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A PHYSICAL AND ECONOMIC EVALUATION OF ARGENTINA´S BEEF PRODUCTION SYSTEMS

Carlos Manuel Méndez Acosta
Martín Fraguío

UNIVERSIDAD CATÓLICA ARGENTINA
Facultad de Ciencias Agrarias
Freire 183
1426-Buenos Aires-Argentina
Phone: 54 11 4553-5235
e-mail address: cmanuelma@ciudad.com.ar

Mª Isabel Alonso Magdaleno

UNIVERSIDAD DE OVIEDO
Facultad de Ciencias Económicas y Empresariales
Avda. del Cristo, s/n
33071-Oviedo-España
Phone: +34 985 10 36 99
e-mail address: ialonso@econo.uniovi.es

ABSTRACT

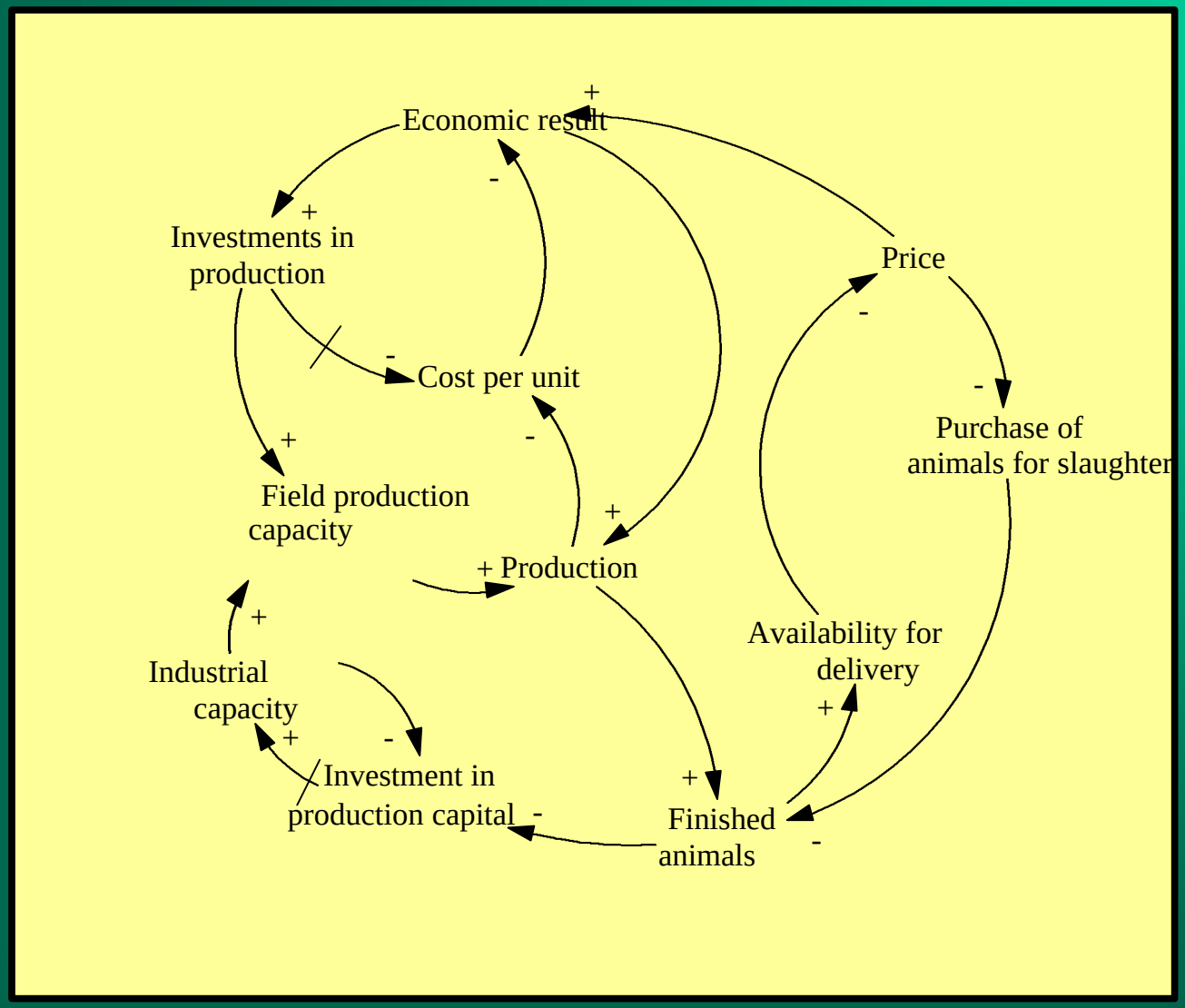
This research studies the physical, economic and financial results obtained by the application of an array of technical methods on the beef production system under grazing conditions generally applied in the "wet argentine pampa". A simulation model of a ranch was developed to represent the responses to the use of different technological packages. Systems Dynamics is the tool employed in this study.

The Argentine beef production system under grazing conditions is integrated by two subsystems: the first is the cow-calf operation and the second is the fattening of calves after weaning. One of the most important figures of the first subsystem is the variable which reflects the number of animals per unit of surface, or carrying capacity. Carrying capacity, feedstuffs quality and ranch management practices —for example: the employment of compensatory growth— are the most important aspects of the second subsystem. The beef production system was simulated employing these variables (carrying capacity, the quality of diet, compensatory growth) as management tools. It also considered the economic and physical answers reached by modifying them.

The response to changes of the variables above mentioned variables has been observed on the economic result ($), return on capital (%), gross margin ($/Ha), beef production (Kg/Ha) and forage requirements (cow equivalent/Ha). These results confirm the figures mentioned in the bibliography of reference to this subject.

