Effect of concentrate build-up strategy in early lactation on production performance, health and fertility of high-yielding dairy cows

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Background (I)

- Reducing the extent and duration of negative energy balance is difficult – cow has high genetic capacity to produce milk
- Most common approach is to increase nutrient intakes
  - Increase dry matter intake
  - Increase the energy density of the diet
- Can be achieved through improved forage quality and/or increased concentrate levels
- However, offering diets containing higher concentrate levels may create a number of challenges

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Background (II)

- Rapid build-up of concentrates in early lactation can cause acidosis
- Negative effect on forage intake and rumen function
- Slow concentrate build-up strategies may help overcome these problems and promote increased forage intakes and improved nutrient utilisation
- Anecdotal evidence of improved energy balance in early lactation
- The experiment was conducted to examine the impact of delaying concentrate build-up in the diet until day-28 post calving

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Objectives

- To assess the effect of delaying concentrate build-up in the diet until day 28 post calving on:
  - Production parameters
  - Energy status
  - Health
  - Fertility

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Animals and treatments

- 56 multiparous Holstein-Friesian dairy animals (mean parity 3.5)
- Two treatments examined:
  - 'Rapid build-up' of concentrates in diet
  - 'Delayed build-up' of concentrate in diet
- Basal forages offered

	Grass silage	**Maize silage**
Dry matter (g/kg)	287	310
Crude protein (g/kg DM)	160	94
ME (MJ/kg DM)	11.6	11.0
Starch (g/kg DM)	-	218

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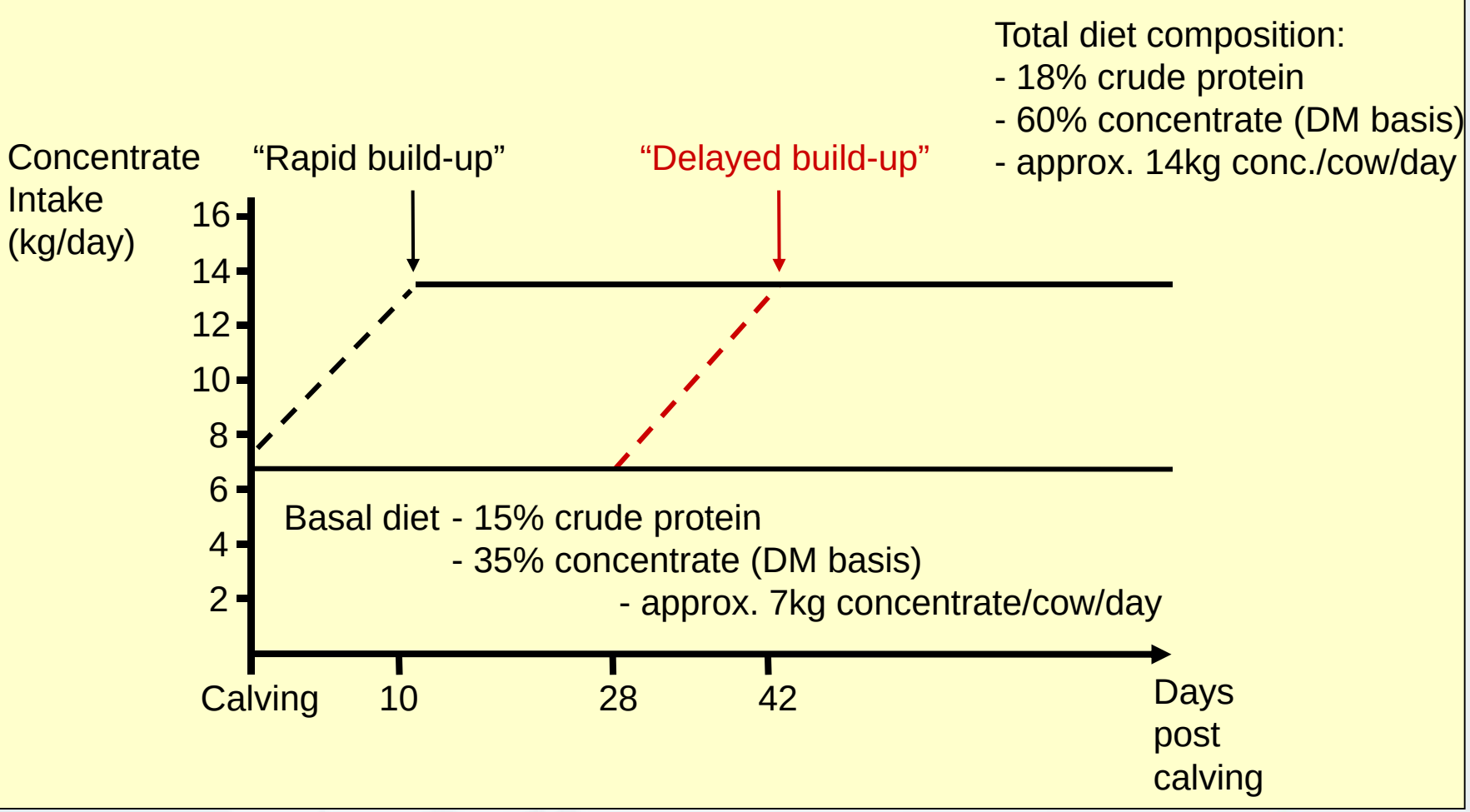
Experimental Treatments



