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Renewal of the dry weight of *Larrea cuneifolia* Cav. after a hailstorm in Mendoza, Argentina

Eduardo Méndez*

UID Botánica y Fitosociología IADIZA-CRICYT, Avda Adrián Ruiz Leal, s/n°, Parque General San Martín CC 507, 5500 Mendoza, Argentina

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This work determines the renewal of the dry weight of *Larrea cuneifolia* Cav., after being affected by a severe hailstorm in the province of Mendoza, Argentina. The dry weight of the year's branches, taking the last 40 cm from the branch extreme, was used to determine recovery. The initial dry weight was reached 207 days after the damage has occurred. This renewal of the dry weight is associated with favorable thermopluviometric conditions during the growing season.

Keywords: hail; dry weight; renewal; *Larrea cuneifolia*; Mendoza, Argentina

Introduction

Hail is a meteorological adversity affecting agricultural crops at different degree, including arid and semi-arid zones of Argentina (Capitanelli, 1967; Ortiz Maldonado, 1991). In Mendoza Province, Argentina, hailstorms are frequent and their damage has long been acknowledged (Prieto, 1983; Prieto *et al.*, 1995). Their frequency and intensity vary widely (Capitanelli, 1949; Ortiz Maldonado & Caretta, 1991); and they affect the natural vegetation cover either partially or totally (Méndez, 1997, 1999).

This work postulates the hypothesis that hailstorms would act over the dynamic functioning of the native plant communities, provoking alterations in the cover of the existing species. The regeneration of the individual components is a condition for the plant community to keep in equilibrium with the external factors (Braun-Blanquet, 1979). The purpose of the work was to estimate the renovation time of the dry weight of *Larrea cuneifolia* Cav. immediately after it has been affected by hail, in order to suggest patterns for conservation management of the species. This species covers an extension of 8640 km^2, i.e. about 5·7% of the Mendoza Province.

Materials and methods

The study was conducted in Agrelo (33°07′S, 68°54′W), Luján de Cuyo, Mendoza. Mean annual precipitation is 230·5 mm and mean annual temperature is 12·5°C.

*E-mail: emendez@lab.cricyt.edu.ar

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Annual rainfall in the year 2000 was 347 mm with 38% occurring during 2 months (March–April) (FCA, 2000). Soils are entisols and torriorthents (INTA, 1990). This area has some cattle activity while the outstanding activity is oil extraction.

The work was done in a *L. cuneifolia* community affected by a severe hailstorm on December 17, 1999. Visually, it was possible to estimate a very strong damage, of 95·60% as measured by count of the year's twig and 93·43% of dry weight loss of the year's twig (Méndez, 1999).

The renewal of the dry weight of *Larrea* in the area affected by hail was measured based on the mean dry weight of this year's twigs (stem diameter less than 2 mm), situated on the last 40 cm of the extreme of the branches. Harvesting was done in five stands of 10×10 m and five plants randomly selected within each stand from December 1999 to the end of 2000 every 27–42 days. Five branches were collected from each plant, giving a total of 25 branches per stand, and a total of 125 branches for each harvesting and 1500 during the whole extraction in the affected area. The twigs were draw out and oven-dried at 70°C to constant weight and weighed to the nearest 0·1 g. An adjacent area with *L. cuneifolia* not affected by the hailstorm was used as a control. In this area, 125 branches were harvested and weighed in December 1999. Before the hailstorm, both the affected and the control areas had similar vegetation composition and cover and species diversity.

The function $y = x/\alpha x + \beta$ was estimated, where y was the mean dry weight of the year's *L. cuneifolia* branches and x was the accumulated days from the beginning of harvesting.

Results and discussion

The mean dry weight of the year's twigs was 79·95 g in the control area (Table 1). This weight was used as the starting point for establishing the renewal time. Until approximately 14 days (C2) after the hail, there was no change in the dry weight since only a 0·72% of recovery of the dry weight was observed. It seems that during this period, the buds awakened and owing to the transport of substances sprouting was

Table 1. *Renewal of the dry weight in the L. cuneifolia Cav. year's twigs (Agrelo, Luján de Cuyo, Mendoza, Argentina)*

