Irrigated Cropping Council

2021 Fodder for the Future
ICC Irrigated Faba Bean Fodder Trial

Summary

The faba bean variety PBS Bendoc was sown at two rates at two Time of Sowings to assess fodder production and feed quality at 3 maturity stages.

Some observations:

Sowing rates had little impact on fodder production.

The first time of sowing (23 April) produced higher fodder (dry matter) totals than the later sowing (17 May).

Dry matter production exceeded 20 t/ha for some treatments.

The last sampling for quality occurred at physiological maturity, where the plants were only 22% dry matter.

Quality did not decline during pod filling. The highest crude protein and metabolisable energy contents were at physiological maturity.

Objectives

To evaluate the dry matter production of irrigated faba beans for fodder production:

1. Optimal sowing rate
2. Optimal sowing date
3. Assess the fodder production at three cutting dates
4. The influence of the time of cutting on feed quality.

Methodology

The following varieties, target populations and sowing dates were selected for the trial.

Table 1: Crop target populations and time of sowing

Crop	Target populations	Time of sowing
Faba Beans	15 and 25 plants/m^2	2 April, 17 May

The trial design was blocked by time of sowing (ToS) with the early and late sown plots grouped together within the same irrigation bay.. Within each sowing block, the sowing rate treatments were randomised using a randomised complete block design generated by 'Digger' trial design software, with 4 replicates. Plot size was 12m by 1.8m.

The trial was established on a surface irrigated border check layout. Soil type was a grey vertisol.

Pre-irrigation (1.2 Ml/ha) occurred on 10 April. Sowing of the first ToS occurred on 23 April followed by the second ToS on 17 May.

All plots received 200 kg Superfect/ha (18 Kg P/ha, 22 kg S/ha) at sowing.

Sowing rates calculations were based on the target population, seed size and an assumed establishment rate of 90%.

The first spring irrigation was on 28 August (1.0 Ml/ha) and again on 29 September (0.9 Ml/ha).

Table 2: Fodder cutting dates

		End of Flowering	Mid pod fill	Physiological maturity*
Faba Beans	ToS1	27 September	18 October	5 November
	ToS2	11 October	25 October	9 November

*: Due to lodging issues, accurate quadrat cuts were unable to be taken and so the plots were sampled for dry matter percentage and feed quality assessment only.

When taking the dry matter cuts, samples were cut at a height of 50mm above the soil surface.

Two samples consisting of 3 rows by 1m were cut, weighed and a subsample of approximately 400g was randomly selected and shredded. This was then dried at 60 degrees C to determine dry matter percentage.

Physiological maturity was determined by the change in colour of the bean hilum to a dark silver colour. At this stage, the plants had begun to lose their lower leaves while the stems and upper canopy remained green.

Samples were taken from each plot for feed quality assessment.

Statistical analysis of the data was conducted using 2 way ANOVA, with ToS and plant population as the factors.

Results

Plant establishment was higher for ToS2 than for ToS1 (Table 3).

Table 3: Plant Establishment

	ToS1	ToS2

Target Population	Plants/m^2	Establishment %	Plants/m^2	Establishment %
15 plants/m^2	11.8	71	15.4	92
25 plants/m^2	21.9	78	27.8	100

Table 4: Faba Bean stem number (stems/m^2) and stems/plant assessed at end of flowering

Target Population	**Stems/m^2**			**Stems/plant**		
	ToS1	***ToS2***	***Mean***	***ToS1***	***ToS2***	***Mean***
15 plants/m^2	74.0 -	77.1 -	**75.5 -**	6.5 -	5.0 -	**5.7** a
25 plants/m^2	85.1 -	92.0 -	**88.5 -**	3.9 -	3.3 -	**3.6** b
Mean	**79.5 -**	**84.5 -**		**5.2 -**	**4.2 -**	
LSD ToS St/m^2 p = 0.05		ns		**P val**		0.471
LSD Pop'n St/m^2 p=0.05		ns		**P val**		0.055
LSD N TxP St/m^2 p=0.05		ns		**P val**		0.754
LSD ToS St/pl p = 0.05		ns		**P val**		0.072
LSD Pop'n St/pl p=0.05		1.11		**P val**		0.002
LSD N TxP St/pl p=0.05		1.57		**P val**		0.383

Although there were higher stem numbers in the high sowing rate treatment, they were not statistically different (P=0.055) to those of the lower population.
The data in Table 4 shows a that there were fewer stems per plant as population increased, and lower stem numbers from the later sowing date. Only the population effect was statistically significant and the data should be viewed with caution due the high variability (cv%=21).