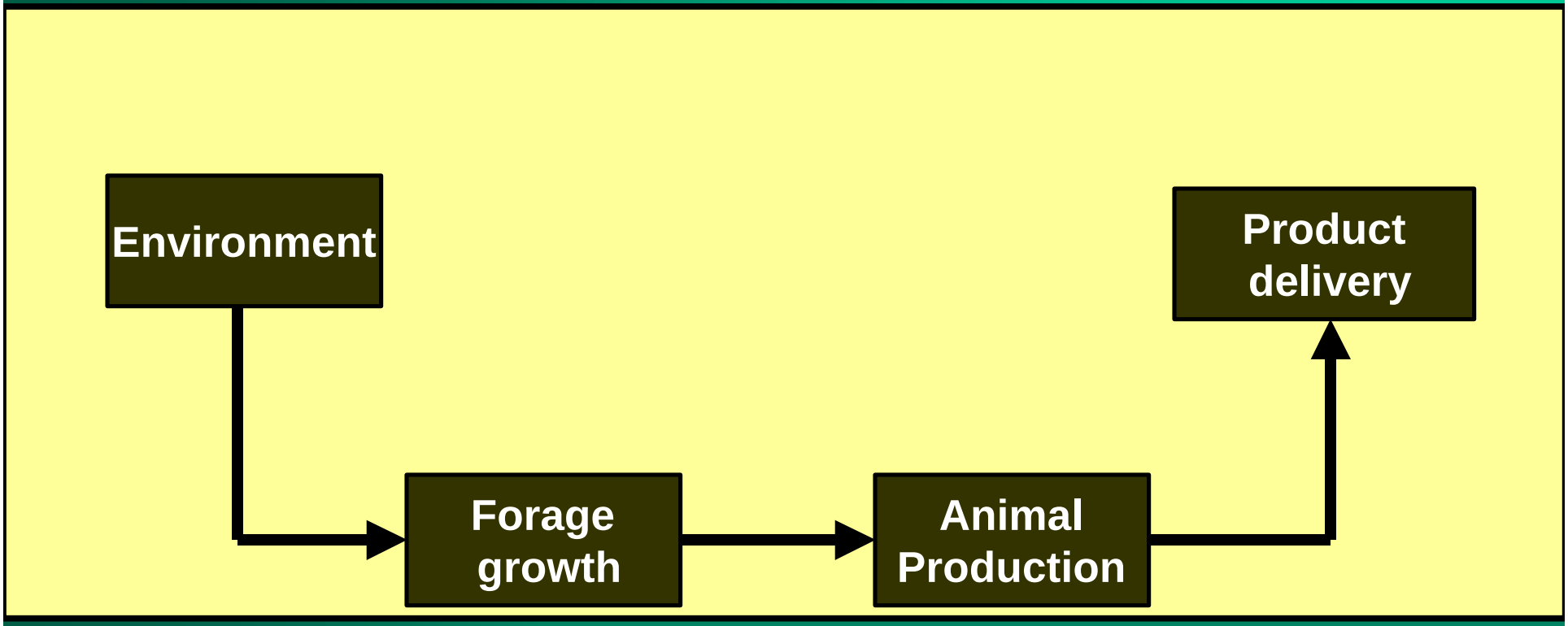
This study has done a sensibility analysis and a risk evaluation to measure the economical support of the thesis. Also, it was useful to analyse different strategies in the beef production system.