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Results

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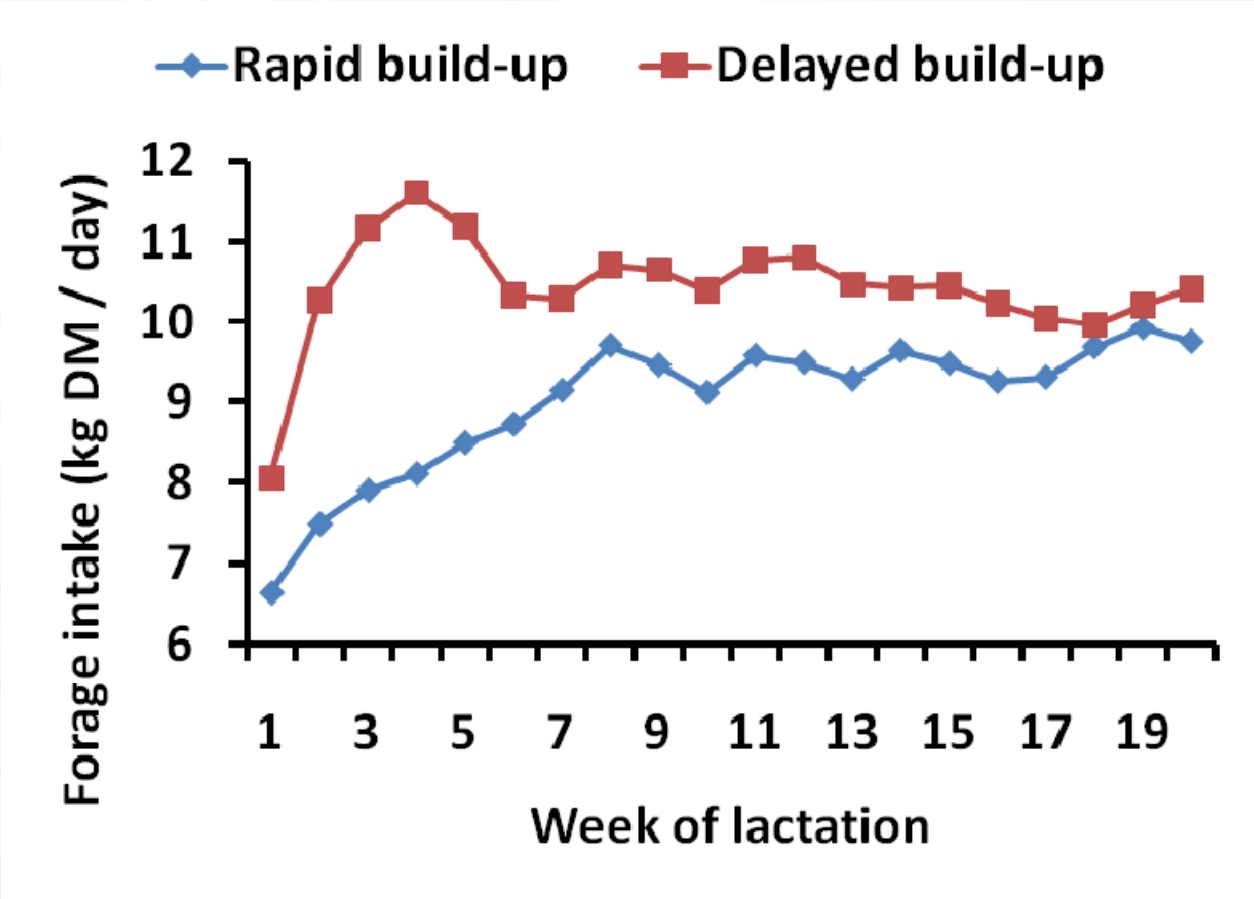
