FLOWERING CYCLE-RELATED SEED QUALITY PARAMETERS ON 15 NEW GUINEAGRASS (*PANICUM MAXIMUM* JACQ.) HYBRIDS

R. Usberti [1]; J. A. Usberti, Jr. [2] and R. S. Paterniani [3]

[1] Central Seed Testing Laboratory, DSMM-CATI, Campinas, Brazil. P.O. Box. 1291

[2] Genetics Department, Instituto Agronomico, Campinas, Brazil. P.O. Box. 28

[3] Campinas State University - (UNICAMP) - Brazil

ABSTRACT

Fifteen new guineagrass (*Panicum maximum* Jacq) hybrids, widely variable in flowering cycles, were tested for eleven seed quality parameters: seed viability (tetrazolium)-TZ; normal germination (with and without previous chemical scarification)-TG and NG; presence of viable seeds after the germination tests- RSTG and RSNG; seed dormancy-DTG and DNG; germination rate-TGR and NGR and seed vigor (after accelerated aging test) -AATG and AANG. The genetic materials used presented no significant differences for tetrazolium seed viability. Late- and intermediate-flowering genotypes showed the highest correlations between flowering cycle and seed quality for TG, NG, TGR and NGR (r= 0.468**; 0.731**; 0.422* and 0.683**, respectively) while very early- and early-flowering ones had correlations for DTG and DNG of r= -0.473** and -0.758**, respectively. Erratic hybrid performance was observed as to AATG and AANG seed vigor, with low (r= 0.360*) or no correlation (r= -0.033^{ns}) with flowering cycle, respectively. Chemical scarification showed no effects on late- and intermediate-flowering hybrids (low seed dormancy) but markedly increased seed germination on early- and very early-flowering ones (high seed dormancy). The tetrazolium test was a reliable and efficient method to estimate seed viability potential. These results may be of great importance for laboratory tests as well for trading and sowing operations.

KEYWORDS

seeds, germination, percentage, rate, dormancy, accelerated aging, viability

INTRODUCTION

Guineagrass is often utilized to establish forage fields in Brazil, mainly on medium and high fertility soils. The success of trading and sowing operations are highly dependent on the previous knowledge of several seed quality parameters, mainly seed dormancy and vigor. Different cultivars/ecotypes have shown marked differences for these seed quality parameters. As a consequence, most of the papers on guineagrass seed quality are concentrated on seed storage and dormancy (Harty et al., 1983; Matias and Bilbao, 1985; Hopkinson, 1993; Gonzales and Mendoza, 1994) and few on seed vigor (Usberti, 1982; West, 1993). All of them are restricted to specific cultivars and/or ecotypes (Hopkinson and English, 1985; Matias et al., 1992), not taking into account their flowering cycles. The main objective of this research work was to detect possible correlations among flowering cycle and seed quality parameters, which might be important in laboratory tests as well as in trading/sowing operations.

MATERIALS AND METHODS

Seeds harvested from fifteen new guineagrass hybrids, with a wide spectrum of flowering cycles, were analyzed as to several seed quality parameters. At first, fresh seeds were kept at 35% relative humidity and 18°C for 7 days, followed by a 3 day-period on silica gel at 25°C in order to slowly reduce the moisture content to about 10% . Seed viability was estimated by tetrazolium test (4x50 pure seeds, at 0.2% solution). Germination tests were performed in two 4x100 pure seed samples, using untreated and scarified seeds (concentrated H_2SO_4 for 5 minutes) and countings at 6, 8, 10, 14, 21 and 28 days (ISTA, 1985 a,b). Seed vigor was detected through accelerated aging test during 36 hours at 43°C, followed by normal germination test (Usberti, 1982). Germination rates of treated and untreated seeds were calculated using Kotowski's method (1926). Seed dormancy was estimated by the expression DTG or DNG = TZ - (TG or NG). Remaining viable seeds, after germination and vigor tests, were detected through tetrazolium test. Data from randomized complete block design experiments (three replicates each one) were analyzed in an ANOVA computer software and seed parameter means compared using Duncan's multiple range test. Simple correlations were estimated among flowering cycle and all the seed parameters studied.

