Tannin Contents of Sainfoin (*Onobrycyhis viciifolia* Scop) Grown with or without Irrigation and Harvested at Different Growth Stages

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Key words : condensed tannins ,growing conditions ,growth stage ,in vitro DMD ,sainfoin

Introduction Sainfoin (*Onobrychis viciifolia*) is a perennial legume with high dry matter (DM) yield that is ideally suited for grazing , haymaking and silage conservation (Frame et al ., 1998) . The presence of condensed tannins (CT) in sainfoin forage is believed responsible for its non-bloating status , the high efficiency with which its protein is utilized and the consequent improvements in animal performance when sainfoin is fed (McMahon et al ., 1999) . The variation in CT content among sainfoin varieties and the impact of growth stage on their concentration are not well understood . The objective of this study was to measure CT concentration in four varieties of sainfoin at four different stages of growth .

Materials and methods Four populations of sainfoin (L3401 , L3511 , L3519 and Nova) were seeded under rain-fed or rain-fed plus irrigated conditions using a randomized complete block design replicated four times . Irrigated plots received approximately 75 mm of water per month during the growing season . Swards were harvested at 4 growth stages (vegetative growth , full bud , early bloom and late bloom) during primary growth and again during re-growth . To facilitate re-growth , half of each plot was cut to ~12 cm height at first harvest of vegetative growth . Harvested materials were freeze-dried or oven-dried (at 55℃) and all were analysed for extractable CT (ECT ; Terrill et al ., 1992) and for *in vitro* DM disappearance (IVDMD) and true N disappearance (IVTND ; Wang et al ., 2006) . Data were analyzed using the MIXED ANOVA procedure of SAS and treatment effects were tested using LSMEANS with the PDIFF procedure (SAS , 1999) .

Results and discussion Levels of ECT were highest ($P<0.01$) in Nova and lowest ($P<0.01$) in L3401 (Table 1) . Irrespective of population or forage growth (primary vs . re-growth) , ECT concentrations were highest ($P<0.01$) in vegetative and full bud stages , and higher ($P<0.01$) in early bloom than in late bloom . The ECT content was higher ($P<0.001$) in re-growth forage than in primary growth , irrespective of population or growth stage . Total rainfall (Apr .-Aug .) was 183 mm . Irrigation did not affect ECT content . These trends are likely related to proportion of leaf in the forage , and the evolutionary role of CT for defense against herbivory . More ($P<0.001$) ECT was detected following freeze-drying than after oven-drying , likely because of oxidation of tannins and formation of complexes between tannins and other compounds during oven drying . Increasing ECT concentrations in the forage were associated with a linear ($60.29 - 0.106ECT$; $R^2 = 0.390$) decrease in IVDMD , and a quadratic ($73.75 + 0.037ECT^2 - 0.821ECT$; $R^2 = 0.615$) decrease in IVTND .

Table 1 *Mean concentrations (mg/g DM) of extractable condensed tannins (ECT) in four populations of sainfoin at different stages of growth (n=4) .*

Sainfoin type	Drying method		Forage type		Stage of growth			
	Freeze dried	Oven-dried	Primary growth	Forage re-growth	Vegetative	Full bud	Early bloom	Late bloom
L3401	51 .8	37 .2	34 .5	54 .5	46 .6	51 .6	43 .6	36 .3
L3511	55 .3	40 .3	33 .3	62 .4	52 .6	49 .9	48 .4	40 .6
L3519	58 .6	46 .1	40 .6	64 .1	55 .7	57 .9	49 .9	45 .9
Nova	75 .0	52 .7	49 .7	78 .0	71 .5	67 .0	61 .8	55 .1
SEM[z]	--- 2 .59 ---		--- 2. 59 ---		------- 3. 86 -------			

[z] SEM : Standard error of the mean .

Conclusions Concentration of CT in sainfoin forage varied among lines , decreased with forage maturity , and increased during re-growth . Their effects were less pronounced on IVDMD than on IVTND .

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