The influence of growing degree days on *Robinia pseudoacacia* browse quality and productivity in the southeastern USA

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Introduction The possibility of estimating browse quality and productivity of black locust (BL; *Robinia pseudoacacia* L.) herbage from accumulated air temperature heat units (growing degree days, GDD) could be a valuable tool for researchers and graziers in efficient allocation of feed resources. Accumulated air temperature heat units (GDD) above a 10° C base have been used to predict several forage quality constituents (Onstad & Fick ,1983).

Materials and methods Data were collected for two years to determine the relationship between GDD and herbage mass (HM), estimates of herbage quality N, IVTDMD , NDF, ADF, CELL, and ADL), and estimates of anti-quality agents (Folin-reactive phenolics [FR-phenol], condensed tannins [CT], and hydrolysable tannins [HT]) of a five-year old stand of BL in Raleigh, NC. Herbage mass samples were hand plucked and used to evaluate browse quality variables.

Results With the exception of IVTDMD (58%), 2-yr means of BL herbage quality estimates were high (4.2% N, 37% NDF, and 26% ADF). The 2-yr means for CELL and ADL were 8 and 16%, respectively. Concentrations of FR-phenol, CT, and HT averaged over years were 7.9, 7.6, and 8.0% DM, respectively. Condensed tannins have been reported to depress voluntary intake and ruminal fibre digestion (Terrill *et al*., 1992). Regression analyses were performed by year using GDD as the independent variable. In 1999, there was a significant relationship between GDD and HM, H, NDF, ADF, CELL, ADL, N, and IVTDMD (Table 1). In 2000, the only significant relationships with GDD were N, ADF, and CELL. High rainfall in 2000 caused a flush of new herbage growth that most likely masked the maturity effects demonstrated in the previous year. Horner (1988) reported that non-linear trends might exist when dilution effects caused by leaf expansion occur.

Conclusions In years with moderate to low rainfall, without multiple growth flushes, GDD appear to be closely related to HM, NDF, ADF, CELL, ADL, N and IVTDMD. Under these conditions GDD could serve as a useful predictor of herbage quality and productivity. In both years GDD was a poor predictor of BL tannin concentrations

Table 1 Linear regression equations for NDF, ADF, CELL, ADL, N, IVTDMD, FA-phenol, CT, HT, H, and HM as a function of GDD from 01 March 1999 and 2000, Wake County, North Carolina, USA†

Year	Regression Equations	SE‡	$r^{2\S}$
1999 (g/kg except for HM = kg /ha)			
	NDF=134.4 +0.34(GDD)	23.7	0.93***
	ADF=76.6 +0.24(GDD)	24.9	0.85***
	CELL=52.5+0.04(GDD)	3.3	0.92***
	ADL=23.8+0.19(GDD)	26.1	0.77**
	N=58.2-0.02(GDD)	2.9	0.65***
	IVTDMD=885.7 -0.38(GDD)	45.4	0.82***
	CT=9.3 -0.003(GDD)	1.1	0.34*
	HM=-434.7 +2.2(GDD)	293.7	0.77***
2000 (g/kg)			
	ADF=373.2 -0.07(GDD)	28.3	0.32*
	CELL=104.9 -0.01(GDD)	6.8	0.26*
	N=46.8 -0.008(GDD)	1.9	0.58***

† NDF, neutral detergent fibre; ADF, acid detergent fibre; CELL, cellulose; ADL, acid detergent lignin; N, nitrogen; IVTDMD; in vitro true dry matter disappearance; FR-phenol, Folin-reactive phenolics; CT, condensed tannins; HT, hydrolysable tannins; HM, herbage mass; GDD, growing degree days $=\sum\{[(T\ air_{max} + T\ air_{min}) / 2] - 10\ °C\}$ (from 01 March); ‡ SE= Standard error of mean; § r^2 = coefficient of simple determination; *, **, *** Significant at P= 0.05, 0.01, and 0.001 levels, respectively.

References

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