

NutriForum25

La integración de datos y la inteligencia artificial para mejorar la rentabilidad de las explotaciones a través del manejo y la nutrición



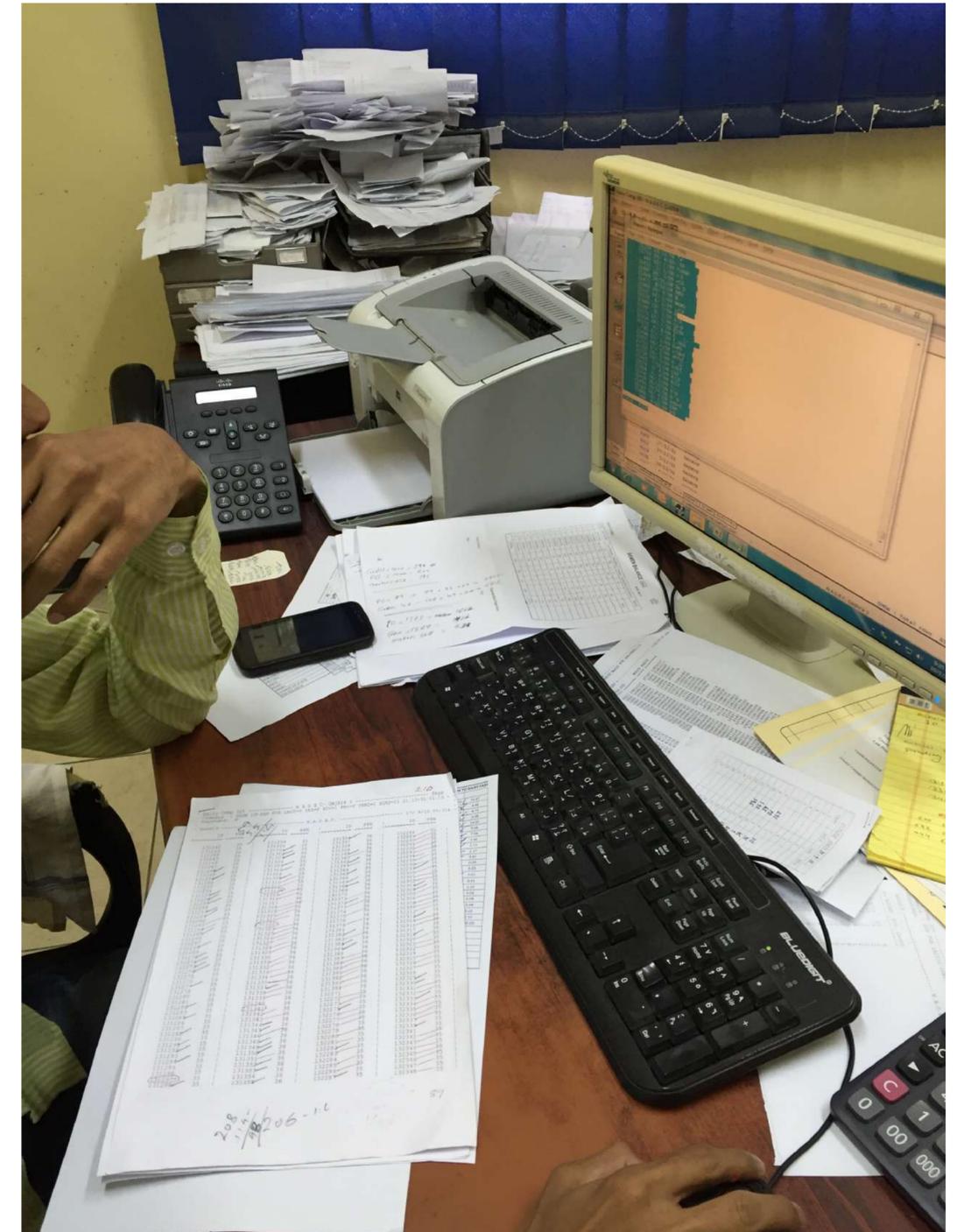
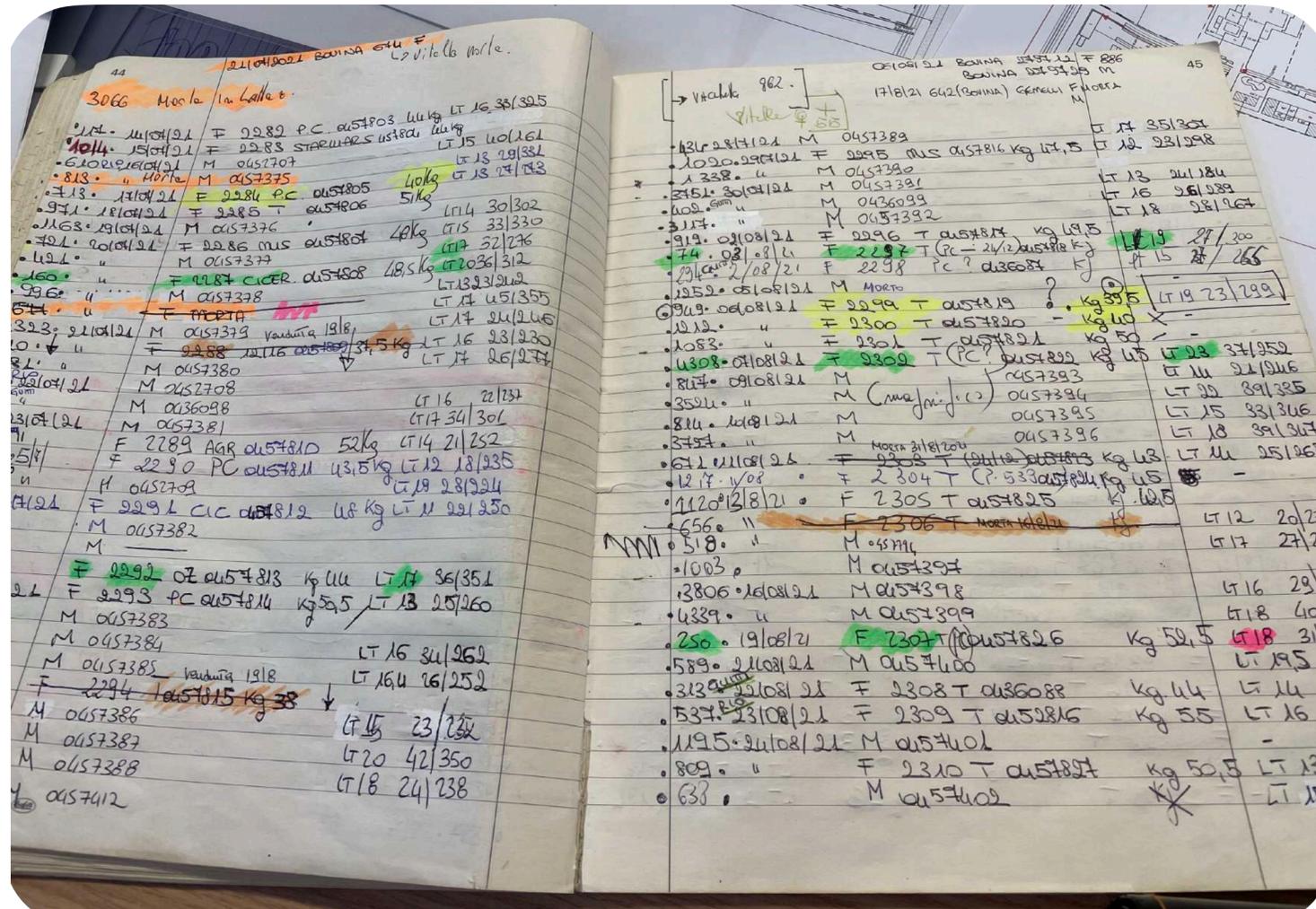
Universitat de Lleida

Alex Bach



Datos

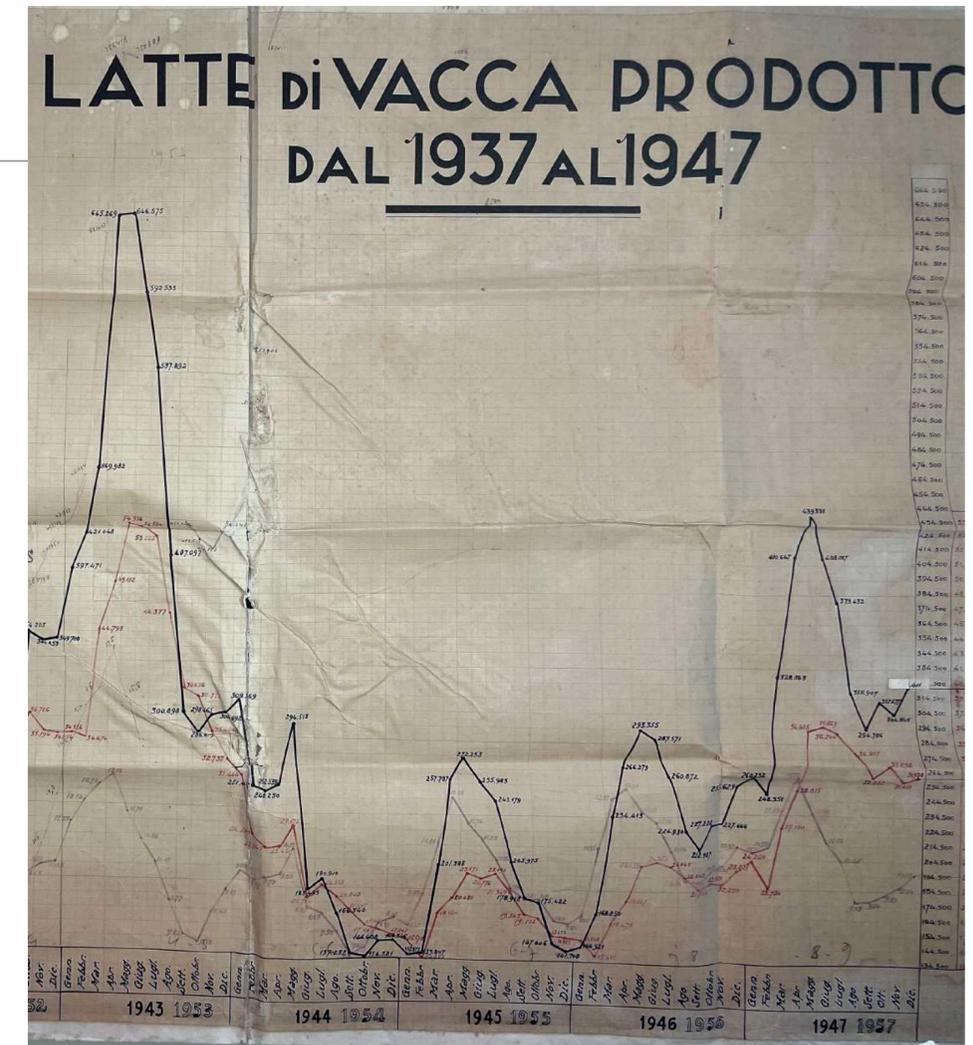
En muchas ocasiones, los datos permanecen como datos, y no se convierten en información



Indicadores

	GEN-22	FEB-22	MAR-22	ABR-22	MAI-22	JUN-22	JUL-22	AGO-22	SET-22	OCT-22	NOV-22	DES-22	TOTAL
Total milk	993,395	963,627	1,063,635	998,645	992,355	879,105	873,845	865,871	843,663	896,829			9,370,970
Mean milk	32,045	34,415	34,311	33,288	32,011	29,304	28,189	27,931	28,122	28,930			30,855
Cows total	885	897	889	882	884	889	898	918	924	927	926		902
Cows mean	805	844	844	830	814	795	777	787	791	794	784		806
%	9.0%	5.8%	5.1%	5.9%	7.9%	10.5%	13.5%	14.2%	14.4%	14.4%	15.3%		10.5%
DIM	174	175	181	195	205	211	212	208	202	191			195
%	3.87	3.83	3.84	3.88	3.82	3.80	3.82	3.89					3.84
%	3.36	3.37	3.32	3.30	3.30	3.25	3.26	3.32					3.31
SSCC	224	221	227	243	227	235	229	225					229
Fertility	41%	28%	19%	27%	18%	26%							26%
kg milk/d (total cows)	39.82	40.76	40.64	40.11	39.33	36.86	36.26	35.49	35.54	36.45			38.1
kg milk/d (lactating cows)	36.22	38.38	38.59	37.76	36.23	32.98	31.38	30.44	30.44	31.20			34.4
kg FCM/d	43.49	44.25	44.18	43.85	42.65	39.81	39.29	38.89					42.1
kg ECM/d	41.4	42.2	42.0	41.6	40.4	37.6	37.1	37.0					39.9
kg TMR/d (as fed)													
kg TMR/d (DMd)													
kg DM/cow													
DMI	24.74	25.04	25.01	24.84	24.59	23.80	23.60	23.36	23.37	23.66			24.2
Efficiency													

	A	B	C	D	E	F	G	H
1	Date	Kg Unifeed	Kg orts	Kg total	% DM	Cows	Kg DM/cow	Efficiency
223	10/8/22	3762	90	3672	47	70	24.7	
224	11/8/22	3642	130	3512	47	70	23.6	
225	12/8/22	3450	120	3330	46	70	21.9	
226	13/8/22	3524	120	3404	46	72	21.7	
227	14/8/22	3386	90	3296	46	72	21.1	
228	15/8/22	3428	40	3388	46	72	21.6	
229	16/8/22	3508	30	3478	46	72	22.2	
230	17/8/22	3720	10	3710	46	71	24.0	
231	18/8/22	3428	20	3408	46	71	22.1	
232	19/8/22	3554	30	3524	46	71	22.8	
233	20/8/22	3554	10	3544	46	71	23.0	
234	21/8/22	3518	100	3418	46	71	22.1	
235	22/8/22	3360	200	3160	48	71	21.4	
236	23/8/22	3280	150	3130	48	70	21.5	
237	24/8/22	3244	100	3144	48	70	21.6	
238	25/8/22	3182	120	3062	48	70	21.0	
239	26/8/22	3258	20	3238	48	70	22.2	
240	27/8/22	3288	60	3228	48	72	21.5	
241	28/8/22	3218	20	3198	48	72	21.3	
242	29/8/22	3298	10	3288	48	72	21.9	
243	30/8/22	3254	50	3204	48	72	21.4	
244	31/8/22	3132	130	3002	48	68	21.2	
245	1/9/22	3022	120	2902	48	68	20.5	
246	2/9/22	3242	60	3182	48	70	21.8	
247	3/9/22	3276	20	3256	48	70	22.3	
248	4/9/22	3262	50	3212	48	70	22.0	
249	5/9/22	3304	60	3244	48	70	22.2	
250	6/9/22	3406	50	3356	48	70	23.0	
251	7/9/22	3298	150	3148	48	70	21.6	
252	8/9/22	3154	60	3094	49	70	21.7	
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Datos

- Varias compañías no permiten compartir datos (que son del ganadero) con otras plataformas



Inteligencia artificial

- Machine learning

- IA generativa

- ChatGPT

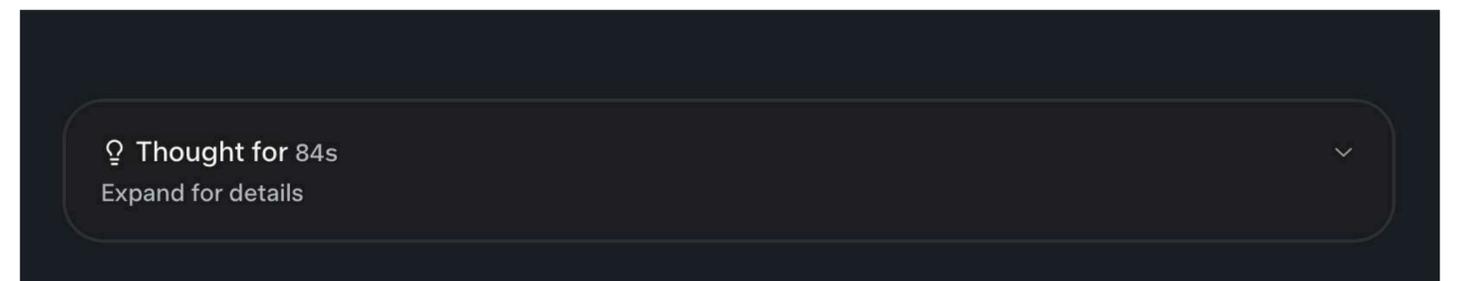
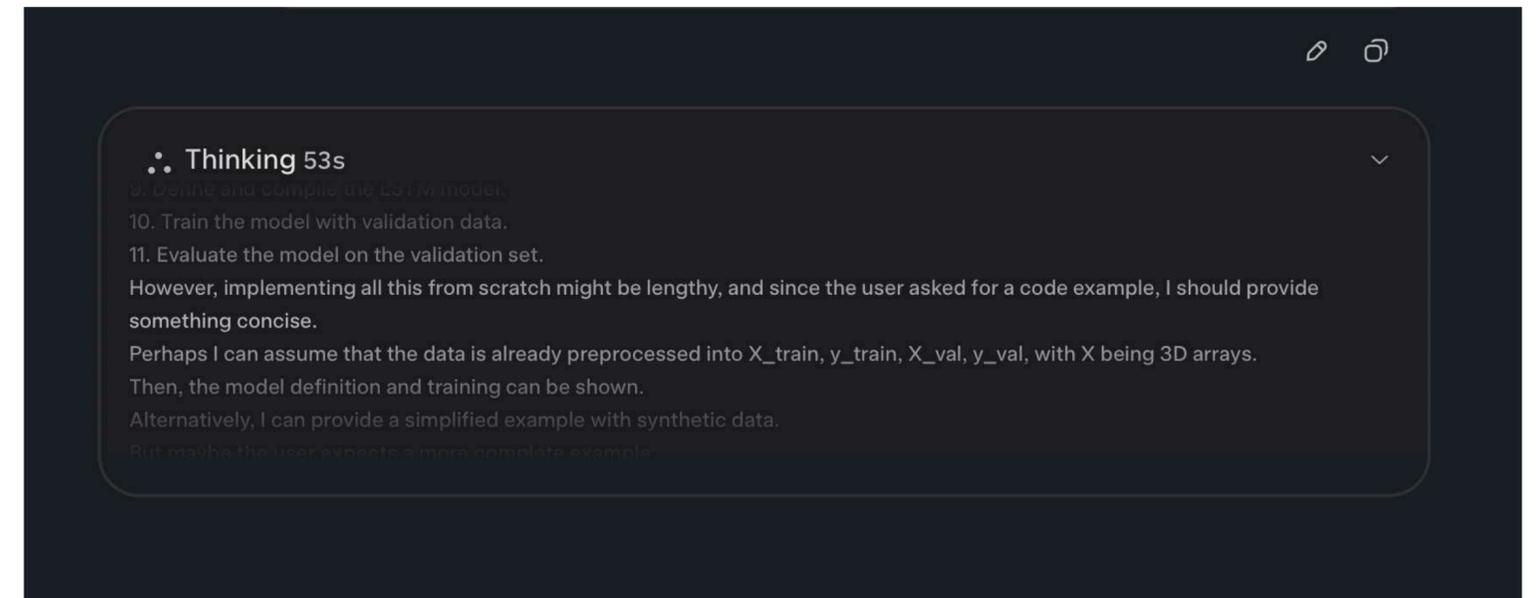
- DeepSeek

- Grok (think)

- Mistral

- Gmini

- ...