RESULTS AND DISCUSSION

Seed quality data is shown in Table 1. Hybrids showed no significant differences for fresh seed viability (average around 88%), confirming the positive effect of slow drying to achieve the highest seed quality (Hopkinson et al., 1988). Germination percentages for untreated seeds (NG) were statistically higher in late- and intermediate-flowering hybrids as compared to those of early and very early ones; the same trend was observed for scarified seeds (TG), with three exceptions: H-140, H-22 and H-42; therefore, a remarkable chemical scarification effect on increasing germination percentage average was detected (from 52.0% to 65.5%). The remaining viable seed measurements revealed that most of untreated seeds and a few of the scarified ones from early- and very early-flowering hybrids were still alive after the germination tests, agreeing with the results of Harty et al. (1983), even though the values were reduced by scarification. Seed dormancy values (DTG and DNG), calculated by the differences among seed viabilities (TZ) and germination percentages (TG and NG), showed that the late- and two of the intermediate-flowering hybrids (H-10 and H-13) had practically no seed dormancy, contrasting with the three other intermediate- (H-56, H-79 and H-55) and all early- and very early-flowering ones (high seed dormancy). Generally, the highest germination rates (TGR and NGR) were obtained on late- and intermediate-flowering genotypes. Finally, accelerated aging tests had contrasting effects, according to specific genotypes, sometimes lowering (expected results) and sometimes increasing germination percentages (unexpected ones). This could be explained by the releasing of seed dormancy by high temperature (43°C), which is harmful to quiescent seeds. Similar results were obtained on Pensacola bahiagrass seeds by West (1993).

There was a high and positive correlation between flowering cycle (FC) and untreated seed germination values (NG) (r= 0.731**) which was reduced by chemical scarification (TG) (r= 0.468*) (Table 2). Similar results were obtained as to remaining viable seed percentages (RSNG and RSTG) (r= -0.673** and -0.315*, respectively). Untreated seed dormancy (DNG) was high and negatively correlated with flowering cycle and the values were again reduced by chemical scarification (DTG) (r= -0.758** and -0.473*), respectively. The same trends were observed for untreated (NGR) and treated (TGR) seed germination rates, strongly correlated with flowering cycle (r= 0.683** and 0.422*, respectively). Vigor results (AANG and AATG) showed little or no correlation with flowering cycle (r= 0.360* and r= -0.033^{ns}, respectively). Therefore, it is quite evident that seed quality parameters in guineagrass are strongly affected by the genotype, explaining the discrepant results found in several papers.

Additionally, sulfuric acid scarification was not completely effective for releasing seed dormancy while the tetrazolium test showed to be a reliable and efficient method to detect guineagrass seed viability.

Moreover, the observed character correlations might be essential in the redefinition of seed testing methodology for this species and other tropical forage grasses.

REFERENCES

Gonzalez, Y. and F. Mendoza. 1994. Germination and viability of seeds of *Panicum maximum* cv. CIH-3 during storage. Pastos y Forrajes **17**: 131-135.

Harty, R.L., J.M. Hopkinson, B.H. English and J. Alder. 1983. Germination, dormancy and longevity in stored seeds of Panicum maximum. Seed Science and Technology **16**: 361-369.

Hopkinson, J.M. 1993. Tropical pasture establishment. 2. Seed characteristics and field establishment. Tropical Grasslands **27**: 276-290.

Hopkinson, J.M. and B.H. English. 1985. Immaturity as a cause of low quality in seed of *Panicum maximum*. Journal of Applied Seed Production **3**: 24-27.

Hopkinson, J.M., B.H. English and R.L. Harty. 1988. Effects of different drying patterns on quality of seed of some tropical pasture grasses. Seed Science and Technology **16**: 361-369.

International Seed Testing Association. 1985 a,b. International rules for seed testing. Rules 1985. Seed Science and Technology **13**: 299-513.

Kotowski, F. 1926. Temperature relations of germination of vegetable seeds. Proc. American Society of Horticultural Science **23**: 176-184.

Matias, C. and B. Bilbao. 1985. Effects of storage on seed germination of some tropical grasses. II. Storage under ambient conditions. Pastos y Forrajes **8**: 53-64.

Matias, C., M. Esperance and V. Ruz. 1992. Seed production and germination potential in *Panicum maximum* Jacq. Crosses and selections. Pastos y Forrajes **15**: 25-32.

Usberti, R. 1982. Accelerated aging test on guineagrass seeds. Revista Brasileira de Sementes **4**: 23-30.

West, S.H. 1993. Reducing dormancy in Pensacola bahiagrass. Journal of Seed Technology **16**: 1-8.

Table 1

Seed quality parameters recorded on 15 new guineagrass (*Panicum maximum* Jacq) hybrids in randomized complete block design experiment.

