

Evaluation of LiGAPS-Beef to assess extensive pasture-based beef production in three agro-ecological regions in South Africa: Supplementary Information

Table S1. Breed type-specific parameters used as input for the LiGAPS-Beef model after model calibration.

Parameter	<i>Bos taurus</i>		Composite		Sanga	
	Male	Female	Male	Female	Male	Female
1. Reflectance coat	0.60	0.60	0.56	0.56	0.60	0.6
2. Coat length	0.012	0.012	0.012	0.012	0.012	0.012
3. Body area (body area: weight factor)	1	1	1.09	1.09	1.16	1.12
4. Maximum cond. body core skin ($W\ m^{-2}\ K^{-1}$)	64.1	64.1	64.1	64.1	64.1	64.1
5. Birth weight (kg)	39.5	37.6	35.8	32.9	30.3	28.8
6. Maximum adult TBW (Gompertz curve) (kg)	1207.16	748.15	1019	691.68	917.44	448.4
7. Birth weight (Gompertz curve) (kg)	39.5	37.6	35.8	33.9	30.3	28.8
8. Constant of integration (Gompertz curve)	1.4	1.6	1.6	1.6	1.8	4.2
9. Rate constant (Gompertz curve)	1.1	1.1	1.4	1.2	1.1	1.5
10. Gompertz reduction (kg TBW)	289.16	144.15	199.91	133.68	147.44	6.4
11. Lactation curve parameters A or milk production (A = 0, no milk production male)	0	8	0	5.68	0	4
12. Lactation parameter B (milk available for calf)	0.068	0.068	0.068	0.068	0.068	0.068
13. Adult maximum weight (kg TBW)	918	604	820	558	770	442
14. Sex	0	1	0	1	0	1
15. Lactation curve parameters A (milk available for calf)	8	8	6.5	5.68	3.5	4
16. Lactation curve parameter B (milk available for calf)	0.068	0.068	0.068	0.068	0.068	0.068
17. Minimum fraction mature TBW for gestation %	0.60	0.6	0.575	0.575	0.55	0.55
18. Maintenance correction factor	0.97	1	0.93	0.93	0.91	0.91
19. Minimum fat tissue % in carcass for gestation	0.32	0.32	0.32	0.2	0.32	0.2
20. Lipid bone parameter	11.1	11.5	12.2	13.5	13.3	14.3
21. Maximum carcass fraction %	0.61	0.57	0.5935	0.55	0.578	0.55
22. Maximum muscle: bone ratio	4.4	4.3	4.1	3.6	4.1	3.6
23. Minimum conduction body core skin	1	1	1.10	1.225	1.3	1.3
24. Maximum latent heat release	4.00	3.08	4.5	3.985	7.5	4.89
25. Minimum latent heat release	1.73	1.73	1.265	1.265	0.8	0.8
26. Latent heat release (latent heat of water vapour)	35.3	35.3	34.9	34.9	34.5	34.5
27. Lactation curve parameter C	0.00338	0.00338	0.00338	0.00338	0.00338	0.00338

TBW: total bodyweight

Gompertz curves: $TBW = (A + (B - A + E) \times e^{(-C \times e^{(-D \times t)})} - E$, where A = birth weight; B = maximum adult weight; C = integration constant; D = rate constant; t is time in days, and E is a reduction factor.

Table S2: Main feed input parameters for LiGAPS-Beef model across the regions

Experiment Number	Region	Breed	ME content (MJ/kg DM)	CP Content (g/kg DM)	Digestibility (%)	HIF (-)	FU (-)	SNSC (g/kg DM)
1	Bloemfontein	Composite	9.7	140.0	64.3	0.33	1.06	224.9
2	Bloemfontein	Composite	9.6	135.0	63.6	0.33	1.07	224.2
3	Phalaborwa	<i>Bos taurus</i>	8.5	115.0	56.3	0.38	1.25	159.1
4	Phalaborwa	Composite	8.5	115.0	56.3	0.38	1.25	159.1
5	Phalaborwa	Sanga	8.5	115.0	56.3	0.38	1.25	159.1
6	Phalaborwa	<i>Bos taurus</i>	8.3	112.0	55.0	0.39	1.28	159.1
7	Phalaborwa	Composite	8.3	112.0	55.0	0.39	1.28	159.1
8	Phalaborwa	Sanga	8.3	112.0	55.0	0.39	1.28	159.1
9	Phalaborwa	<i>Bos taurus</i>	8.5	115.0	56.3	0.38	1.25	165.6
10	Phalaborwa	Composite	8.5	115.0	56.3	0.38	1.25	165.6
11	Phalaborwa	Sanga	8.5	115.0	56.3	0.38	1.25	165.6
12	Buffalo Berlin	<i>Bos taurus</i>	8.0	98.0	53.0	0.41	1.33	151.2
13	Buffalo Berlin	Composite	8.0	98.0	53.0	0.41	1.33	151.2
14	Buffalo Berlin	Sanga	8.0	98.0	53.0	0.41	1.33	151.2
15	Bloemfontein	<i>Bos taurus</i>	8.0	77.0	53.0	0.41	1.33	166.9
16	Bloemfontein	<i>Bos taurus</i>	8.6	100.0	57.0	0.38	1.24	191.5
17	Phalaborwa	Composite	9.5	140.0	63.0	0.33	1.09	210.9
18	Phalaborwa	Sanga	9.5	140.0	63.0	0.33	1.09	210.9
19	Phalaborwa	<i>Bos taurus</i>	8.3	112.0	55.0	0.39	1.28	159.1
20	Phalaborwa	Composite	8.3	112.0	55.0	0.39	1.28	159.1
21	Phalaborwa	Sanga	8.3	112.0	55.0	0.39	1.28	159.1
22	Buffalo Berlin	Sanga	8.1	80.0	53.8	0.40	1.31	173.3
23	Buffalo Berlin	Sanga	8.2	91.5	54.5	0.39	1.29	172.7
24	Buffalo Berlin	Sanga	8.0	103.2	53.0	0.41	1.33	146.3
25	Buffalo Berlin	<i>Bos taurus</i>	8.0	98.0	53.0	0.41	1.33	151.2
26	Buffalo Berlin	Composite	8.0	98.0	53.0	0.41	1.33	151.2
27	Buffalo Berlin	Sanga	8.0	98.0	53.0	0.41	1.33	151.2

