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A Comparison of Seed Cleaning Techniques for Improving Quality of Eastern Gamagrass Seed*

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ABSTRACT

Air screen cleaners are not efficient in separating filled and unfilled seeds of eastern gamagrass [*Tripsacum dactyloides* (L.) L.]. This study was conducted to determine the feasibility of utilizing two seed cleaning apparatus, a fractionating aspirator and gravity separator, to improve seed quality of eastern gamagrass that was initially cleaned with an air screen cleaner. Three seed lots of eastern gamagrass were separated into four fractions by a fractionating aspirator and one lot was separated into two fractions by a gravity separator. Fraction one from the gravity separator and fractions one and two from the fractionating aspirator were shown to significantly ($P<0.05$) increase the number of complete seed units and germination percentage. The gravity separator provided more efficient separation and increased germination percentage of fraction one compared to the corresponding lot from the fractionating aspirator (24 to 48%).

INTRODUCTION

Eastern gamagrass is a native warm-season perennial bunchgrass with potential for livestock forage and cropland erosion control in the Southeast (Ball et al., 1991; Dewald et al., 1996). Stand establishment from seed has given inconsistent results. Seed of eastern gamagrass is protected between a rachis internode and an outer glume association known as a cupulate fruitcase (Galinat,1956). The cupulate fruitcase has shown to inhibit germination in some genotypes of eastern gamagrass, but germination can be enhanced with cold-moist stratification for 60 days followed by exposure to temperatures of at least 30° C (Anderson 1990). Indeterminate seed maturity is another factor that indirectly affects seed quality. A typical combine-run harvest consists of complete seed units (cupulate fruitcase with filled seed), incomplete seed units (cupulate fruitcase with unfilled seed) and other non-viable inert matter. Inability to adequately separate filled seeds from unfilled seeds may lead to poor establishment (Ahring and Franks, 1968).

Air screen cleaners are commonly used for cleaning eastern gamagrass seed. They remove most of the inert matter and a portion of immature seed, but are not capable of separating most of the filled seeds from unfilled seeds. Similarities in seed size and shape, and the inability of the system's air flow mechanism to separate filled seeds from unfilled seeds complicates cleaning operations, thus both seed classes are included in the final product. A South Dakota Seed Blower has been shown to improve separation of filled seeds from

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unfilled seeds of eastern gamagrass thus increasing germination potential 73 to 95% (Ahring and Franks,1968). However, the aerodynamics of the South Dakota Seed Blower prohibits complete separation of filled and unfilled seeds because of potential variability in seed size and weight between seed lots. Furthermore, a South Dakota Seed Blower was designed for processing limited seed quantities and does not have the capacity to accommodate large seed lots.

A fractionating aspirator is a seed cleaner that utilizes terminal velocity to separate light materials from heavy materials and partitions them into fractions. A gravity separator uses specific gravity created by forced air and oscillating movement to separate seed components according to density. Both of these cleaning techniques have potential for improving seed quality of eastern gamagrass by separating filled seeds from unfilled seeds.

There is no published literature on the use of a fractionating aspirator or gravity separator to improve seed quality of eastern gamagrass once the seed has been partially cleaned with an air screen cleaner. Therefore, the objectives of this study were to (a) compare seed quality of fractions separated by a fractionating aspirator and gravity separator, (b) contrast these results to seed quality of a single seed fraction from an air screen cleaner, and (c) compare a fractionating aspirator to a gravity separator to determine which cleaning technique is more effective for improving seed quality of eastern gamagrass.

MATERIALS AND METHODS

Three lots were chosen for the experiment. Lots A, B, and C were harvested with a John Deere 4400 conventional combine in September 1992, 1993, and 1995, respectively, from a stand of eastern gamagrass at the USDA-Natural Resources Conservation Service, Jamie L. Whitten Plant Materials Center (PMC) near Coffeeville, Mississippi. Following harvesting operations, seed was spread evenly on a concrete floor and allowed to air dry in a ventilated warehouse for approximately one week. An air screen cleaner (Clipper M2B, A. T. Ferrell and Co., Saginaw, MI), equipped with an upper and lower screen, was used for seed cleaning. Seed was stored in cloth bags and placed in a seed vault maintained at 13° C and 45% relative humidity. In January 1997, a four and one-half kilogram random sub-sample was collected from each lot.

A 200 gram random sub-sub-sample was obtained from each four and one-half kilogram sub-sample and separated into four seed fractions with a fractionating aspirator (Carter-Day Model No. CF 21, Minneapolis, MN). Each fraction was weighed to determine its percentage relative to the sample size.

Three and one-half kilograms of lot C were separated into two fractions with a gravity separator (Oliver MFG, Rocky Ford, CO). Weight or percentage of the two fractions was not determined due to the excessive loss of seed that fell from the gravity separator to the floor during the cleaning operation.

Percent filled seed was determined by hand dissecting three replicates of 10 randomly selected seed to determine the presence or absence of a grain. A single seed fraction from

each lot separated by an air screen cleaner served as a control. Four replications of 25 seeds were randomly selected from each fraction and control, and planted in 3x5x2 inch containers filled with a commercial potting medium. Containers were placed in a cooler maintained at 5° C with no humidity control on 15 April 1997 for cold-moist stratification. Containers were watered regularly to keep seeds moistened.