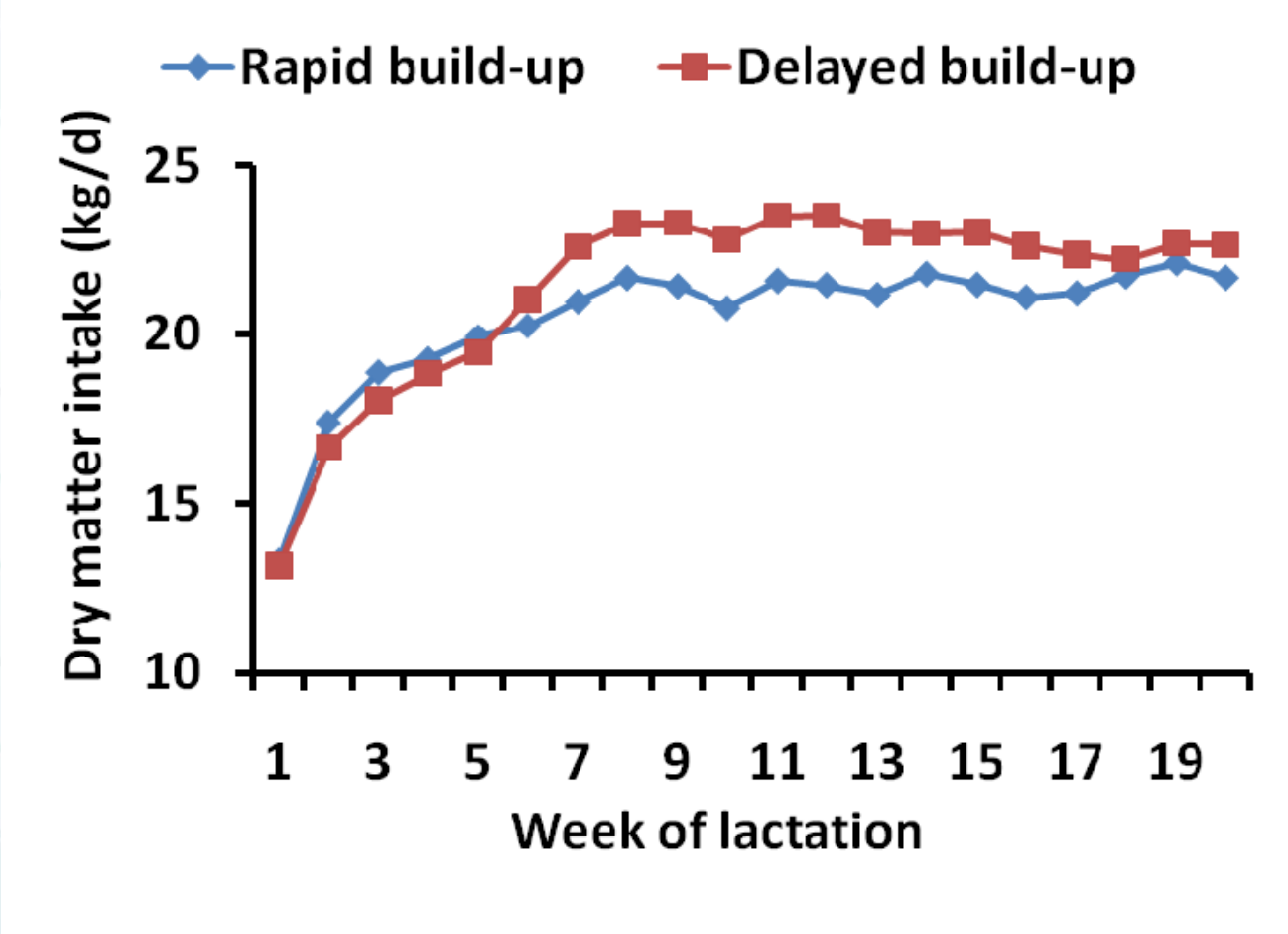
Effect of concentrate build-up strategy on forage intake (grass silage & maize silage)