DESIGN OF THE MODEL

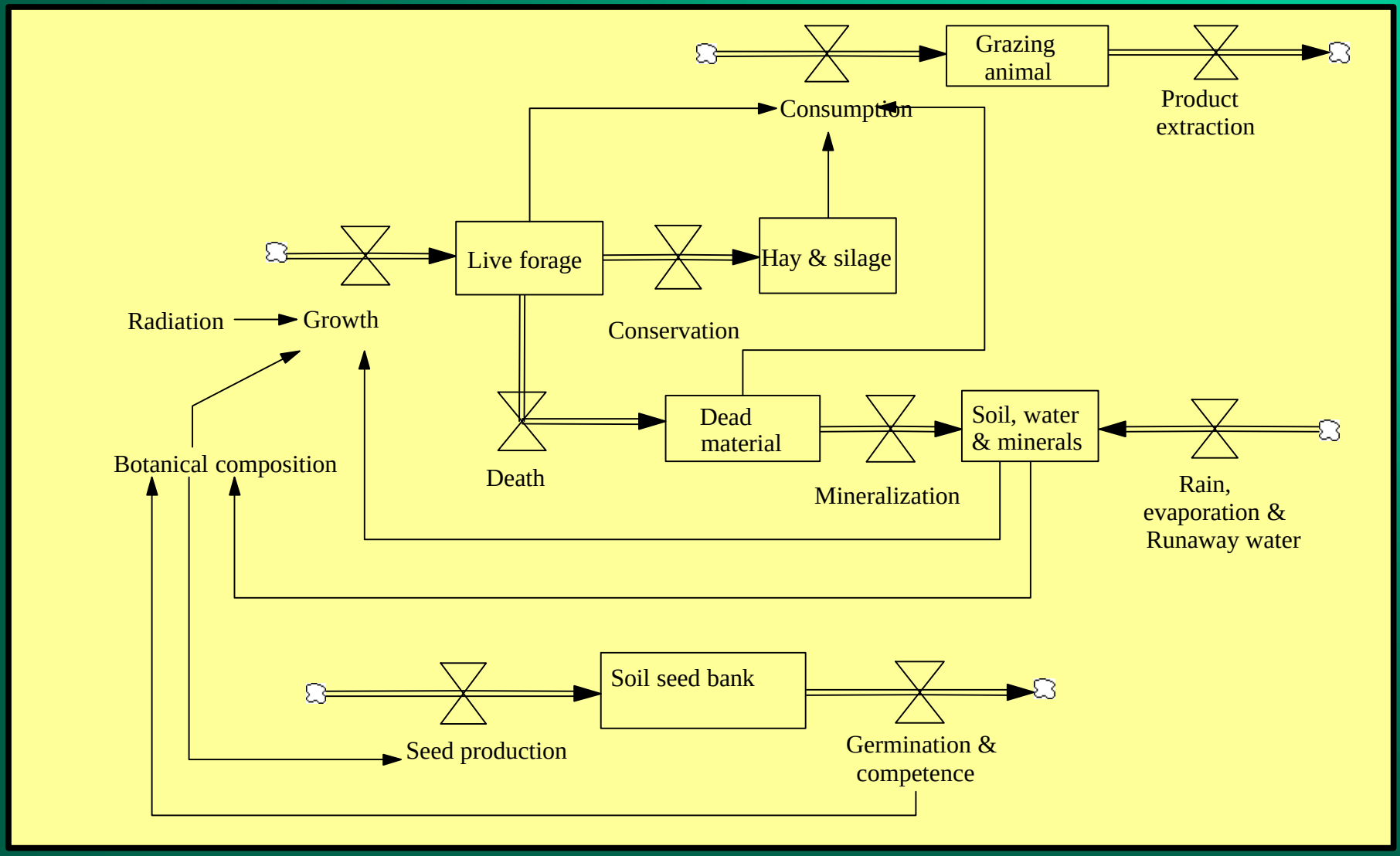


CAUSUAL DIAGRAM

DESIGN OF THE MODELO

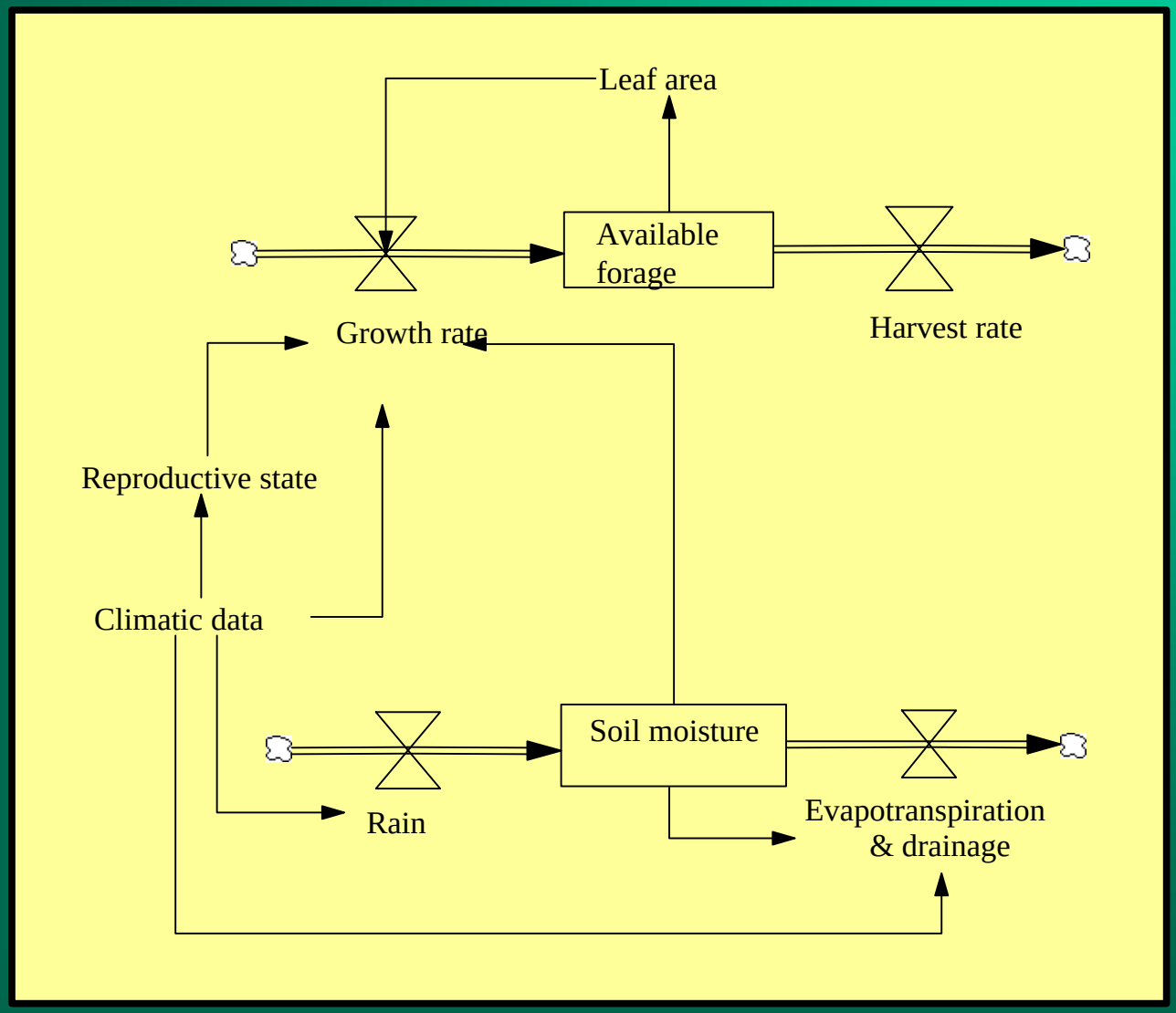


DESIGN OF THE MODEL



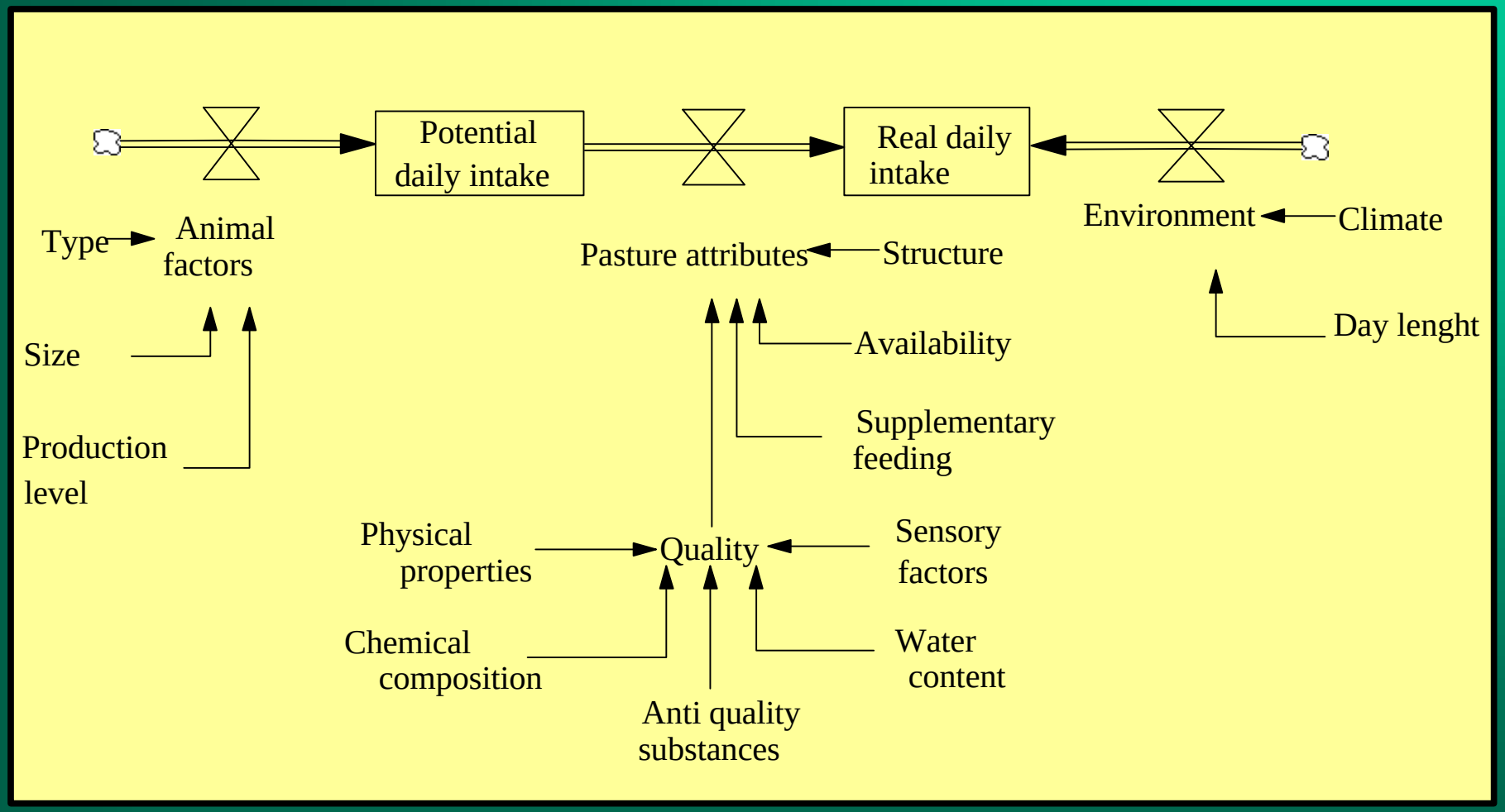
FLUX DIAGRAMS : BIOLOGICAL COMPONENTS