Table 5a: Faba bean dry matter (t/ha) at the end of flowering

Target Population	**ToS1**	**ToS2**	**Mean**
	t/ha	**t/ha**	**t/ha**
15 plants/m^2	13.3 **-**	11.0 -	**12.1 -**
25 plants/m^2	14.7 -	11.5 -	**13.1 -**
Mean	**14.0 a**	**11.2 b**	
LSD ToS p = 0.05	2.058	**P val**	0.015
LSD Population p=0.05	ns	**P val**	0.321
LSD ToSxPop'n. P=0.05	2.911	**P val**	0.649

At this first cutting stage, the average dry matter content was 13.8%. Population had no influence on dry matter yield but the earlier sowing had a higher yield than the later sowing (14.0 vs. 11.2 t DM/ha).

Table 5b: Faba bean dry matter (t/ha) at mid-pod fill

Target Population	**ToS1**	**ToS2**	**Mean**
	t/ha	**t/ha**	**t/ha**

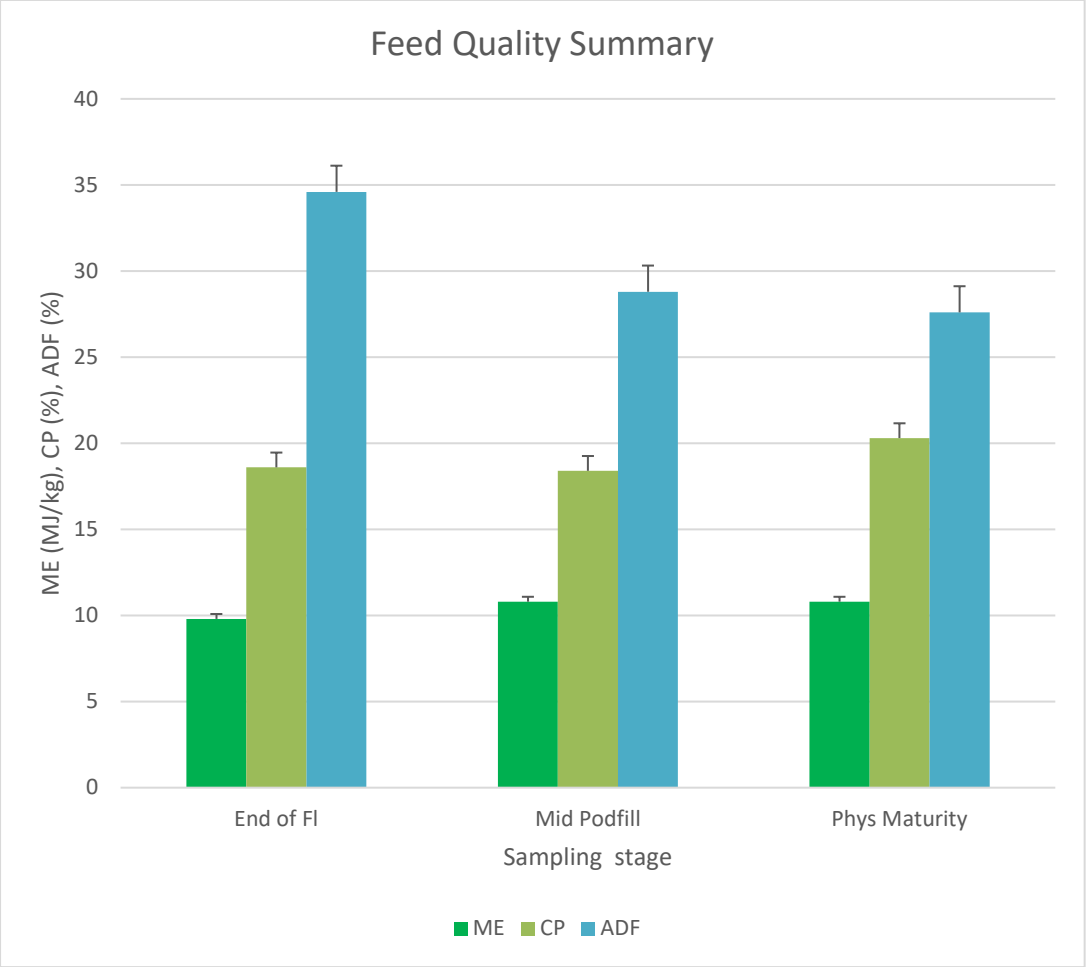
15 plants/m²	19.51	-	13.21	-	**16.2** -
25 plants/m²	21.12	-	13.62	-	**17.8** -
Mean	**20.32**	**a**	**13.42**	**b**	
LSD ToS p = 0.05	3.808		**P val**		0.003
LSD Population p=0.05	ns		**P val**		0.561
LSD ToSxPop'n. P=0.05	5.386		**P val**		0.728

