# Potential sources of sexuality in *Cenchrus ciliaris* L.: Seed fertility, environment and its implication in plant breeding

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**INTRODUCTION:** The demand for new germplasm in warm-season forage species has increased substantially over the last decades. Buffel grass (*C. ciliaris* L.*)* is an aposporic and pseudogamous apomictic species, and fully sexual plants are very rare or absent. Highly sexual facultative apomictic plants (HSFAs) obtained at the IFRGV (CIAP-INTA) represent an alternative to carry out controlled crosses in the Buffel grass breeding program. Therefore, fertility is considered a character of interest for selection of maternal sources. This trait, based on the seed production under self and open pollination, seems to be influenced by environmental factors.

**OBJECTIVES:** 1) To compare seed fertility of four HSFAs, 2) to determine the moment of maximum cross fertility, and 3) to determine the influence of bioclimatic variables on the expression of fertility in the HSFAs.

**MATERIALS AND METHODS:** The HSFAs were agamically divided and transplanted during late spring in an isolate plot under a nylon cover structure, in a completely randomized design with three replications (agamic clones) at experimental area of the IFRGV (31, 47°S, 64, 15°W, Córdoba, Argentina). Four HSFAs were analyzed: the introduced sexual clone (Sx), one selfing (S1) plant of Sx, and two F1 plants: 32/9 y 191. Fertility was estimated as Nº caryopses/Nº spikelets per panicle (considering each panicle one experimental unit), in three panicles/HSFA, considering two pollination methods (OP: open and SP: self-pollination) at three flowering times: beginning (BF), flowering peak (FP) and end of flowering (EF) during three years. Selfed seed set was obtained by enclosing panicles, prior to stigma exertion, in acetate tubes. Due to the protogynous flowering behavior of buffel grass, open pollinated seed set was accomplished by labelling immature inflorescences prior to stigma exertion, which were exposed to foreign pollen. At maturity, the panicles were individually harvested and threshed. To determine the potential environmental influence on the seed fertility expression, bioclimatic variables (thermal time, photoperiod, accumulated radiation and precipitations) were recorded ten days before panicles were labelled (OP or SP) to harvest (cycle duration). An exploratory Principal Component Analysis (PCA) was carried out with the variables: bioclimatic, fertility, genotype, pollination method, flowering time, and cycle duration. Also, a mixed generalized linear model (MLGM) was fitted with binomial distribution and logit link function, taking into account the correlation among panicles from the same HSFA clonal plant and using the bioclimatic variables as covariates, with statistical software InfoStat.

**RESULTS:** The biplot resulting from the PCA explained 88.7% of the total variability. The PC1, which explained 56.5% of the total variability, allowed to differentiate flowering times. The first two flowering times (BF, FP) were associated with the bioclimatic variables accumulated radiation, photoperiod, thermal time and accumulated precipitation, and they were opposite to the cycle duration and fertility. The variability explained by the PC2 was 32.2%; it allowed differentiation of HSFAs by the pollination method applied on the panicles. High variation was observed among HSFAs under OP; three of them (Sx, 32/9 and 191) were more fertile at FP. In contrast, all four HSFAs under SP at FP were associated with a greater accumulated radiation. All of the HSFAs under SP showed lower fertility values than under OP at all flowering times considered, and they were less self-fertile at FP. The MLGM and DGC test results validated the PCA. The HSFAs showed different fertility expression, under different pollination methods and flowering times and were influenced by environmental conditions ($p$-value $\leq 0.05$). Highest fertility was detected in HSFAs Sx, 32/9 and 191 under OP conditions and mainly at the time of maximum flowering.

**CONCLUSION:** The HSFAs Sx, 32/9 and 191 under OP conditions at FP time would be the most promising genotypes to be pollinated to achieve the highest efficiency in hybridizations.