DESIGN OF THE MODEL



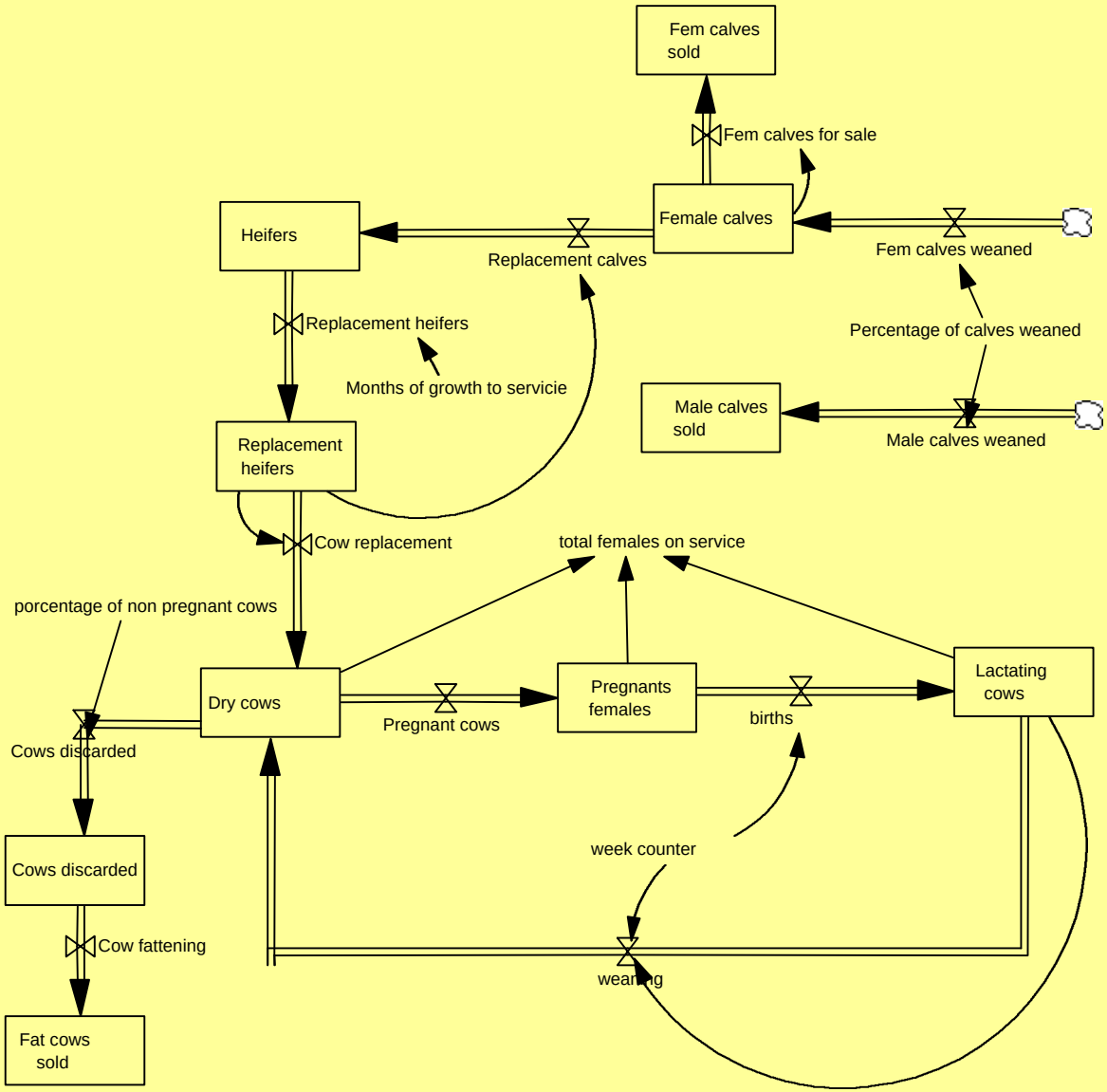
FLUX DIAGRAM: GROWTH RATE AND FORAGE AVAILABILITY

DESIGN OF THE MODEL



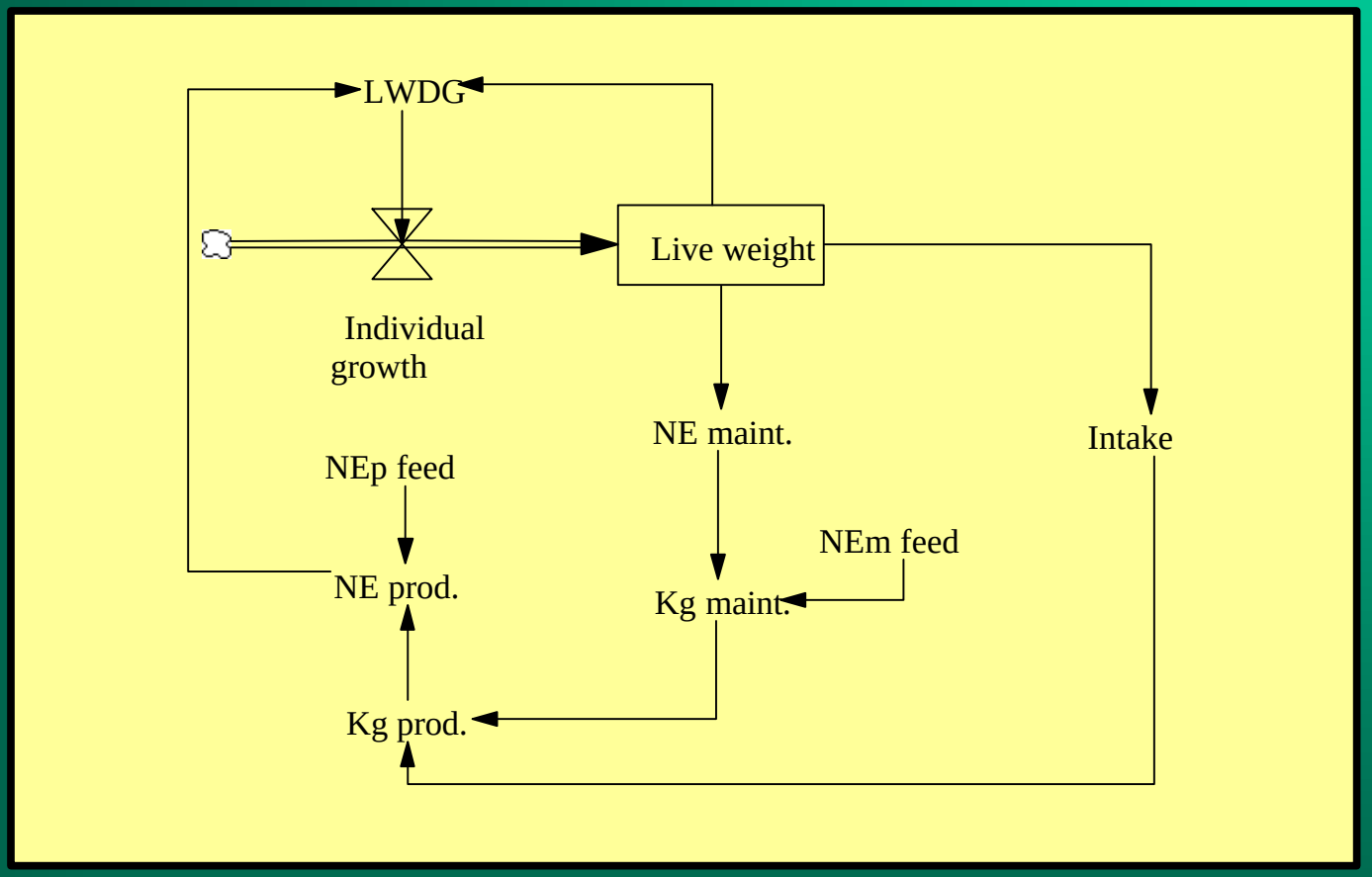
FLUX DIAGRAM: INTAKE OF THE GRAZING ANIMAL

