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

N. Edouard*, M. Boval*, D. Sauvant†

* INRA Antilles-Guyane, UR0143 URZ Unité de Recherches Zootechniques, 97170 Petit-Bourg, F.W.I.

† INRA AgroParisTech, UMR0791 MoSAR Modélisation Systémique Appliquée aux Ruminants, 75231 Paris, France.

contact: Maryline Boval, Maryline.Boval@antilles.inra.fr

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	R ²	
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		

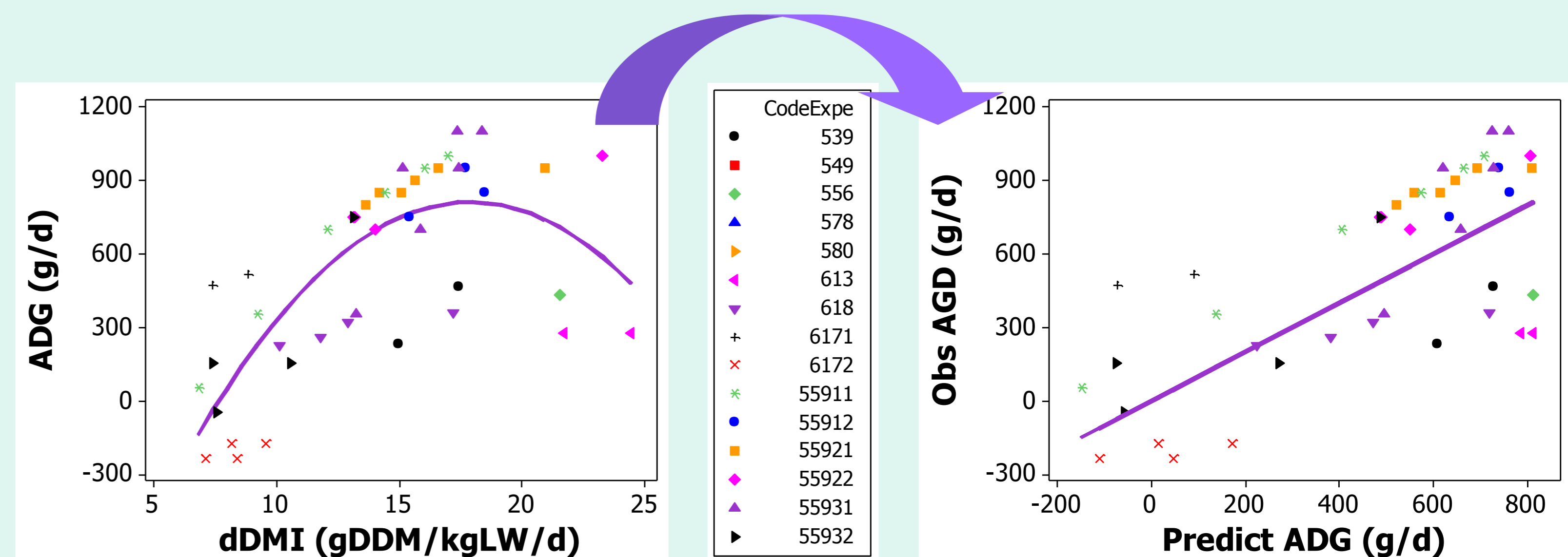
Statistical analyses (ANOVAs):

- Intra-study variability determinants: experimental conditions (year, season)
- Inter-studies variability determinants (on the previous model residuals)
=> animal, resource, environment factors

Results

Focus on ADG ~ digestible Dry Matter Intake (dDMI)

- Intra-study variability determinants: experimental conditions (CodeExpe)
Quadratic Model (GLM): $ADG = f(dDMI + dDMI^2 + CodeExpe)$



