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Breeding Strategies for *Brachiaria* spp. to Improve Productivity–An Ongoing Project

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Breeding strategies for *Brachiaria* spp. to improve productivity – an ongoing project

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Introduction

Two strategies have been used in the breeding of *Brachiaria* (syn. *Urochloa*) to produce new cultivars. The first involves exploring the natural variability existing in nature, which is the selection of ecotypes, mostly apomicts, from the diversity in germplasm banks. This strategy proved efficient originally and the cultivars in use in Brazil were derived in this way, but progress with this strategy is limited in the medium to long term.

The generation of novel variability through crossings is the alternative strategy to continue producing new improved varieties. This has been possible only through artificial chromosomal duplication of diploid and sexual *B. ruziziensis* and the fact that this species is cross-compatible with *B. brizantha* and *B. decumbens*, the 2 most important species for tropical pastures.

Crossings between species have been carried out at Embrapa Beef Cattle, Campo Grande, MS, Brazil, since 1988 (Valle *et al*. 1993, 1999, 2001, Resende *et al*. 2002). The initial success in obtaining interspecific hybrids in *Brachiaria* is indisputable and also helped establishing a practical methodology as well as allowing for the identification of apomictic parents with good combining ability. However, a comprehensive genetic improvement strategy to benefit from gains in quantitative characteristics associated with the majority of agronomic traits of economic interest in these species had not been started.

Therefore, 3 methodologies are being used for this purpose: reciprocal recurrent selection; intra-population recurrent selection; and directed crosses between sexual and apomictic plants. The last 2 strategies are already underway and the strategies for agronomic evaluations are reported here.

Methods

Intra-population Recurrent Selection

Twenty one sexual progeny from the agronomic evaluation of an experiment involving 1000 individuals were re-combined. The mode of reproduction was confirmed prior to planting to make sure all plants were sexual. The planting was done in December 2011, using previously prepared cuttings placed in an intercrossing area (Fig. 1a) arranged in randomised blocks, with 8 replicates and square plots of 1 m x 1 m. This area was isolated physically and spatially to avoid external pollen contamination from apomictic plants. In addition, periodic maintenance of the crossing and surrounding areas was performed to eliminate possible compatible signal grasses, different from those that were being recombined.

Two harvests of seed were performed: second week of April; and first week of May 2012; and the half-sib progeny produced are now being evaluated in replicated plot experiments (Fig. 1b). The dormancy of seed was broken

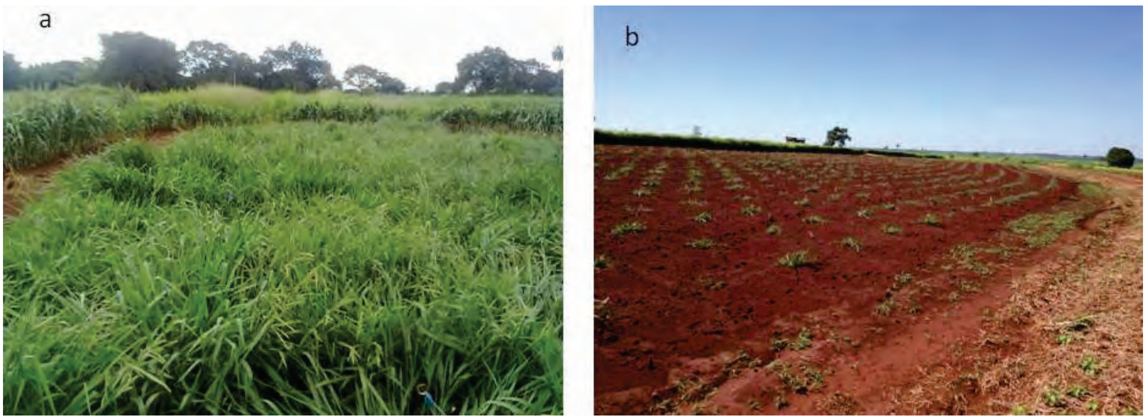

Figure 1. (a) Intrapopulation crossing block; (b) spaced plant half-sib progeny to evaluate individual plant performance

and seeds were germinated in plastic tubes of 280 cm3 in October 2012. For each progeny, 108 tubes were planted. After 75 days, 50 plantlets of each progeny were transplanted to the field in an experiment arranged in randomised blocks with 10 replicates; each plot contained 5 plants, spaced 1.5 m between rows and 1.5 m between plants within rows. In addition to the 21 progeny of half-sibs, 5 control varieties were used, resulting in 1300 plants, which will be evaluated individually for leaf dry matter production, culm dry matter, total dry matter, regrowth capacity and nutritional value.

Directed Crosses between Apomicts and Sexuals

Crossings between 5 apomictic parents – *Brachiaria brizantha* (cvv. Marandu and Paiaguás, and B4), *B. decumbens* (cv. Basilisk) and interspecific hybrid cv. Mulato II – and 4 sexual parents (BS09, BS15, HBGC336-T1 and HBGC336-T2) were made. These parents are divergent for characters of economic interest, such as: high productivity, resistance to spittlebugs, drought tolerance, tolerance of toxic aluminium levels and high nutritive value. The crossings were carried out both in the field and in the greenhouse, which resulted in successful production of all possible combinations. As for half-sibs, seed dormancy of these full-sib progeny was broken before seeds were germinated in tubes of 280 cm^3 at the beginning of October 2012. Again, 108 tubes per progeny were prepared. Seventy days after planting, the best 50 plantlets of each progeny were selected to be evaluated agronomically.

The experiment was arranged in randomised blocks with 10 replicates, each plot containing 5 plants, spaced 1.5 m between rows and 1.5 m between plants within rows. In addition to the 20 progeny of full-sibs, the 9 parents were planted as controls, resulting in 1450 plants, which will be evaluated for leaf dry matter production, culm dry matter, total dry matter, regrowth and nutritional value**.**

Discussion

The experiments were established between January 10 and January 16, 2013 so no harvests have been done. At least 7 harvests will be carried out (2 in the dry season and 5 in the rainy season) in order to select superior hybrids to continue breeding. It should be possible to estimate the number of half-sib progeny that are superior to the cultivars. In the case of full-sib progeny, in addition to the superiority in relation to parent material, estimates of heterosis and combining ability will be determined.

In both groups of progeny, after selection for leaf dry matter production, total dry matter production, leaf:stem ratio, regrowth and nutritional value, the progeny will be subjected to selection for biotic (spittlebugs) and abiotic (drought and flooding tolerance) stresses.

Conclusions

The sexual progeny selected by these strategies will be used to continue the intrapopulation recurrent selection program. Among the full-sibs, it is expected that half will be apomictic and the superior genotypes will be candidates for new cultivars.

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