Hybrid	FCz		TZ	TG	NG	RSTG	RSNG	DTG	DNG	TGR	NGR	AATG	AANG
	days	ranking	(%)	(%)	(%)	(%)	(%)	(%)	(%)			(%)	(%)
H-12	215.7 ay	L	88,0 a	78.0 abc	84.4 a	2.0 cde	1.6 d	9.18 def	3.12 d	10.5 ab	11.5 ab	71.0 cd	57.3 e
H-21	214.8 a	L	89,0 a	84.4 ab	85.7 a	1.4 cde	1.0 d	4.53 efg	2.51 d	12.1 a	11.9 ab	77.8 bc	65.9 cde
H-38	214.3 a	L	94,0 a	85.1 ab	86.3 a	2.3 cde	3.6 d	6.20 defg	3.96 d	10.8 ab	9.1 bc	82.9 abc	53.7 ef
H-54	205.4 ab	L	87,0 a	77.3 abc	77.3 a	3.7 cde	4.7 d	6.75 defg	5.05 d	10.6 ab	7.7 c	82.4 bc	65.5 cde
H-64	198.2 b	L	82,0 a	57.0 de	73.4 a	9.3 bc	1.4 d	18.32 cd	4.50 d	6.6 c	8.8 bc	38.6 g	31.8 g
H-10	169.3 c	I	90,4 a	84.9 ab	88.3 a	1.2 cde	0.4 d	4.27 efg	2.56 d	13.1 a	13.6 a	74.4 bcd	83.8 b
H-13	139.4 d	I	88,2 a	86.3 ab	87.2 a	0.4 e	0.6 d	1.80 fg	0.96 d	12.4 a	12.0 ab	85.0 ab	77.1 bc
H-56	137.7 de	I	86,3 a	44.2 ef	30.4 b	29.5 a	48.3 b	42.04 ab	55.76 c	4.1 de	3.4 d	47.2 efg	37.6 g
H-79	132.1 ef	I	89,0 a	7.3 f	9.6 c	41.6 a	75.2 a	51.38 a	79.00 ab	2.8 de	0.7 e	55.3 ef	42.5 fg
H-55	127.4 fg	I	89,7 a	32.2 f	3.0 c	40.0 a	80.9 a	57.36 a	86.22 a	2.6 e	0.2 e	56.0 ef	63.3 de
H-140	123.4 gh	E	91,5 a	64.2 cd	37.9 b	8.0 bcd	36.3 bc	26.74 bc	52.36 c	8.4 bc	3.6 d	53.1 efg	75.9 bcd
H-22	118.4 hi	E	88,7 a	88.8 a	22.6 b	0.9 de	46.9 b	0.88 g	65.89 bc	13.2 a	2.0 d	92.6 a	92.9 a
H-42	115.2 i	E	89,3 a	73.7 bc	30.7 b	3.5 bcde	36.2 bc	14.78 cde	58.10 c	8.1 bc	2.5 d	60.9 de	71.5 cd
H-31	91.2 j	VE	83,9 a	55.1 de	30.5 b	12.3 b	26.8 c	28.14 bc	52.78 c	7.2 c	2.6 d	45.7 efg	40.4 fg
H-33	89.8 j	VE	87,4 a	33.8 f	32.6 b	7.0 bcde	35.0 bc	51.06 a	52.12 c	4.5 d	3.8 d	41.0 fg	41.4 fg
Xx	152.86		88,3	65.5	52.0	10.9	26.6	21.6	35.0	8.5	6.2	64.3	60.0
CV(%)x	3.08		4,7	9.5	12.8	38.0	20.5	24.6	16.3	9.4	13.1	9.2	8.7

[x] X=overall character mean; CV=coefficient of variation (%);

[y] Means, in the same column, followed by different letters are statistically different, according to Duncan's multiple range test, at 5% probability level;

[z] FC=flowering cycle (L=late; I=intermediate; E=early and VE=very early); TZ=seed viability (tetrazolium test); TG, NG=normal germination test with and without sulphuric acid scarification; RSTG, RSNG= remaining viable seeds, after germination tests; DTG, DNG = seed dormancy; TGR, NGR= germination rates; AATG, AANG= vigor after accelerated aging test, followed by germination tests.

Table 2

Simple correlation coefficients calculated among flowering cycle and eleven seed quality parameters on 15 new guineagrass (*Panicum maximum* Jacq.) hybrids.

	TZ (%)	TG (%)	NG (%)	RSTG (%)	RSNG (%)	DTG (%)	DNG (%)	TGR	NGR	AATG (%)	AANG (%)
FC (days)z	0.142ns	0.468*	0.731**	-0.315*	-0.673**	-0.473*	-0.758**	0.422*	0.683**	0.360*	-0.033ns
t value	0.52	3.47	7.03	2.18	5.95	3.52	7.62	3.05	6.13	2.53	0.22

[z] FC=flowering cycle (L=late; I=intermediate; E=early and VE=very early); TZ=seed viability (tetrazolium test); TG, NG=normal germination test with and without sulphuric acid scarification; RSTG, RSNG= remaining viable seeds, after germination tests; DTG, DNG = seed dormancy; TGR, NGR= germination rates; AATG, AANG= vigor after accelerated aging test, followed by germination tests;
** ; * ; [ns] = Student t test significant at 1% , 5% probability level and not significant, respectively.