- During the first 18 weeks of lactation, forage intake was significantly higher with cows allocated to the delayed build-up treatment

Effect of concentrate build-up strategy on total dry matter intake



- During the first 6 weeks of lactation, total DMI was unaffected by concentrate build-up strategy

Effect of concentrate build-up strategy on DM intake (day 1-150)

	Rapid Build-up	*Delayed Build-up*	*SED*	*P-value*
Forage DM intake (kg/day)	9.0	10.4	0.34	<0.001
Concentrate DM intake (kg/day)	11.5	11.0	0.19	0.004
Total DM intake (kg/day)	20.5	21.4	0.53	0.095

- Adopting a delayed concentrate build-up strategy improved forage intake during early/mid lactation

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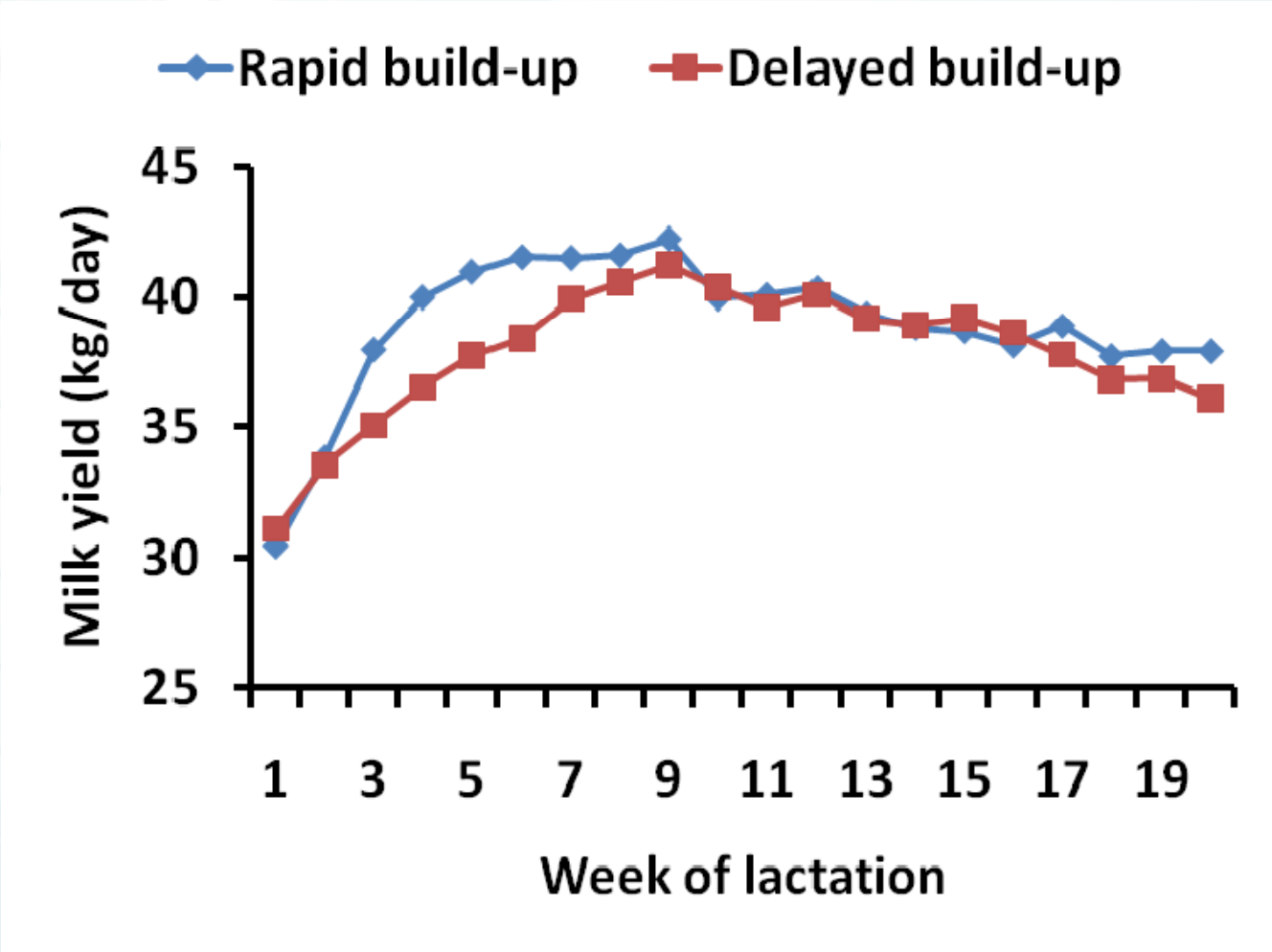
Effect of concentrate build-up strategy on milk production (day 1-150)



