Grazing starting time in *Neonotonia wightii* under irrigation conditions

T. E. Ruiz, G. Febles and G. Bernal

Instituto de Ciencia Animal, Apartado Postal 24, San José de las Lajas, Mayabeque, Cuba

Email: teruizv@ica.co.cu

Four grazing starting times (6, 7 ½, 9 and 10 ½ months after sowing in September) were evaluated in a pure *Neonotonia wightii* cv Tinaroo (glycine) grassland using a random block design with four replications, under irrigation conditions during the dry season. Instantaneous stocking rate of 38 LCU/ha/d with a rotation interval of 35 and 49 d was used for the rainy and dry seasons, respectively, with occupation times of two and three days per season. In the first rotation it was shown that the lowest grass height was shown by the most delayed grazing starting time ($P < 0.001$). However, the highest legume and total yield was attained at 6 and 10 ½ months ($P < 0.001$). In the last rotation, the lowest grassland height, as well as total and glycine yield, was the starting time of nine months ($P < 0.001$). The highest values were attained with the treatment at 7 ½ months. On concluding the first grazing year, the starting time at six months did not produce damages to the legume grassland, since there were no differences for weed yield and presented the highest values of glycine ($P < 0.01$). At the ending of the experiment, when all treatments had the same number of rotations, there was no effect of the studied grazing starting times regarding weed yield. For glycine, the lowest yield was for six months ($P < 0.01$). Concerning total yield, although the highest value ($P < 0.01$) was demonstrated for the 10 ½ month treatment, this had greater incidence of weeds. It is concluded that under irrigation conditions, productive grasslands of glycine, stables in time, can be attained when grazing starts 7 ½ months after sowing.

Key words: *Neonotonia wightii*, *establishment, grazing starting time, irrigation*

Studies developed by Ruiz and Febles (2001) during the 70's and the 80's of the XX century indicate that establishment is one of the most important stages for plant development and must include the necessary scientific and practical bases for using efficiently plant species and prolonging their useful life span, in function of animal feeding. Therefore, the establishment must be considered as an integrated system, involving sowing, seedling emergence, growth and early management of the plant element. This will influence on the necessary time for starting the exploitation of the areas.

The objective of this experiment was to study the time that must elapse between sowing and the grazing starting time to attain stability in the botanical composition and for obtaining adequate yields in glycine grasslands under irrigation conditions during the dry season.

Materials and Methods

Treatments and design. A random block design was used with four replications, represented by paddocks of 480 m^2 each for studying four grazing starting times in pure glycine grasslands. Treatments consisted of starting grazing at 6, 7 ½, 9 and 10 ½ months after sowing, in September, and under irrigation conditions during the dry season. The experimental units were 30 frames of 2 m^2 each, randomly distributed in each paddock. These were taken as net area.

Experimental procedure. The experiment was conducted in a red ferrallitic soil of good drainage, clayish and deep on limestone (Hernández *et al*. 1999), equivalent (Duran and Pérez 1994) to the sub-type rodic ferrallic cambisol (FAO-UNESCO), with plowing and two harrow disc pass preparation. The average temperature was approximately 24.16 º C. The warmest month was June with 26.3 ºC and the coldest January and February, with 20.4 ºC and 20.2 ºC, respectively. Maximum temperature attained up to 33 ºC in August and minimum of 5 ºC in January. Annual rainfall were in the order of 1300 mm the highest values in July (244.6 mm)[1].

Sowing was made in September, according to the methodology described by Ruiz (1982). An instantaneous stocking rate of 38 LAU/ha/d was used. The pasture rested 35 d in the rainy season and 49 in the dry season during nine rotations. The occupation times in each paddock were of two and three days in each season, respectively. During these periods, animals were maintained throughout the day and night in each paddock. Irrigation was by aspersion every two weeks. Availability, botanical composition, and leaf percentage were measured in each rotation. The first measurement was carried out by grass cutting at 20 cm height before each grazing. The botanical composition was by hand separation of the components, which were dried in an oven at 70 ºC for two days. Duncan's (1955) multiple range test was applied in the necessary cases.

Results and Discussion

In the first rotation of this experiment (table 1), the lowest grassland height was shown for the most extended grazing starting time ($P < 0.001$). Nonetheless, the highest legume and total yield was attained at 6 and 10 ½ months ($P < 0.001$). In the last rotation (table 1),

[1]Data from the Meteorological Station of the Institute of Animal Science.

the lowest grassland height, as well as total and glycine yield, was for the nine months of grazing starting time ($P < 0.001$). The highest values were achieved with the treatment at 7 ½ months.

