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The In Vitro Dry Matter Digestibility (IVDMD) Method

Edmundo Barrios*

Abstract

In vitro dry matter digestibility (IVDMD) is reported for a standard set of organic materials. IVDMD ranged from 82% for leaflets of the legume *Crotalaria ochroleuca* to 7% for sawdust.

In a review by Chesson (1997) it was proposed that decomposition processes in the rumen and in the soil, although different, were sufficiently similar to be considered for comparative plant tissue studies. Studies by Tian et al. (1996) supported this hypothesis, by showing that plant degradation during in situ ruminant nylon bag assay correlated with decomposition in a litter-bag study. More recently, Cobo et al. (2002) showed that the in vitro dry matter digestibility (IVDMD) method, which simulates in vitro processes taking place in the rumen of cattle during plant digestion, was closely related with decomposition processes for 12 plant materials with different tissue qualities (Figure 1).

The highly significant ($P < 0.001$) correlations obtained during this study between IVDMD and plant decomposition suggested that laboratory-based IVDMD tests could be used as surrogates for decomposition of plant tissues in the field (Cobo et al. 2002). In the present study, the importance of this finding to model parameterisation was further evaluated by assessing their IVDMD values of 32 standard organic materials covering a wider range of tissue qualities.

Method

The IVDMD is a laboratory test used as a plant quality index for animal feed by animal nutritionists (Tilley and Terry 1963; Harris 1970). The method includes two consecutive digestion phases. During the first digestion phase in this study, plant materials were incubated under anaerobic conditions with rumen microorganisms for 48 hours at 39°C. This was followed by a 24 hour acid-pepsin digestion phase at 39°C, under anaerobic conditions. Following this 72 hour incubation, residual plant materials were collected and oven dried (105°C for 12 hours). Ash contents were determined by combustion (550°C for 2 hours) and these data used to correct plant sample weight for potential contamination with soil.

Calculations were made using the following equation:

$$\%IVDMD = (1 - wd - wb/ws) \times 100$$

where wd = weight of dry plant residue, wb = weight of dry residues from blank, and ws = dry weight of original plant sample.

Results and Discussion

The IVDMD method showed a wide range of qualities in the 32 plant materials tested related to their differing chemical compositions (Table 1). The highest IVDMD value (82.4%), corresponding to

* Tropical Soil Biology and Fertility Institute of CIAT (TSBF-CIAT), CIAT, A. A. 6713, Cali, Colombia <e.barrios@cgiar.org>.

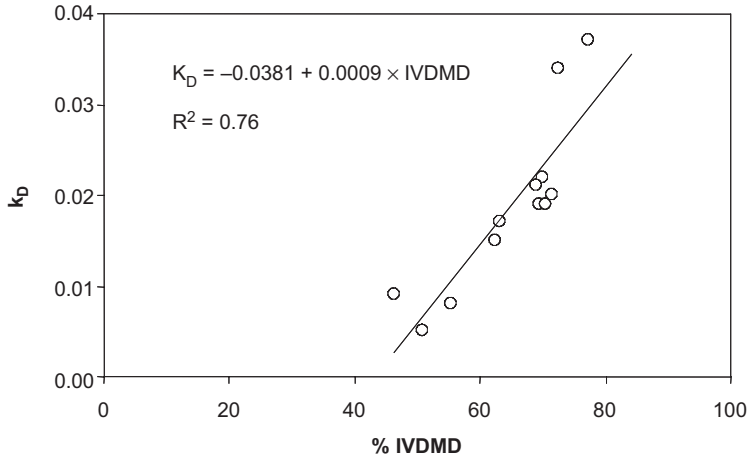

Figure 1. Linear regression between in vitro dry matter digestibility (IVDMD) of plant materials and their respective rates of decomposition (K_D). N=12. Reproduced from Cobo et al. (2002).

Table 1. In vitro dry matter digestibility (IVDMD) values for 32 standard organic materials.

Lab ID	Plant name	Plant part	IVDMD (%)
TSBF1	*Zea mays*	Stover	55.91
TSBF2	*Croton megalocarpus*	Leaf	58.78
TSBF3	*Senna spectabilis*	Leaflets	60.88
TSBF4	*Lantana camara*	Leaf	57.36
TSBF5	*Calliandra calothyrsus*	Leaflets	35.88
TSBF6	*Senna siamea*	Leaflets	60.03
TSBF7	*Crotalaria ochroleuca*	Leaflets	82.37
TSBF8	*Crotalaria grahamiana*	Leaflets	74.73
TSBF9	*Tithonia diversifolia*	Leaf	52.85
TSBF10	*Gliricidia sepium*	Leaflets	62.48
TSBF11	*Gliricidia sepium*	Leaflets	63.21
TSBF12	*Senna siamea*	Leaflets	61.94
TSBF13	*Flemingia congesta*	Leaflets	32.21
TSBF14	*Senna spectabilis*	Leaflets	59.59
TSBF15	*Calliandra calothyrsus*	Leaves	37.51
TSBF16	*Calliandra calothyrsus*	Leaflets	38.36
TSBF17	*Calliandra calothyrsus*	Leaves	38.85
TSBF18	*Calliandra calothyrsus*	Leaflets	37.18
TSBF19	*Calliandra calothyrsus*	Leaves	33.41
TSBF20	*Calliandra calothyrsus*	Leaflets	34.64
TSBF21	*Saccharum officinarum*	Stover	54.12
TSBF22	*Lantana camara*	Leaves	70.83
TSBF23	*Lantana camara*	Stems	21.15
TSBF24	Cattle manure		26.84
TSBF25	*Tithonia diversifolia*	Leaves	61.67
TSBF26	*Gliricidia sepium*	Stems	31.08
TSBF27	*Senna spectabilis*	Leaflets	58.06
TSBF28	*Sesbania sesban*	Leaves	76.48
TSBF29	*Gliricidia sepium*	Leaflets	54.52
TSBF30	*Sesbania sesban*	Stems	22.80
TSBF31	*Eucalyptus saligna*	Leaf litter	26.02
TSBF32	Sawdust		6.99

rapid decomposition rates, was found for leaflets of the legume *Crotalaria ochroleuca*. Intermediate values were found for leaves of *Calliandra calothyrsus* (38.9%). The lowest IVDMD value (7%), corresponding to slow decomposition rates, was measured for sawdust.

The IVDMD results were consistent with expected results based on existing information in the literature and in our databases. This observation further confirms the potential of this test to save time and variability associated with decomposition studies in the field. This finding could also be of practical importance for screening plant materials for different farm uses and could be linked to decision-tree schemes similar to those reported by Palm et al. (2001).

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