Inteligencia artificial

● Aprendemos:

● **Por ensayo y error:** La mayoría de la 'IA' o 'Machine learning' usa esta técnica. Se basa en 'fuerza bruta':

● Millones de iteraciones por segundo a través de redes neuronales hasta conseguir el objetivo:

● **Supervisado:** el objetivo está marcado (i.e. Producción de leche)

● **Sin supervisar:** Cuando se consigue categorizar o ordenar las variables en base a unas probabilidades predeterminadas

Inteligencia artificial

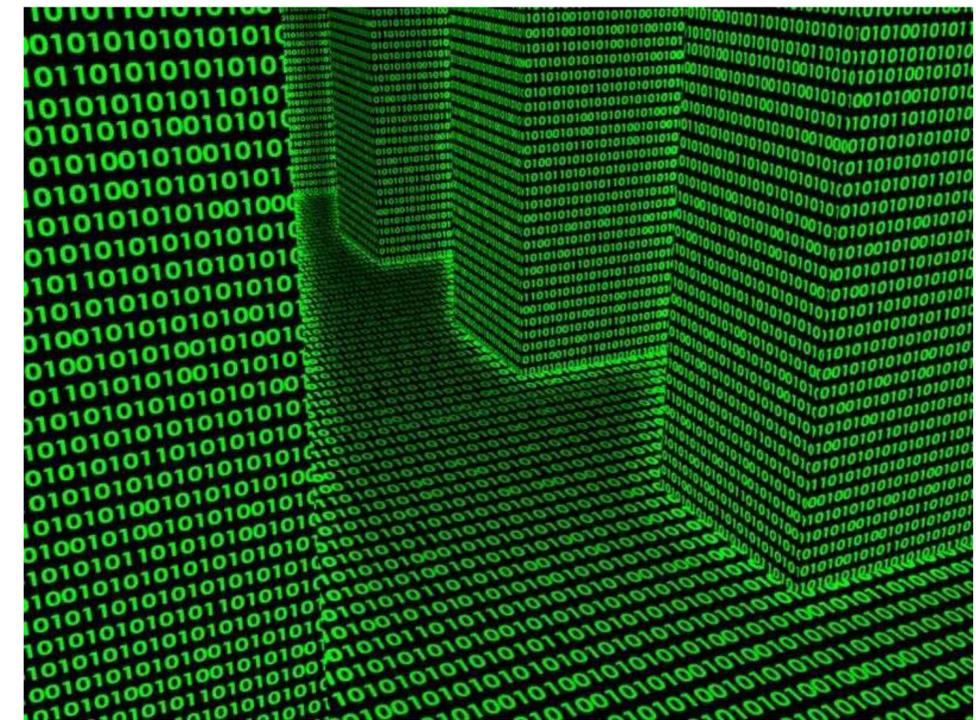
- **Por imitación:** Se realiza una acción sin la necesidad de entender la mecánica, motivo, o funcionamiento de esa acción
- No se trata de replicar lo existente (sería poco inteligente): aplicar una respuesta parecida ante una situación similar
- **Behavioral cloning:** Requiere menos poder computacional y puede ser más 'inteligente' que los modelos que aprenden por ensayo y error



Inteligencia artificial



- DeepSeek: 685,000 millones de parámetros en el modelo
- Trabaja con MoE (mixture-of-Experts): selecciona 37,000 millones de parámetros para tareas concretas
- En producción animal trabajamos con.... 20?, 30?, 50? parámetros (algoMilk trabaja con 28 parámetros, sensores de rumia trabajan con 5 parámetros)

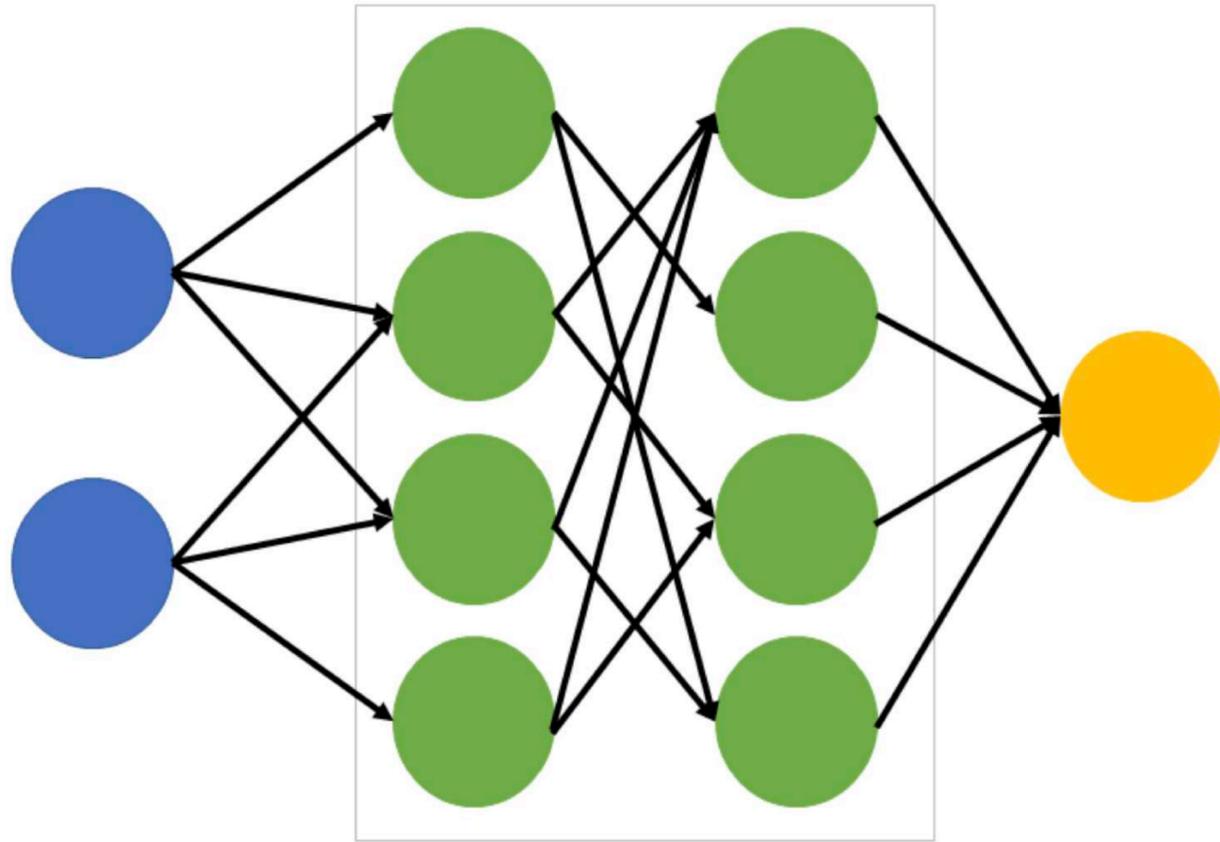


Inteligencia artificial

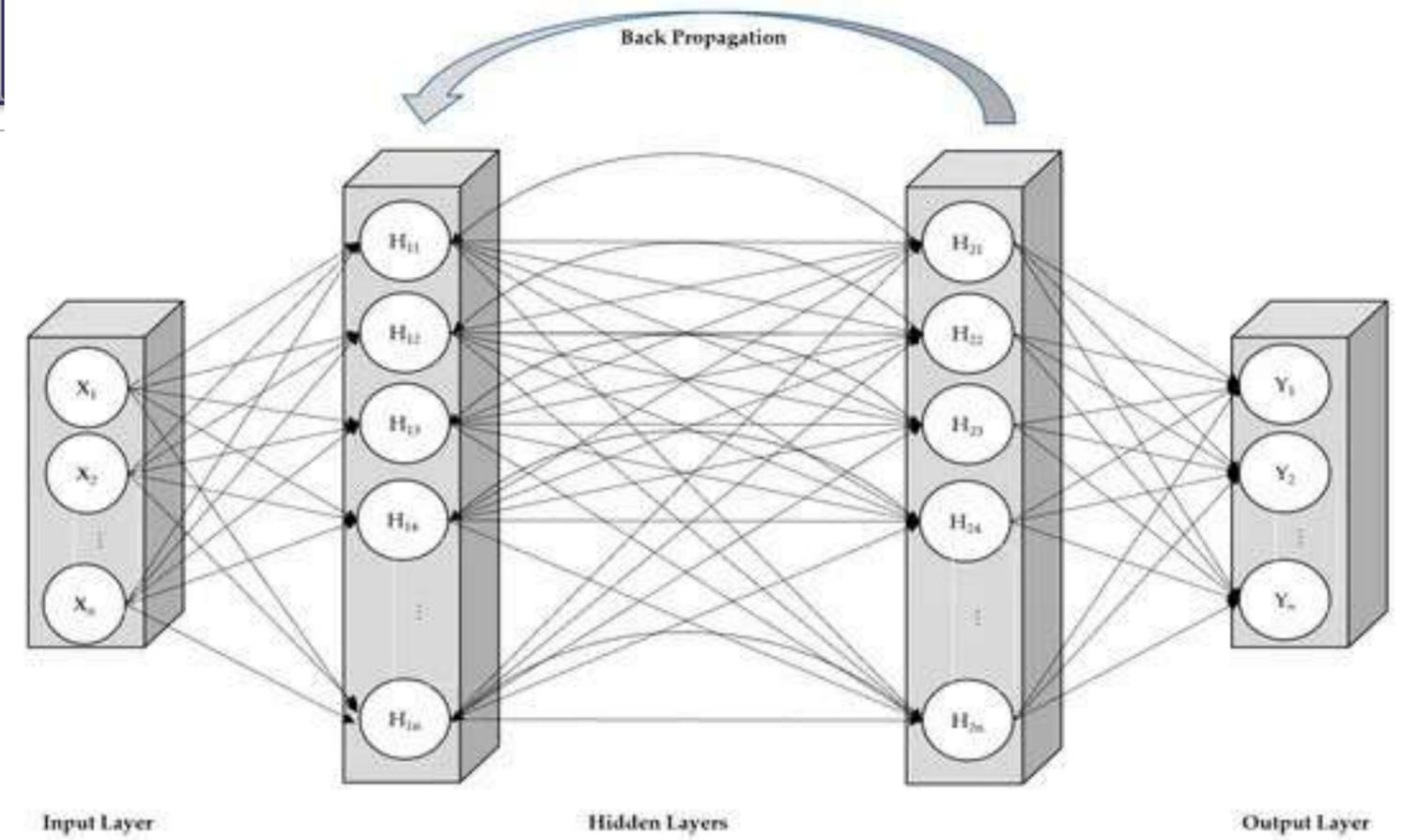
Input layer

Hidden layer

Output layer



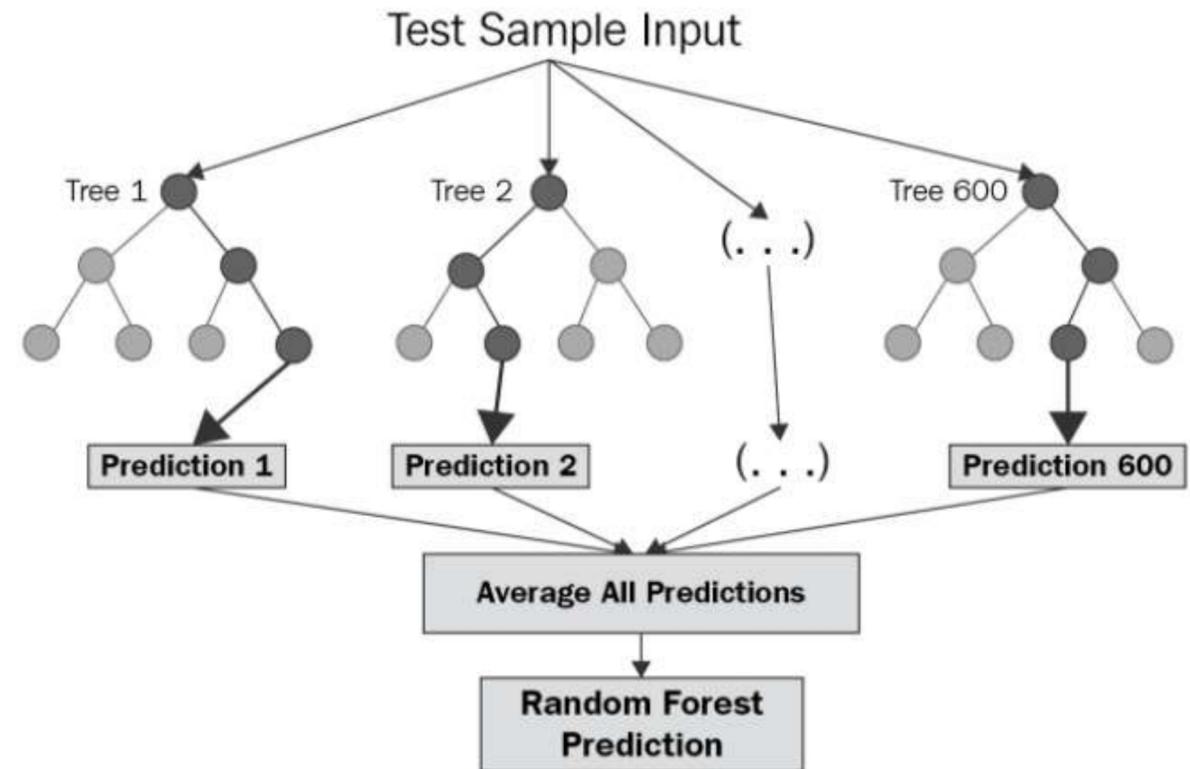
Artificial neural networks



Input Layer

Hidden Layers

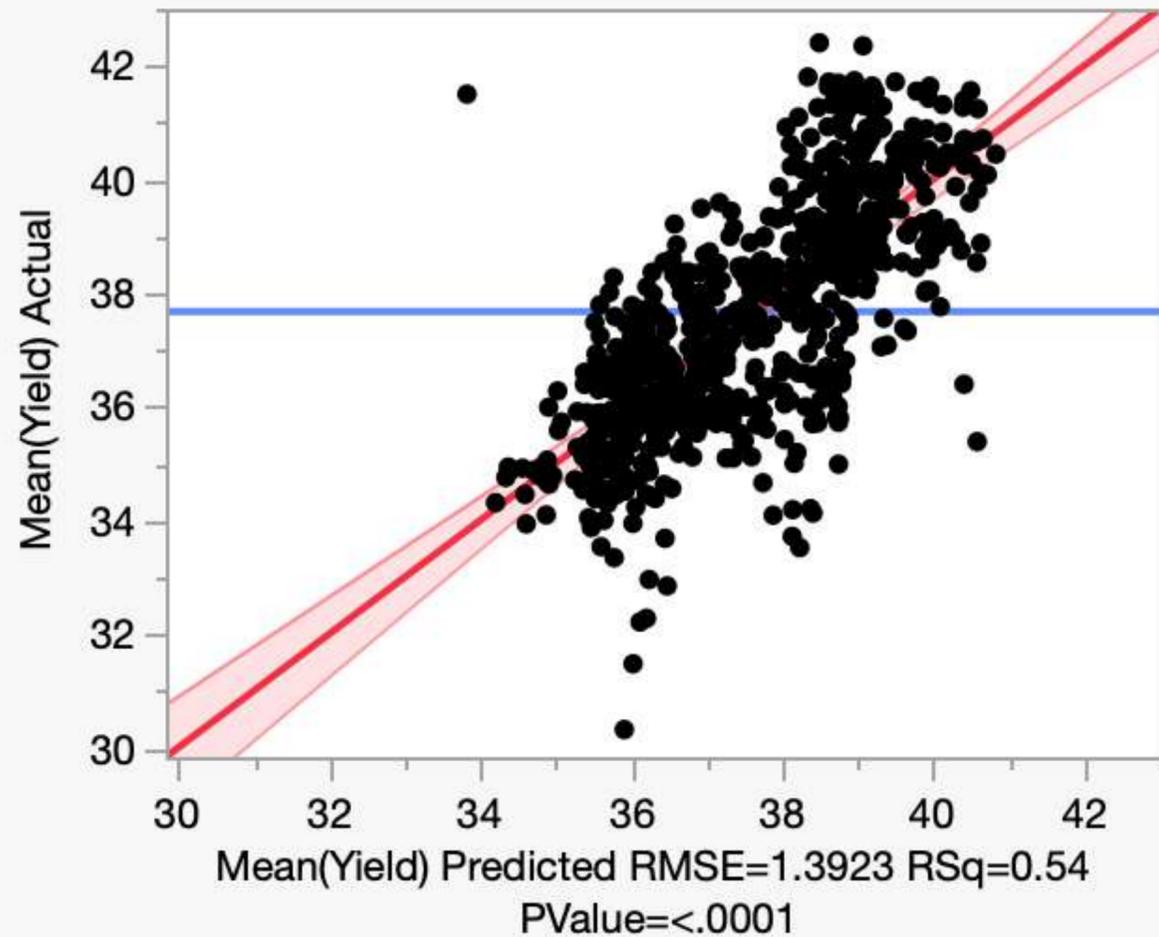
Output Layer



Inteligencia artificial Leche ~IMS, DEL, NL, PB%, NDF%, NEI

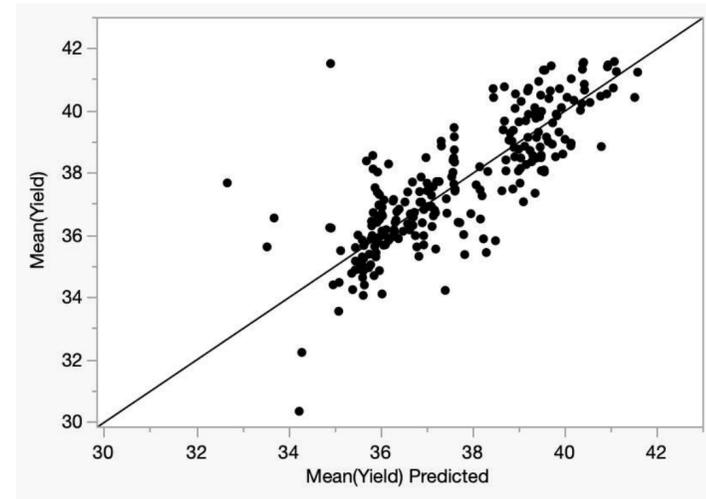
Regresión

Measures	Value
RSquare	0.541616
RSquare Adj	0.537758
Root Mean Square Error	1.392322
Mean of Response	37.67431
Observations (or Sum Wgts)	720