Points	Month	Date	Days after hail	Dry weight				Difference (%)
				Without hail		With hail		
				(g)	(%)	(g)	(%)	
C1	D	29-12-99	0	79·95	100	5·22	6·57	−93·43
C2	J	12-I-2000	14			5·83	7·29	−92·71
C3	F	15-II	48			22·4	28·02	−71·98
C4	M	28-III	90			99·06	123·9	+23·9
C5	M	4-V	128			71·88	89·9	−9·95
C6	J	4-VI	159			89·34	111·7	+11·7
C7	J	4-VII	189			81·44	101·8	+1·8
C8	A	4-VIII	220			77·96	97·5	−2·5
C9	S	8-IX	255			70·03	87·9	−9·6
C10	O	6-X	283			80·3	100·4	+0·4
C11	N	7-XI	315			89·9	112·4	+12·4
C12	D	4-XII	342			79·6	99·6	–0·4

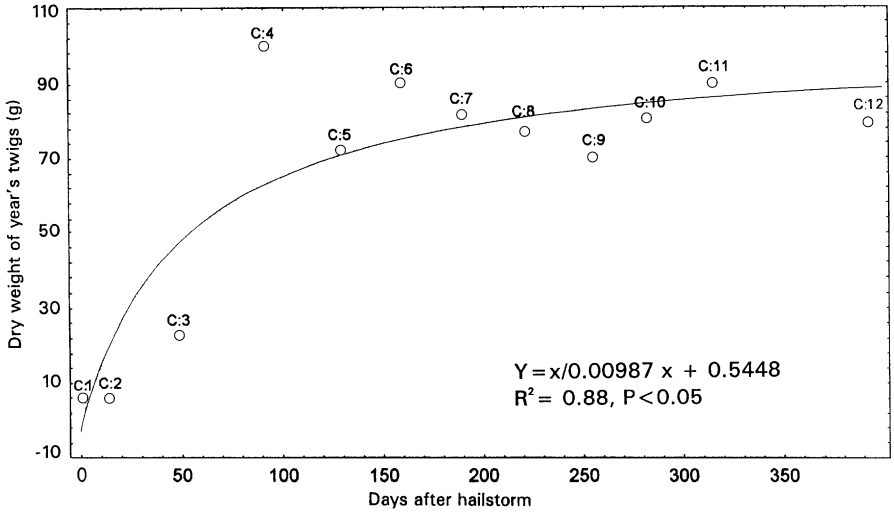

Figure 1. Renewal of the dry weight in the L. cuneifolia Cav. year's twigs (Agrelo, Luján de Cuyo, Mendoza, Argentina).

favored. After another 34 days (C3) a larger recovery is noticeable, rising steeper and reaching +20% renewal. After another 42 days (C4), there is a brusque and accelerated sprouting. Intense heat and cold in April and even frost at the beginning of May provoke the death of new shoots. This resulted in a dry weight decrease (C5 in Fig. 1), after reaching a maximum (C4), which would point at its dependence of climatic factors. These results are similar to those given by Araya & Avila (1981) on shrub sprouts after a fire. They showed a larger sprout volume than was originally present. In our study, the renewal of the dry weight of *L. cuneifolia* occurred because it happened during the highest vegetative growth period, with temperature and precipitation favoring the activation of sleeping or latent buds. The lower or higher inhibition of the latent buds, conditioned to the hail frequency and intensity, would be similar to that provoked by fire of some shrubs (Matlack *et al.*, 1993). It is probable that the highest hail frequency and intensity could wear these sprouts out, and could even eliminate them, thus provoking the plant death. It is interesting pointing out that the recovery of the dry weight of the vegetation includes what is vegetative and reproductive as well. It is possible that the loss of the *L. cuneifolia* reproductive structure by hail could be similar to that destroyed by fire as mentioned by Hoffmann (1998) to which he assigns a negative impact over reproduction because of an immediate reduction.

In respect to renewal responses, not only of individual plants but of vegetation as well, Lyon (1976) studied renewal response after a fire and developed a cover curve establishing that after 5–6 years, it reaches 50% of the initial cover. In addition, this author indicated that the cause of fluctuations was due to precipitation, a possibility in the present study as well.

According to the function estimated ($r^2 = 0{\cdot}88$, $p < 0{\cdot}05$) the renewal time was about 207 (Fig. 1).

Conclusions

1. The renewal of the dry weight of the *Larrea cuneifolia* Cav. year's twigs after a severe hailstorm follows a function indicating that after 207 days, during a

period of maximum vegetative growth and with favorable precipitation, it regains the initial recovery in dry weight of this year's last apical 40 cm of the *L. cuneifolia* branches.

2. The renewal curve of the vegetal cover or of plants generally speaking is an intrinsic response and each one will have its own renewal curve.
3. The renewal curve of the dry weight is of great value when recovering from man-induced or natural phenomena (overgrazing, fire, hail, frost, etc.) as they aid in knowing the real situation of the species on the terrain, and to suggest patterns for their better management and/or conservation.

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