ME= metabolizable energy, CP= crude protein, HIF= heat increment of feeding, FU= fill units, SNSC= Soluble non-structural carbohydrates

Table S3: Measured and simulated production parameters for simulations 1-27

Simulation	Measured ADG (kg LW/day)	Simulated ADG (kg LW/day)	Live weight gain (kg)	Average simulated feed intake (kg DM/day)	Average simulated feed efficiency (g/kg DM)
1	1.16	1,24	124.2	7.8	159.5
2	1.01	1.22	123.7	7.9	155.9
3	0.40	0.41	127.9	7.0	58.5
4	0.52	0.45	140.6	6.9	65.1
5	0.51	0.43	133.1	5.5	77.5
6	0.37	0.38	185.3	7.3	51.2
7	0.35	0.41	202.9	7.3	56.7
8	0.40	0.38	187.5	5.8	65.3
9	0.52	0.41	276.9	7.9	51.9
10	0.51	0.48	324.6	8.1	59.6
11	0.47	0.47	317.7	6.8	69.3
12	0.20	0.19	66.0	5.4	35.6
13	0.18	0.25	84.5	6.0	41.0
14	0.20	0.14	47.5	4.4	31.6
15	0.93	0.19	35.0	5.6	34.1
16	1.37	0.61	111.0	6.7	91.0
17	0.66	0.72	150.9	6.6	108.6
18	0.60	0.70	143.1	5.6	125.1
19	0.33	0.38	189.3	7.4	51.9
20	0.23	0.42	205.7	7.3	57.2
21	0.30	0.40	198.0	6.2	65.2
22	0.27	0.22	13.2	5.4	40.5
23	0.30	0.30	18.2	5.8	51.6
24	0.37	0.22	13.6	5.7	38.9
25	0.21	0.17	58.9	4.9	35.1
26	0.26	0.20	68.3	5.1	39.0
27	0.22	0.15	52.2	4.5	34.0

ADG= average daily gain, LW = live weight, DM = dry matter.

Analysis of Variance Table1

Response=ADG

Factors	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sensitivity\$ME	2	1.2479	0.62398	8.0242	0.002763 **
Residuals	20	1.5552	0.07776		

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Analysis of Variance Table 2

Response=ADG

Factors	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sensitivity\$ME	2	1.24795	0.62398	18.5924	6.709e-05 ***
ME\$Breed	2	0.35471	0.17735	5.2846	0.017296 *
ME\$Region	2	0.66356	0.33178	9.8860	0.001602 **
Residuals	16	0.53697	0.03356		

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Analysis of Variance Table 3

Response=ADG

factors	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sensitivity\$CP	2	0.00177	0.00088	0.0258	0.974520
CP\$Breed	2	0.57776	0.28888	8.4566	0.002823 **
CP\$Region	2	1.25163	0.62582	18.3199	5.73e-05 ***
Residuals	17	0.58073	0.03416		

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

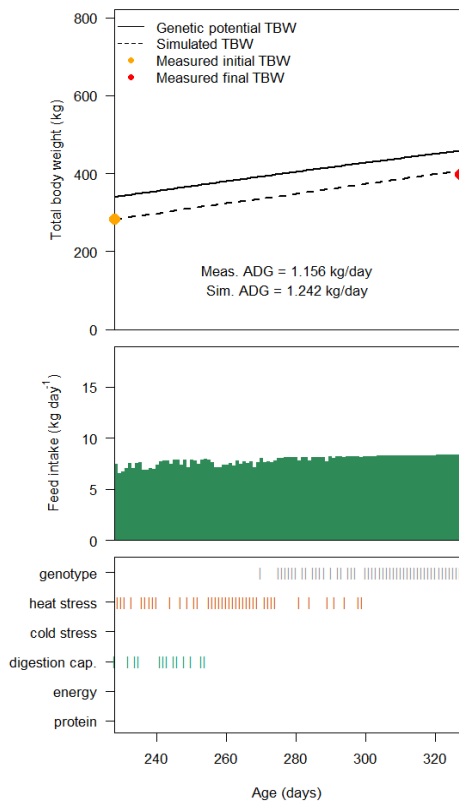


Figure S1: Defining and limiting factors for growth for simulation 1.

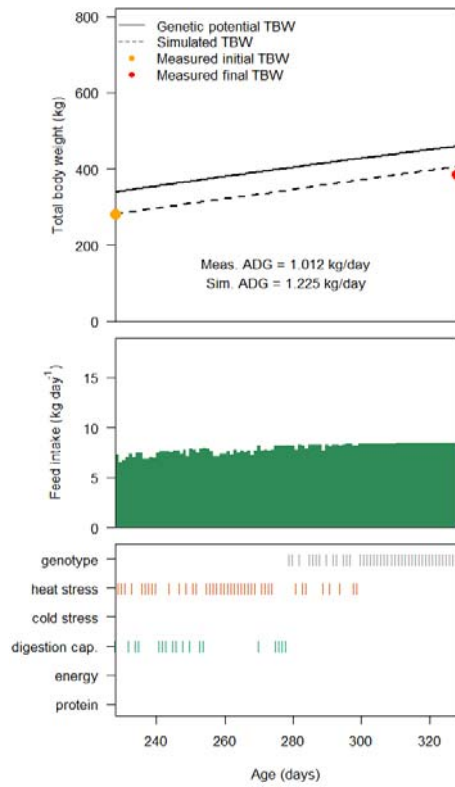


Figure S2: Defining and limiting factors for growth for simulation 2.