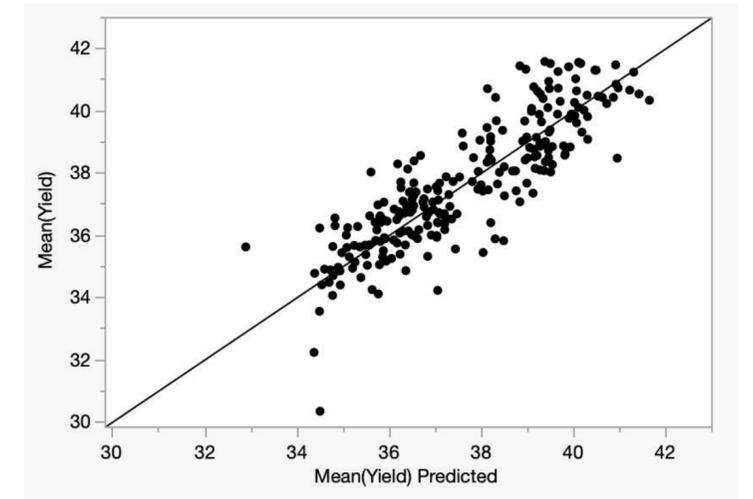
Neural (3 Neuronas)

Measures	Value
RSquare	0.6498607
RASE	1.1986533
Mean Abs Dev	0.8776488
-LogLikelihood	384.03292
SSE	344.82472
Sum Freq	240



Neural (5 Neuronas)

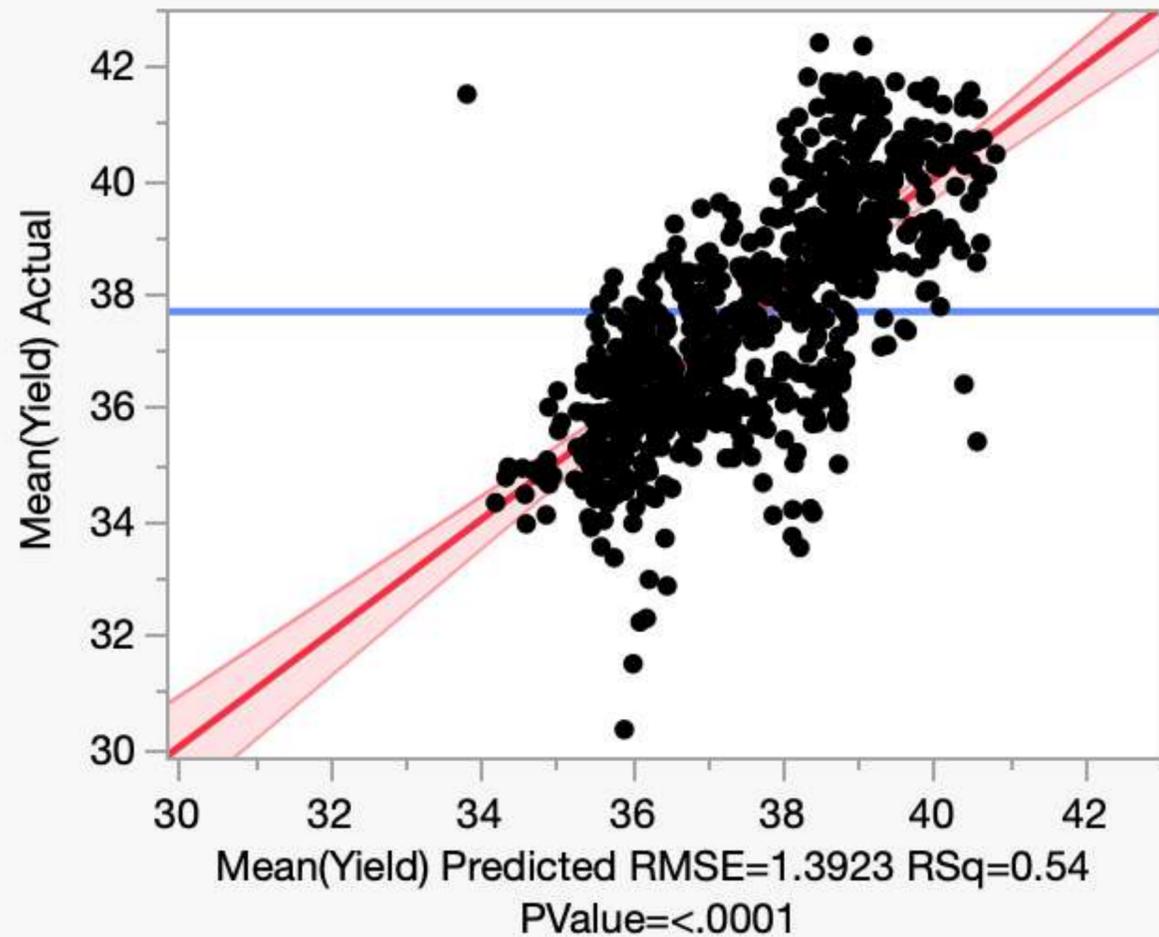
Measures	Value
RSquare	0.7354316
RASE	1.0419387
Mean Abs Dev	0.806799
-LogLikelihood	350.40519
SSE	260.55269
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Inteligencia artificial Leche ~IMS, DEL, NL, PB%, NDF%, NEI

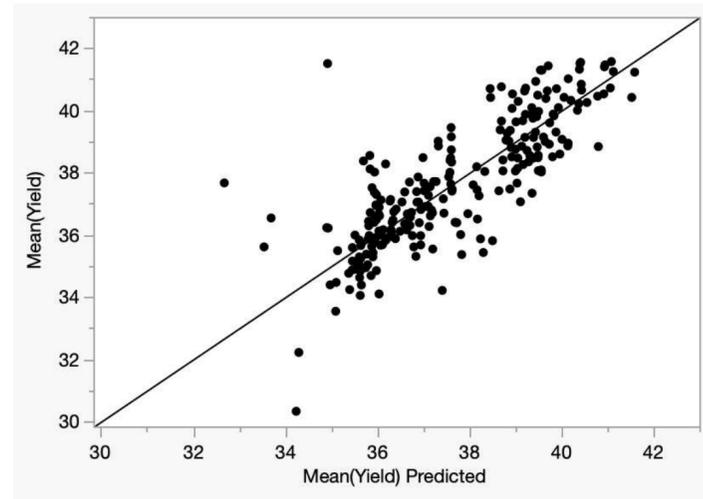
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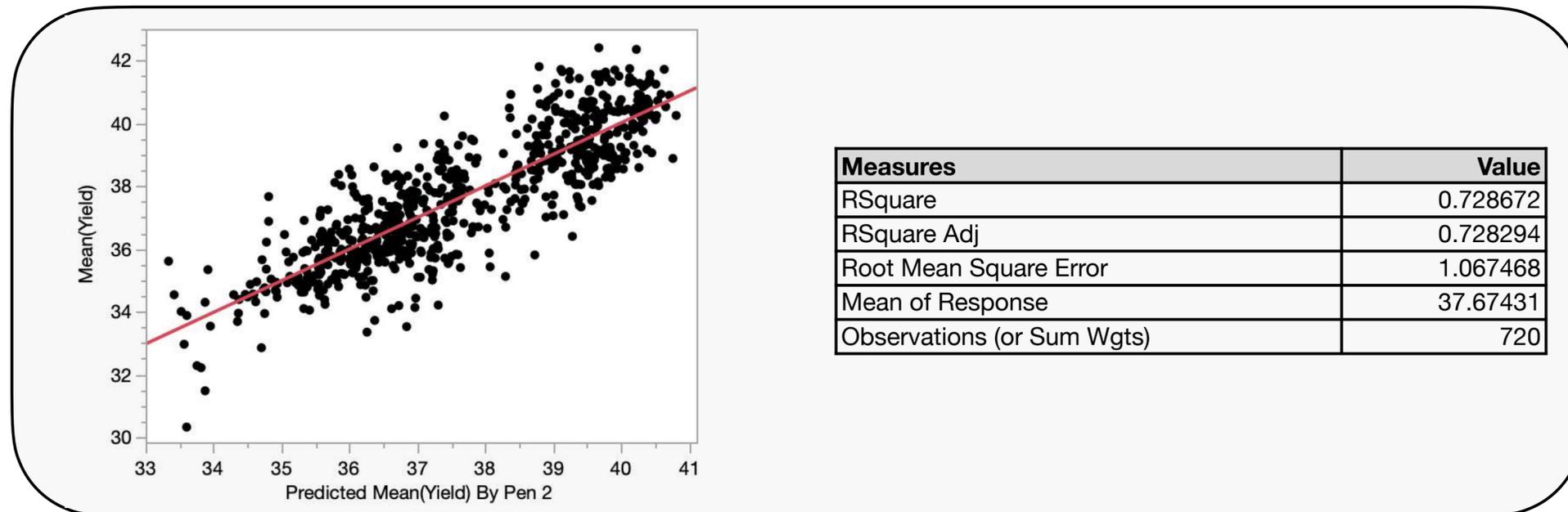
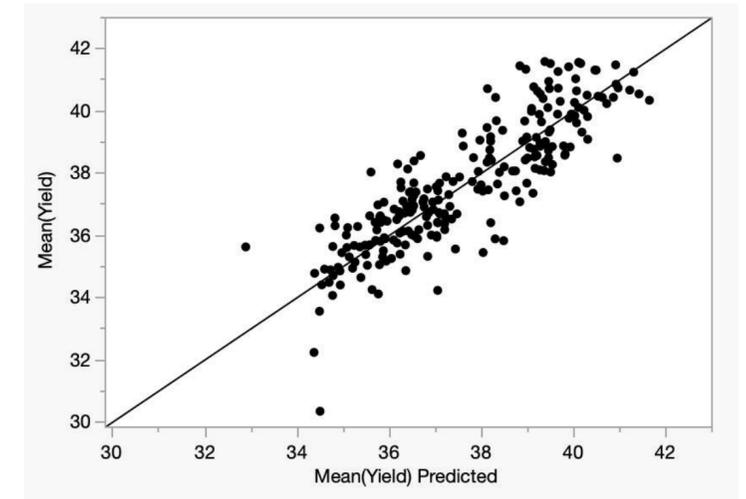
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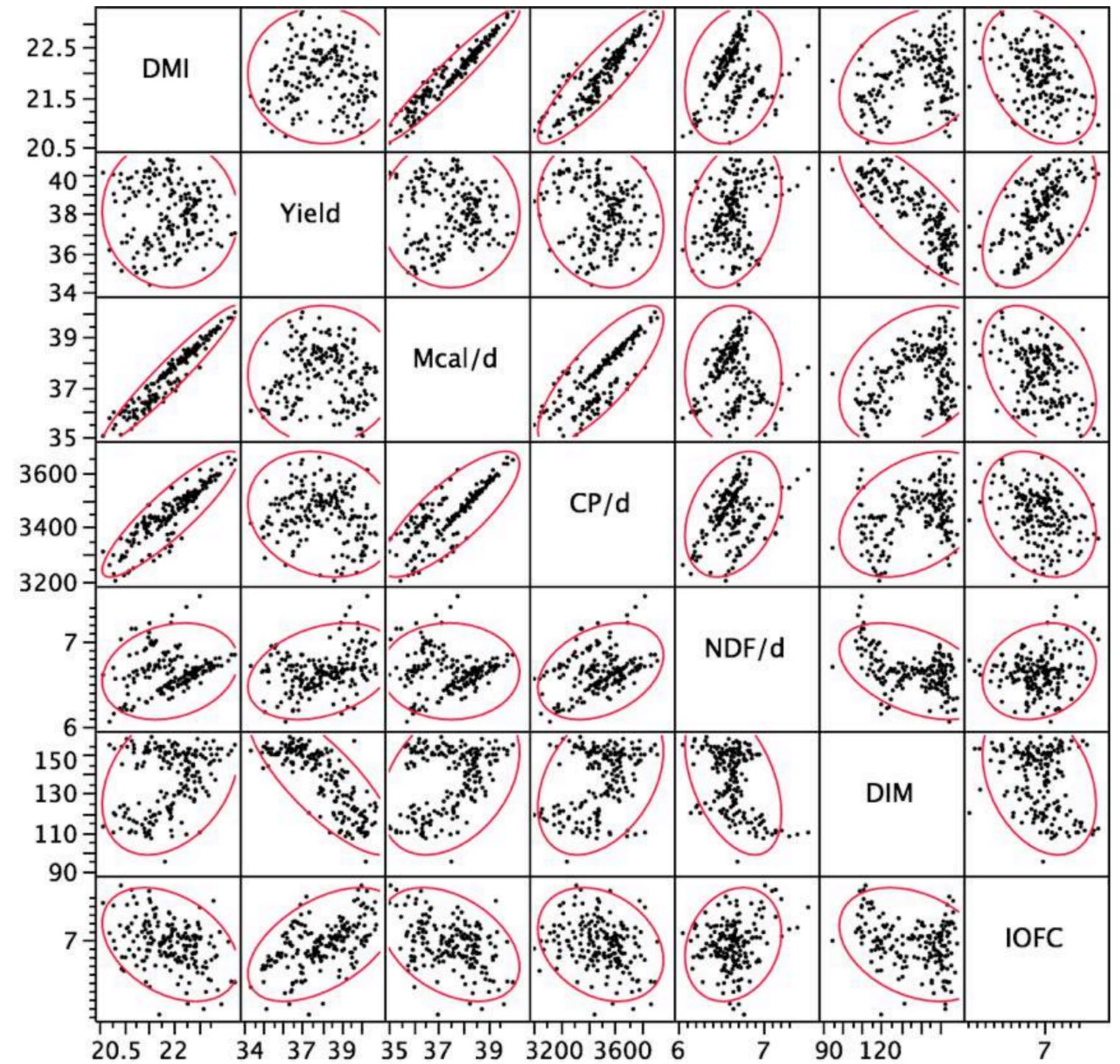
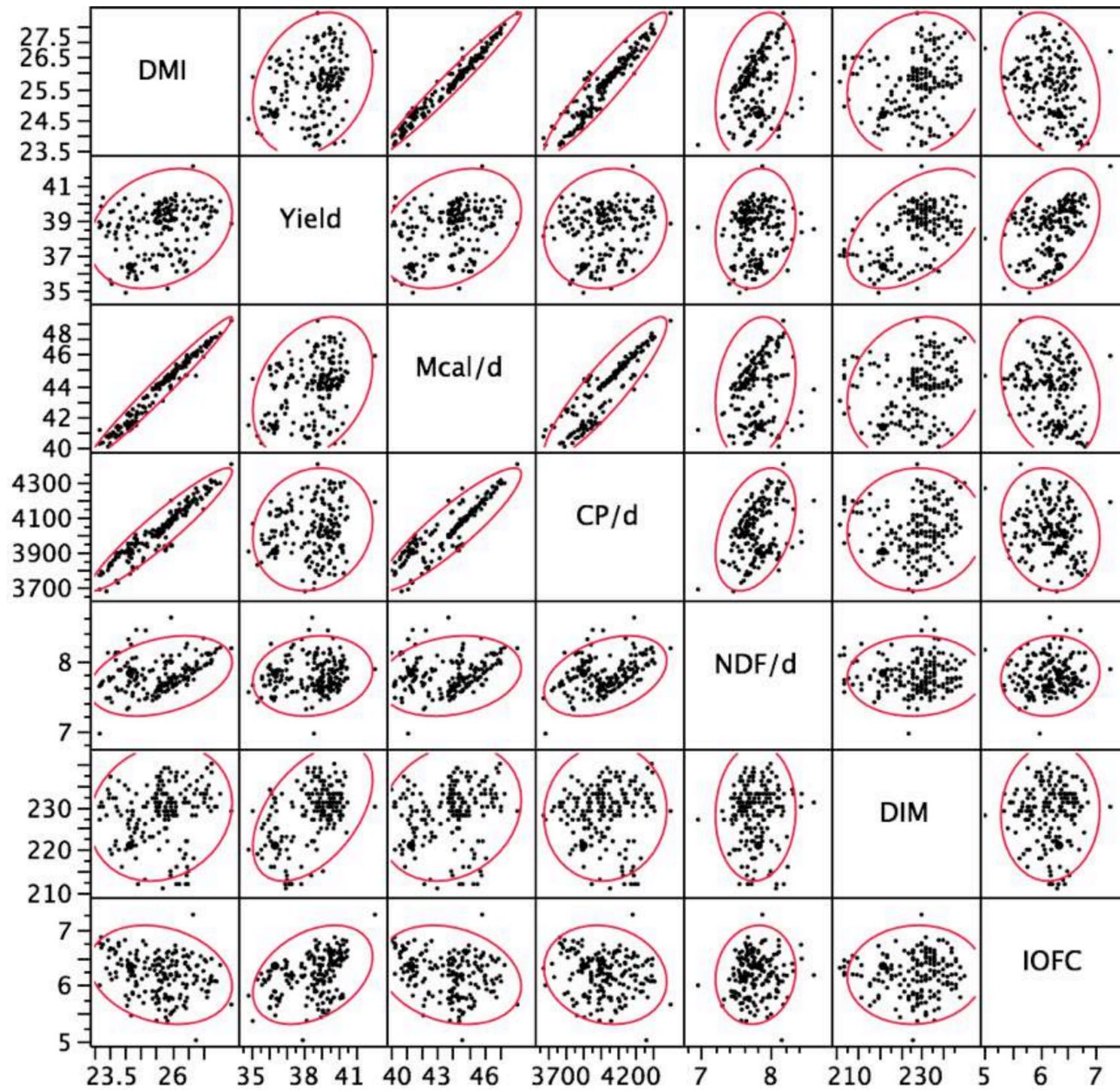
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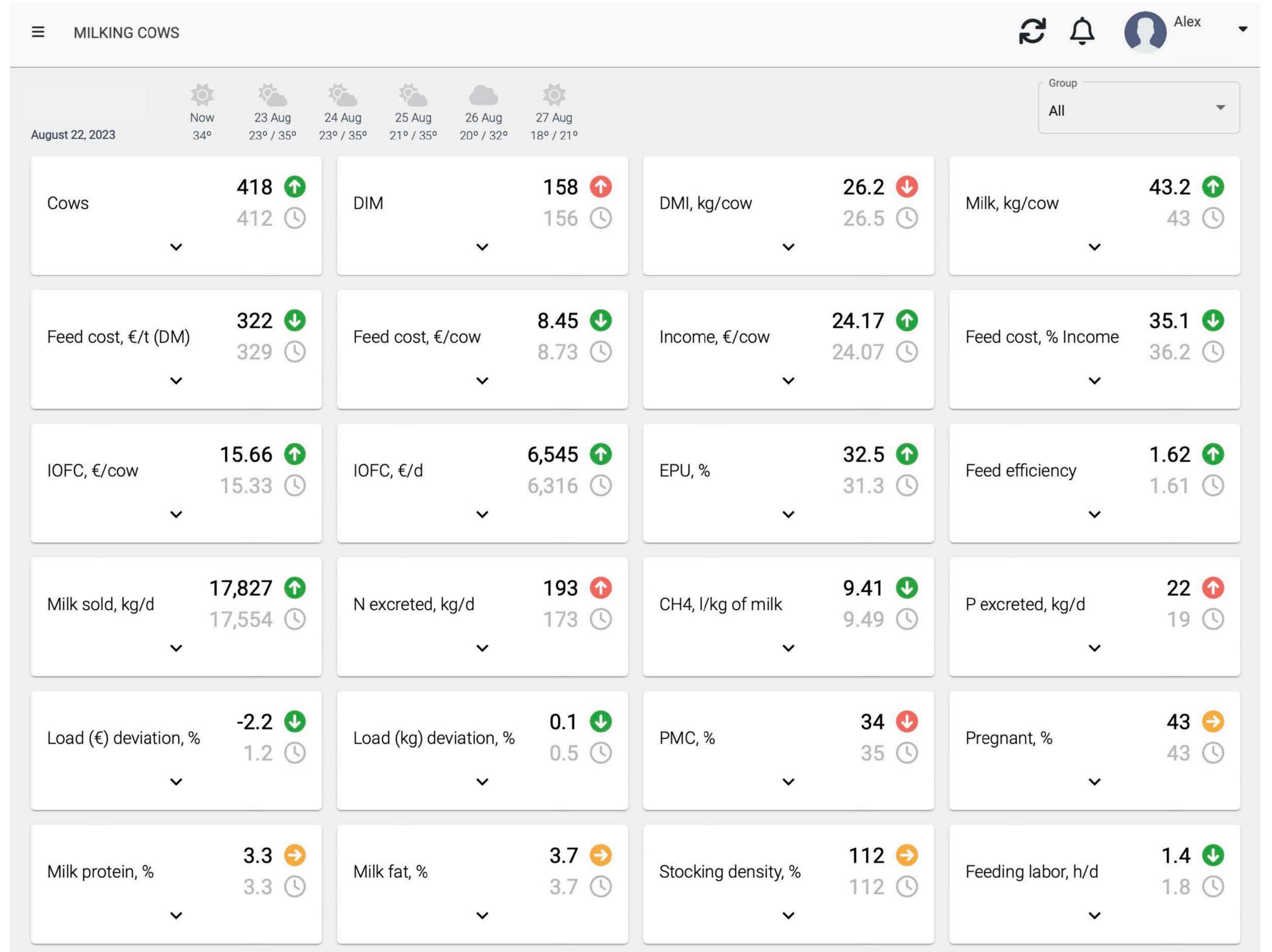