- During weeks 3-6 of lactation, cows allocated to the delayed concentrate build-up strategy had significantly lower milk yields than those allocated to the rapid build-up strategy

Effect of concentrate build-up strategy on milk production parameters (day 1-150)

	Rapid Build-up	*Delayed Build-up*	*SED*	*P-value*
Milk yield (kg/d)	38.9	37.9	1.61	0.514
Milk fat (g/kg)	40.5	41.6	1.43	0.416
Milk protein (g/kg)	34.2	33.3	0.71	0.224
Milk fat + protein yield (kg/d)	2.88	2.81	0.12	0.558

- Delayed build-up strategy had no effect on milk production or composition

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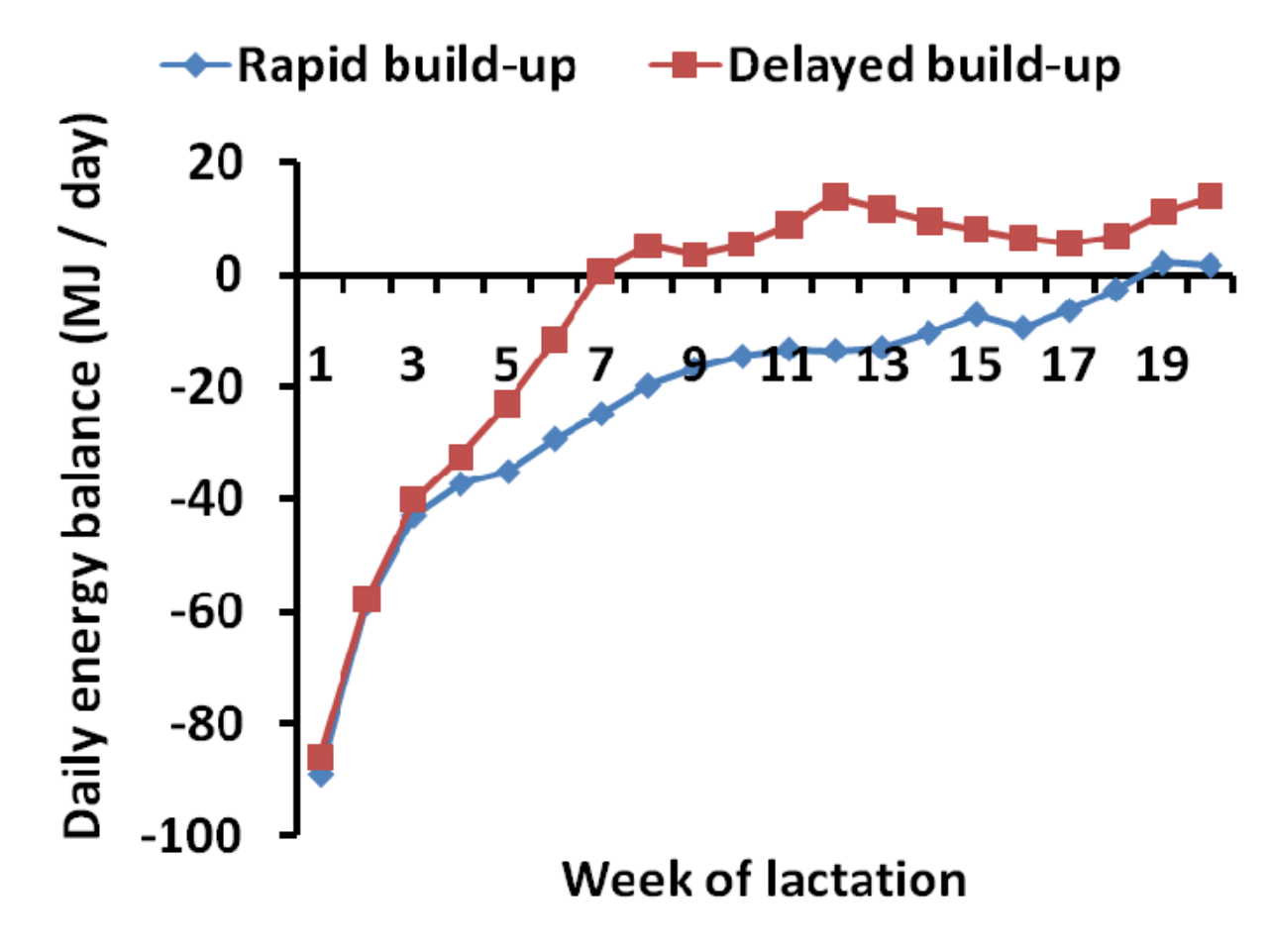
Effect of concentrate build-up strategy on daily energy balance (day 1-150)