On concluding the first grazing year, when all treatments had no similar number of rotations, it was demonstrated that when it started early there were no damages to the legume grassland, since there were no differences for weed yield. In addition, it showed the highest values of glycine ($P < 0.01$), if compared to more prolonged starting times (table 2).

At the end of the experiment (table 3), when all treatments had the same number of rotations and one year of grazing had elapsed, it was revealed that there was no effect of the grazing times studied on weed yield. While for glycine the lowest yield was for the six months grazing time ($P < 0.01$). In regard to total yield, although the highest value ($P < 0.01$) was obtained for the treatment of 10 ½ months, there was higher weed incidence.

According to Benedetti (2005), it must be considered that grassland management with legumes has received poor attention in Latin America and there is poor information on the effect of management on pasture dynamics, its stability, persistency and productivity.

In Cuba, studies carried out for laying down efficient

Table 1. Effect on yield of the grazing starting time after sowing

Grazing starting time, months	Number of rotations	Grazing month	Height, cm	Yield, t MS/ha	
				Total	Glycine
				First grazing	
6	9	March 15	42.06[b]	1.74[b]	1.69[b]
7½	8	April 30	40.67[b]	1.32[a]	1.29[a]
9	6	June 15	41.84[b]	1.28[a]	1.24[a]
10½	4	July 30	36.50[a]	1.60[b]	1.60[b]
SE ±			0.73***	0.08***	0.08 ***
				Last grazing	
6	9	March	39.19[b]	1.58[b]	1.50[b]
7½	9	April	38.39[b]	1.91[c]	1.88[c]
9	9	June	33.05[a]	1.20[a]	1.12[a]
10½	9	July	39.06[b]	1.65[b]	1.55[b]
SE ±			0.55***	0.09***	0.08***

[abc] Means with different superindices differ at $P < 0.05$ (Duncan 1955)
***$P < 0.001$

Table 2. Effect of grazing starting time after sowing on accumulated yield at the end of the first grazing year

Grazing starting time, months	Yield, t MS/ha		
	Total	Glycine	Weeds
6	11.80[a]	11.59[a]	0.20
7 ½	10.45[b]	10.25[b]	0.19
9	9.43[c]	9.18[c]	0.16
10 ½	8.09[d]	7.86[d]	0.22
SE ±	0.20 **	0.19**	0.08

[abcd] Means with different superindices differ at $P < 0.05$ (Duncan 1955)
**$P < 0.01$

Table 3. Effect of grazing starting time after sowing on accumulated yield

Grazing starting time, months	Yield t MS/ha		
	Total	Glycine	Weeds
6	11.80[a]	11.51[a]	0.20
7 ½	12.29[a]	12.15[ab]	0.24
9	12.47[a]	12.23[b]	0.23
10 ½	13.23[b]	12.81[b]	0.42
SE ±	0.24**	0.23**	0.09

[ab] Means with different superindices differ at $P < 0.01$ (Duncan 1955) **$P < 0.01$

establishment technologies with tropical legumes, no matter if they are creeping or shrub-like, have given great importance to the phase corresponding to the grazing starting time after sowing (Ruiz and Ayala 1987, Ruiz *et al*. 1988 and Ruiz *et al*. 2007).

Studies conducted at CIPAV (2009) indicate that it is necessary to consider that after plant sowing a reasonable period is required for its complete establishment. This time is essential for a good development of roots, stem and foliage. Therefore, the plant must not be harvested or grazed before reaching the optimum stage.

On analyzing integrally the results of this paper, the application of irrigation in glycine sowing during the dry season in the establishment stage had a positive effect at grazing starting time after sowing at 7½ months. In this way, a 1½ month lead for the exploitation of these areas was attained. Ruiz *et al*. (1987) reported as best time at nine months, but under non-irrigation conditions. Thus, the exploitation will be started at the end of April of the following year after sowing. In this way, the utilization of sown areas was attained in a productive and anticipated way, without glycine impairment.

It is reaffirmed that grazing starting is an indicator of importance, since if it is carried out in an anticipated way or it is too much extended could negatively influence on the useful lifespan of the grassland. According to Greenwood and Mckenzie (2001), overgrazing could occur when animals cause damages to the grassland, on decreasing the regeneration capacity of the pasture through the removal of the soil protective vegetation. This causes the grassland loss and, thus, weed invasion is facilitated. On the contrary, according to the criteria of Topall (2001), when grazing is very light, an excess of residual biomass is produced that can propitiate the proliferation of undesirable plants. Ruiz and Ayala (1987) and Ruiz *et al*. (1988) arrived at similar considerations. Also, Benedetti (2005) states that fixed management system do not respond to environment changes and can result in overgrazing or undergrazing and, as consequence, in an inadequate system that decisively influences on the maintenance of the legume-grass balance.

