

CIENCE & IMPACT

"SYSTOOL", A NEW CALCULATION TOOL FOR THE FRENCH "SYSTALI" PROJECT P. Chapoutot¹², P. Nozière³ and D. Sauvant¹²

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Objectives

The new French feed unit system, developed by INRA in the Systali project, is based on digestive flows of nutrients and multiple animal responses (Sauvant et al., EAAP 2013). It integrates a mechanistic digestion model accounting for the effects of feeding level (FL), proportion of concentrate (PCO) and rumen protein balance (RPB), on digestive processes. A new calculation tool has been developed in order to determine the new nutritive values and nutrient flows easily and to validate them by comparing them to the animal responses described in published experimentations.

Systool design

Systool is implemented with Excel and linked to the new INRA feed table proposing feed values calculated with a reference value for FL, with the hypothesis of PCO=0 and ignoring RPB. Systool calculates the feed and ration values by taking into account the digestive interactions (DI) due to FL, PCO and RPB (*Figure 1*) and compares them to the observed values in the publications.

Systool operation mode

1. The trial is described: characteristics of animals (species, body weight), feedstuffs (20 feeds max) and rations (feed and diet composition, *in vivo* measurements...) for different treatments (16 max).

2. Feeds whose composition best matches the reported data are selected in the INRA table by the user, who specifies their level of incorporation in the diets (X_i)



Figure 1 : Feed and ration evaluation in Systali project

3. The Systali 'Table' values of each feed (FTV_i) are automatically extracted from the INRA table (yellow values in Figure 2).

4. Systool calculates the nutrient flows and the values of feeds "in the ration" (FRV_j) according to the FL and PCO of the actual diet. The RPB of the ration, calculated as an output variable, can also modify these FRV_j thanks to an iterative calculating process, which rapidly converges toward a final prediction (*orange values in Figure 2*).

			FEED IDENTIF	ICATION									MAIN	CRITE	BIA								
										-			Feed composition		Feed 'Table' values		values	Effici	ency r	atio	Feed 'T	able' values	
																					or	Feed 'R	ation' value:
						Alto	m Col Ta	ble Sustali	1	114	2		25	28	53	33	56	47	124	137	69	126	161
Num Trt	Code Publi	Code Trt	Feed Name	Feed Nmber	Code Inra	DMI	72 ration	Veight	N [.] 2007	Type	Name_INBA _2007	Criteria ->	ом	CP	Starch	NDF	EE	GE	OMd	NED	Ndr	StED	Ed
						KgDM/d		(de 0 à 1)	1	Canc-	1	Units ->	4/kaDH	afkaDi	H alkaDH	4/k4Df	4/kaDH	kcal/kqDH	x	×	x	x	x
5	Doreau_1990	Bég 2 lact	Corn Silage	1	FE4730		64	1.0	FE4730	0	EN: Maïs, Hach	age fin sans	958	71	353	439	30	4472	72.6	75.3	70.0	72.2	69.8
																			63.7	0.0	70.0	0.0	61.3
Ration label	Systali V2-4		Dehyd Beet Pulp	2	CF0170		30	0.3	CF0170	1	Pulpe de bettera	ave déshydra	92%	91	0	454	10	4060	82.6	56.3	85.0	0.0	76.9
													/		1				75.3	57.7	85.0		69.6
Urea ?	1		Maize	3	CC0060		30	0.3	CC0060	1	Maïs		986	94	742	120	43	4463	87.6	6.6	90.0	61.4	84.7
																			80.3	14	90.0	58.9	77.4
Animal ?	٧L		Barley		CC0010	1	30	0.3	CC0010	1					602	216	21						78.1
											3. Extra	action	of FT	ΓV;	K			4. Calc	ulati	on o	of FR	V, 6	70.8
			Dehyd Alfalfa	5	DRUGHT		30	0.1	CD0050	1				,	_\ ∘	379	34					1	63.6
				2 Eoo	d colo	otion													61.3	0.0	80.0		56.3
			Minerals	2. Fee	u sele	clion	30	0.0	_CMV	1	CMV		0	0	1	0	0	0	0.0	10	0.0	0.0	0.0
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			Formald Soyabear	snor			5	0.5	CT0290	1	Tourteau de soj	a tanné	927	516	0	139	21	4703	90.6	32.0.	93.0	0.0	90.3
			-	specifications		0113					1					4	1		83.3	29.7	93.0		83.0
6 Relative		nfluonoo	Formald Rapesee	د ا د د د د		1 7	- 5	0.5	CT0250	1	Tourteau de col	za tanné	921	380	0	319	26	4611	75.6	33.0	81.0	0.0	73.4
0. K	elative	nnuence	-																68.3	31.0	81.0		66.1
of !	f FL, PCO & RPB		Urea	9	C.A0010		1	1.0	CYOUTU		Uree		1000	2875		1 –		2530	98.6	100.0	0.0	0.0	100.0
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Figure 2 : Feed selection and specifications, extracted 'Table' values and calculated 'Ration' values for each trial of a publication (from Doreau et al., 1990) 5. Systali final ration values, calculated without (yellow) or with (orange) DI, can be compared, and related to the observed measures in the publication (green) and/or to the INRA 2007 values (blue).

6. The influence of FL, PCO and RPB can be weighted in the DI calculation according to the type of animal (*Cattle vs Small ruminants*). Their relative influence upon OMd are presented. Special attention is paid to the utilization of urea in the diet (*Chapoutot et al., 3R 2013*)

Conclusion

Systool: a regularly updated user-friendly tool, used to test and validate the Systali hypothesis in comparing the new model output with numerous scientific publication results (*Nozière et al., EAAP 2013*).