Quantitative review and meta-analysis of the determinants of ruminant production in the tropics

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Introduction and objective

↗ Environmental issues → **Ruminant production systems** ← Food demand (meat, milk…) ↗

Multi-function of grazing systems
⇒ Sustainable production

In the tropics: grazing = major ruminant breeding system

However: - Limited knowledge about the variability of production in différents tropical contexts compared to temperate conditions
- What is the maximum productivity that can be achieved and in which feeding context ?

Quantitative review of the bibliography and meta-analysis

Feeding (intake, digestibility) → variability → Performances (average daily gain)
animal - ressource - environnement

Material and methods

Bibliographic search:

- First step: several species of ruminants
Keywords: tropical, grazing, average daily gain (ADG), intake/digestibility

- Second step: focused on growing cattle
(>50% of the papers) ⇒ Data set construction (9 papers), N = 68

Data set description: ADG in g/d (mean +/- SE) / variables

Variable		N	Mean	SE	p	R²
Latitude	North	21	406	91	<0.001	0.15
	South	47	707	43		
Climate	Tropical Humid	19	628	65	<0.001	0.35
	Sub-Trop Humid	6	924	85		
	Semi Arid	33	696	55		
	Warm Arid	10	132	96		
Season	Rainy	35	746	52	<0.01	0.14
	Dry	33	474	64		
Breed	Mixed	55	715	41	<0.001	0.33
	Indian Zebu	13	188	80		
Forage	Grass	29	448	70	<0.001	0.16
	Grass + Legume	39	738	49		

Statistical analyses (ANOVAs):

- **Intra-study variability** determinants: experimental conditions (year, season)

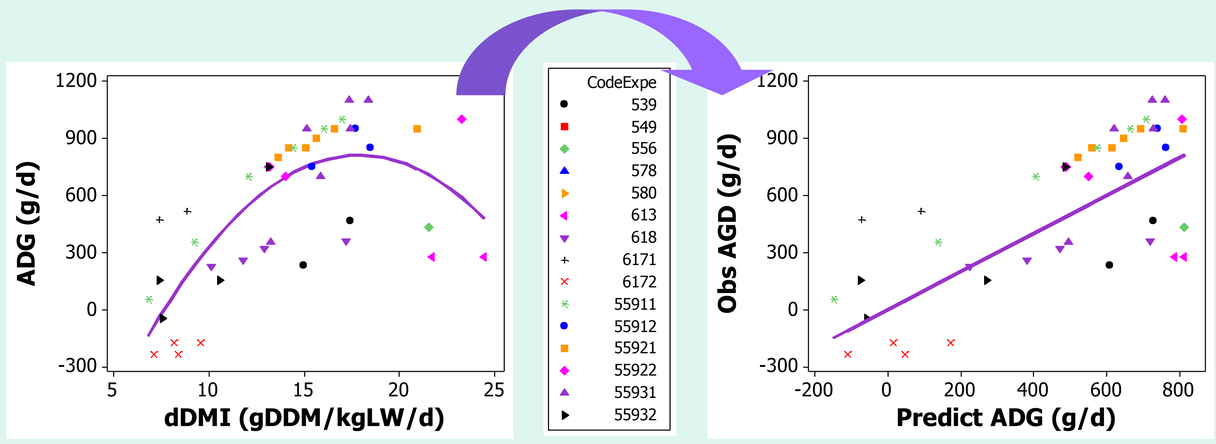
- **Inter-studies variability** determinants (on the previous model residuals)
=> animal, resource, environnent factors

Results

Focus on ADG ~ digestible Dry Matter Intake (dDMI)

- **Intra-study variability** determinants: experimental conditions (CodeExpe)

Quadratic Model (GLM): ADG = f(dDMI + dDMI² + CodeExpe)



Predict ADG = - 1207.1 + 184.16 dDMI – 4.196 dDMI², p<0.001, R² = 0.93, RSE = 124g

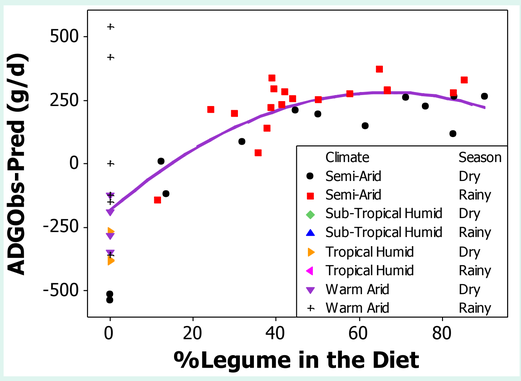
⇒ ***dDMI & experimental cond. explain a large part of intra-study ADG variations***

- **Inter-studies variability** determinants (on the previous model residuals)

Best model: (Quadratic Model - GLM)

ADGobs-pred = f(%legume in the diet + %legume in the diet² + Season + Climate)

p<0.01, R² = 0.71, RSE = 156g



⇒ ***Forage and environmental factors seem to be major determinants of inter-studies dDMI~ADG variations***

⚠ Some factors (eg season) appear both among intra and inter-studies determinants making model interpretations tricky

Conclusion

The great **variability of ADG** observed in tropical conditions illustrates the **flexibility** to **improve animal production from tropical pastures:** young cattle having same digestible intakes can grow 4 times more than others, in response to climatic and resource variations.
This work will contribute to **better quantify the relationship between ADG and feeding,** even if few data are available, and should offer the opportunity to **identify appropriate strategies for animal management in tropical pastures.**