Rule Change Proposal No. 10

Purpose

To remove the "Fresh and Dormant" instructions from the "Additional Directions" for *Panicum virgatum* (Switchgrass) in Table 3.

Present Rule

Kind of Seed	Substrata	Temperature ºC	First Count Days	Final Count Days	Additional Directions
Panicum virgatum Switchgrass	P, TS	15-30	7	14	Light, KNO_3. Fresh and dormant: prechill at 5ºC for 2 weeks. Ungerminated seeds: see sec. 4.2e and 4.9k.

Proposed Rule

Kind of Seed	Substrata	Temperature ºC	First Count Days	Final Count Days	Additional Directions
Panicum virgatum Switchgrass	P, TS	15-30	7	14	Light; Ungerminated seeds: see sec. 4.2e and 4.9k.

Harmonization

The AOSA Rules and Federal Seed Act methods are in harmony with each other. International Seed Testing Association Rules have a 28 day germination period compared to 14 days for AOSA and FSA. Canadian Method and Procedures do not specify methods for this species.

Supporting Evidence

Switchgrass is a native indeterminate flowering warm-season grass which produces varying fruit sizes (seed units), some of which are commonly dormant at harvest. This dormancy dissipates over one to three years, resulting in slow establishment of field plantings (Coukos 1944 and Byers 1973). It is apparent that seed dormancy of warm season grasses exists at normal planting dates so the use of "Fresh and dormant" treatments in seed testing laboratories has been questioned. Warm-season grasses are normally planted into warm soil conditions (20-25˚C), compared to cool-season grasses, which can be planted in fall (dormant) or spring seedlings. Most warm season grasses

are sold on a Pure Live Seed (PLS) basis, which includes germinated and dormant seeds.

Therefore, breaking dormancy in the laboratory is not important in the pricing of these seeds, nor does it necessarily represent the expected field emergence potential of the seed lot. With common use of tetrazolium (TZ) testing on a number of native species, the practice of prechilling to aid in determining total viability of the seed lot is of less importance.

An emerging use of switchgrass is as a source of renewable biomass fuel production, especially due to its high forage yielding characteristic. However, the economics of producing biomass fuel requires full stand establishment in the first year of production. Selecting non-dormant seed lots is critical to establishing full stands of switchgrass. The present dormancy breaking specifications within the AOSA germination methodology creates a situation where the dormancy level of switchgrass seed lots is not clear. This situation is causing biomass producers to look for other methods, such as seedlings/gram of seed, as benchmarks in determining switchgrass seeding rates (Vogel 2002).

The proposed change is supported by the Native Seed Working Group's study of ten seed lots during the Summer/Fall of 2002. The Native Seed Working Group is composed of 14 laboratories involved in testing native seed; The University of Kentucky, Minnesota Department of Agriculture Seed Laboratory and Mid-West Seed Services, Inc received seed from ten seed lots, the experimental design and data forms. Testing was conducted using four true replicates of 100 seeds grouped into four separate blocks, each block containing only one of each seed lot and treatment combination. The results for the second study, switchgrass prechill, are presented below. Responses of ten switchgrass seed lots were evaluated across three prechill methods (0, 7 and 14 days of prechill). Data was collected, submitted and statistically analyzed by Amanda Patin, Mid-West Seed Services, Inc.

Prechill test results are presented in Table 1. First count germination was significantly lower without prechill 29% compared to 70% and 73% for 7 and 14 days of prechill, respectively. Germination at 14 days was 65%, 78% and 78% for 0, 7 and 14 days of prechill, respectively. Dormant seed percentage with 0 days of prechill was 11% higher than both 7 and 14 day prechill treatments. Prechill viability means showed 7 and 14 days of prechill as providing a post-TZ (TZ after germination) viability of 80% (Table 1). Zero days of prechill provided a post-TZ viability of 78%. Pre-TZ (TZ before germination) viability was 79%.