Measures	Value
RSquare	0.728672
RSquare Adj	0.728294
Root Mean Square Error	1.067468
Mean of Response	37.67431
Observations (or Sum Wgts)	720

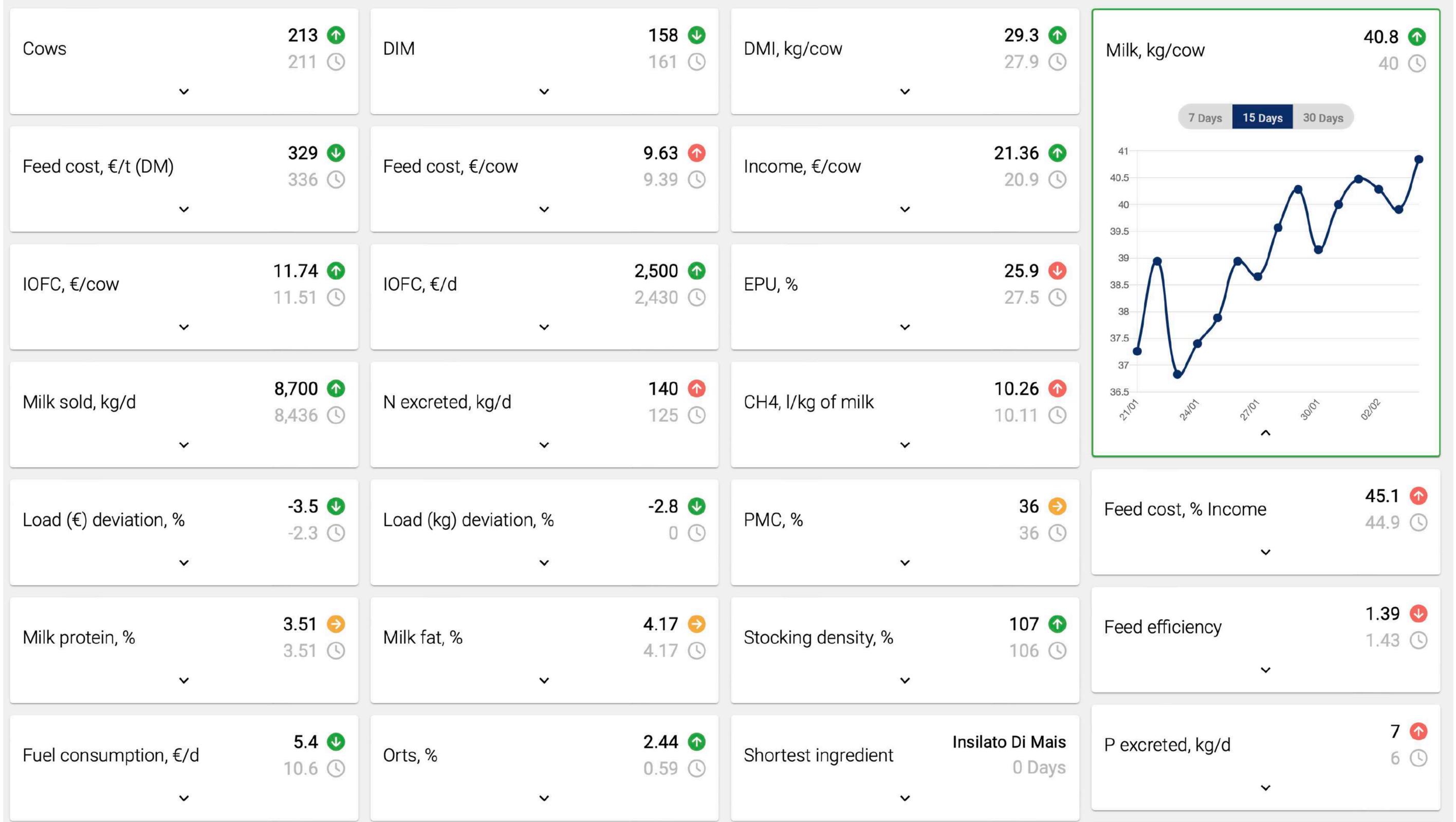
Integración



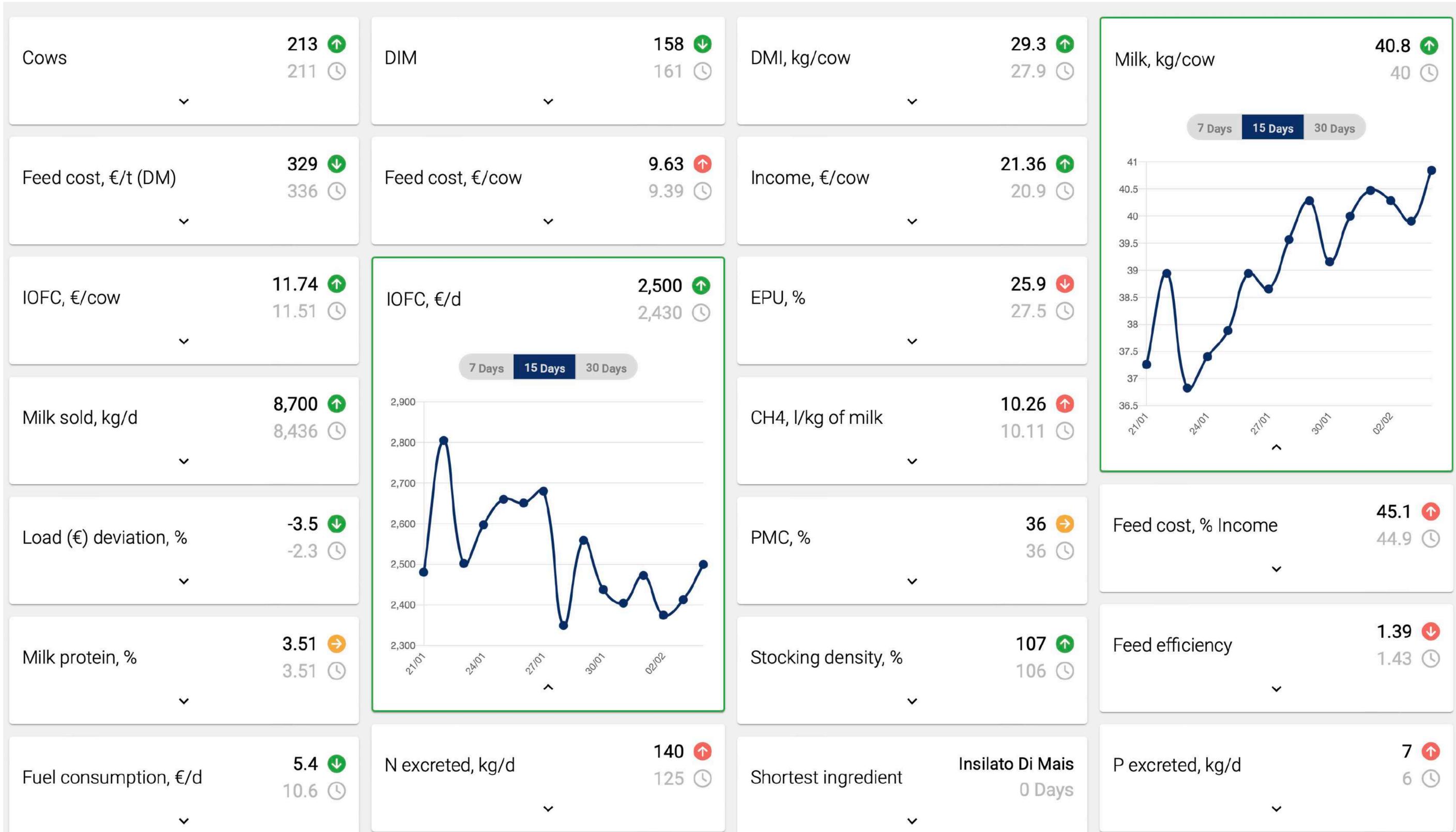
Integración y Optimización



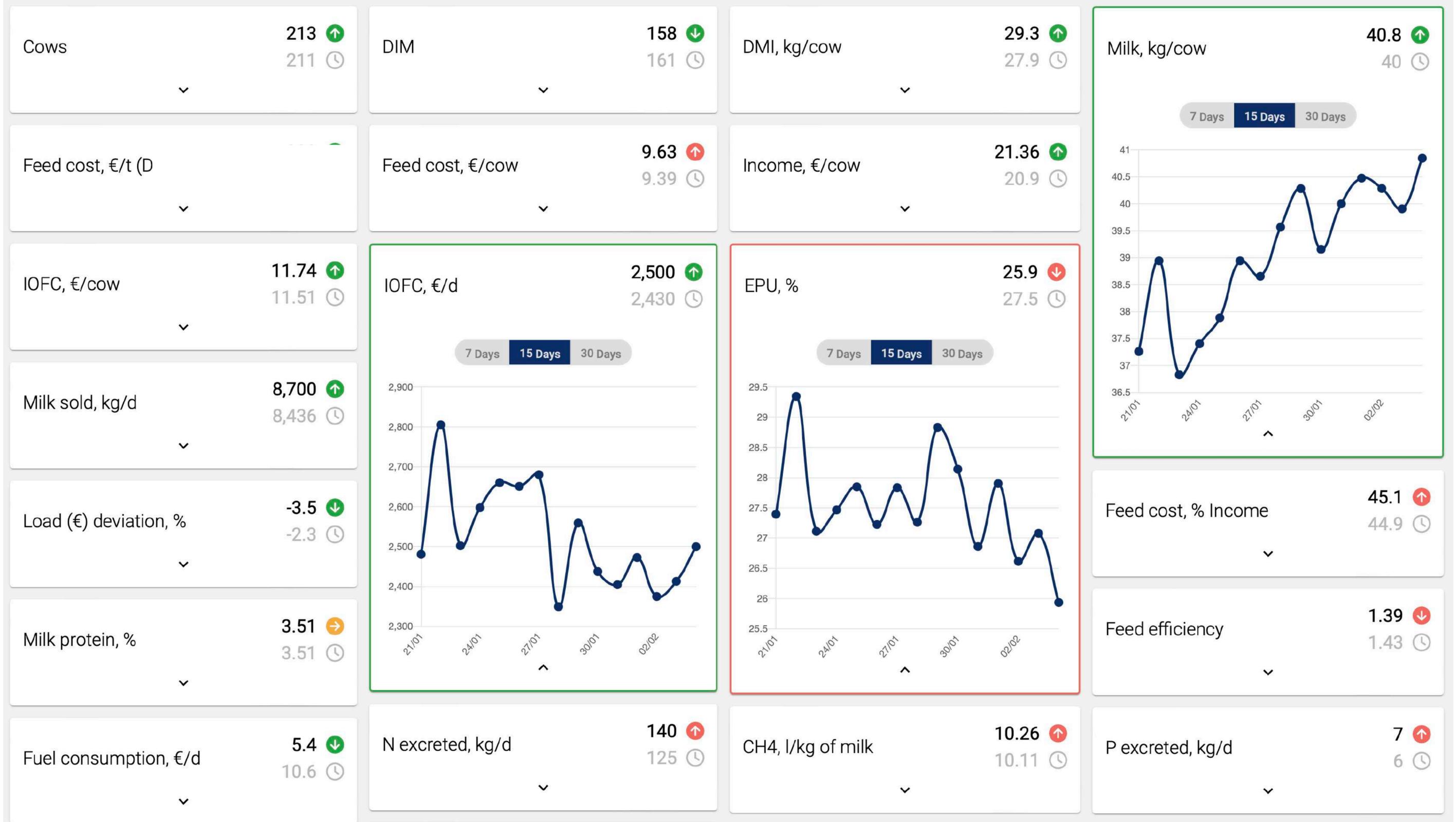
Eficiencia - EPU



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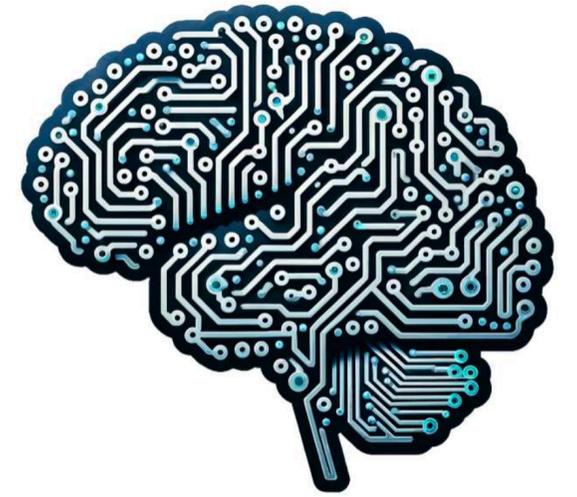


Algunas preguntas clave



- ★ A qué nivel de producción debo racionar?
- ★ Cada cuánto debo cambiar la ración? Cómo?
- ★ Debo hacer grupos de vacas? Cuándo las cambio?
- ★ Con robots, cuánto pienso he de dar a cada vaca?
- ★ Es rentable inseminar esta vaca?