DESIGN OF THE MODEL



FLUX DIAGRAMS: EVOLUTION OF HEAD COUNT IN A COW CALF OPERATION

DESIGN OF THE MODEL



FLUX DIAGRAMS: INDIVIDUAL BEEF PRODUCTION

RESULTS OBTAINED

11:49 AM Thu, Feb 22, 2001 — Table 17: p5 (Untitled Table)

Weeks	1 Intake	2 Intake	3 Intake	4 Intake	5 Intake	6 Intake	7 Intake	8 Intake	9 Intake	10 Intake
.0000	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
4.0000	6.49	6.54	6.58	6.62	6.66	6.70	6.73	6.77	6.80	6.84
8.0000	7.00	7.09	7.17	7.25	7.32	7.40	7.47	7.53	7.60	7.67
12.0000	7.52	7.64	7.76	7.88	7.99	8.09	8.20	8.30	8.39	8.48
16.0000	8.04	8.21	8.36	8.51	8.66	8.79	8.93	9.05	9.18	9.30
20.0000	8.58	8.78	8.97	9.15	9.33	9.50	9.66	9.81	9.96	10.10
24.0000	9.12	9.36	9.58	9.80	10.00	10.20	10.39	10.57	10.74	10.91
28.0000	9.64	9.92	10.18	10.43	10.66	10.89	11.10	11.31	11.51	11.70
32.0000	10.18	10.49	10.79	11.06	11.33	11.58	11.82	12.05	12.27	12.49
36.0000	10.73	11.08	11.40	11.71	12.00	12.28	12.54	12.80	13.04	13.28
40.0000	11.31	11.69	12.04	12.37	12.69	12.99	13.28	13.56	13.82	14.08
44.0000	11.90	12.31	12.69	13.05	13.39	13.72	14.03	14.33	14.61	14.89
48.0000	12.51	12.94	13.35	13.74	14.10	14.45	14.78	15.10	15.40	15.70
Final	13.12	13.59	14.02	14.43	14.82	15.18	15.54	15.87	16.20	16.51

VARIATION IN GRAZING VOLUNTARY INTAKE

RESULTS OBTAINED

11:49 AM Thu, Feb 22, 2001 — Table 17: p2 (Untitled Table)

Weeks	1 LWDG	2 LWDG	3 LWDG	4 LWDG	5 LWDG	6 LWDG	7 LWDG	8 LWDG	9 LWDG	10 LWDG
.0000	0.58	0.63	0.69	0.74	0.78	0.83	0.88	0.92	0.96	1.01
4.0000	0.60	0.65	0.70	0.74	0.79	0.83	0.87	0.91	0.95	0.99
8.0000	0.61	0.66	0.70	0.75	0.79	0.83	0.87	0.91	0.94	0.98
12.0000	0.62	0.67	0.71	0.75	0.79	0.83	0.87	0.90	0.94	0.97
16.0000	0.63	0.68	0.72	0.76	0.80	0.83	0.87	0.90	0.93	0.96
20.0000	0.64	0.69	0.73	0.77	0.80	0.84	0.87	0.90	0.93	0.96
24.0000	0.62	0.66	0.71	0.75	0.78	0.82	0.85	0.88	0.91	0.94
28.0000	0.64	0.68	0.72	0.76	0.79	0.82	0.85	0.88	0.91	0.94
32.0000	0.65	0.69	0.73	0.76	0.80	0.83	0.86	0.89	0.92	0.94
36.0000	0.68	0.71	0.75	0.78	0.81	0.84	0.87	0.90	0.93	0.95
40.0000	0.70	0.74	0.77	0.80	0.83	0.86	0.89	0.91	0.94	0.96
44.0000	0.71	0.75	0.78	0.81	0.84	0.87	0.89	0.92	0.94	0.96
48.0000	0.73	0.76	0.79	0.82	0.85	0.87	0.90	0.92	0.94	0.96
Final	0.74	0.77	0.80	0.83	0.85	0.88	0.90	0.92	0.95	0.97

LIVE WEIGHT DAILY GAIN (LWDG) VARIATION

RESULTS OBTAINED

11:49 AM Thu, Feb 22, 2001 — Table 17: p1 (Untitled Table)