Containers were removed from the cooler and placed in a greenhouse on 27 May 1997. Germination counts were made 7, 14, and 21 days after placement in the greenhouse. Total germination was determined by summing germination counts at the end of 21 days.

Filled seed and germination percentages by fraction and lot were subjected to an analysis of variance procedure in MSTAT-C (Michigan State Univ., 1988) and significant means were determined by least significant difference (LSD) at $P<0.05$ (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

There was variability between lots in the percentage of seed contained in each fraction. (Table 1). Fractions one and two, which contained the heaviest seed, accounted for 40, 37 and 28% of the seed in lots A, B, and C, respectively. Light seed and inert matter, contained in fractions three and four, accounted for over 60% of the seed lots. Differences in percentages of seed for each fraction indicate that a fractionating aspirator and gravity separator have the capability to make discreet separations between seed components not obtainable with an air screen cleaner.

Table 1. Percent of seed lot accounted for in each fraction as determined by fractionating aspirator.

	Seed Lot		
	A	B	C
	----------%----------		
Fraction 1	20	11	20
Fraction 2	17	17	20
Fraction 3	35	35	30
Fraction 4	28	37	30

Quality of seed fractions was defined by determining the presence or absence of a seed grain (filled and unfilled seed) of each fraction by lot and cleaning technique. Seed fractions one and two from the fractionating aspirator, and seed fraction one from the gravity separator, significantly ($P<0.05$) increased filled seed as compared to the other fractions and control (Table 2). This trend was seen in all lots.

Table 2. Percent seed fill by seed lot and fraction for two cleaning techniques.

	Fractionating Aspirator			Gravity Separator
	Seed Lot			
	A	B	C	C
	----------%----------			

Fraction 1	93	90	87	90
Fraction 2	90	90	80	30
Fraction 3	57	73	43	--
Fraction 4	10	20	20	--
Control	47	23	23	23
Mean	59	61	58	48
LSD (0.05)	22	12	25	30

Percent germination for each fraction by lot and cleaning technique is presented in Table 3. Depending on cleaning technique, fractions one and two were found to increase percent germination more than fractions three and four and the control. This relationship in germination pattern was significant ($P<0.05$) for lot B separated by fractionating aspirator, and fraction one in lot C separated by gravity separator.

Table 3. Percent germination by seed lot and fraction for two cleaning techniques.

Separator	Fractionating Aspirator			Gravity
	Seed Lot			
	A	B	C	C
	----------%----------			
Fraction 1	43	21	24	48
Fraction 2	35	29	25	15
Fraction 3	15	15	18	--
Fraction 4	3	3	3	--
Control	22	22	16	22
Mean	24	18	17	28
LSD (0.05)	12	12	10	13

Results show that seed quality of seed lots used in this study was improved with these seed cleaning techniques. Fractions one and two from the fractionating aspirator and fraction one from the gravity separator contained the highest seed quality. Consequently, the other seed fractions can be discarded during cleaning operations because they contribute only weight. Fraction one from lot C cleaned by the gravity separator had a higher germination percentage compared to fraction one of the same lot cleaned with a fractionating aspirator.

CONCLUSIONS

Both the fractionating aspirator and gravity separator were effective in separating the highest quality seed of eastern gamagrass in the lots tested. Fractions one and two were found to contain the highest percentage of filled seeds and had the highest percent germination. Gravity separator improved germination percentage of fraction one of lot C compared to fraction one from the fractionating aspirator.

Potential implications of such cleaning techniques include pricing of lots based on seed quality and selecting for seedling vigor. Seed companies upgrading seed cleaning equipment to improve seed quality of eastern gamagrass may want to consider a fractionating aspirator

as opposed to a gravity separator due to reduced equipment costs.

LITERATURE CITED

Ahring, R. M. and H. Franks. 1968. Establishment of eastern gamagrass from seed and vegetative propagation. J. Range Management. 21:27-30.

Anderson, R. C. 1990. Aspects of the seed biology of eastern gamagrass. Eastern Gamagrass Conference Proceedings: 1989 January 23-25: The Kerr Center for Sustainable Agriculture, Poteau, OK. pp.5-9.

Ball, D. M., C. S. Hoveland and G. D. Lacefield. 1991. Southern forages. Potash and Phosphate Institution, Atlanta, GA.

Dewald. C., J. Henry, S. Bruckerhoff, J. Richie, D. Shepard, S. Dabney, J.Douglas, and D. Wolfe. 1996. Guidelines for the establishment of warm season grass hedge for erosion control. J. Soil and Water Conserv.(1): 16-20.

Galinat, W. C. 1956. Evolution leading to the formation of the cupulate fruitcase in AmericanMaydae, Bot. Mus. Leafl. Harvard Univ. 17:217-239.

Gomez, K. A. and A. A. Gomez. 1984. Statistical procedures for agricultural research. 2nd ed. John Wiley and Sons, Inc., NY

Martin, J. H., W. H. Leonard and D. L. Stamp. 1976. Principals of Field Crop Production. 3rd.ed. Macmillian Publishing Co., Inc, NY.

Michigan State Univ., 1988. MSTAT-C Microcomputer Statistical Program.

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