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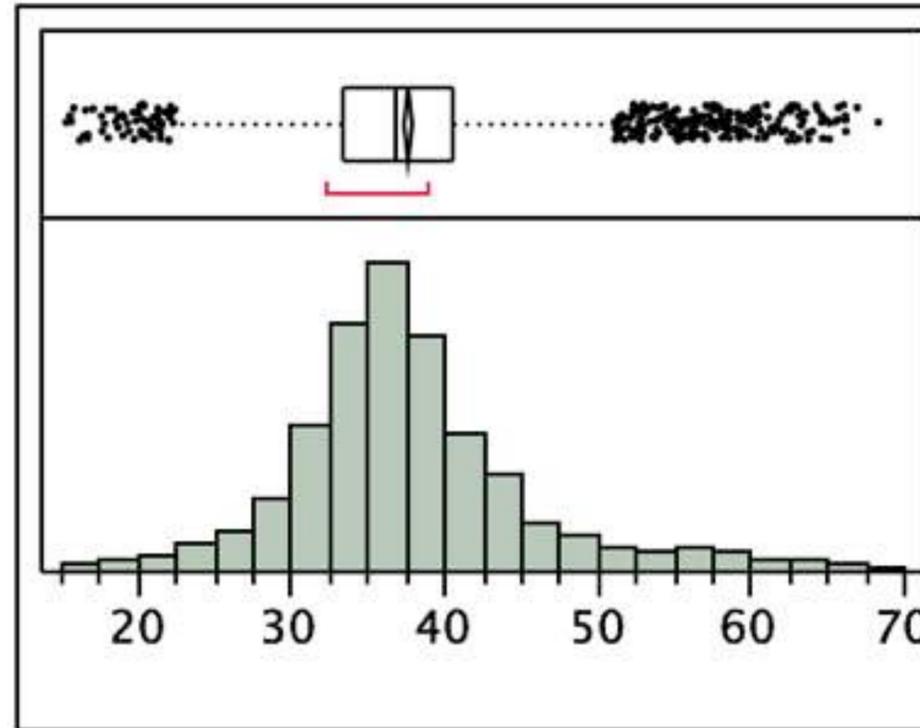
Nivel de Producción

50 kg -> 334 €

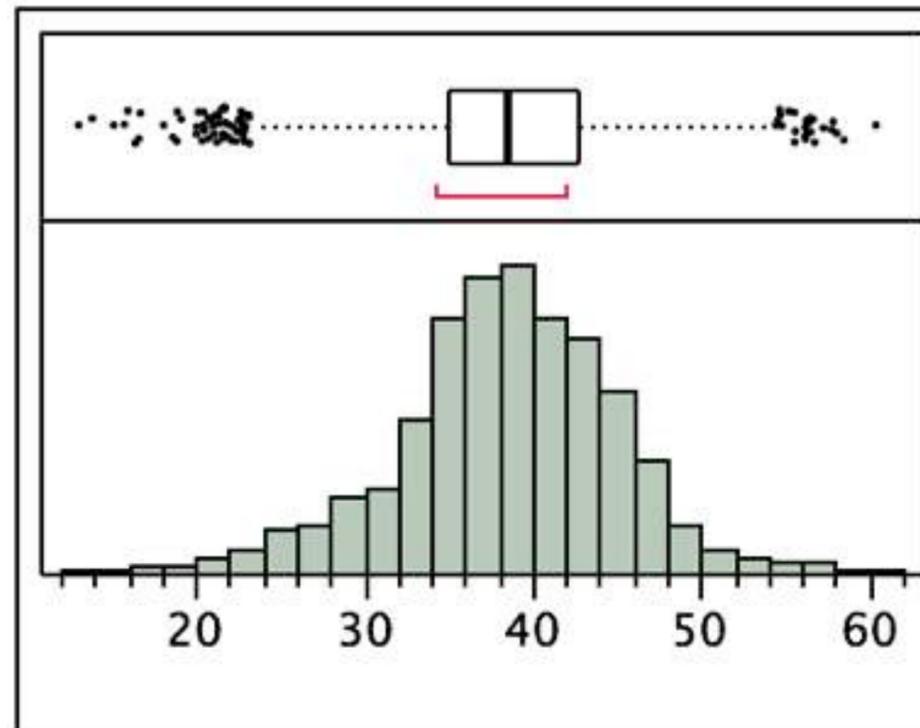
38 kg -> 328 €

35 kg -> 278 €

22 kg -> 218 €

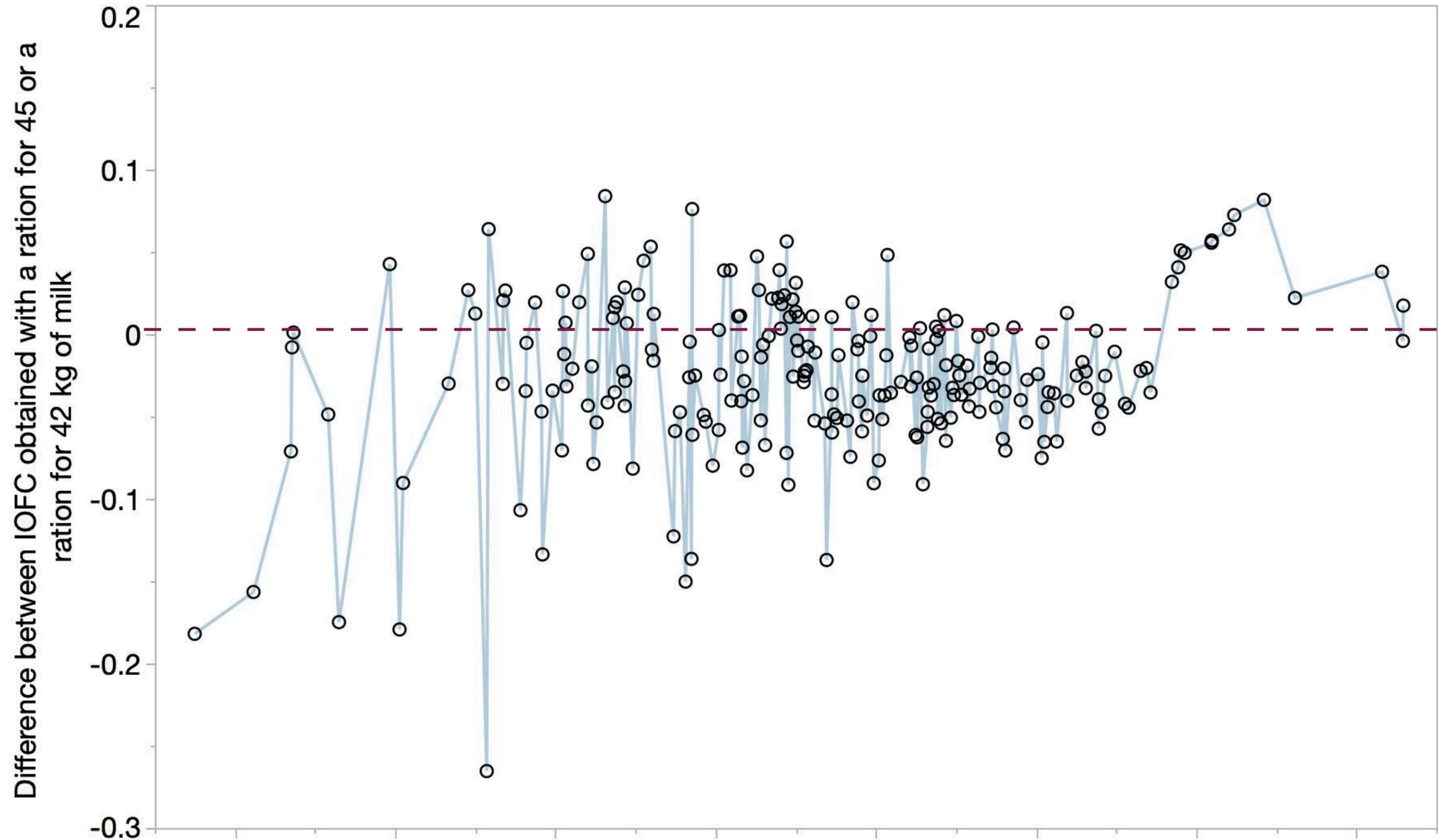


37.5



38.4

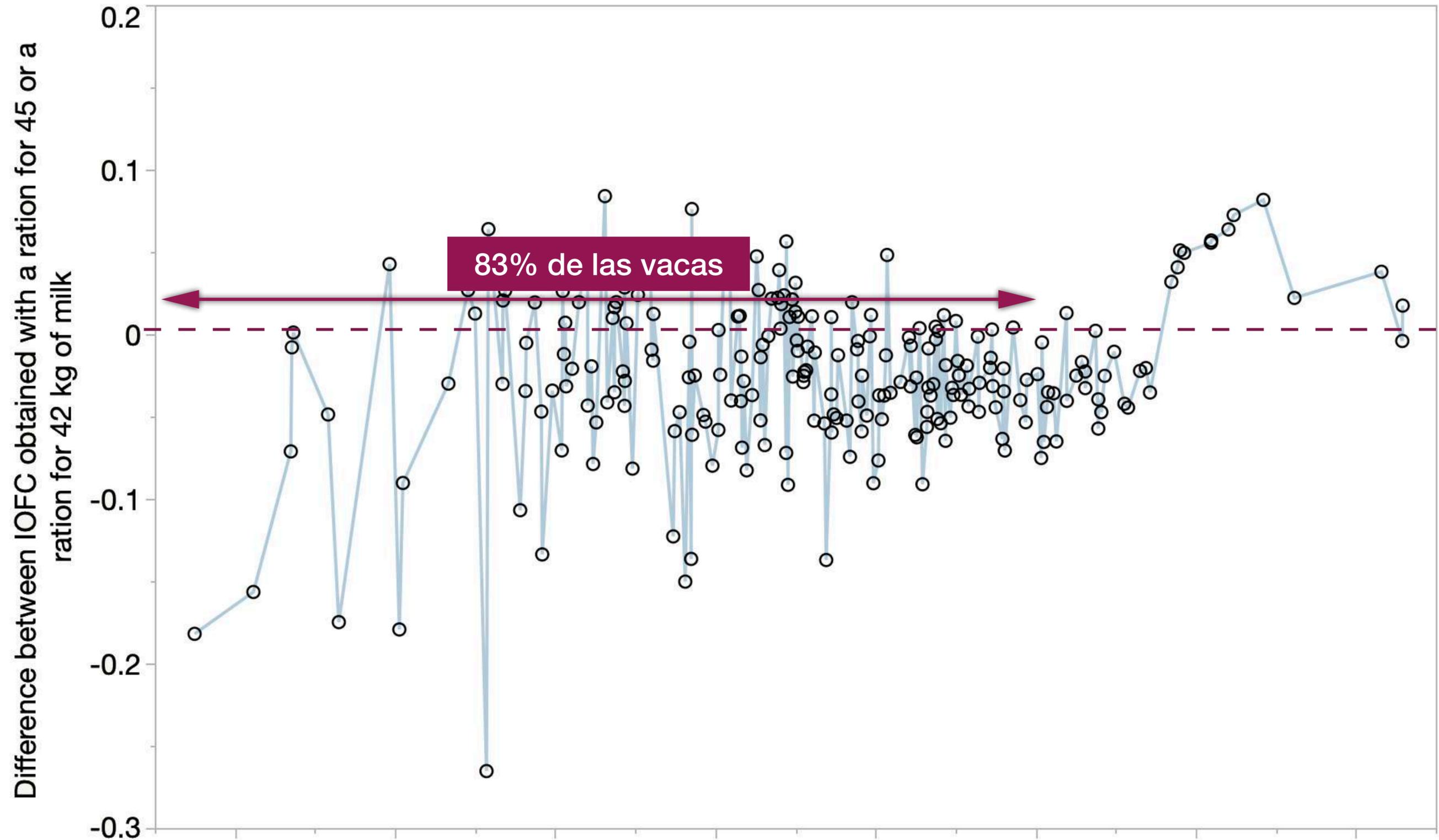
Nivel de Producción



Vacas (ordenadas por producción)

Bach et al. (2020)

Nivel de Producción



Vacas (ordenadas por producción)

Bach et al. (2020)

Cómo cambio la ración?

✿ Qué sabemos de los animales al confeccionar una ración?

Startup Costs **Utility** Import/Export

Parameters
User nutrients
Units under English system
User Lists
Report Settings
Quick data entry
Ingredients by formula
Feed analysis preview
Deletes

Animals Type Default [Cattle]

Animal type **Lactating Dairy Cow** Save User Default Exit
Restore animal type

Animal type	U.M.	User default	Original Default
Number of animals	n	1	1
Days in cycle	days	365	365
Breed type		Dairy	Dairy
Primary breed		Holstein	Holstein
Secondary Breed			
Average production/head/year	lbs		
Lactation number	n	2.00	2.00
Calving interval	months	13.00	13.00
Age at first calving (AOFC)	months	24.00	24.00
Age (actual average)	months	43.00	43.00
Mean FBW	lbs	1,385.0	1,385.0
Mature FBW	lbs	1,475.0	1,475.0
Days since calving (DIM)	days	100.0	100.0
Days pregnant	days	0	0
Daily milk production	lbs	85.00	85.00
Milk fat	% w/w	3.75	3.75
Milk total protein	% w/w	3.36	3.36
Milk true protein	% w/w	3.10	3.10
Casein	% w/w	2.62	2.62
Milk lactose	% w/w	4.85	4.85
Body reserves change	lbs	0.000	0.000
BCS (1-5)		3.00	3.00
Target BCS		3.00	3.00
Days to reach target BCS	days	100	100
Calf birth weight	lbs	85.0	85.0
ADG	lbs/day	0.000	0.000

Technical services, training and IT solutions
oriented to the technical and economic management of livestock farms and animal's feeds producers

Farms Structure Farms ON

Animal type
Environment
Activity

Open external file

Cost

Cómo cambio la ración?

✿ Qué sabemos de los ingredientes de una ración?

The image displays a software interface for managing feed rations. It is divided into several panels:

- Main Panel (Left):** Contains navigation tabs for 'Main', 'Startup', 'Costs', and 'Utility'. Below these are several menu items with icons, including 'Units under En...', 'Rep...', 'Quic...', 'Ingredients', and 'Feed anal...'.
- Ingredient List Panel (Middle-Left):** A table with columns for 'ID Cod', 'Description', and 'UM'. It lists various feed components such as D.M., CP, Sol.Prot., Ammonia (Prot.A1), ADIP, NDIP, ADF, NDF, ADL, EE, Starch, Sugar, Ash, Ca, P, Mg, K, Na, S, Cl, NDFD 24, NDFD 30, NDFD 48, Lag Time, Kd CHO B3, and STARCH D 7.
- Recipe Filter Panel (Middle-Right):** Shows a filter for 'Recipes: Lactating Dairy Cow/High'. It lists various feed components with checkboxes, including CP, TRUE PROTEIN, Sol Prot/CP, RDP/CP, RUP/CP, aNDF, peNDF, Forage, EE, NFC, Starch, Sugar, and monensin.
- Nutrients List Panel (Right):** A detailed list of nutrients with checkboxes and units (UM). Selected nutrients include NFC, Sugar, Starch, Forage, CP, and Ammonia (Prot.A1). Other nutrients listed include Total CHO, Acetic, Propionic, Butyric, Lactic, Org. Acids, Soluble Fiber, CHO B3 Lig*2.4, CHO C Lig*2.4, CHO C uNDF 240h, CHO B3 uNDF 240h, RD CHO 3x Level 1, RD Starch 3xLevel 1, Concentrate, Soluble Protein, NDIP, ADIP, Prot. A2, Prot. B1, Prot. B2, RDP 3x Level 1, RUP 1x Level 1, RUP 3x Level 1, PDIN, PDIE, PDIA, and dE INRA.
- Control Panel (Far Right):** Includes a 'Select' dropdown, a search field, a 'Nutrient' list showing 'Ammonia (Prot.A1)', and 'Proceed' and 'Close' buttons.

Cómo cambio la ración?

✿ Qué sabemos de los ingredientes de una ración?