Weeks	1: Live weight	2: Live weight	3: Live weight	4: Live weight	5: Live weight	6: Live weight	7: Live weight	8: Live weight	9: Live weight	10: Live weight
.0000	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
4.0000	216.45	217.92	219.33	220.69	222.00	223.26	224.49	225.68	226.83	227.95
8.0000	233.33	236.20	238.94	241.57	244.10	246.53	248.89	251.17	253.37	255.52
12.0000	250.56	254.77	258.78	262.61	266.29	269.83	273.24	276.53	279.72	282.81
16.0000	268.08	273.58	278.81	283.79	288.56	293.14	297.55	301.80	305.91	309.89
20.0000	285.91	292.65	299.05	305.13	310.95	316.52	321.87	327.03	332.01	336.82
24.0000	303.98	311.93	319.45	326.59	333.40	339.93	346.18	352.20	358.01	363.62
28.0000	321.49	330.68	339.34	347.56	355.38	362.86	370.02	376.91	383.54	389.94
32.0000	339.43	349.79	359.55	368.79	377.58	385.96	393.99	401.70	409.12	416.28
36.0000	357.80	369.30	380.11	390.33	400.03	409.28	418.14	426.63	434.80	442.68
40.0000	376.95	389.51	401.30	412.44	423.00	433.07	442.69	451.92	460.79	469.35
44.0000	396.77	410.33	423.05	435.05	446.42	457.26	467.61	477.53	487.06	496.25
48.0000	416.95	431.46	445.07	457.90	470.05	481.62	492.67	503.26	513.43	523.23
Final	437.41	452.86	467.32	480.95	493.86	506.14	517.86	529.09	539.88	550.27

LIVE WEIGHT VARIATION

RESULTS OBTAINED

11:49 AM Thu, Feb 22, 2001 — Table 17: p4 (Untitled Table)

Weeks	1: ENm racion	2: ENm racion	3: ENm racion	4: ENm racion	5: ENm racion	6: ENm racion	7: ENm racion	8: ENm racion	9: ENm racion	10: ENm racio
.0000	1.42	1.50	1.59	1.67	1.76	1.84	1.93	2.02	2.10	2.19
4.0000	1.42	1.49	1.57	1.65	1.72	1.80	1.87	1.95	2.02	2.09
8.0000	1.41	1.49	1.56	1.63	1.69	1.76	1.83	1.89	1.96	2.02
12.0000	1.41	1.48	1.54	1.61	1.67	1.73	1.79	1.85	1.90	1.96
16.0000	1.41	1.47	1.53	1.59	1.65	1.70	1.75	1.81	1.86	1.91
20.0000	1.41	1.46	1.52	1.58	1.63	1.68	1.73	1.78	1.82	1.87
24.0000	1.34	1.40	1.45	1.51	1.56	1.61	1.66	1.70	1.75	1.79
28.0000	1.35	1.40	1.45	1.50	1.55	1.60	1.64	1.69	1.73	1.77
32.0000	1.35	1.40	1.45	1.50	1.54	1.59	1.63	1.67	1.71	1.74
36.0000	1.38	1.43	1.48	1.52	1.56	1.60	1.64	1.67	1.71	1.74
40.0000	1.41	1.45	1.50	1.53	1.57	1.61	1.64	1.68	1.71	1.74
44.0000	1.41	1.46	1.49	1.53	1.57	1.60	1.63	1.66	1.69	1.72
48.0000	1.42	1.45	1.49	1.53	1.56	1.59	1.62	1.65	1.68	1.70
Final	1.42	1.45	1.49	1.52	1.55	1.58	1.61	1.64	1.66	1.69

VARIATION OF ENERGETIC CONCENTRATION IN THE DIET (Net energy for maintenance)

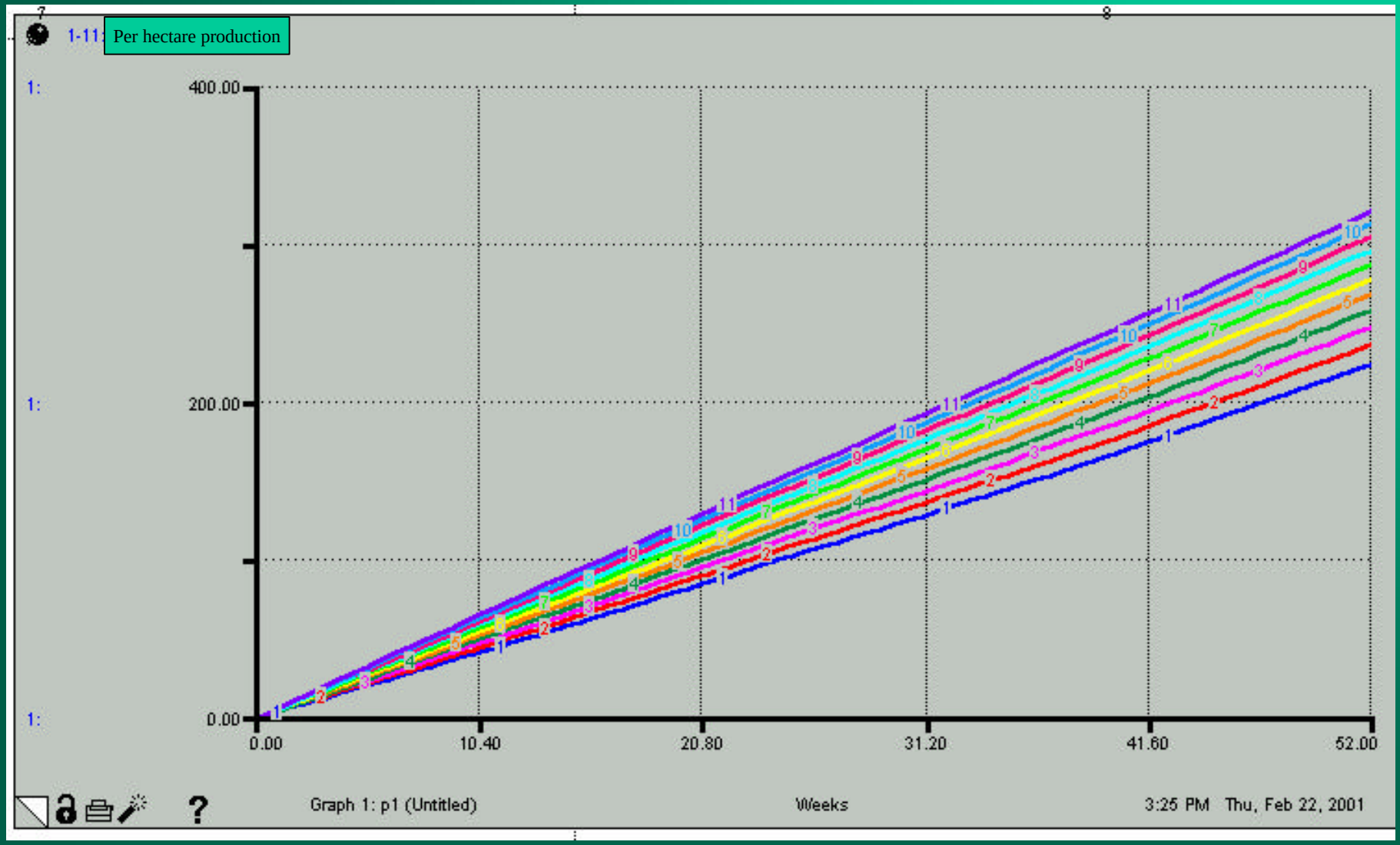
RESULTS OBTAINED

11:49 AM Thu, Feb 22, 2001 — Table 17: p3 (Untitled Table)

