

Forage production estimate of incienso (*Flourensia thurifera* (Mol.) DC.), repanda (*Atriplex repanda* Phil.) and numularia (*Atriplex nummularia* Lindl.) according to shrub size and annual rainfall

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Key words: *Flourensia*, *Atriplex*, forage production estimate, regression, shrub size

Introduction The range lands of central-north semiarid zone of Chile is dominated by shrubs which contribute with fresh forage during critical times of the year when herbaceous species become dry due to seasonality. Shrubs also ensure soil and water conservation and give animals shelter and shadow, so it should be strategically used promoting its conservation. In order to program range managements, it is fundamental to estimate the dry matter production. Direct cutting measurements, although precise, are low effective, time consuming and expensive and therefore indirect methods, using multiple variables regressions, might be more useful (Azócar *et al.*, 2004). The objective of this study was to estimate forage production of three shrubs species, using plant size parameters and annual rainfall.

Materials and methods Data was obtained from experimental field "Las Cardas", located 30°14' south and 71°19' west. Climate is Mediterranean arid, varying with a maximum and minimum monthly mean temperature of 26°C and 5°C in January and July, respectively. Average annual rainfall is 144 mm concentrated between June and August. Vegetation is dominated by scrubland species as *Gutierrezia resinosa*, *Flourensia thurifera* and planted *Atriplex* spp., coexisting with *Acacia caven* and *Lithraea caustica* trees and with an herbaceous stratum dominated by therophytes.

In August or September, available forage dry matter (g DM shrub⁻¹) of *Flourensia thurifera*, *Atriplex repanda* and *Atriplex nummularia* was measured, along 1978 to 2004, registering annual rainfall the year of cutting (R, in mm) and of the previous year (R_p, in mm). Height (h, in cm), major diameter (M, in cm), minor diameter (m, in cm) and plant density (D, plants ha⁻¹) of at least 250 shrubs of each species was measured, to calculate volume (V) as V=(M m π h) / 12 and area (A) as A=(M m π) / 4, grouping the plants as small, intermediate or large. A multiple stepwise regression analysis was applied to fit the best curve between real DM, shrub size and annual rainfall.

Results and discussion The shrub size measurements and the annual rainfall gave a good estimate of the real DM production for the three shrubs species, adjusting regressions with high coefficients of determination (Table 1). Precision of models decreased under higher rainfall conditions and larger shrub size, especially in *A. nummularia*.

Table 1 Real and estimated (Est.) dry matter production (g DM shrub⁻¹) of *F. thurifera*, *A. repanda* and *A. nummularia* according to median annual rainfall (R) and shrub size, showing the best regression adjusted.

Median R	<i>F. thurifera</i>				<i>A. repanda</i>				<i>A. nummularia</i>			
	< 120 mm		> 120 mm		< 120 mm		> 120 mm		< 120 mm		> 120 mm	
	Real	Est.	Real	Est.	Real	Est.	Real	Est.	Real	Est.	Real	Est.
Dry matter production (g DM shrub ⁻¹)												
<i>Shrub size</i>												
Small	4.2	3.5	10.3	9.2	183.7	135.9	148.0	165.8	71.2	60.6	105.2	92.8
Intermediate	24.7	29.9	49.8	46.1	540.3	646.1	897.4	1,032.3	312.9	326.8	485.5	458.4
Large	126.5	133.2	155.3	137.9	655.0	682.7	1,564.3	1,483.6	474.8	581.4	1,676.0	1,565.0
Regression	ln(DM) = -4.68 + 1.82 ln(R _p) - 0.268 ln(R _p) ² + 0.277 ln(V) + 0.055 ln(V) ln(R _p) (R ² = 86%)				DM = 942.128 A - 0.138 D A + 0.0098 R _p ² - 2.122 R _p - 0.572 R _p A (R ² = 96%)				ln(DM) = 25.6 + 0.619 ln(V) - 11.83 ln(R) + 1.64 ln(R) ² + 3.75 ln(R _p) - 0.846 ln(R) ln(R _p) (R ² = 84%)			

Conclusions The proposed models to estimate available forage from *F. thurifera*, *A. repanda* and *A. nummularia* by shrub size and previous year annual rainfall, are reliable and easy to apply, simplifying the need of direct cut measurements for forage budgeting. Further research on this technique should be carried out in other shrub species.

Reference

Azócar, P.; Mansilla, A.; Patón, D.; Torres, C. y Santibañez, F. (2004). Estimación de la producción de forraje del incienso (*Flourensia thurifera* (Mol.) DC.) según tamaño del arbusto y precipitación anual. Avances en Producción Animal. N°29 (1 y 2): 29-37.