Reciprocal recurrent selection in the breeding of *Brachiaria decumbens*

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Keywords: Apomixis, cultivar, intraspecific hybridization, signalgrass.

Introduction

Pastures of *Brachiaria decumbens* cv. Basilisk radically changed the scenario of livestock production in central Brazil in the early 1970s and in fact, promoted the development of this vast region. However, despite the reasonable biomass yields and nutritional value when grown on these tropical acid soils, its susceptibility to grassland spittlebugs has limited its use. The breeding of *B. decumbens* in Brazil has been restricted to interspecific crosses using cv. Basilisk as a pollen donor due to the lack of compatible sexual ecotypes within this species. Recently, the successful chromosome duplication of a sexually reproducing diploid accession produced 3 successful events (Simioni and Valle 2009), enabling intraspecific crosses. This paper reports the onset of the research to obtain superior apomictic hybrids in *B. decumbens* using reciprocal recurrent selection (RRS), a cyclic breeding strategy.

Methods

Four hundred and fifty-seven intraspecific hybrids, obtained from crossings between the 3 sexual plants artificially tetraploidized by colchicine, and the apomictic tetraploid cv. Basilisk, represented the base population of this work. The reproductive mode of these hybrids was determined by microscopic analysis of cleared ovaries (Young et al. 1979). A chi-squared test was performed on this population to verify whether the genetic segregation for apomictic to sexual plants fitted the expected model for a tetrasomic monogenic inheritance. The 80 F_1 sexual plants identified were crossed with cv. Basilisk in order to produce full-sib progeny (1st year of a RRS). For this, each sexual plant was vegetatively propagated and transplanted into a uniform pasture of cv. Basilisk. The sexual plants were spaced 5 m from each other to avoid crossing between them and to enhance crosses with the apomictic genitor. Besides natural crossing, manual crossings were also performed using pollen of the apomictic genitor onto flowers of the sexual plants. Inflorescences were bagged and the seeds harvested 20 days after pollination.

Seeds were harvested on each sexual plant and germinated in the greenhouse. The seedlings were planted in the field in December 2012, and will be evaluated for agronomic traits, nutritive value and resistance to spittlebugs during the 2013 growing season (3 cuts every 35 days in the rainy season; 1 cut in the middle and 1 at the end of the dry season) as the 2nd year of RRS. The progeny will be selected using a selection index, which will take into account information for all traits evaluated. The recombination of selected sexual progeny will be done in the third year, in a crossing block comprising only the sexual plants that gave rise to these selected progeny. Seeds will be harvested and a new improved sexual population produced to start the next cycle of selection. At the end of the second year, superior hybrids with high performance will be identified. If these hybrids are apomictic, they can enter the hybrid evaluation program as candidates for a new cultivar (Figure 1).

Results and Discussion

Of the 457 hybrids in the base population, 153 were subjected to characterization of their mode of reproduction. Of these, 80 were sexual and 73 apomictic, a proportion of apomictic to sexual plants not significantly different from the 1:1 ratio ($P>0.05$) (Table 1). This result corroborates the proposed hypothesis of a single dominant gene controlling apomixis (Valle and Savidan 1996).

Crossings between the 80 sexual tetraploid plants and the apomictic cv. Basilisk were performed in a crossing block scheme to obtain full-sib progeny. The percentage

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of filled seed ranged from 0.0% to 20.7% across sexual plants, with an average of 3.96%, showing that the percentage of filled seeds produced by artificial crossing was very low in intraspecific *B. decumbens* crosses. These progeny are under evaluation in the field and will be selected for further recombination. In each selection cycle, superior apomictic hybrids will be identified to proceed to cultivar development. *B. decumbens* had never been bred before and only a single cultivar is available commercially.

