and have an average of 1,500 kg DM/ha residual remaining on 30 April. You also have great peace of mind and can rest easily with this knowledge!

d. There is no *need* to provide hay!

Grazing plan – feed budget based

AIMS graze plan calculator – a tool to assist the process



www.aimsag.com.au/software Excel spreadsheet & Guide to use the calculator

Summary

- Planning is essential to achieve optimal outcomes
- Measurement of herbage mass allows informed decisions by using;
- Calculation of pasture growth rate
  Calculation of water use efficiency
  Preparing a feed budget
- Pasture Checklist provides a simple tool
- A graze plan is the most important activity you can undertake to ensure optimal utilisation
- Grow more – use more – leave more