In research studies carried out by Reyes *et al*. (1993), on studying how the starting time in grassland exploitation intervenes and in its development and stability, it is referred that this factor influences on greater density of growth points that made contact with the soil. Also, grazing allowed the formation of new shoots by removing the plant cover.

The fact that there were no differences between weed levels in each treatment, could be an indicator of the good development of the legume, favored also by the humidity condition it had during the dry season. It must be added that early grazing, when realized adequately, avoids creeping legumes, such as glycine, climbing in weed plants or grow above these diminishing rooting of these legumes. This affects the productive life of these plants in time. In addition, grazing makes the animal eats the weed plants present. This is not achieved when the time of the first grazing is prolonged, since these plants age and are, thus, less desirable for the animal and also produce seed that is incorporated to the soil, resulting negative for the future stability of the grassland.

Días-Filho (1990) indicates that when vigorous grasslands are achieved, the physical spaces that are ideal for the germination of weed plant seeds can be reduced.

It is concluded that under irrigation conditions it can be attained productive and stable in time glycine grasslands when grazing starts at 7½ months after sowing.

Acknowledgements

Thanks are given to Dr. Verena Torres and to the technician Lucía Sarduy from the Department of Biomathematics of the Institute of Animal Science for the analysis of the information presented in this paper.

References

Benedetti, E. 2005. Leguminosas na producto de rumiantes nos trópicos. EDUFU- Editora da Universidade Federal de Uberlandia. Brasil. p. 41

CIPAV 2009. Sistemas silvopastoriles: establecimiento y manejo. In: Proyecto enfoques silvopastoriles integrados para el manejo de ecosistemas. Ed. E. Murgueitio. Cali. Colombia

Dias-Filho, M.B. 1990. Plantas invasoras em pastagens cultivadas da Amazonia: estrategias de manejo e controle. Belem: EMBRAPA-CPATU. Documnetos 52:103

Duncan, D.B. 1955. Multiple ranges and multiple F. test Biometrics 11:1

Duran, J.L. & Pérez, J.M. 1994. Correlación de la clasificación genética con otros sistemas de clasificación. Primera conferencia de clasificación de los suelos. La Habana, Cuba. p. 21

Greenwood, K. L. & Mckenzie, B.M. 2001. Grazing effects on soil physical properties and the consequences for pastures: a review. Aust. J. Exp. Agric. 41:1231

Hernández, A., Pérez, J.M. & Bosch, O. 1999. Nueva versión de clasificación genética de los suelos de Cuba. Instituto de Suelos. AGRINFOR- MINAG. Cuba. p. 64

Reyes, F., Hernández, M., Rodríguez, O. & Cárdenas, M. 1993. Estudio del comportamiento agronómico de *B. purpurascens*. III. Momento de iniciar la explotación. Pastos y forrajes. Vol. 16. No. 3

Ruiz, T.E. 1982. Estudios sobre el establecimiento de *Glycine wightii*. PhD Thesis Universidad Agraria de La Habana "Fructuoso Rodríguez Pérez". La Habana, Cuba

Ruiz, T.E. & Ayala, J. R. 1987. A study on *Neonotonia wightii* stablishment. VI. Effect of the start of grazing. Cuban J. Agric. Sci. 20:93

Ruiz, T.E., Febles, G., Díaz, H., Méndez, E. & Díaz, J. 2007. Time to start grazing after the sowing of multiple associations of creeping legumes and *Panicum maximum*. Cuban J. Agric. Sci. 41:77

Ruiz, T.E. & Febles, G. 2001. Algunas valoraciones conceptuales sobre el establecimiento de las leguminosas en el trópico. I Foro Latinoamericano de Pastos y Forrajes. Instituto de Ciencia Animal. La Habana. Cuba. [CD-ROM]

Ruiz, T.E., Febles, G., Cobarrubia, O., Díaz, L.E. & Bernal, G. 1988. Plant height as a critérium for grazing *Leucaena leucocephala* after sowing. Cuban J. Agric. Sci. 22:215

Ruiz, T.E., Febles, G., Jordán, H. & Castillo, E. 2005. Legumes: their possibilities to implant sustainable cattle systems. Cuban J. Agric. Sci. 39:485

Topall, O. 2001. Effet de la défoliation et des caractéristiques du milieu sur la dégradation des peuplements fourragers en région de frontiére agricole amazonienne. Region de Maraba, Para, Brasil. p. 221

Received: September 15, 2013