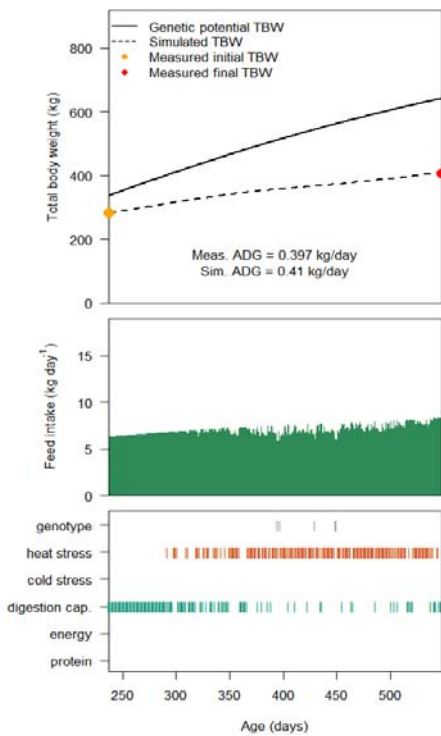


Figure S3: Defining and limiting factors for growth for simulation 3.

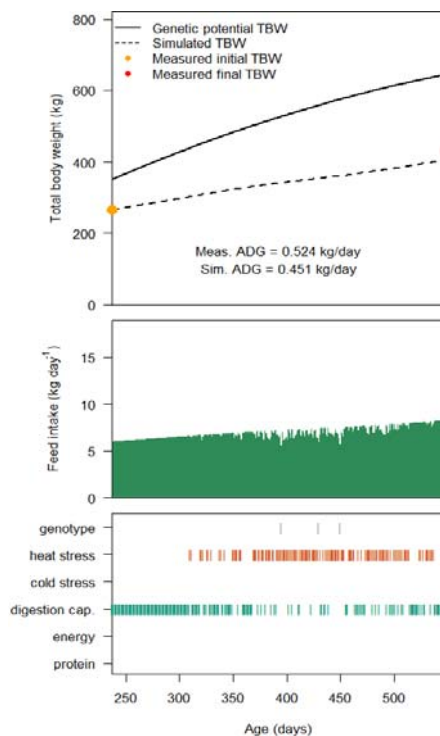


Figure S4: Defining and limiting factors for growth for simulation 4.

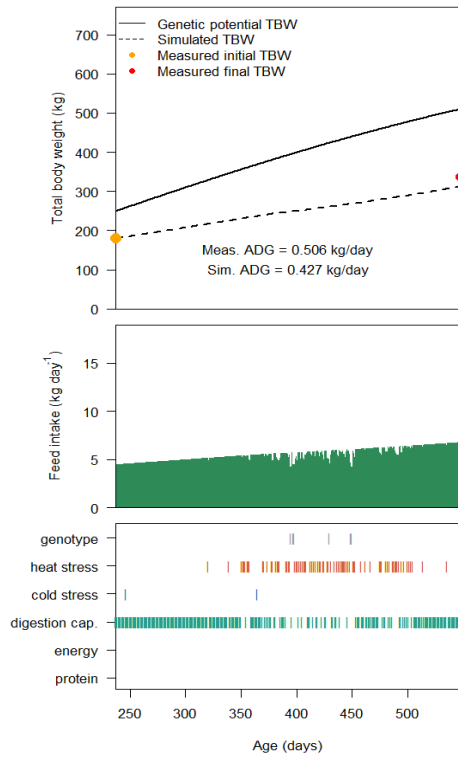


Figure S5: Defining and limiting factors for growth for simulation 5.

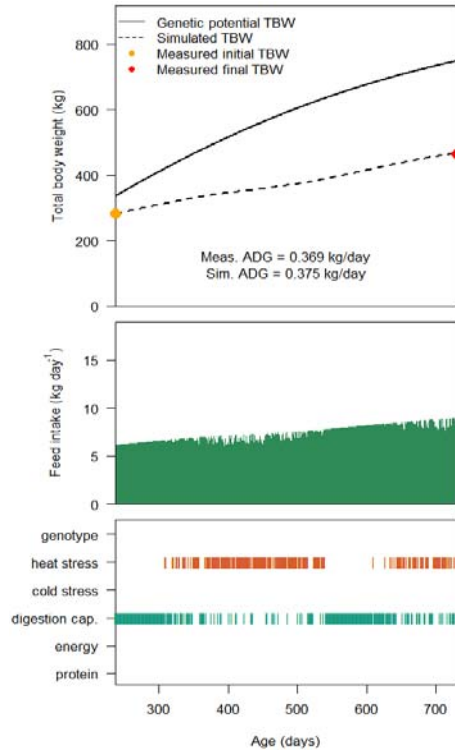


Figure S6: Defining and limiting factors for growth for simulation 6.