The image shows a software interface for managing feed rations. It consists of several overlapping windows:

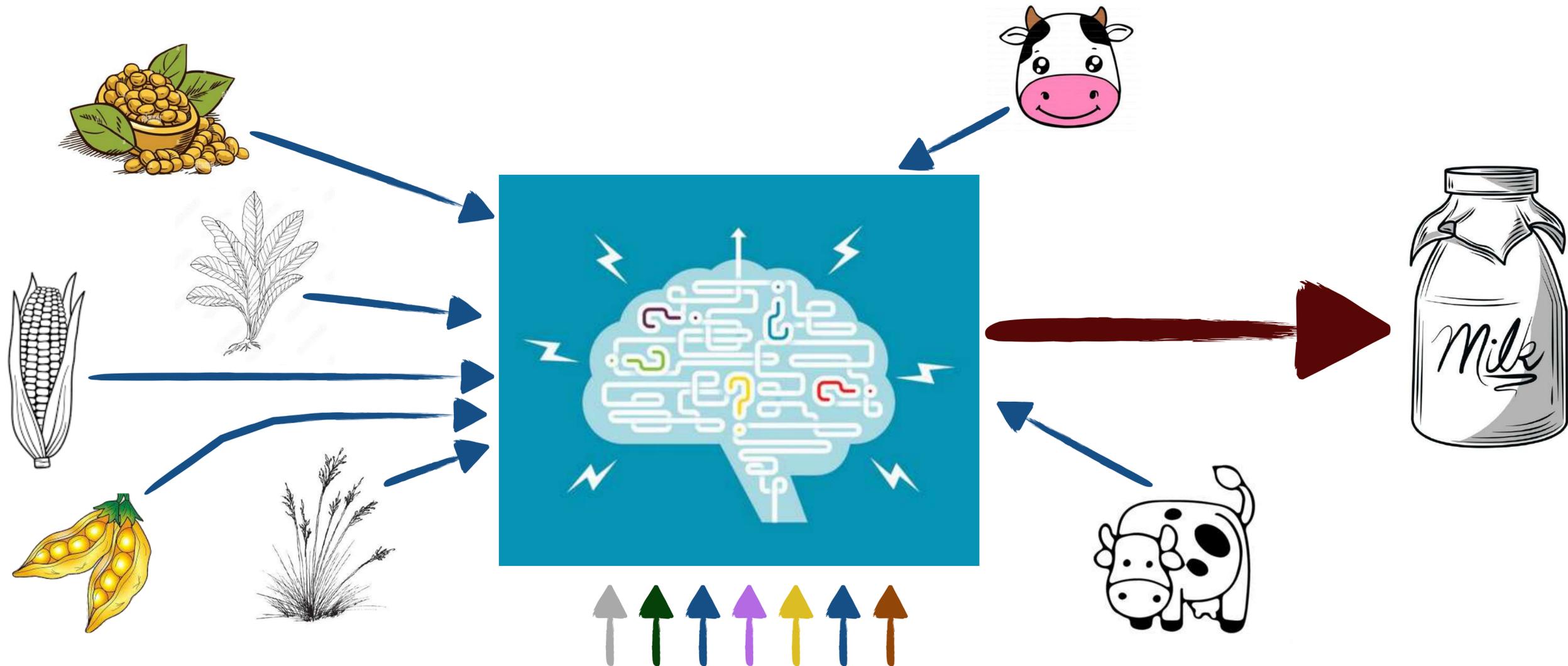
- Main Window:** A sidebar on the left with tabs for 'Main', 'Startup', 'Costs', and 'Utility'. The 'Utility' tab is active, showing a list of ingredients.
- Ingredients List:** A table with columns for ID Cod, Description, and UM. A purple box highlights the following items:

ID Cod	Description	UM
00953	NDFD 24	
00954	NDFD 30	%/hr
00955	NDFD 48	
00956	Lag Time	
00181	Kd CHO B3	%/hr
00957	STARCH D 7	%/hr
- Recipe Window:** Titled 'Recipes: Lactating Dairy Cow/High', it shows a tree view of recipe components like CP, TRUE PROTEIN, Sol Prot/CP, RDP/CP, RUP/CP, aNDF, peNDF, Forage, EE, NFC, Starch, Sugar, and monensin.
- Nutrients List Window:** A detailed list of nutrients with checkboxes and units. A purple box highlights the following items:

Description	UM
<input checked="" type="checkbox"/> NFC	%
<input type="checkbox"/> Total CHO	%
<input type="checkbox"/> Acetic	%
<input type="checkbox"/> Propionic	%
<input type="checkbox"/> Butyric	%
<input type="checkbox"/> Lactic	%
<input type="checkbox"/> Org. Acids	%
<input checked="" type="checkbox"/> Sugar	%
<input checked="" type="checkbox"/> Starch	%
<input type="checkbox"/> Soluble Fiber	%
<input type="checkbox"/> CHO B3 Lig*2.4	%
<input type="checkbox"/> CHO C Lig*2.4	%
<input type="checkbox"/> CHO C uNDF 240h	%
<input type="checkbox"/> CHO B3 uNDF 240h	%
<input type="checkbox"/> RD CHO 3x Level 1	%
<input type="checkbox"/> RD Starch 3xLevel 1	%
<input checked="" type="checkbox"/> Forage	%
<input type="checkbox"/> Concentrate	%
<input checked="" type="checkbox"/> CP	%
<input type="checkbox"/> Soluble Protein	%
<input checked="" type="checkbox"/> Ammonia (Prot.A1)	%
<input type="checkbox"/> NDIP	%
<input type="checkbox"/> ADIP	%
<input type="checkbox"/> Prot. A2	%
<input type="checkbox"/> Prot. B1	%
<input type="checkbox"/> Prot. B2	%
<input type="checkbox"/> RDP 3x Level 1	%
<input type="checkbox"/> RUP 1x Level 1	%
<input type="checkbox"/> RUP 3x Level 1	%
<input type="checkbox"/> PDIN	%
<input type="checkbox"/> PDIE	%
<input type="checkbox"/> PDIA	%
<input type="checkbox"/> dE INRA	unit
- Control Panel:** On the right, there are 'Select' and 'Search' dropdowns, a 'Nutrient' dropdown showing 'Ammonia (Prot.A1)', and 'Proceed' and 'Close' buttons.

Cómo cambio la ración?

- ★ **Nuevo paradigma:** La IA puede predecir el valor nutricional de los ingredientes en base a la respuesta de las vacas que los consumen



Cómo cambio la ración?

	GRUPPO 5	*GRUPPO 5 (SUGGESTED)
AS FED (KG)	54.9	54.45
DRY MATTER (KG)	25.69 (25.22)	25.3
COST DRY MATTER (TON)	319.41	314.11
COST FORMULA (€/DAY)	8.21 (8.05)	7.95
NUMBER OF COWS	222	222
TOTAL COST (€/DAY)	1,822 (1,788)	1,764
IOFC (€/DAY)	3,099 (3,060)	3,088
IOFC (€/COW)	13.96 (13.78)	13.91

Ingredient	Gruppo 5	*Gruppo 5 (Sugge 
Medica ensilata	1.50	1.50
Medica secca	2.50	2.50
Farina di Grain	8.20	8.20
Mel. 34 - Triump...	2.30	2.08
Mix Bal.	2.10	1.92
Sali	0.50	0.45
H2O	1.80	1.80
Trinciato mais	36.00	36.00

Nutrient	Gruppo 5	*Gruppo 5 (Suggested
DM, kg/d	25.69 (46.80)	25.30 (46.46)
CP, kg/d	3.77 (14.66)	3.61 (14.27)
NEI, Mcal/d	43.62 (1.70)	42.91 (1.70)
NDF, kg/d	7.53 (29.29)	7.47 (29.52)
ADF, kg/d	4.38 (17.03)	4.34 (17.17)
NFC, kg/d	12.05 (46.89)	11.95 (47.23)
Starch, kg/d	8.31 (32.36)	8.29 (32.77)
Sugar (WSC), k...	0.59 (2.30)	0.59 (2.34)
EE, kg/d	0.83 (3.24)	0.81 (3.21)
Ash, kg/d	1.59 (6.21)	1.53 (6.04)
Forage, kg/d	11.06 (43.05)	11.06 (43.72)
ME, Mcal/d	70.48 (2.74)	69.41 (2.74)
Soluble Protein,...	1.03 (4.02)	1.01 (3.98)
RUP 3x, kg/d	8.41 (32.72)	8.34 (32.96)
Ca, kg/d	0.14 (0.54)	0.13 (0.53)
Mg, kg/d	0.05 (0.21)	0.05 (0.21)
K, kg/d	0.40 (1.54)	0.38 (1.51)
Na, kg/d	0.95 (3.69)	0.94 (3.67)

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NaCl	0.95 (0.39)	0.48 (0.37)

Cuándo debo cambiar la ración?

	ID ↑	Pen	Group	Ration	% Ration to fe...	Head count
	1	1 HIGH FIRST ...	HIGH FIRST L...	HIGH DIET	81	120
	2	2 HIGH	HIGH	HIGH DIET	103	180
	3	3 MIDS	MIDS	MIDS DIET	100	205
	4	4 LOWS	LOWS	LOWS DIET	91	125
	6	6 FRESH COWS	FRESH	FRESH DIET	104	118
	8	8 CALVING YA...	CALVING YARD	DRY DIET	70	5
	9	9 DRY COWS	DRY	DRY DIET	97	132

	ID ↑	Pen	Group	Ration	% Ration to fe...	Head count
	1	Patio 1	Leche	Lactación	112	112
	4	Patio 4	Leche	Lactación	110	112
	5	Patio 5	Leche	Lactación	103	80
	6	Patio 6	Leche	Lactación	112	112
	7	Patio 7	Leche	Lactación	94	160
	8	Patio 8	Leche	Lactación	70	54
	9	Patio 9	Secas	Secas	93	57
	10	Preparto	Preparto	Preparto	108	23

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	1	1 HIGH FIRST ...	HIGH FIRST L...	HIGH DIET	81	120
	2	2 HIGH	HIGH	HIGH DIET	103	180
	3	3 MIDS	MIDS	MIDS DIET	100	205
	4	4 LOWS	LOWS	LOWS DIET	91	125
	6	6 FRESH COWS	FRESH	FRESH DIET	104	118
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	5	Patio 5	Leche	Lactación	103	80
	6	Patio 6	Leche	Lactación	112	112
	7	Patio 7	Leche	Lactación	94	160
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	ID ↑	Pen	Group	Ration	% Ration to fe...	Head count
	1	Pati-1	Alta	1 ALTA	102	105
	2	Pati-2	Primer Part	2 PRIMIPARES	102	80
	3	Pati-3	Baixa	3 BAIXA	98	82
	5	Secas-5	Eixutes	4 EIXUTES	102	16
	8	Secas-8	Eixutes	4 EIXUTES	102	55

	ID ↑	Pen	Group	Ration	% Ration to fe...	Head count
	1	Patio 1	Leche	Lactación	112	112
	4	Patio 4	Leche	Lactación	110	112
	5	Patio 5	Leche	Lactación	103	80
	6	Patio 6	Leche	Lactación	112	112
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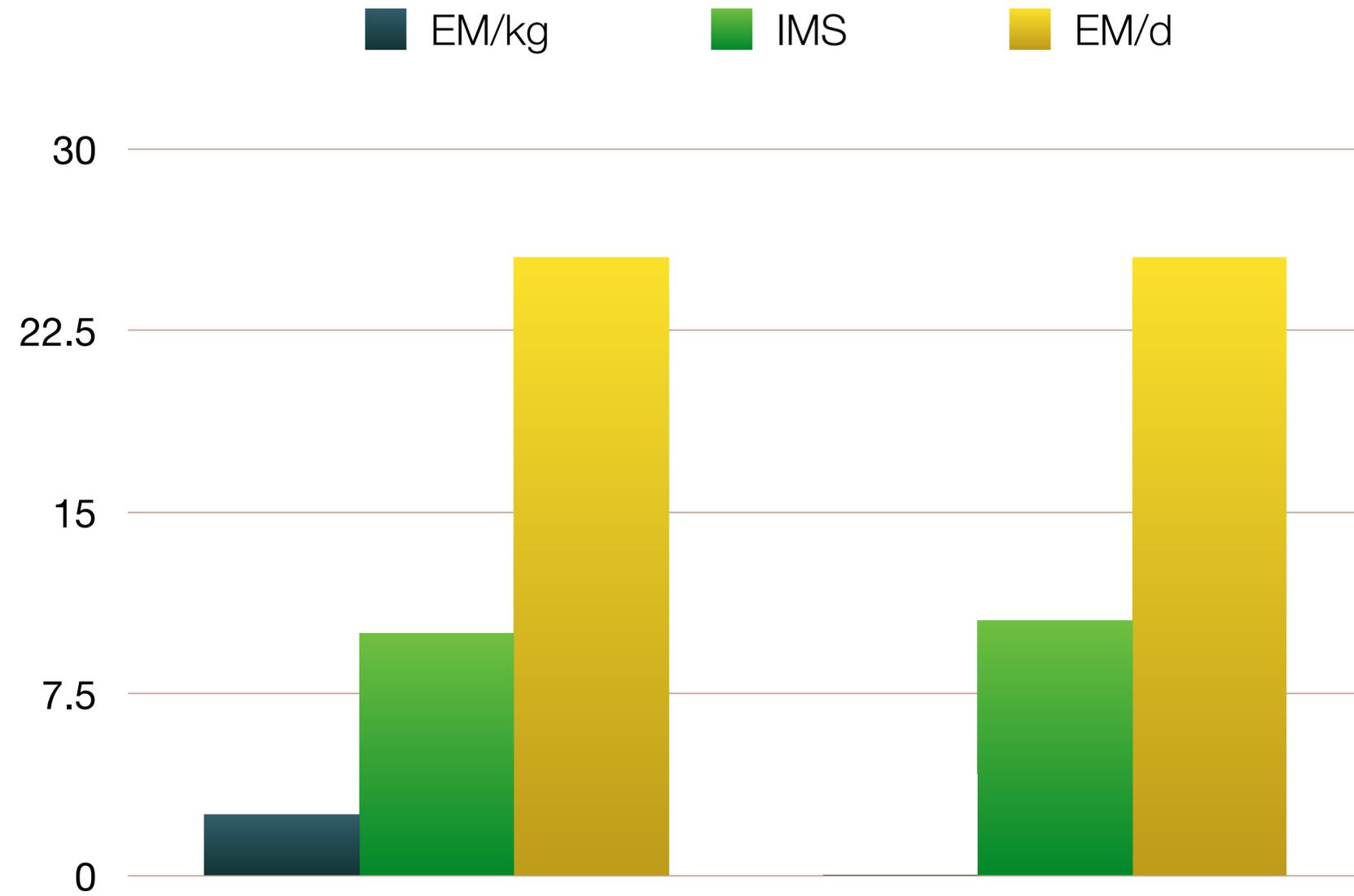
Cuándo debo cambiar la ración?

	ID ↑	Pen	Group	Ration	% Ration to fe...	Head count
	1	1 HIGH FIRST ...	HIGH FIRST L...	HIGH DIET	81	120
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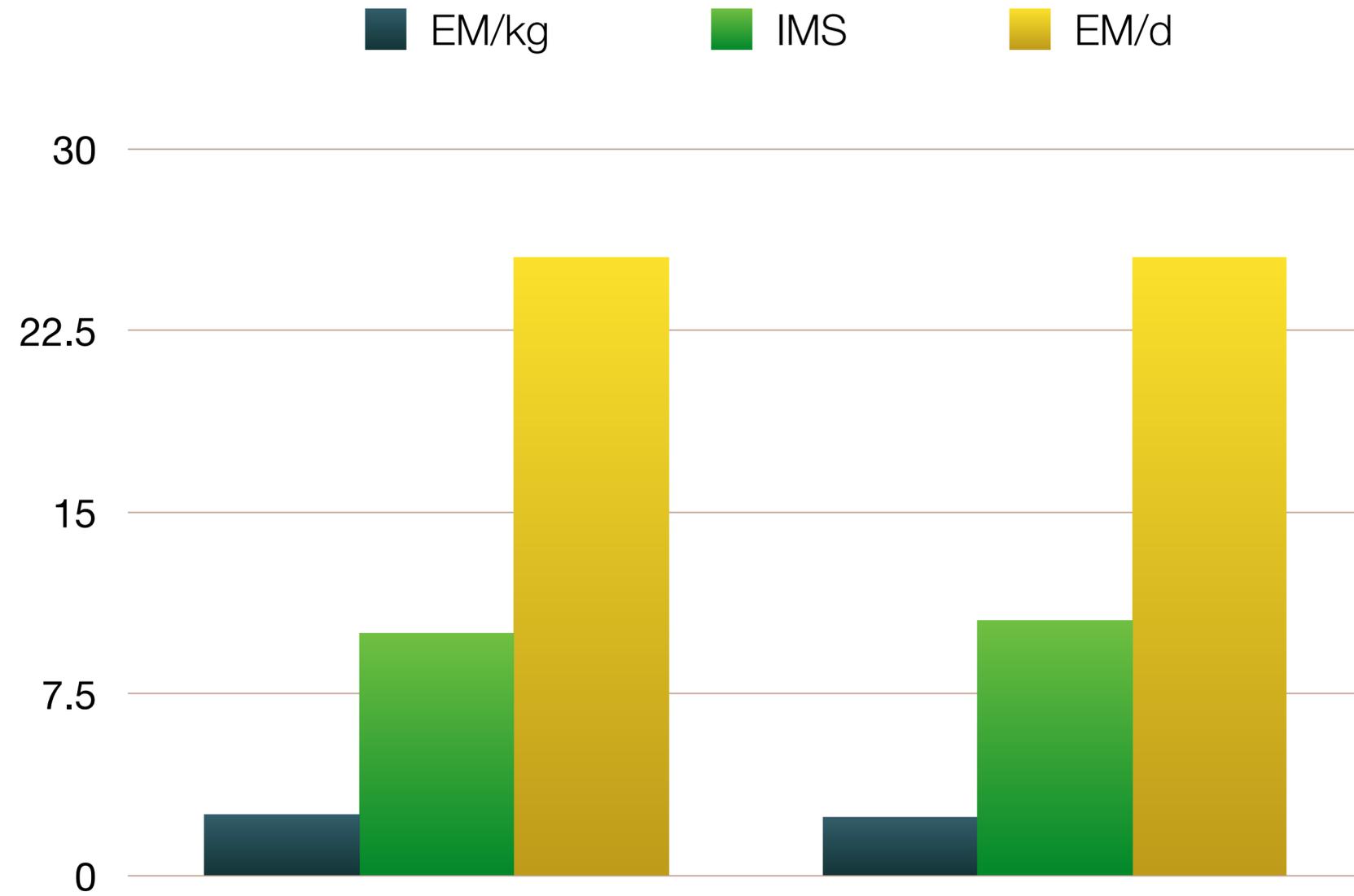
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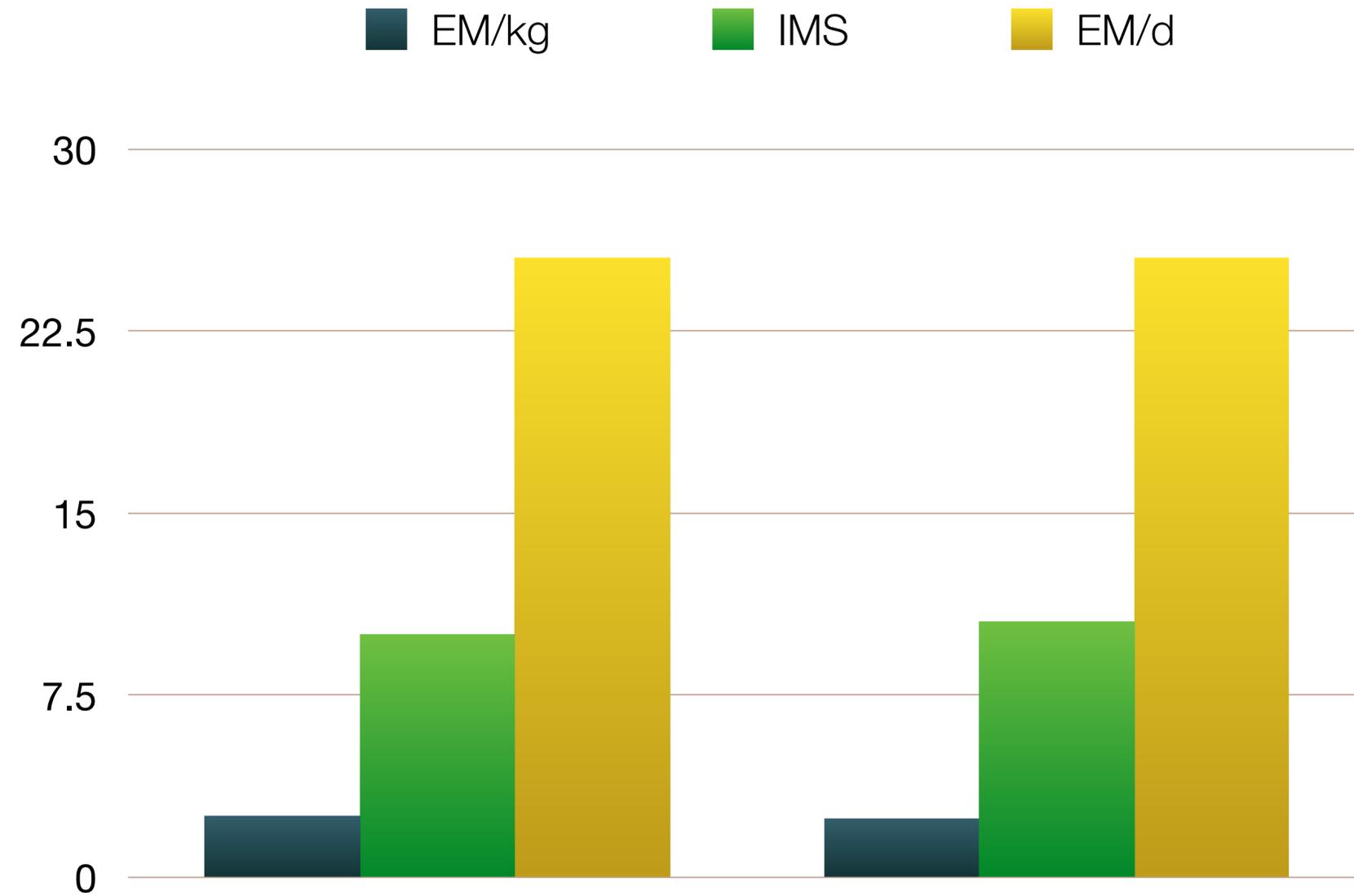