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

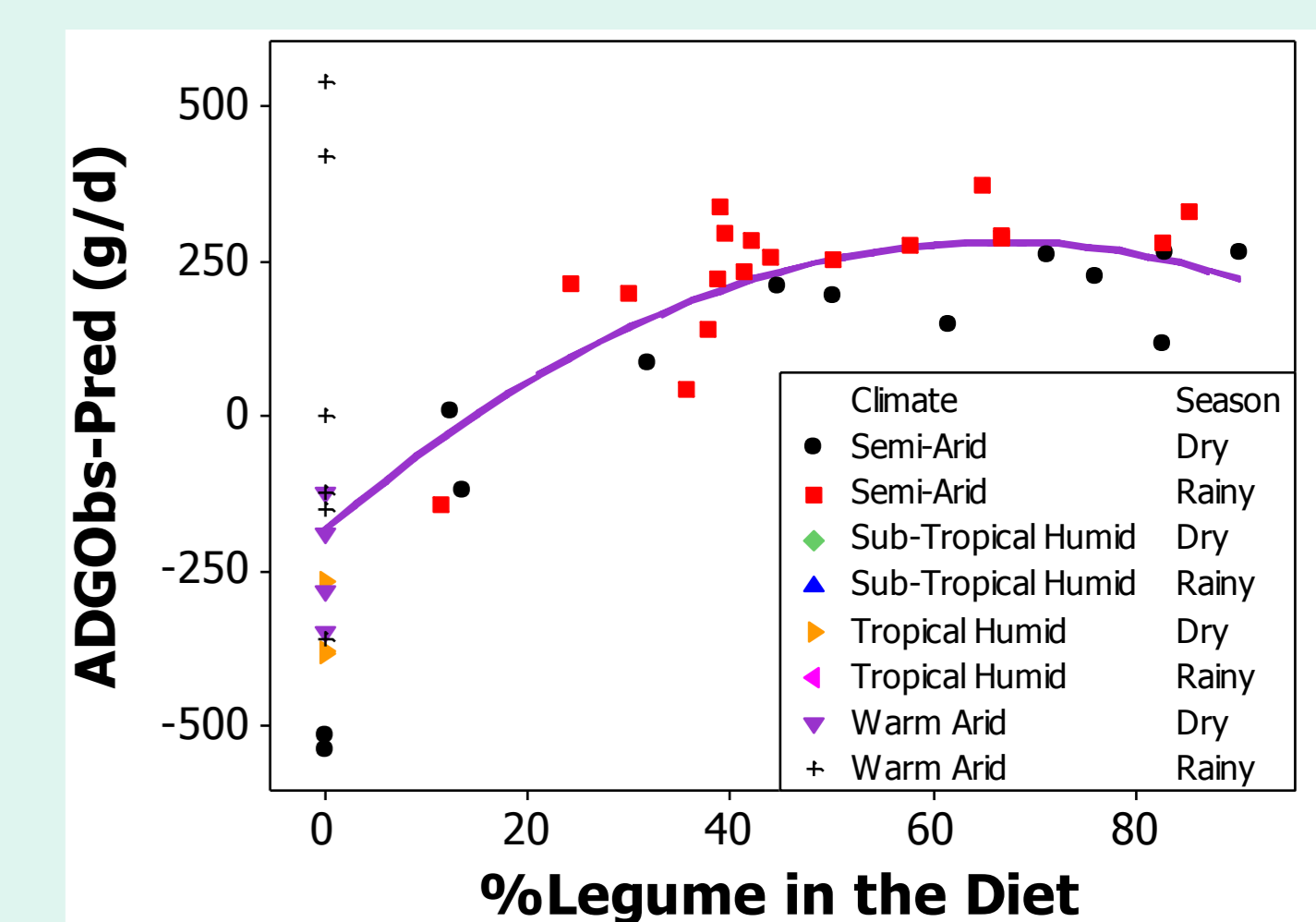
⇒ dDMI & experimental cond. explain a large part of intra-study ADG variations

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

Best model: (Quadratic Model - GLM)

$ADG_{Obs-pred} = f(\%legume \text{ in the diet} + \%legume \text{ in the diet}^2 + Season + Climate)$
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.

