# Effects of Selection for Seed Size on Grazing-Type Population of an Inter-Specific Hybrid (*Pennisetum purpureum* × *P. glaucum*)

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**The XXI International Grassland Congress / VIII International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.**

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

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**Key words:** *Pennisetum purpureum* × *P. glaucum*, seed size selection, grazing-type population

**Introduction** The original inter-specific hybrid *Pennisetum purpureum* × *P. glaucum* was a cross-pollinated population quite variable as to morpho-agronomic, forage and seed traits (Schank *et al.*, 1996). Recurrent selection was able to significantly increase seed physical purity and phenotypical uniformity of resulting populations-cutting and grazing types (Usberti *et al.*, 2005). However, little is known about the behavior of seed size during the selection process, which might be very useful for the development of new cultivars, and it is the main purpose of this research work.

**Materials and methods** A grazing-type population was scored as to its seed size frequencies (SSF), during the 2006 growing season. Seed samples were picked up, seed physical purities (SPP) and numbers of intact seeds/gram (NIS) scored for all individual plants. Separation of large, intermediate or small seed size was carried out, based on mean standard deviations-MSD (large and small seeds identified whenever NIS, in the sample, was one MSD below or above the average, respectively and intermediate size ones in the interval). The original population was split into two sub-populations (P-8 and P-M), each one carrying large and small seed-sized progenies, which were sown in isolated plots. In the 2007 growing season seed samples were again picked up from all individual plants of the selected sub-populations and scored for SSP, NIS and numbers of chemically scarified (treatment with $H_2SO_4$, 10) seeds/gram (NSS); seed size frequencies (SSF) were also determined. Finally, linear correlations between the cited seed traits were estimated.

**Results and discussion** Selection for seed size caused significant changes on SSF of the resulting sub-populations. Intermediate SSF increased in all cases, mostly at the expense of a remarkable reduction of large SSF, small SSF remaining constant (Table 1). Clearly, there might be some sort of stabilizing selection in action, which favors the occurrence of medium-sized seeds. Estimated linear correlations between SPP and NIS, NSS (Table 2) have shown high and negative values as well as high and positive NIS × NSS correlations, for most of the selected sub-populations. So, there is a strong trend that the higher the NIS or NSS (small seeds), the smaller the SPP, and vice versa for large seeds. It suggests that an individual plant has a limited amount of energy allocated to reproductive activities, which becomes unable to produce whole seeds whenever occurs a higher amount of them (high production of empty seeds). Finally, the evolution of SPP, NIS and NSS after two selection cycle (Table 3) seems to be based on an overall reduction of seed size (significant increases in NIS and NSS in all cases, but much more pronounced on the last ones). On the other hand, mild decreases in SPP were observed in large seed sub-populations (19.4%, on the average) but severe ones in small seed sub-populations (47.4%, on the average). The same principle of energy allocation might explain these results.

**Table 1** *Seed size frequency distributions observed on the original and desired grazing-type* Purpureum *x* P. glaucum *populations.*

| Population | Growing Season 2006 Intact Seed Size Frequency (%) | | | | | |
|---|---|---|---|---|---|---|
| | Large | | Intermediate | | Small | |
| Original Grazing Type | 39.4 | | 48.8 | | 11.8 | |
| | Growing Season 2007 Seed Size Frequency (%) | | | | | |
| | Intact Seeds | | | Scarified Seeds | | |
| P8-LS | 8.3 | 79.2 | 12.5 | 8.3 | 83.8 | 8.3 |
| P8-SS | 5.9 | 77.7 | 16.4 | 12.9 | 69.5 | 17.6 |
| PM-LS | 20.4 | 68.7 | 11.3 | 11.3 | 75.0 | 13.7 |
| PM-SS | 12.6 | 71.0 | 16.4 | 17.7 | 71.0 | 11.3 |

Observations: P8 and PM = Selected populations; LS = Large seed; SS = Small seed

**Table 2** *Estimated linear correlations between seed physical purity (SPP) and number of intact and scarified seeds / g (NIS/g and NSS/g) observe in selected grazing-type populations of* Pennisetum purpureum × P. glaucum.

| Population | SPP× NIS/g | SPP× NSS/g | NIS/g× NSS/g |
|---|---|---|---|
| P8-LS | -0.54 | -0.57 | 0.69 |
| P8-SS | -0.54 | -0.64 | 0.57 |
| PM-LS | -0.74 | -0.64 | 0.6 |
| PM-SS | -0.23 | -0.04 | 0.30 |

Observations: P8 and PM = Selected grazing-type populations; LS = Large seed; SS = Small seed

**Table 3** *Seed physical purity (SPP) and number of intact and scarified seeds / gram (NIS/g and NSS/g) recorded on four selected populations of grazing-type hybrids of* Pennisetum purpureum × P. glaucum *in two consecutive growing seasons (2006 and 2007)*

| Population | Growing Season | | | | | |
|---|---|---|---|---|---|---|
| | 2006 | | | 2007 | | |
| | SPP | NIS/g | NSS/g | SPP | NIS/g | NSS/g |
| Original P8 | 68.9 | 323.1 | 449.4 | - | - | - |
| P8-LS | 67.2 | 226.4 | 377.6 | 57.8 | 308.5 | 453.8 |
| P8-SS | 64.2 | 374.4 | 535.5 | 33.8 | 461.6 | 748.1 |
| Original PM | 66.1 | 322.2 | 479.4 | - | - | - |
| PM-LS | 66.6 | 307.7 | 368.5 | 50.0 | 338.0 | 556.7 |
| PM-SS | 61.9 | 343.3 | 619.2 | 32.6 | 450.6 | 1041.5 |

Observations: P8 and PM = Selected grazing-type populations; LS = Large seed; SS = Small seed

**Conclusions** Selection for seed size significantly affects its frequencies of the resulting populations, with predominance of medium-size seeds. It has also been observed a marked trend of seed size reduction during the selection process (significant increases of numbers of intact and scarified seeds) along with drastic reduction of seed physical purities in small seed size populations. It can be suggested, in similar selection schemes, the choice of genetic materials with medium-size seeds, to avoid undesirable fluctuations in expected seed productions.

## References

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