At the mid-pod fill harvest the sowing rate did not affect the DM yield but the first time of sowing resulted in a higher DM yield than the later sowing (20.3 vs 13.4 t DM/ha) (Table 5b).
At mid-pod fill, the dry matter content averaged 17.0%.

The intended third cut at physiological maturity was not possible as most plots had lodged badly and accurate quadrat cuts were not possible. Samples were collected for dry matter content which averaged 22%.

Part 2: Feed quality

Figure 1: Effect of growth stage on the ME, CP and ADF contents of Faba beans at 3 stages of maturity.



The plant population did not influence the quality parameters of ME, CP or ADF (Figure 1). Time of sowing did not influence ME or CP contents but did have an effect on ADF content with a slightly lower ADF content at the second ToS (31.2 Vs 29.5 %DM).
The quality parameters measured were affected by the maturity at the time of harvest, with ME ($p<0.001$, 10.8 Vs 9.8) and CP ($p<0.001$, 20.3 vs 18.6 %DM) higher at the last than at the first harvest. Later sampling saw a decline in ADF ($p<0.001$) compared to the first harvest (27.6 vs 34.6 %DM).

Conclusions

Fodder yields exceeded 20 t DM/ha for some treatments at the middle harvest. (Were unable to do DM assessments at the final harvest).
The plant populations used in this trial had little influence on yield or feed quality.
Fodder yields saw a benefit from sowing in late April compared to mid-May.
The Faba beans had some logistical problems for forage conservation. Lodging was an issue late in the season and the water content at physiological maturity was still too high to ensile it immediately.
Feed quality parameters improved from the first (end of flowering) to the final (physiological maturity) harvest with both ME (10.8 vs 9.8 MJ/kg DM) and CP (20.3 Vs 18.6 %DM) contents increasing and the ADF content decreasing (27.6 vs 34.6 %DM).

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Appendix 1: Soil Test Results

Paddock Name		Bay 1		
Sampling Date		4/6/2021		
Sample Depth		0-10 cm	10-30 cm	30-60 cm
Soil Colour		Grey		
Soil Texture		Clay		Clay
Nitrate Nitrogen	mg/kg	11	5	3
Ammonium Nitrogen	mg/kg	11	10	6
Total Nitrate N	kg/ha			45.5
Phosphorus (Colwell)	mg/kg	69		
Phosphorus Buffer Index (PBI-Col)		98		
Available Potassium	mg/kg	639		
Sulphur (KCl40)	mg/kg	14.8		
Organic Carbon (W&B)	%	1.45		
pH (1:5 Water)		6.4		
pH (1:5 CaCl2)		7.7		
Electrical Conductivity (1:5 water)	dS/m	0.140		
Elec. Cond. (Sat. Ext.)	dS/m	0.896		
Chloride	mg/kg			
Calcium (Amm-acet.)	cmol(+)/kg	14.66		
Potassium (Amm-acet.)	cmol(+)/kg	1.77		
Magnesium (Amm-acet.)	cmol(+)/kg	10.90		
Sodium (Amm-acet.)	cmol(+)/kg	1.48		
Aluminium (KCl)	cmol(+)/kg	0.06		
Cation Exch. Cap.	cmol(+)/kg	28.87		
Calcium/Magnesium Ratio		1.34		
Sodium % of Cations (ESP)	%	5.1		
Aluminium Saturation	%	0.2		
Copper (DTPA)	mg/kg	3.02		
Iron (DTPA)	mg/kg	48.4		
Manganese (DTPA)	mg/kg	17.72		
Zinc (DTPA)	mg/kg	0.64		
Boron (Hot CaCl2)	mg/kg	2.95		