Weeks	1: ENp racion	2: ENp racion	3: ENp racion	4: ENp racion	5: ENp racion	6: ENp racion	7: ENp racion	8: ENp racion	9: ENp racion	10: ENp racion
.0000	0.92	0.99	1.06	1.14	1.21	1.28	1.36	1.43	1.50	1.58
4.0000	0.92	0.98	1.05	1.11	1.18	1.24	1.31	1.37	1.43	1.50
8.0000	0.91	0.98	1.04	1.10	1.15	1.21	1.27	1.32	1.38	1.43
12.0000	0.91	0.97	1.02	1.08	1.13	1.18	1.23	1.28	1.33	1.38
16.0000	0.91	0.96	1.01	1.06	1.11	1.16	1.21	1.25	1.29	1.34
20.0000	0.91	0.96	1.01	1.05	1.10	1.14	1.18	1.22	1.26	1.30
24.0000	0.87	0.92	0.97	1.01	1.05	1.10	1.14	1.18	1.21	1.25
28.0000	0.87	0.92	0.96	1.01	1.05	1.08	1.12	1.16	1.19	1.23
32.0000	0.88	0.92	0.96	1.00	1.04	1.07	1.11	1.14	1.18	1.21
36.0000	0.89	0.93	0.97	1.01	1.04	1.08	1.11	1.14	1.17	1.20
40.0000	0.91	0.95	0.98	1.02	1.05	1.08	1.11	1.14	1.17	1.19
44.0000	0.91	0.95	0.98	1.01	1.04	1.07	1.10	1.13	1.15	1.18
48.0000	0.92	0.95	0.98	1.01	1.04	1.07	1.09	1.12	1.14	1.16
Final	0.92	0.95	0.98	1.01	1.03	1.06	1.08	1.11	1.13	1.15

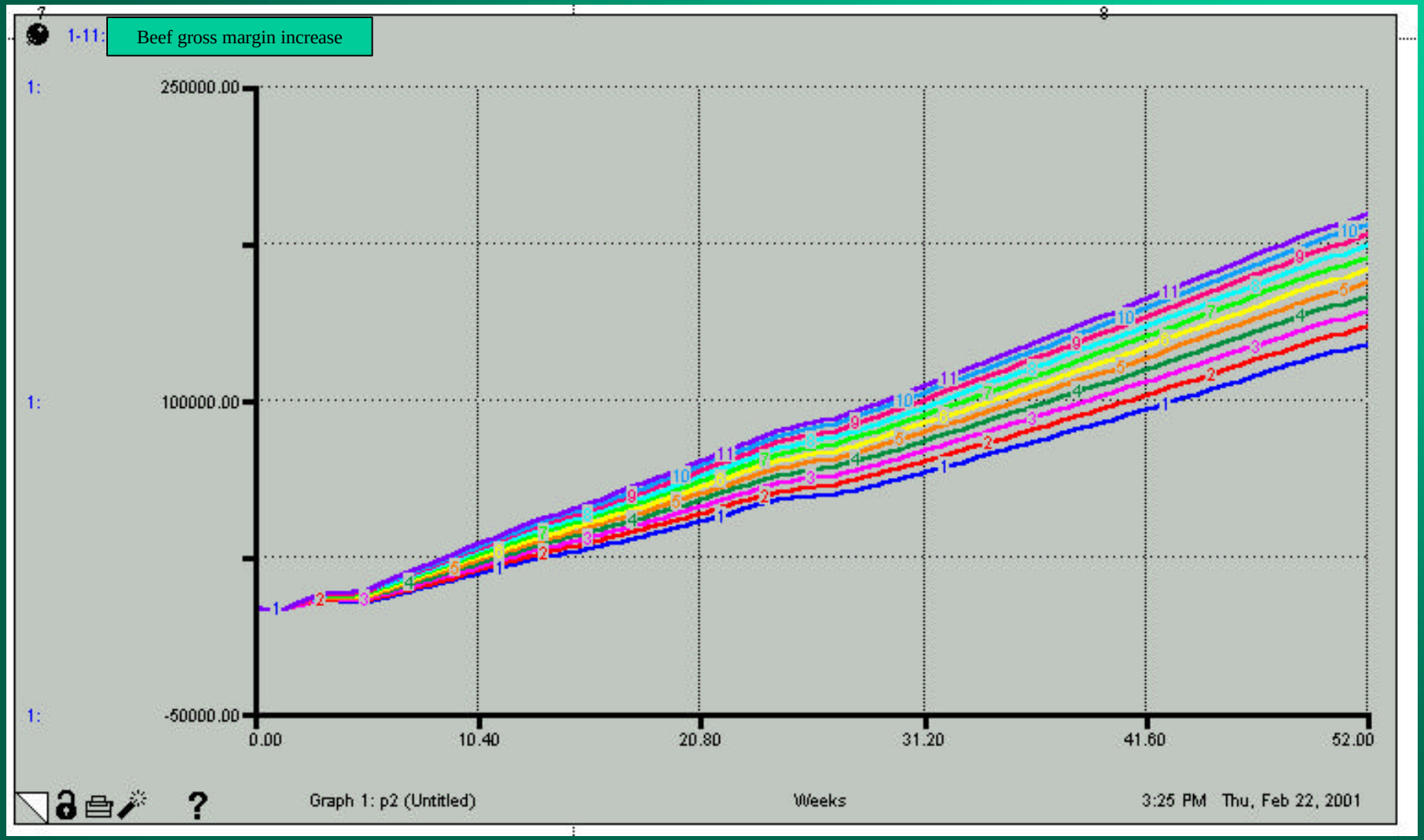
VARIATION OF ENERGETIC CONCENTRATION OF THE DIET (Net energy for weight gain)

RESULTS OBTAINED



TOTAL BEEF PRODUCTION VARIATION AS CORN SUPPLEMENTATION INCREASES

RESULTS OBTAINED



BEEF GROSS MARGIN VARIATION AS CORN SUPPLEMENTATION INCREASE

RESULTS OBTAINED

12:08 PM Thu, Feb 22, 2001 — Table 17: p6 (Untitled Table)