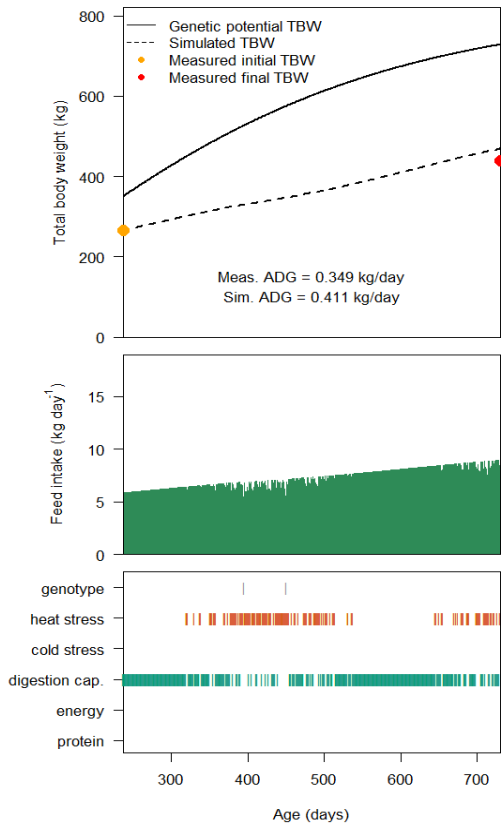


Figure S7: Defining and limiting factors for growth for simulation 7.

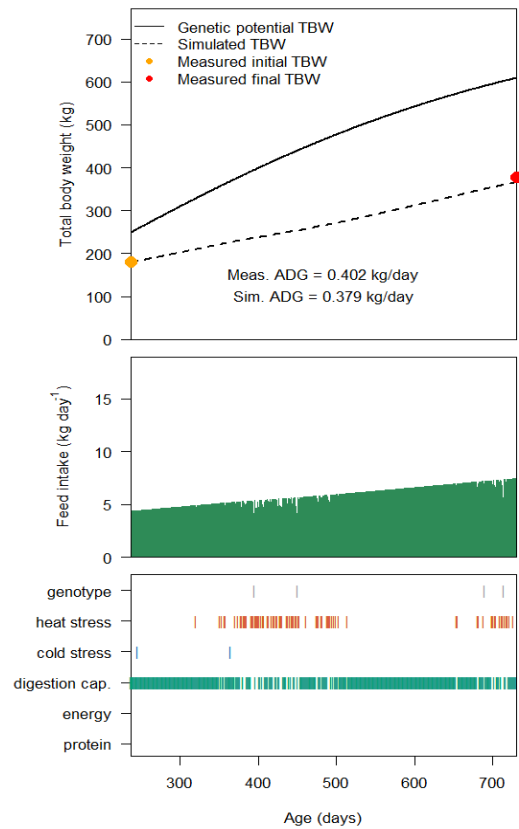


Figure S8: Defining and limiting factors for growth for simulation 8.

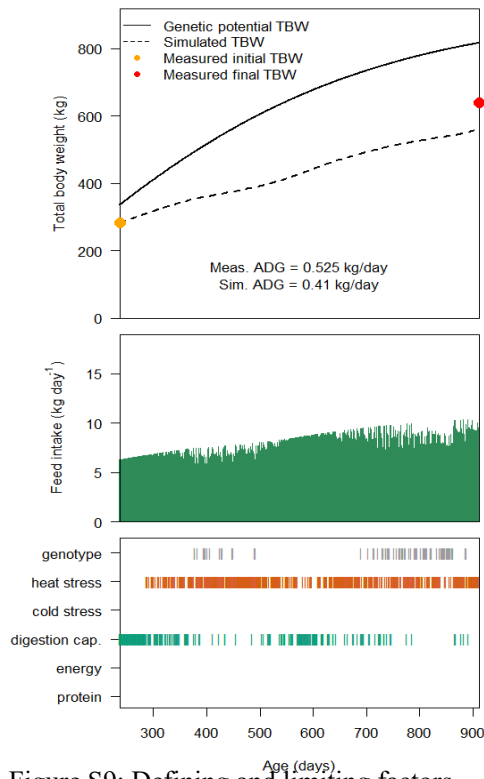


Figure S9: Defining and limiting factors for growth for simulation 9.

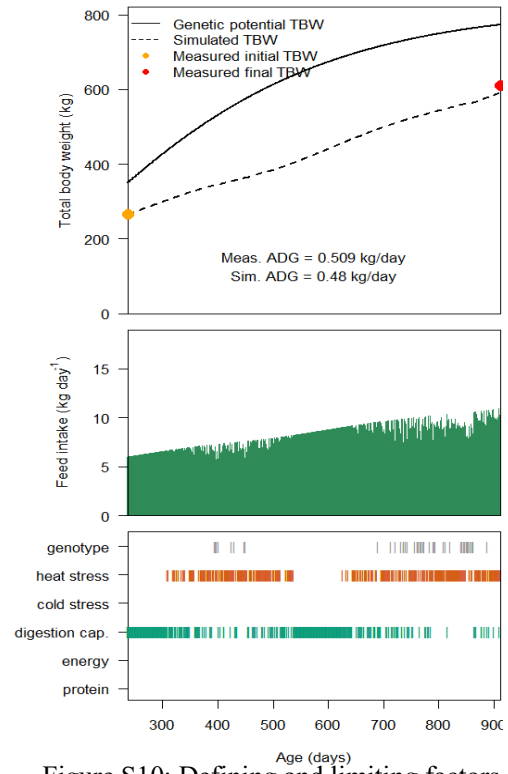


Figure S10: Defining and limiting factors for growth for simulation 10.