Cuándo debo cambiar la ración?



Cuándo debo cambiar la ración?

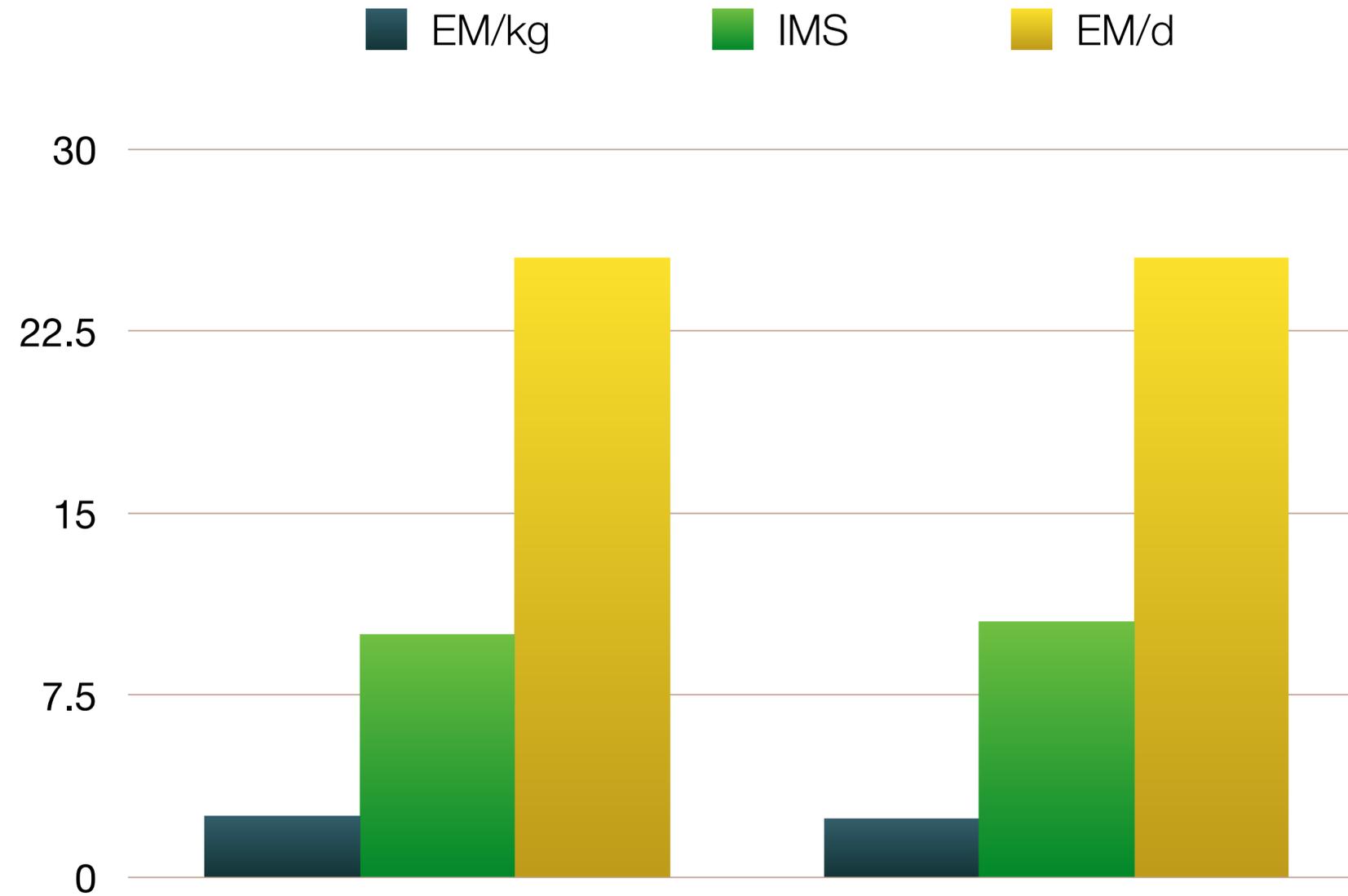
203 €/TM ~ 2.03 €/d



Cuándo debo cambiar la ración?

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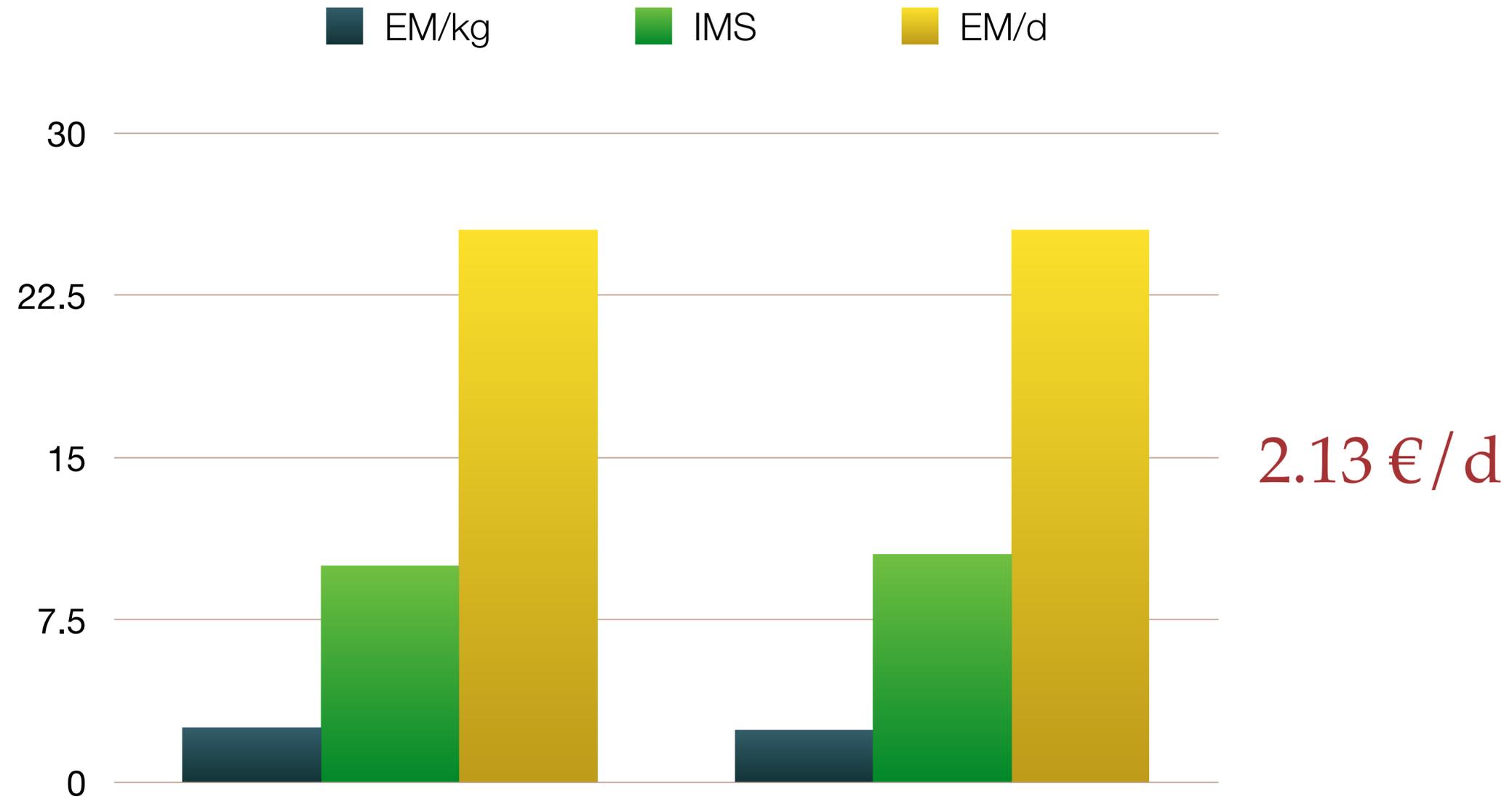
190 €/TM ~ 2.0 €/d



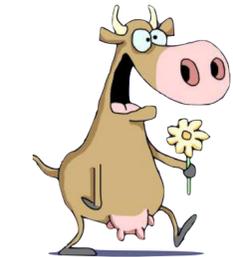
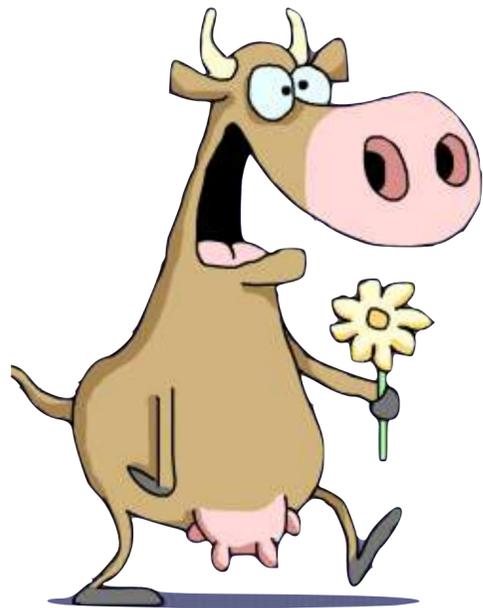
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203 €/TM ~ 2.03 €/d

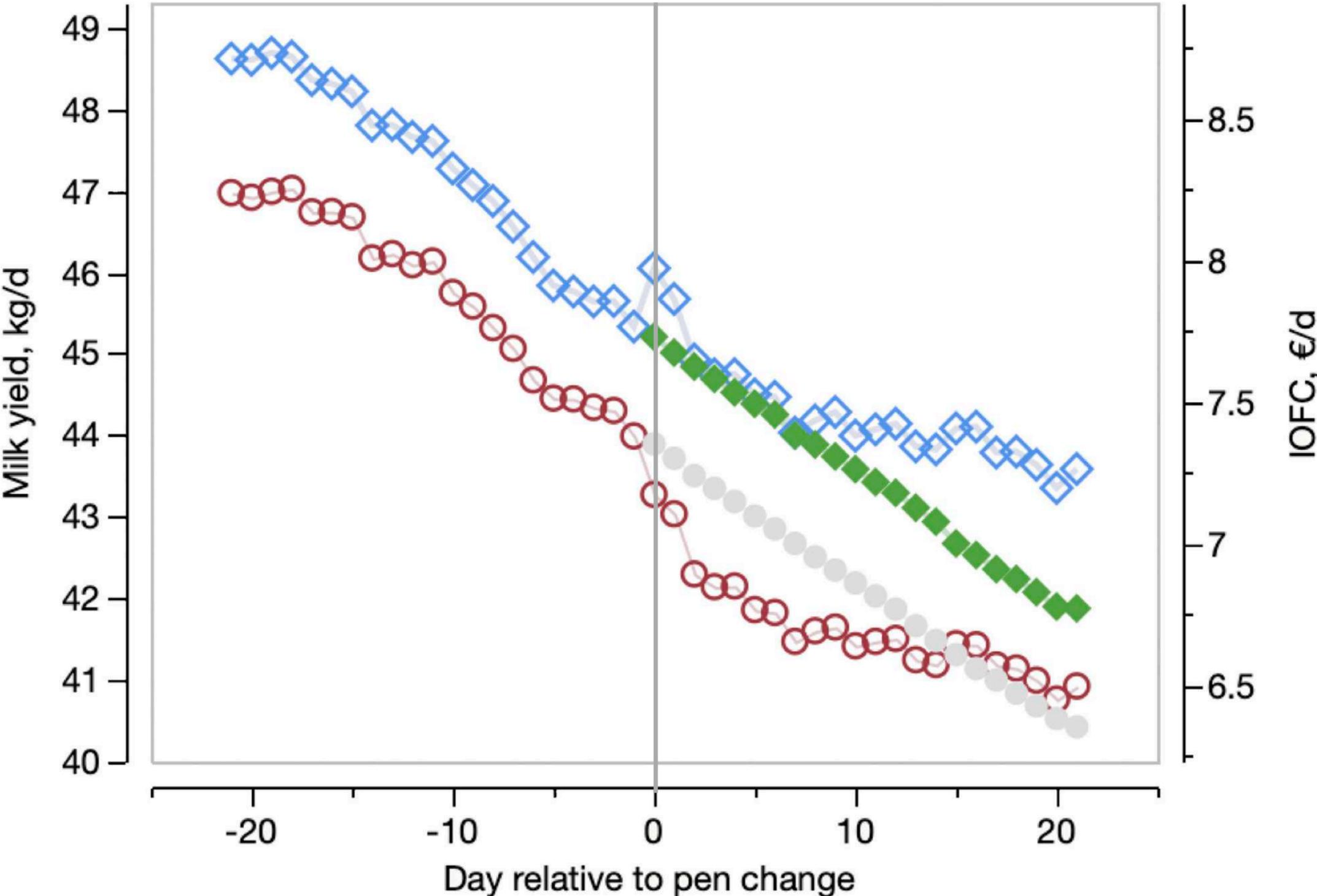
190 €/TM ~ 2.0 €/d

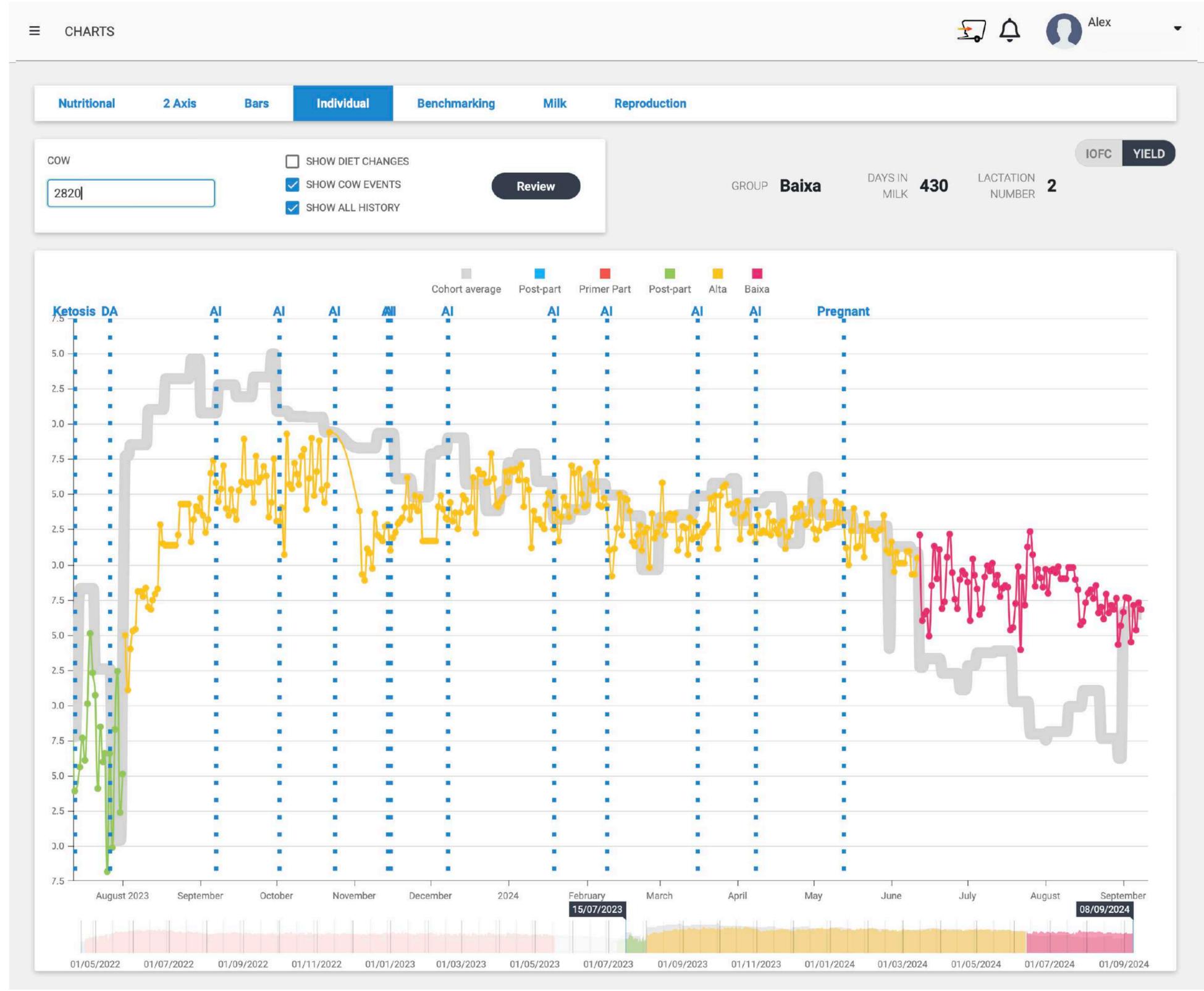


Grupos



- ◊ Observed IOFC, €/d
- ◆ Predicted IOFC had cows not changed diets, €/d
- Observed milk yield, kg/d
- Predicted milk yield had cows not changed diets, kg/d