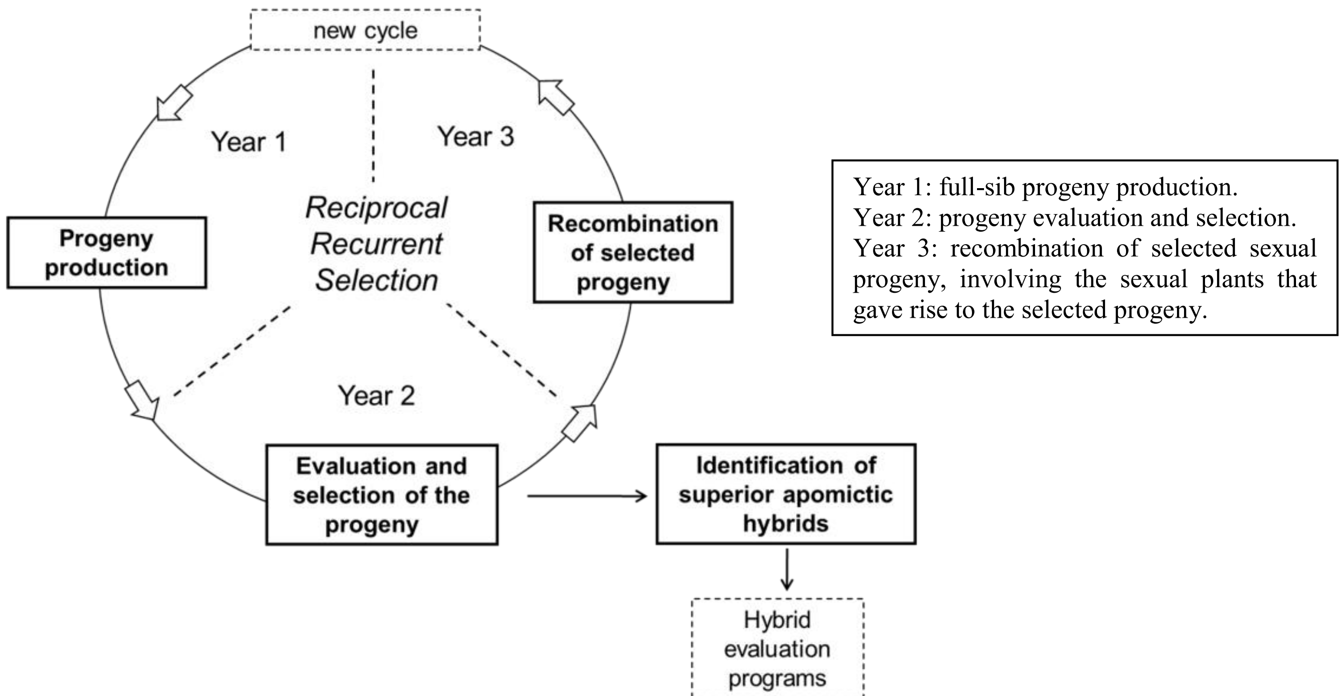

Figure 1. Reciprocal recurrent selection scheme in *Brachiaria decumbens* and relation with the hybrid evaluation programs underway at Embrapa Beef Cattle.

Table 1. Number of hybrids evaluated for mode of reproduction.

	Apomictic	Sexual	Total
Number observed	73.0	80.0	153.0
Number expected	76.5	76.5	153.0
χ^2 test: 0.32 (P > 0.05)			

Conclusion

The inheritance of apomixis in intraspecific crosses of *Brachiaria decumbens* has a monogenic control with the apospory allele dominant to sexuality, which is in agreement with other species of *Brachiaria*. The prospect of generating novel variability and selecting new cultivars is now a reality and should promote grassland diversification in the tropics where cv. Basilisk is already extensively and successfully used.

Acknowledgments

Authors are grateful to UNIPASTO and CNPq for financial support.

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Barrios SCL; Valle CB do; Alves GF; Simeão RM; Jank L. 2013. Reciprocal recurrent selection in the breeding of *Brachiaria decumbens*. Tropical Grasslands – Forrajes Tropicales 1:52–54.
DOI: 10.17138/TGFT(1)52-54

This paper was presented at the 22nd International Grassland Congress, Sydney, Australia, 15−19 September 2013. Its publication in *Tropical Grasslands – Forrajes Tropicales* is the result of a co-publication agreement with the IGC 2013 Organizing Committee. Except for adjustments to the journal's style and format, the text is essentially the same as that published in: **Michalk LD; Millar GD; Badgery WB; Broadfoot KM, eds. 2013. Revitalising Grasslands to Sustain our Communities. Proceedings of the 22nd International Grassland Congress, Sydney, Australia, 2013. New South Wales Department of Primary Industries, Orange, NSW, Australia. p. 209–210.**