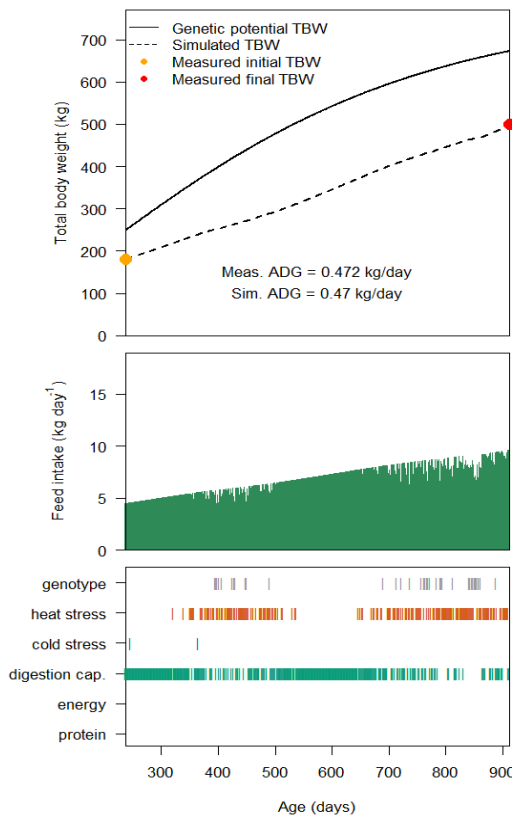


Figure S11: Defining and limiting factors for growth for simulation 11.

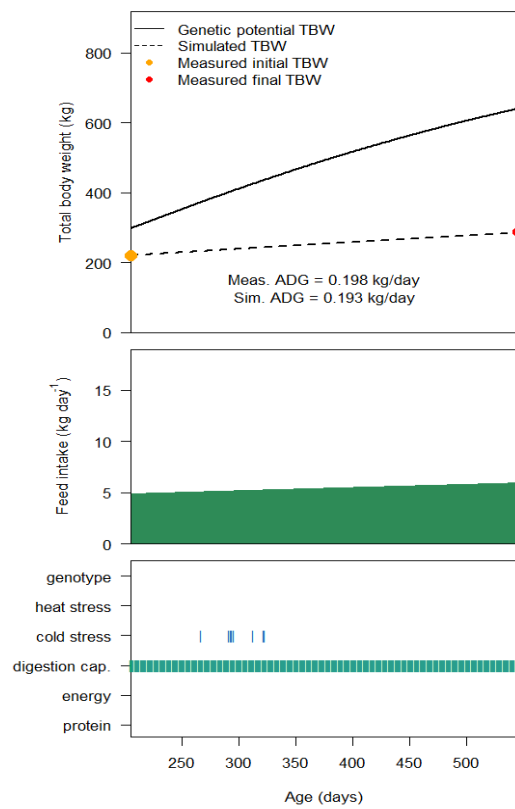


Figure S12: Defining and limiting factors for growth for simulation 12.

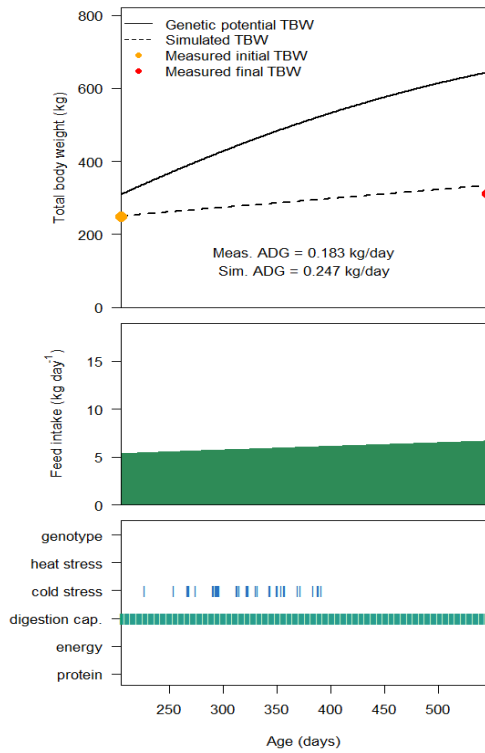


Figure S13: Defining and limiting factors for growth for simulation 13.

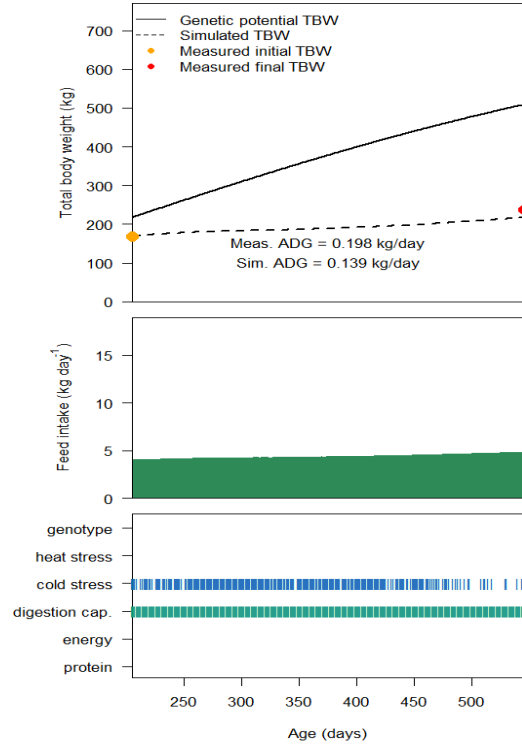


Figure S14: Defining and limiting factors for growth for simulation 14.

