Resumen

La cebadilla criolla y la cebadilla intermedia son especies con una significativa producción de forraje de una elevada calidad nutricional. La diferencia en longevidad que existe entre ambas especies origina también diferencias del momento en que expresan su mayor potencial de producción forrajero. La cebadilla criolla tiene alta producción durante el primer año, es una especie anual o bianual, y este carácter depende del manejo de pastoreo a que fue sometida el primer año así como de la severidad de las condiciones ambientales durante el verano siguiente. La cebadilla intermedia persiste en el cultivo por más de un año aunque su producción es más baja durante el año de implantación, por lo cual no resulta conveniente sembrarla como única gramínea en la pastura. Por el contrario, la mezcla de ambas especies ofrecería la ventaja de una oferta más balanceada de forraje durante la vida útil de la pastura.

Con el objeto de evaluar el crecimiento de la cebadilla criolla y la cebadilla intermedia, en distintas etapas de su desarrollo y el efecto de la disponibilidad de nitrógeno (suministrado como fertilizante o a través de una asociación con alfalfa) o del agua en el rendimiento, la dinámica de las macollas y la calidad del forraje, se plantearon un ensayo en el invernáculo y dos en el campo.

El primer ensayo se realizó en condiciones semicontroladas, con plantas de cebadilla criolla y cebadilla intermedia. Se midió el contenido de agua del suelo, el potencial agua foliar, el contenido relativo en agua, la conductancia estomática, la dinámica de macollas y el rendimiento de materia seca. Los parámetros agua en suelo y planta en la cebadilla criolla e intermedia dieron valores similares para el mismo tratamiento. El rendimiento de materia seca total de ambas cebadillas fue de 2414 y 2431 g m^{-2} en la criolla e intermedia, respectivamente sin déficit de agua y promedió para ambas cebadillas con déficit de agua 1164 g m^{-2}. No hubo diferencias significativas en el número de macollas totales de cada cebadilla sin déficit de agua en cada fecha de medición, con déficit de agua el número total de macollas fue mayor en la cebadilla intermedia en la primera y segunda fecha de medición.

Uno de los ensayos a campo, realizado en Argerich, se efectuó en una pastura en el primer año y medio de su implantación. La pastura estuvo constituida por una mezcla de cebadilla criolla y cebadilla intermedia, en la que se usaron dos niveles de nitrógeno (0 y 77 kg N ha^{-1}(1,5 año)$^{-1}$) y una tercera alternativa en la que la mezcla de gramíneas se asoció con alfalfa. En los tres tratamientos se emplearon dos niveles de disponibilidad de agua.

En el otro ensayo a campo, realizado en Pasman, se hizo durante tres años con pasturas puras de cebadilla criolla, cebadilla intermedia y falaris bulbosa, bajo dos niveles de nitrógeno (0 y 150 kg N ha^{-1} año^{-1}). El ensayo se condujo en secano.

En ambos ensayos se evaluaron entre otros la densidad, la altura y la longitud de lámina verde de las macollas, y el rendimiento de materia seca. En el ensayo de Argerich también se determinó la calidad del forraje.

En el ensayo en Argerich el mayor número de macollas se tuvo en las parcelas fertilizadas con nitrógeno, seguida por las sin fertilizar y el menor número se observó en la asociación con alfalfa, esto ocurrió tanto con riego como sin riego. Con nitrógeno hubo un incremento en el número de macollas del 32,7% respecto al tratamiento sin nitrógeno incluyendo todas las fechas de medición. El riego aumentó el número de macollas en un 18,9%, promedio para todos los tratamientos y fechas de medición.

La altura y la longitud de lámina verde aumentaron con la fertilización con nitrógeno, tanto en Argerich como en Pasman, y lo mismo con riego en Argerich. Se observó una mayor supervivencia de macollas en el tratamiento no fertilizado de Argerich.

En Argerich con riego se tuvo un aumento en el rendimiento de 28,6%, promediando todos los tratamientos y fechas de corte. Con la fertilización con nitrógeno se tuvo un incremento del 26,2%, respecto al no fertilizado, considerando todas las fechas de corte. En la asociación con alfalfa se tuvo un rendimiento 44% mayor que en el fertilizado con nitrógeno. El rendimiento de la asociación para todo el período estudiado fue de 11.300 y 9.100 kg ha^{-1} con y sin riego, respectivamente.

Las tasas de crecimiento más altas se tuvieron en la asociación con alfalfa regada, para todas las fechas de corte. En los distintos tratamientos las mayores tasas de crecimiento se tuvieron en la fecha de corte de comienzos de enero.

En el primer y segundo año del ensayo de Pasman, el rendimiento de la cebadilla criolla excedió el de las otras dos especies. El rendimiento de la cebadilla intermedia fue siempre el menor.

El rendimiento promedio de los tres años de falaris bulbosa fue el mayor, 7.700 kg ha^{-1} $año^{-1}$ para el tratamiento fertilizado y el menor rendimiento fue el de la cebadilla intermedia sin fertilizar, 5.700 kg ha^{-1} $año^{-1}$. El rendimiento de falaris bulbosa en el tercer año fue significativamente mayor que los de cebadilla criolla y cebadilla intermedia. La respuesta al nitrógeno fue de un incremento del rendimiento de 35,2%, promediando las especies y los tres años de ensayo.

