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EASTERN GAMAGRASS ESTABLISHMENT: I. GREENHOUSE PLANTING DEPTH STUDY

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ABSTRACT

Placement of stratified eastern gamagrass [*Tripsacum dactyloides* (L.) L.] seed at the proper seeding depth is important for germination and subsequent growth. Planting stratified seed too shallowly may result in secondary dormancy if the seed dries before germinating. Conversely, planting the seed too deeply may prevent emergence. Objective of this study was to determine how deep stratified seed of PMK-24 and accession 9062680 could be planted without significantly reducing emergence and seedling growth. Complete seed units of eastern gamagrass were planted in two gallon nursery containers filled with a Grenada silt loam soil at depths of 0.5, 1, 1.5, 2, 2.5, and 3 inches. PMK-24 had a higher germination percentage than 9062680 but the difference was not significant. As seeding depth increased, germination percentages significantly decreased. Depth of 0.5 inch produced the greatest seedling emergence (80%) but did not significantly increase emergence percentage over the 1 to 1.5 inch depths (73 and 71%). There were no differences in emergence percentages and seedling growth between 1 to 2.5 inch depths. Seedlings that emerged from 2.5 and 3 inches were slightly chlorotic but recovered quickly. These preliminary results suggest that eastern gamagrass may have enough seed reserves to germinate and emerge from deeper depths. This test will continue under field conditions before final recommendations are made.

INTRODUCTION

Stratification is a germination enhancement method used to overcome physiological dormancy in various types of seeds. Stratification, also known as prechill, involves storing seeds at temperatures between 35° and 42° F with moist sand, peat or other mediums for different time intervals (Beinz, 1980). The cupulate fruitcase that surrounds the grain in eastern gamagrass can effect germination. A 60 day stratification period and exposure to temperatures of 30°C reduces the inhibitory effect of the cupulate fruitcase; thus improving germination of eastern gamagrass (Anderson, 1990). Many commercial seed growers offer stratified eastern gamagrass seed for spring plantings.

Placing spring-planted stratified seed at the proper seeding depth is critical for optimum germination and subsequent seedling growth. Planting stratified seed too shallowly increases the potential for the seed to dry out before germinating, resulting in the loss of stratification and initiating secondary seed dormancy (Martin et al., 1976). If drying occurs, germination may be delayed until the seed undergoes a natural stratification process and will likely not germinate

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until the next spring. Conversely, planting the seed too deeply may prevent seedling emergence. Dewald (1996) recommends planting stratified eastern gamagrass at a depth of 1 to 1.5 inches.

Placing stratified eastern gamagrass seed deeper into a higher soil moisture retention zone may give the seed an opportunity to germinate before dehydration. There is no published information on seedling emergence of eastern gamagrass when planted at depths greater than 1 to 1.5 inches. Objective of this study was to determine the potential for PMK-24 and accession 9062680 eastern gamagrass to germinate at deeper depths without significantly reducing emergence percentage.

MATERIALS AND METHODS

This study was conducted under greenhouse conditions at the USDA-NRCS Jamie L. Whitten Plant Materials Center (PMC) near Coffeeville, Mississippi in October 1998. Seed of accession 9062680 (680) and PMK-24 (accession 421612; released as 'Pete' in 1988) was hand harvested from seed increase plots at the PMC in July-August 1998, and stored at room temperature. To insure that only filled seed was used in the experiment, a South Dakota seed blower (Seedburo Equipment, Chicago, IL) was used to separate the heaviest seed units as described by Ahring and Franks (1964). Percent fill for both seed lots were determined by randomly dissecting three replicates of 10 seeds and determining the presence or absence of a grain. On 4 August 1998, both seed lots were soaked in tap water for 24 hours, then placed in plastic bags and stored at 38° F until 20 October 1998.

Two gallon nursery containers were filled with a Grenada silt loam soil and watered to insure soil settling before planting. Containers were partitioned into six sections and depths of 0.5, 1, 1.5, 2, 2.5, and 3 inches were randomly assigned to each section. Ten seeds of 680 and PMK-24 were planted on 20 October 1998 at each designated depth. Experiment was designed as a split plot with eastern gamagrasses as a whole plot and seeding depth as a split plot. The experiment was replicated 7 times. Containers were watered and placed in a greenhouse maintained at a temperature of approximately 68° F during the day and 55° F at night. Seedling emergence was recorded 7, 14, 21, and 28 days after planting.

Seed length and width of 680 and PMK-24 were determined by randomly measuring 10 seed units (cupulate fruitcase plus grain). Cupulate fruitcase and grain weights were determined by separating the cupulate fruitcase from the grain of three replicates of 10 seeds and weighing the components separately.

The 28 day germination count and seed components (cupulate fruitcase and grain) were subjected to an analysis of variance procedure using MSTAT-C (Michigan State Univ., 1988). Significant means were separated with a multiple range test at $P \leq 0.05$.