- Delaying concentrate build-up resulted in an earlier return to positive energy balance

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Effect of concentrate build-up strategy on body tissue and energy status (day 1-150)

	Rapid Build-up	*Delayed Build-up*	*SED*	*P-value*
Liveweight (kg)	638	627	7.0	0.100
Body condition score	2.33	2.27	0.052	0.295
ME requirement (MJ/d)	273	268	9.3	0.566
ME intake (MJ/d)	252	262	6.3	0.154
Average daily energy balance (MJ/d)	-21.3	-6.3	7.93	0.065
Cumulative energy balance (MJ)	-2334	-1382	571	0.136

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Effect of concentrate build-up strategy on blood parameters (day 1-150)

	Rapid Build-up	***Delayed Build-up***	***SED***	***P-value***
Urea (mM)	4.1	3.7	0.16	0.041
Total protein (g/l)	55.8	56.1	1.41	0.793
NEFA (meq/l)	0.36	0.38	0.038	0.500
BHB (mM)	0.72	0.85	0.052	0.011
Glucose (mM)	3.38	3.25	0.051	0.014

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Effect of concentrate build-up strategy on % of cows with one or more incidences of a range of health issues (day 1-150)

	Rapid Build-up	*Delayed Build-up*	*Odds ratio*	*P-value*
Right dilated abomasum (%)	45	18	0.3	0.026
Mastitis (%)	55	43	0.6	0.352
Uterine infection (%)	31	32	1.1	0.928

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Effect of concentrate build-up strategy on reproductive performance

	Rapid Build-up	*Delayed Build-up*	*Odds Ratio*	*P-value*
Days to onset of luteal activity	33.0	44.8	-	0.136
Days to 1st service	74.7	76.5	-	0.452
Conception rate to 1st service (%)	41	36	0.8	0.754
Conception rate to 1st + 2nd service (%)	59	59	1.0	0.990
100 d in-calf rate (%)	63	64	1.0	0.960
Overall conception rate (%)	74	86	2.2	0.281

- Model: Y = Constant + Treatment

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Effect of abnormal ovarian activity on reproductive performance

- No treatment effect on incidence of abnormal cycles (Rapid build-up, 37.0%, Delayed build-up, 22.7%)

	Normal	*Abnormal*	*Odds Ratio*	*P-value*
Conception rate to 1st service (%)	50.0	13.3	0.15	0.011
Conception rate to 1st + 2nd service (%)	67.7	40.0	0.31	0.071
100d 'in-calf' rate (%)	73.5	40.0	0.24	0.026
Overall conception rate (%)	85.3	66.7	0.34	0.147

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Conclusions

- Adopting a delayed concentrate build-up strategy in early lactation
  - Improved forage intake and rumen health
  - Had no detrimental effect on production performance
- Results highlight that achieving normal ovarian function is a key driver of reproductive success

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Acknowledgements

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