Table 1. Mean germination, dormant seed and viable seed response of three prechill methods averaged across three laboratories, two moistening agents and ten seed lots. N= 240

Mean Percentages

Prechill	7d germ	14d germ	Dormant	Post-TZ Total Viable	Pre-TZ Total Viable (N=120)
0 days	29	65	13	78	79
7 days	70	78	2	80	79
14 days	73	78	2	80	79
LSD	2.58	1.82	1.27	1.27	

Significant viability differences are demonstrated between laboratories for the prechill methods averaged across ten seed lots and two moistening agents (Table 2). Laboratory one had 11% and 4% lower seed lot viabilities on 0 day prechill than laboratory two and three, respectively. No significant differences were seen between laboratories one and two for 7 day prechill viabilities. Laboratory one had 3% lower and 4% higher seed lot viabilities on 14 day prechill than laboratory two and three, respectively.

Table 2. Total mean viable response of three laboratories averaged across ten seed lots and two moistening agents for three prechill methods. N= 80

Mean Percent Viable

Lab	0 days Prechill	7 days Prechill	14 days Prechill
1	73	82	80
2	84	83	83
3	77	76	76
LSD	2.31	2.36	2.48

Moistening agent means were significantly different at 7 days for KNO_3 compared to water but not significantly different across 14 day germination, dormant and total viability responses (Table 3). These data suggest that KNO_3 may not be important for breaking dormancy in switchgrass.

Table 3. Mean germination, dormant seed and viable seed response of two moistening agents and ten seed lots across three laboratories. N= 360

Mean Percentages

Moistening Agent	7d germ	14d germ	Dormant	Viable
Distilled H_20	58	73	6	79
0.2% $KN0_3$	56	74	6	80
LSD	1.14	NS	NS	NS

Additional Supporting Evidence 2003

The proposed change is supported by the Native Seed Working Group's study of six seed lots during the Summer/Fall of 2003. The Native Seed Working Group is composed of 15 laboratories involved in testing native seed; six of these laboratories expressed interest in conducting this native grass study. Six laboratories received seed from six seed lots, the experimental design and data forms; five laboratories returned data (Colorado State University, Nebraska State Seed Laboratory, North Dakota State Seed Department, Texas Department of Agriculture and Mid-West Seed Services, Inc). Testing was conducted using four true replicates of 100 seeds grouped into four separate blocks, each block containing only one of each seed lot and treatment combination. Responses of six switchgrass seed lots were evaluated across two methods, 0 days prechill, light and water (proposed germination method) and 14 days prechill at 5°C, light and 0.2% KNO_3 (present AOSA germination method). Data was collected, submitted and statistically analyzed by Amanda Patin, Mid-West Seed Services, Inc.

First count germination was significantly lower for the proposed method, 31% compared to 65% for the present method (Table 4.). Germination at 14 days was 72% and 76% for proposed and present methods, respectively. Dormant seed percentage in the proposed method was 5% higher than the present method. Total viabile seed percentages were not significantly different between the two methods.

Table 4. Mean germination, dormant seed and viable seed response of two methods averaged across five laboratories and six seed lots.
N= 120

Mean Percentages

Germination Methods	7d germ	14d germ	Dormant Seed	Total Viable
Proposed	31	72	7	79
Present	65	76	2	78
LSD	1.12	1.16	0.586	NS

Laboratories two and four had significantly lower viable seed percentages on the proposed method (Table 5) than laboratories one, three and five. Laboratory one had significantly higher viable seed percentage than all other laboratories in the present AOSA germination method. Laboratory five had a significantly higher viable seed percentage than laboratories two, three and four on the present germination method.

Table 5. Total mean germination, dormant seed and viable seed response of five laboratories averaged across six seed lots. N= 24

Mean Percentages

Lab	Proposed Germination Method				Present AOSA Germination Method			
	7d germ	14d germ	Dormant	Total Viable	7d germ	14d germ	Dormant	Total Viable
1	29	67	15	82	73	81	2	83
2	11	70	5	75	54	74	1	75
3	33	76	6	82	68	75	1	76
4	23	68	7	75	64	73	1	74
5	57	77	4	81	69	77	3	80
LSD	2.59	3.00	1.69	2.67	2.37	2.17	0.814	2.16

Literature Cited

Byers K.L. 1973. Evaluation of methods of reducing seed dormancy in switchgrass, Indiangrass, and big bluestem. Thesis South Dakota State University. 40p.

Coukos, D.J. 1944. Seed dormancy and germination in some native grasses. J. Amer. Soc. Agron. 36:337-345.

Vogel, K.P. 2002. The Challenge: High quality seed of native plants to ensure establishment. Seed Technology. 24:9-15.

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