

# Comparison of aerobic and anaerobic methods to assess quality of tropical multipurpose shrub legumes

K. Tscherning<sup>1,2</sup>, E. Barrios<sup>2</sup>, C. Lascano<sup>2</sup>, M. Peters<sup>2</sup> and R. Schultze-Kraft<sup>1</sup>



<sup>1</sup> University of Hohenheim (380), 70593 Stuttgart, Germany

<sup>2</sup> Centro Internacional de Agricultura Tropical (CIAT), A.A. 6713, Cali, Colombia



## Research Questions



To what extent could *in vitro* digestion by rumen microbes be used as a guide to assess decomposition of three tropical legumes with contrasting quality (*Calliandra* sp., *Cratylia argentea*, *Indigofera constricta*)?

How do different pre-treatments (fresh, frozen, freeze-dried, oven-dried, sun-dried) of this legume material influence quality characteristics and long-term degradation processes (in the rumen and on the soil)?

## Methods

- Litterbag experiment (soil science)
- Gas production experiment (animal nutrition)
- *In-vitro* dry matter digestibility (IVDMD) (animal nutrition)
- Indigestible fiber (INDF) (animal nutrition)
- Condensed tannin (CT) and lignin analysis



## Results - Decomposition

Decomposition rates (k) of leaf tissue applied to the soil surface differed significantly and were

- fastest for *Indigofera* (no CT, low lignin content): k = 1.35 / day
- medium for *Cratylia* (low CT, high lignin content): k = 0.33 / day
- slowest for *Calliandra* (high CT, high lignin content): k = 0.19 / day

Pre-treatments ⇒ no effect for *Cratylia* and *Calliandra*  
 ⇒ significant difference for *Indigofera* between treatments

## Results – *in-vitro* Rumen Digestion

Gas production rates (k) differed significantly among species being

- fastest for *Indigofera* (no CT, low lignin content): k = 8.57% / h
- medium for *Cratylia* (low CT, high lignin content): k = 6.16% / h
- slowest for *Calliandra* (high CT, high lignin content): k = 2.51% / h

Pre-treatments ⇒ no effect for *Cratylia*  
 ⇒ significant difference for *Indigofera* and *Calliandra* between treatments



## Correlations between quality factors (INDF, IVDMD, lignin, CT) and degradation in soil and rumen

Quality parameters	Soil (aerobic)		Rumen (anaerobic)	
	Rate of decomposition	Extent of decomposition	Rate of gas production	Extent of gas production
INDF	-0.746 (P<0.0004)	-0.920 (P<0.0001)	-0.873 (P< 0.0001)	-0.912 (P< 0.0001)
IVDMD	0.749 (P<0.0001)	0.868 (P<0.0001)	0.641 (P< 0.0001)	0.980 (P< 0.0001)
lignin + CT	-0.680 (P<0.0001)	-0.906 (P<0.0001)	-0.922(P< 0.0001)	-0.950 (P< 0.0001)

## Conclusions

**Aerobic (decomposition) and anaerobic (rumen digestion) degradation of these legumes are a function of indigestible fractions of the cell wall, such as lignin alone or lignin corrected by the presence of condensed tannins.**

**Differences in decomposition and digestibility were more related to intrinsic plant quality parameters than to changes in quality induced by pre-treatments.**