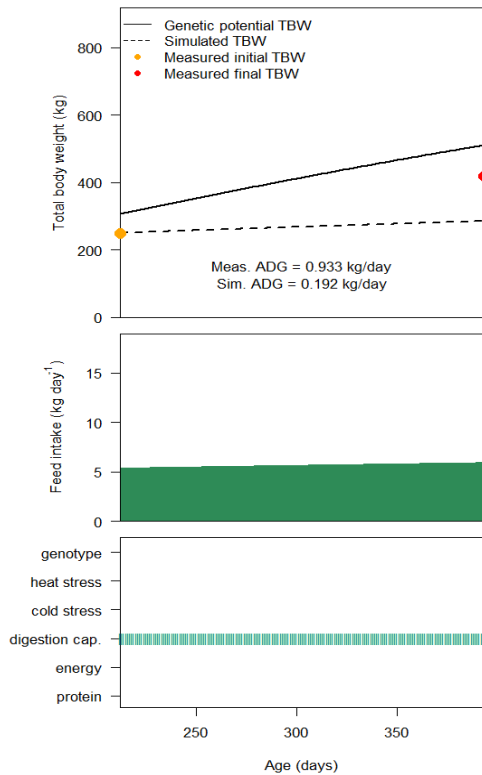


Figure S15: Defining and limiting factors for growth for simulation 15

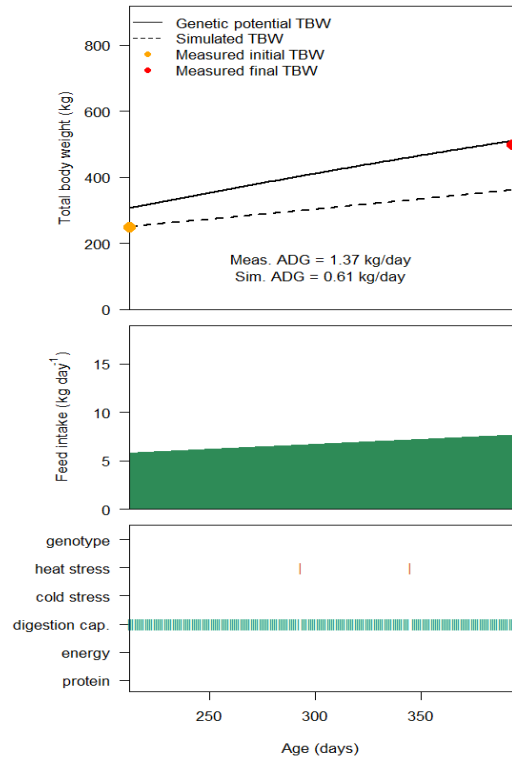


Figure S16: Defining and limiting factors for growth for simulation 16.

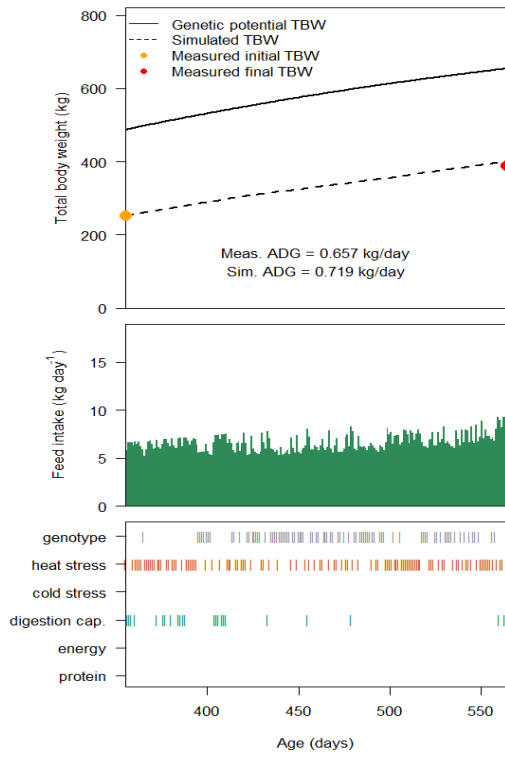


Figure S17: Defining and limiting factors for growth for simulation 17

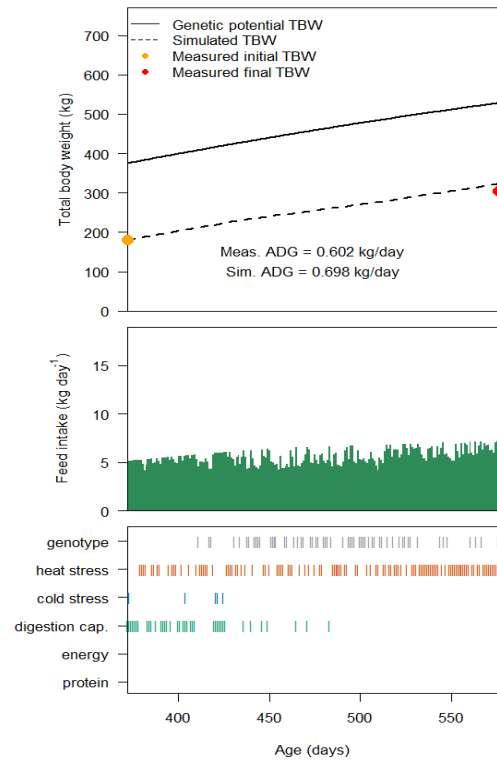


Figure S18: Defining and limiting factors for growth for simulation 18.