Los niveles de proteína bruta fueron mayores en los tratamientos con riego y con fertilización nitrogenada, respecto de los no regados y no fertilizados. En la asociación con alfalfa el nivel de proteína bruta de las gramíneas asociadas fue mayor que en el tratamiento no fertilizado.

La digestibilidad *in vitro* de las gramíneas fue ligeramente mayor en la asociación con alfalfa respecto al tratamiento no fertilizado.

El rendimiento de MS de las gramíneas aumentó significativamente con la fertilización y la disponibilidad total fue mayor cuando el forraje producido incluyó el aporte de la alfalfa. La asociación de ambas gramíneas con alfalfa provocó un mayor rendimiento de forraje total, aun si se compara con un aporte de 44 kg ha^{-1} de N. Asimismo la asociación provocó un

incremento en el contenido de N y en la digestibilidad del forraje lo cual tiene implicancias positivas sobre la producción animal.

Abstract

Bromus catharticus and *Bromus parodii* are species with a significant production of forage of high nutritional quality. The difference in longevity between the two causes differences at the time that express their full potential forage production. *B. catharticus* has high production during the first year, it is an annual or biennial species, and this character depends on the grazing management in the first year and the severity of environmental conditions during the following summer. *B. parodii* persist for more than a year but its production is lower than in *B. catharticus* during the first year, so these species are not appropriate as the only grass in the pasture. By contrast, the mixture of both species should have the advantage of a more balanced supply of forage during the lifetime of the pasture.

In order to evaluate the growth of *B. catharticus* and *B. parodii* or a mixture of both bromus at different growth stages of their development, the effect of nitrogen (supplied as fertilizer or through an association with alfalfa) and water availability on yield, tiller dynamics and forage quality, three experiments were done, one in the greenhouse and the other two in the field.

The first test was conducted in the greenhouse with *B. catharticus* and *B. parodii*. It was measured soil water content, leaf water potential, relative water content, stomatal conductance, the dynamics of tillers and dry matter yield. Soil and plant water parameters for *B. catharticus* and *B. parodii* showed, in general similar values under the same treatment. Total dry matter yield of *B. catharticus* and *B. parodii* were 2414 and 2431g m^{-2} without water deficit, respectively. With water deficit yield averaged 1164 g m^{-2} for both bromus. There were no significant difference in the number of total tillers of both bromus without water deficit. With water deficit the total number of tillers was greater in *B. parodii* in the first and second date of measurement.

One of the field trials was conducted in Argerich on a pasture in the first eighteen months of its implementation. The pasture consisted of a mixture of *B. catharticus* and *B. parodii* with two levels of nitrogen (0 and 77 kg N ha^{-1} $(1.5\ yr)^{-1}$ and a third alternative was used, the mixture of both bromus associated with alfalfa. In all cases there were used two levels of water availability. The other field trial was located in Pasman with *B. catharticus*, *B. parodii* and *Phalaris aquatica* grown under two nitrogen levels (0 and 150 kg N ha^{-1} yr^{-1}). In both trials were evaluated tiller density, height and total green lamina length and dry matter yield. In Argerich it was also determined forage quality.

In Argerich the largest number of tillers were in the plots fertilized with nitrogen, followed by the unfertilized and the lowest numberof tiller were in bromus associated with alfalfa, in both irrigated and nonirrigated treatment. With nitrogen there was an increase in the number of tillers of 32,7% compared to the treatment without nitrogen, considering all

measurement dates. Irrigation increased tiller number in 18,9%, average for all treatments and measurement dates.

Height and length of green leaf lamina increased with nitrogen fertilization in both Argerich and Pasman. There was greater survival of tillers in the unfertilized treatment than in the fertilized treatment of Argerich.

Irrigation in Argerich increased yield in 28,6%, averaged over all treatments and harvest dates. Nitrogen fertilization increased yield in 26,2%, compared to the unfertilized treatment. Association with alfalfa gave a 44% higher yield than the N fertilized treatment. The association gave a yield for the entire study period of 11.300 and 9.100 kg ha^{-1} with and without irrigation, respectively.

Highest growth rate were in the irrigated association with alfalfa, for all harvest dates. In each different treatment the highest growth rate was obtained at the beginning of January.

In the first and second year of the experiment in Pasman, yield of *B. catharticus* exceeded the other two species. Yield of *B. parodii* was always the smallest. In the third year, the production of *P. aquatica* was the highest and the average yield of the three years was largest in *P. aquatica* fertilized with 7.700 kg ha^{-1} yr^{-1} and the lowest yield was in *B. parodii* unfertilized, 5.700 kg ha^{-1} yr^{-1}. Nitrogen increased yield in 35,2%, including all species and three years.

Crude protein levels were higher in treatments with irrigation and nitrogen fertilization with respect to the nonirrigated and nonfertilized. In association with alfalfa crude protein level of the mixture of grasses was higher than in the unfertilized treatment.

In vitro digestibility of dry matter was slightly higher in the association with alfalfa compared to the unfertilized treatment.

The DM yield of grasses increased significantly with fertilization and total availability was greater when the forage produced included the contribution of alfalfa. The association of both grasses with alfalfa caused a greater total forage yield, even when compared with a contribution of 44 kg ha-1 of N. association also caused an increase in the N content and forage digestibility which has positive implications for animal production.

Certifico que fueron incluidos los cambios y correcciones sugeridas por los jurados.

Firma del Director: ……

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