Weeks	1: Cow Eq Carry capacity	2: Cow Eq Carry capacity	3: Cow Eq Carry capacity	4: Cow Eq Carry capacity	5: Cow Eq Carry capacity
.0000	584.94	389.94	197.94	132.94	132.94
4.0000	584.94	389.94	197.94	132.94	132.94
8.0000	682.44	438.69	246.69	165.44	165.44
12.0000	1,039.94	617.44	425.44	284.61	284.61
16.0000	1,089.44	618.19	474.19	317.11	317.11
20.0000	967.94	545.44	425.44	284.61	284.61
24.0000	930.44	605.44	605.44	497.11	219.61
28.0000	1,060.44	670.44	670.44	540.44	262.94
32.0000	1,157.94	719.19	719.19	572.94	295.44
36.0000	987.94	532.94	532.94	381.27	306.27
40.0000	893.69	544.32	352.32	235.86	235.86
44.0000	682.44	438.69	246.69	165.44	165.44
48.0000	617.44	406.19	214.19	143.77	143.77
Final	584.94	389.94	197.94	132.94	132.94

VARIATION OF HERD REQUIREMENTS AS SEASONS GROW UNFAVORABLE

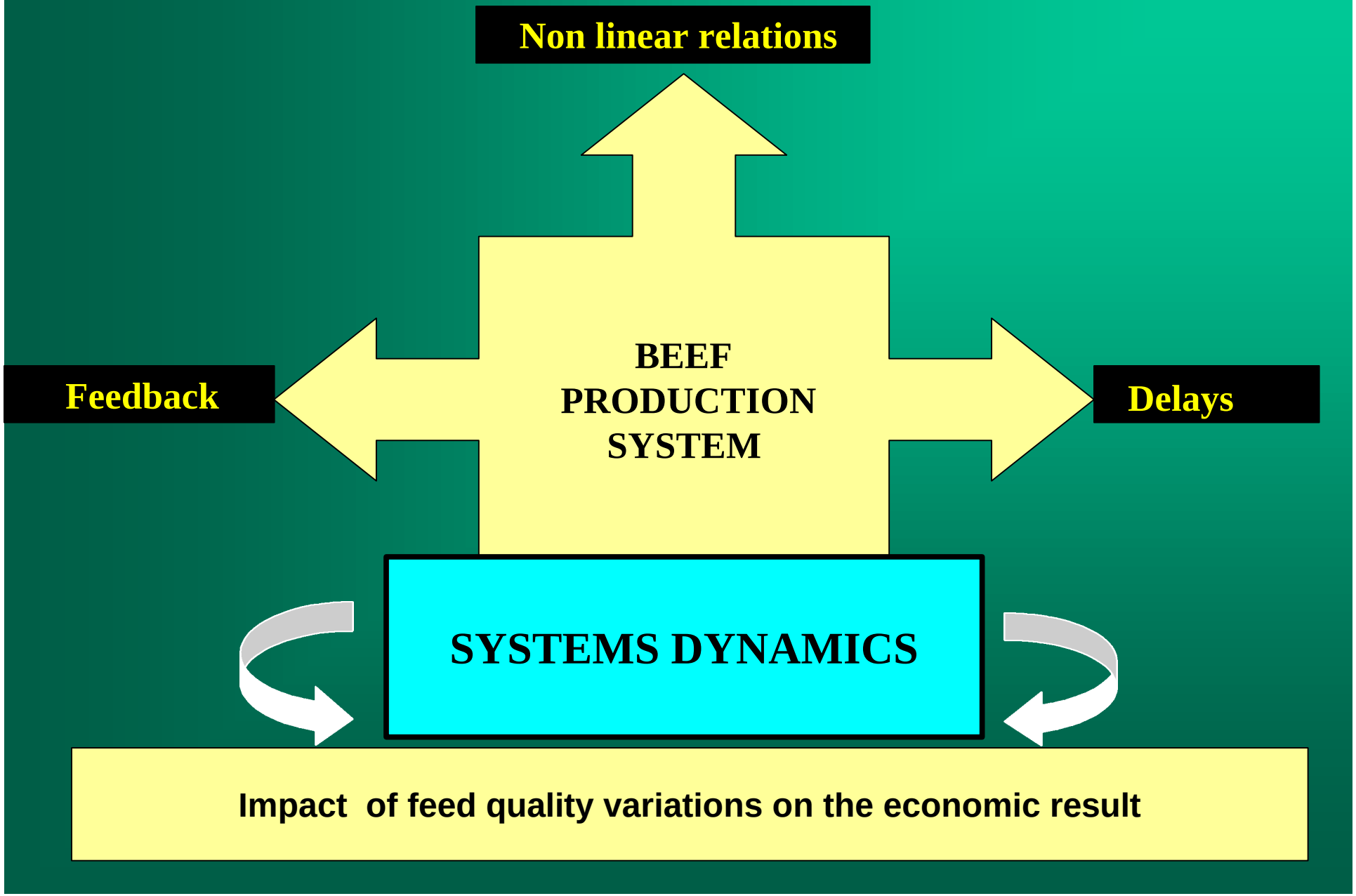
RESULTS OBTAINED

12:08 PM Thu, Feb 22, 2001 — Table 17: p7 (Untitled Table)

Weeks	1: Cow Eq Requirements	2: Cow Eq Requirements	3: Cow Eq Requirements	4: Cow Eq Requirements	5: Cow Eq Requirements
.0000	676.62	677.06	577.74	577.74	577.74
4.0000	713.18	713.80	592.39	592.32	592.32
8.0000	750.03	750.80	606.99	606.88	606.88
12.0000	787.02	787.84	665.63	621.52	621.52
16.0000	824.40	825.15	687.66	636.02	636.02
20.0000	862.35	863.13	709.65	650.41	650.41
24.0000	892.60	888.83	810.79	791.34	664.63
28.0000	930.81	926.43	847.44	827.30	679.06
32.0000	969.22	964.20	884.33	863.51	693.44
36.0000	1,012.29	1,008.71	927.02	906.12	707.77
40.0000	1,056.83	1,056.75	857.24	772.69	721.84
44.0000	1,098.12	1,098.41	803.18	786.34	735.61
48.0000	1,139.60	1,140.16	817.25	800.20	749.51
Final	1,181.40	1,182.23	831.40	814.15	763.47

VARIATION OF HERD REQUIREMENTS AS SEASONS GROW UNFAVORABLE

CONCLUSIONS



CONCLUSIONS

Systems dynamics is a methodology that simplifies the analysis of complex systems in which a large number of interrelations between variables is found, and in which intuition is not sufficient or trustworthy in the decision taking process.

The use of this methodology permits a clear visualization of the cause: effect relationships that are hard to explain and weren´t previously noted.

The results obtained in the simulation do not differ with other methods in the calculi employed. The advantages found by the use of Systems Dynamics are two: on one side the transparency of the formulas and equations employed, wich facilitates enormously the communication. On the other side the comprenhension achieved thru the flux diagrams. Both factors add significant value to team work.

It is possible to extend this methodology to other environments, finding that it is an extraordinary tool in production strategy analysis, simplifying the comprenhension of the system. As an example the model proves that a modification of the quality of the diet modifies the economic result.

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