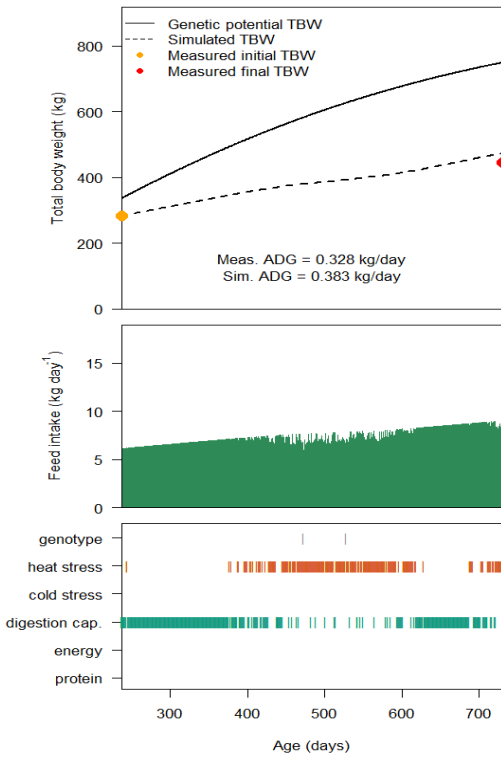


Figure S19: Defining and limiting factors for growth for simulation 19.

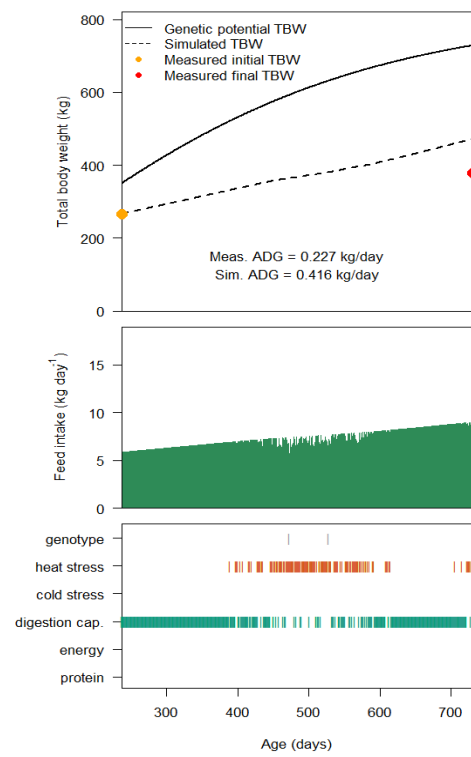


Figure S20: Defining and limiting factors for growth for simulation 20.

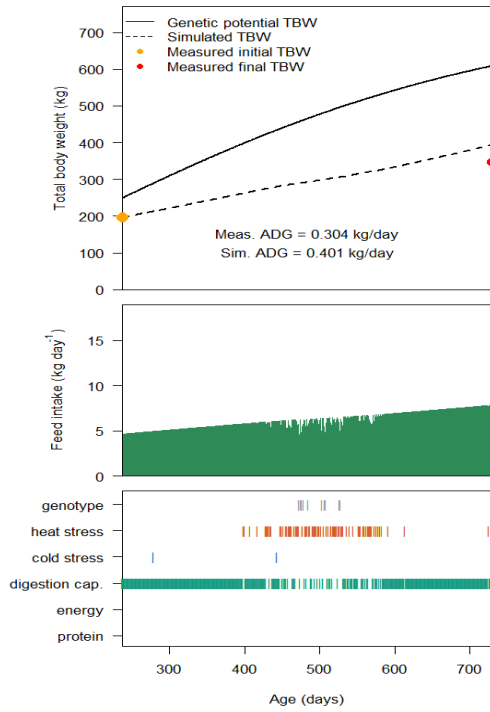


Figure S21: Defining and limiting factors for growth for simulation 21.

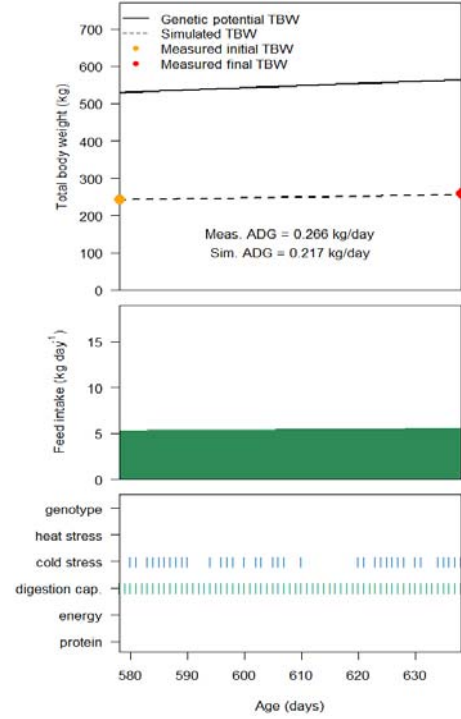


Figure S22: Defining and limiting factors for growth for simulation 22.

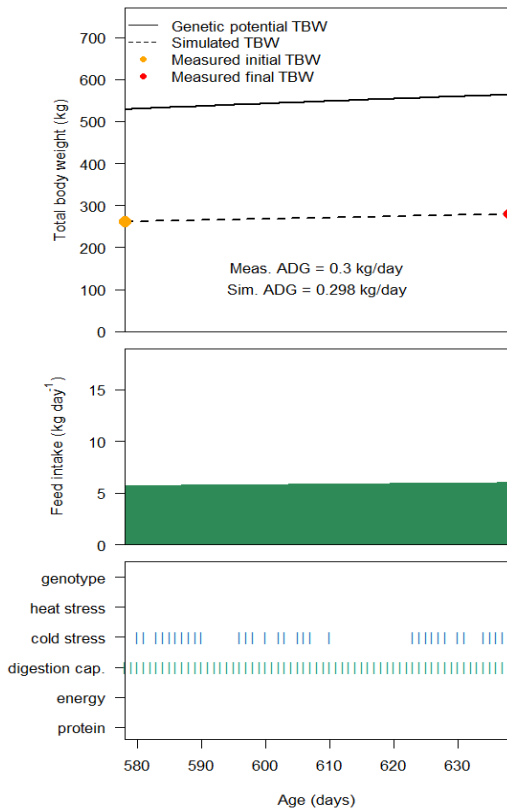


Figure S23: Defining and limiting factors for growth for simulation 23.