Robots de ordeño/ Batch milking



Robots de ordeño/Batch milking

☰ PRECISIÓN SUGERIDA



Alex

Exportar

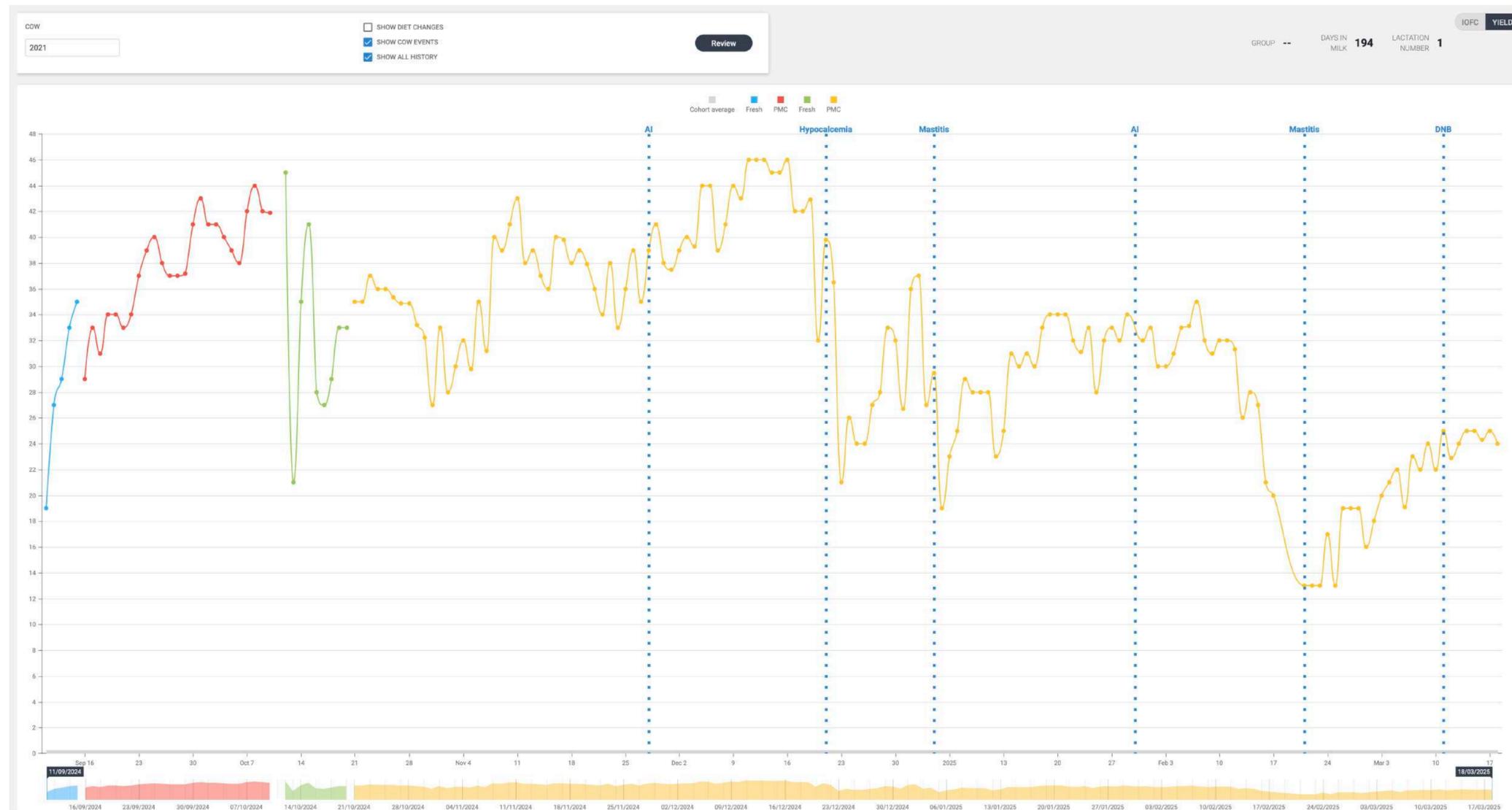
Guardar

<input type="checkbox"/>	Fecha de cálculo	Vaca	Lactación	Días en lactación	Leche, kg/d	Ingrediente	Cantidad, kg	Sugerido, kg	Diferencia
<input type="checkbox"/>	07/03/2024	2	1	322	25.89	productiebrok so...	3.07	1.51	-1.56
<input type="checkbox"/>	07/03/2024	3	2	0	32.3	productiebrok so...	4.12	3.71	-0.41
<input type="checkbox"/>	07/03/2024	4	6	0	28.24	productiebrok so...	3.14	1.47	-1.67
<input type="checkbox"/>	07/03/2024	5	2	0	47.93	productiebrok so...	6.86	6.53	-0.33
<input type="checkbox"/>	07/03/2024	7	1	67	27.07	productiebrok so...	3.22	2.86	-0.36
<input type="checkbox"/>	07/03/2024	9	2	245	49.34	productiebrok so...	5.88	5.91	0.03
<input type="checkbox"/>	07/03/2024	9	2	245	49.34	Topstart Fiber Ex...	1.06	0.35	-0.71
<input type="checkbox"/>	07/03/2024	13	2	379	33.39	productiebrok so...	4.97	4.31	-0.66
<input type="checkbox"/>	07/03/2024	14	9	81	22.2	productiebrok so...	1.92	0.64	-1.28
<input type="checkbox"/>	07/03/2024	16	1	76	30.43	productiebrok so...	3.7	3.33	-0.37

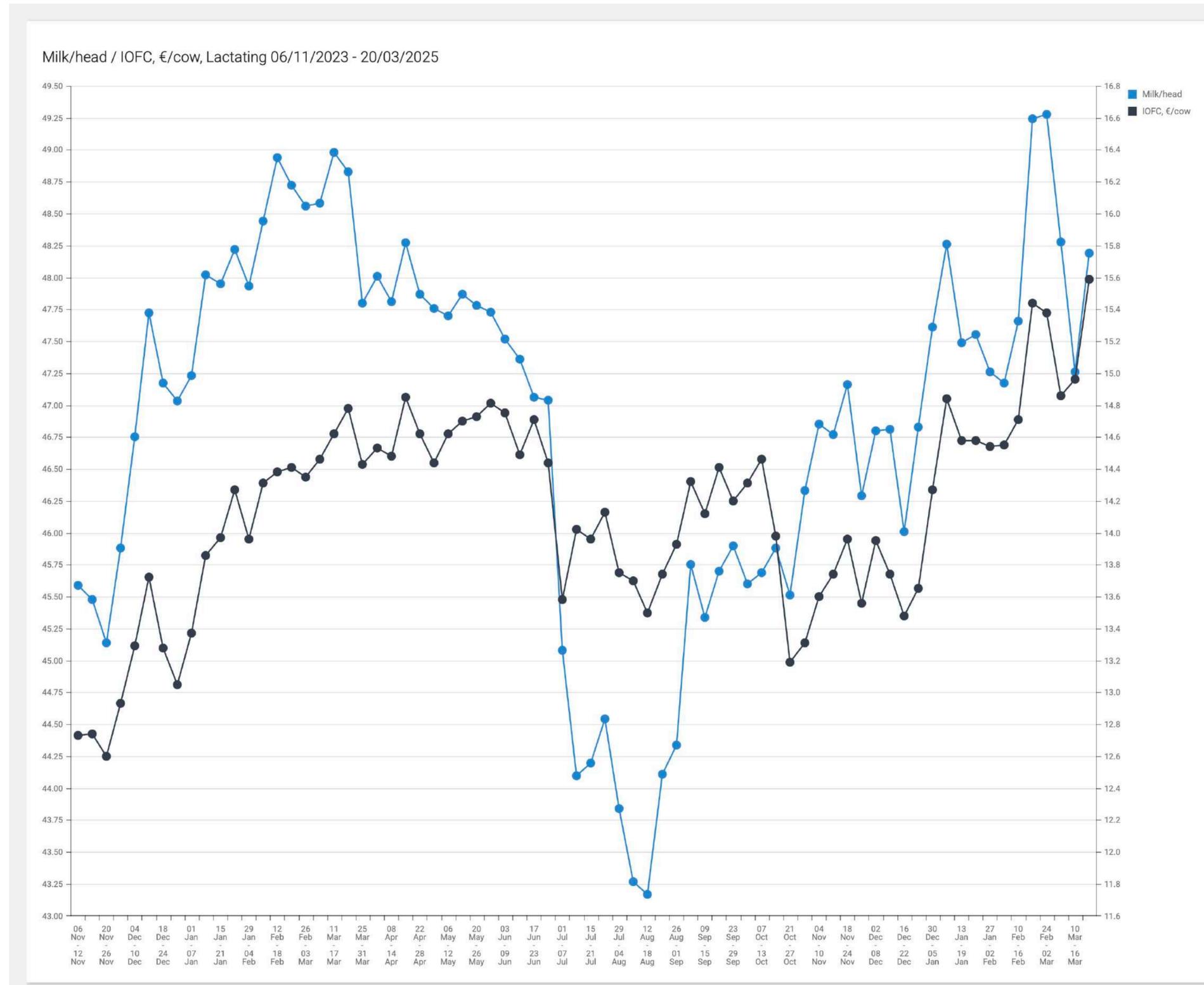
Inseminar o no Inseminar...



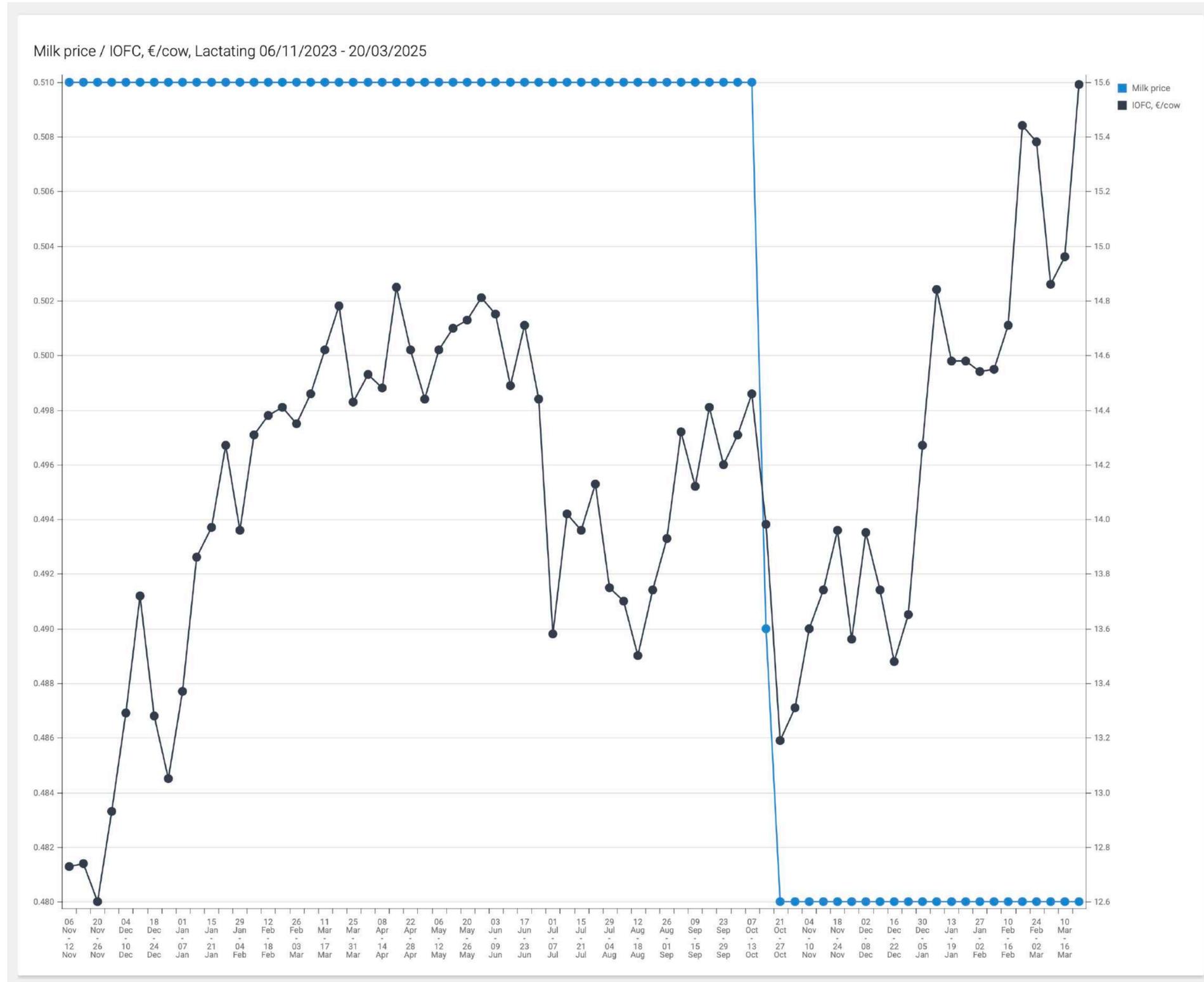
	Cow number ↓	DNB	Days in milk	Days pregnant	Current lactation	Productive life	Productive life (cohort)	Yield total	Yield total (cohort)	Total IOFC	IOFC total (cohort)	Yield (predicted)	IOFC (predicted)	N° AI	Dry days	IOFC	IOFC (cohort)	Yield (10 d)	Yield (cohort)
⊙	2062		300	164	1	300	317.00	9,116.50	11,181.17	2,322.23	2,674.79	1,415.63	379.95	2	0	7.84	8.59	29.61	35.89
⊙	2024		127	0	1	127	139.00	5,690.22	4,713.70	1,908.59	1,140.11	9,675.44	2,987.06	2	0	18.18	8.74	51.52	36.12
⊙	2023		129	0	1	129	141.00	3,667.08	4,791.70	1,129.13	1,158.24	9,339.06	2,830.77	1	0	12.02	8.73	39.30	36.13
⊙	2022		198	117	1	198	214.00	8,923.34	7,472.25	2,988.89	1,805.32	3,543.58	1,103.23	2	0	18.04	8.81	51.41	36.46
⊙	2021	✓	184	0	1	184	199.00	5,760.11	6,948.24	1,523.81	1,681.10	7,278.65	2,283.58	2	0	2.62	8.83	19.83	36.49
⊙	2019		250	185	1	250	268.00	9,010.39	9,372.86	2,767.17	2,248.82	1,070.09	315.62	1	0	10.77	8.68	35.35	36.16
⊙	2018		278	180	1	664	348.00	26,270.19	12,320.93	6,066.21	2,903.00	1,112.37	309.78	2	1023	11.19	8.49	36.50	36.02
⊙	2017		267	198	1	267	285.00	9,224.60	9,965.99	2,685.30	2,390.73	651.10	186.48	1	0	10.03	8.63	31.41	35.96
⊙	2016		293	157	1	293	311.00	12,058.50	10,899.42	3,841.14	2,592.00	1,772.24	512.37	4	0	15.36	8.51	44.08	35.80



Consecuencias



Consecuencias



Resumen

- ☆ Podemos usar métodos de adquisición e integración de datos eficaces y a tiempo real
- ☆ La IA permite gestionar múltiples aspectos de la producción:
 - ✱ Decidir el nivel de producción óptimo
 - ✱ Cambiar las raciones con frecuencia
 - ✱ Gestionar la mejora genética de la explotación
 - ✱ Formar grupos y establecer cambios de grupo
 - ✱ Alimentación de precisión 'real'
- ☆ **Cambio de mentalidad:** Usar la tecnología disponible:

Calculadora-> Excel-> IA

NutriFo^um25



La **alimentación** del **futuro**

GRACIAS



Universitat de Lleida