RESULTS AND DISCUSSION

Seedling emergence percentages for PMK-24 and 680 were 70 and 60%, respectively, but the difference was not significant. Differences in emergence percentages may be partially explained by the difference in percent seed fill (presence of a seed grain, which is related to potential seed germination). Percent seed fill of PMK-24 and 680 was 96% and 94%, respectively. Anderson (1990) reports that stratification reduces the inhibitory effects of the cupulate fruitcase and improves germination of eastern gamagrass. A comparison of seed characteristics of PMK-24 and 680 is presented in Table 1. It is interesting to note that although 680 produced a larger seed unit and heavier cupulate fruitcase and grain than PMK-24, the difference in grain weight was not significant. The larger seed unit and weights may be attributed to differences in ploidy levels (Janick, 1972). PMK-24 is a diploid and 680 is a tetraploid (Dewald, personal communication). It is possible that the larger cupulate fruitcase of 680 may be more restrictive to germination than that of PMK-24.

Maximum seedling emergence for all depths occurred within 14 days after planting (data not shown). Seeds that emerged from depths of 2.5 and 3 inches were slightly chlorotic but

recovered. Seedling emergence decreased significantly with increased planting depths (Fig. 1.). Seedling emergence was greatest at 0.5 inch but it did not significantly increase emergence over the 1 and 1.5 inch depth. Planting stratified eastern gamagrass seed at 0.5 or less would not be recommended unless irrigation water is available to maintain soil moisture conditions at a level conducive for germination. The recommended planting depths of 1 to 1.5 inches (Dewald, 1996) gave high emergence percentages but were not significantly higher than those obtained at 2.0 to 2.5 inches. Depths of 0.5 to 2.5 inches significantly increased emergence over the 3 inch depth. The data suggests that there may be enough food reserves in eastern gamagrass seed to germinate and emerge from depths up to 2.5 inches.

CONCLUSIONS

Emergence percentages of PMK-24 were higher than 680, but was not significant. Accession 680 had a larger seed unit and heavier cupulate fruitcase and grain weight than PMK-24, but grain weights were not significantly different. Differences in seed characteristics may be attributed to differences in ploidy levels. Seedling emergence percentages decreased significantly as planting depth increased. The 0.5 depth provided the highest seedling emergence percentage and the 3 inch depth the lowest. Seedling emergence and growth at 2.0 and 2.5 suggests that stratified seed of eastern gamagrass may have the seed reserves to emerge from depths greater than the recommended planting depth of 1 to 1.5 inches.

Field experiments will be conducted to evaluate seedling emergence and growth at these various depths before final recommendations are made. Additional seed studies will also be conducted on 680 to evaluate various seed germination methods to further advance this selection for conservation use.

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Table 1. Seed characteristics of 9062680 and PMK-24.

Gamagrass	Length	Width	Fruitcase	Grain
	--------mm-------		----------g---------	
9062680	.420a*	.245a	1.66a	.49
PMK-24	.336b	.179b	0.75b	.46

* Means in columns followed by different case letters are significantly different at P≤0.05.

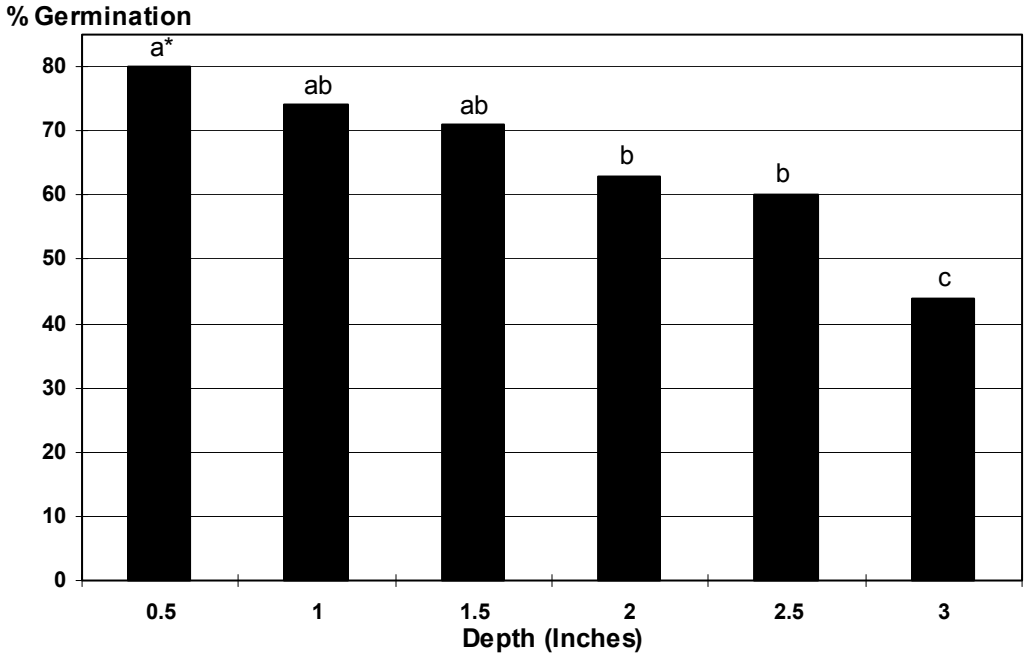

Fig. 1. Seedling emergence of eastern gamagrass as influenced by planting depth.

*****Bars with the same case letters are not significantly different at the P≤0.05.