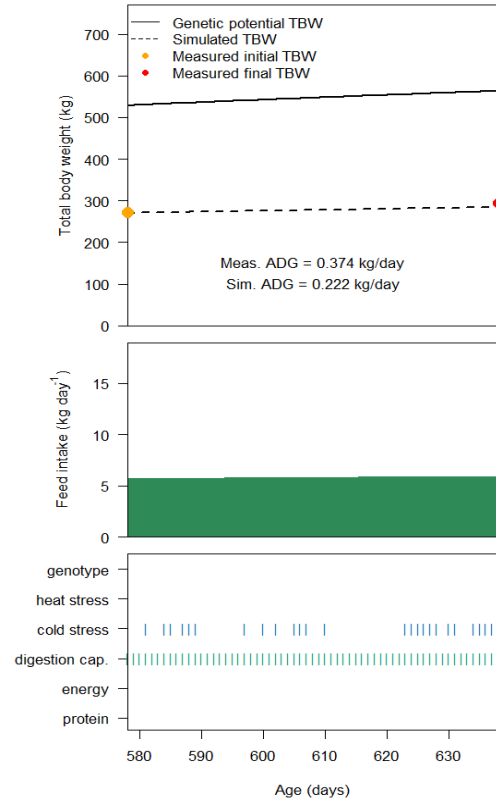


Figure S24: Defining and limiting factors for growth for simulation 24.

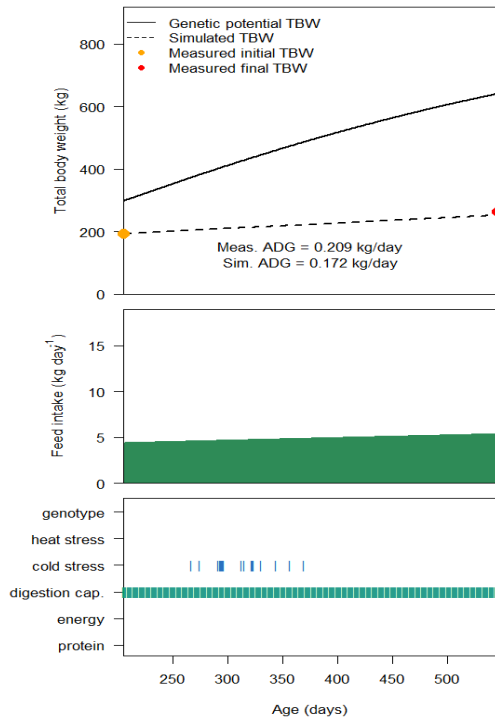


Figure S25: Defining and limiting factors for growth for simulation 25.

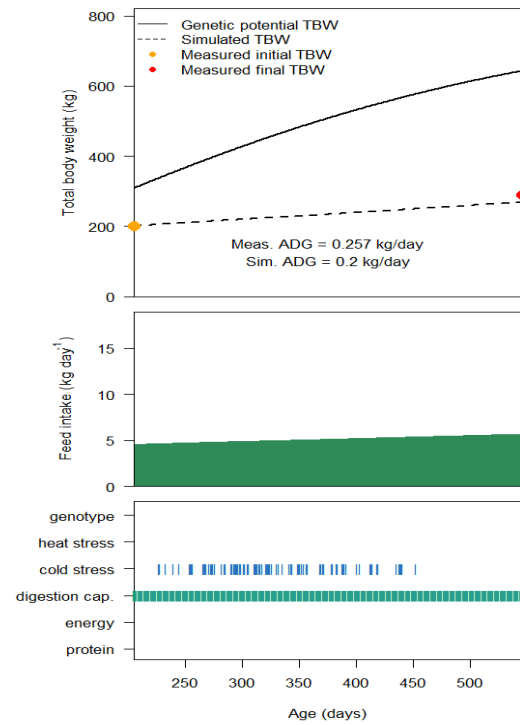


Figure S26: Defining and limiting factors for growth for simulation 26.

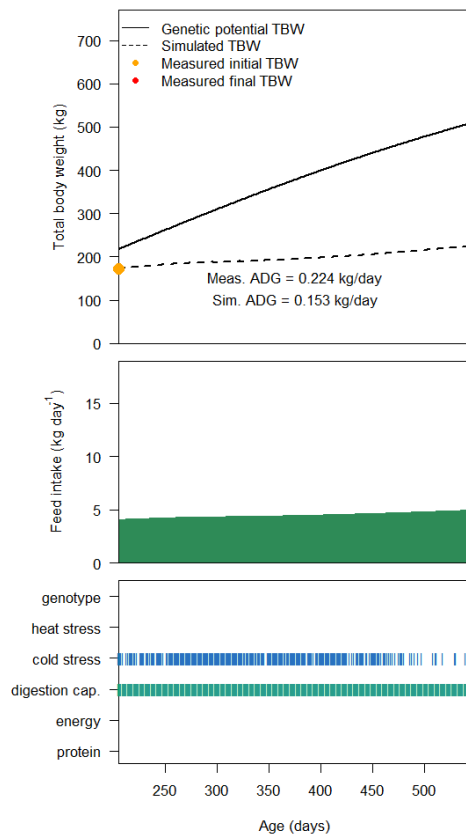


Figure S27: Defining and limiting factors for growth for simulation 27.