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**FINAL STUDY REPORT**
**James E. "Bud" Smith Plant Materials Center**
**Knox City, Texas**

# Assembly and Evaluation of Western Wheatgrass Germplasm for Pasture and Hay Planting

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## ABSTRACT



USDA-NRCS James E. "Bud" Smith PMC

Western wheatgrass [*Pascopyrum smithii* (Rydb.) Á. Löve] is a native, cool season, perennial grass occurring in Texas rangeland that is relished by livestock. Lack of an adapted cultivar limits the use of this grass for rangeland restoration. The objective of this study is to assemble and evaluate western wheatgrass to identify elite germplasm for use in a cultivar or pre-varietal development program. Twenty-eight collections were received from the field but only twenty-four were transplanted into a common nursery at the James E. "Bud" Smith Plant Materials Center (PMC), Knox City, Texas on a Miles fine sandy loam soil, and evaluated on plant attributes, seed production, and plant performance from 2011-2013. Accessions 432400, 9107804, 9107813, 9108834, and 9107848 were the only collections that survived the 2011 and 2012 growing seasons, but their populations had diminished drastically. Survival and adaptability hinders the further development of these accessions for release consideration from the James E. "Bud" Smith PMC.


## INTRODUCTION

Western wheatgrass is a native, cool season, perennial grass occurring in Texas vegetational areas including the Blackland Prairies, Edwards Plateau, High Plains, Trans-Pecos, and the Rolling Plains in low, moist flats or flood plains (Hatch and Pluhar, 1993; Gould, 1978). Western wheatgrass begins growth in late winter to earlier spring when daily temperatures reach 50-56°F and becomes semi-dormant in the midsummer (Leithead et al., 1971). These authors report that growth continues in the fall if moisture is available and leaves may remain green in the winter. New growth is desired by livestock and remains palatable year round (Leithead et al., 1971). Although it has been called one of the most valuable native grasses, in Texas, it rarely produces abundant forage for cattle in rangelands (Gould, 1978). A controlled grazing system should be part of the management for sustainable production.

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Several commercial varieties of western wheatgrass are available, but have not been successful to the PMC environment. The objective of this study is to assemble and evaluate western wheatgrass germplasm and identify superior ecotypes for pasture and hay plantings in the southern plains. This is accomplished by contributions of western wheatgrass collections made by field office staff from known populations occurring in Texas and evaluating them in a common nursery for superior plant characteristics.

## MATERIALS AND METHODS

Twenty-eight accessions and three commercial varieties of western wheatgrass were evaluated at the USDA-Natural Resources Conservation Service (NRCS), James E. “Bud” Smith PMC, Knox City, TX from 2011 to 2013. Seed collections were made by NRCS field office staff and provided to the PMC (Table 1). The assembly of collections were initially planted in the greenhouse in 15 February 2011 and seedlings transplanted to the evaluation nursery 4 May 2012. A smooth, firm seedbed was prepared prior to transplanting. Plots consisted of ten plants from each accession spaced at twelve inches with 40 inch row spacing in non-replicated plots. Soil type was a Miles fine sandy loam. Weeds were controlled by hand weeding and cultivation. Irrigation was applied the first year to ensure establishment. Accessions were rated annually in early April and early July for survival, plant height (inches), seed maturity (mid to late spring, early to mid-summer, and late summer to early fall), plant growth characteristics (erect/prostrate growth and lodging), and seed production (1 = worst, 9 = best). Measurements taken in April and July were averaged for each year for comparison.

Seed was hand harvested from the surviving accessions in July 2012-2013 from the evaluation nursery and 100 seed were placed on a Petri dish and moistened with 15 ml distilled water. Non replicated seed samples were placed in a germination chamber (Seedburo Equipment Co., Chicago, IL) with alternating day/night temperature (15/30 °C) and (12 h/12 h). Germination counts were taken every 7 days for total of 28 days.

## RESULTS AND DISCUSSION

Of the twenty-eight accessions planted in 2011, twenty-four accessions were established in the field (Table 2). The other four collections never germinated. Several factors may have contributed to poor germination (i.e. immature seed, poor storage prior to shipment to PMC, or damaged during shipping and processing). A summary of the evaluations made in 2011-2013 are presented in Table 2. With the exception of 432400, 9107804, 9107813, 9107834, and 9107848, the populations were completely lost within two growing seasons. The few that remained were reduced to just a plant or two. All surviving accessions were similar in growth habit and seed production potential with some variability in height and maturity.

Seed production 432400, 9107823, and 9107824 were rated poor in 2011 and good in 2012. However, hand collected seed from the evaluation nursery in early July of 2011 and 2012 failed to germinate in the germination chamber (data not shown). None of the other seed harvested from the surviving accessions

germinated. It is anticipated above average temperatures and below average precipitation during pollination may have attributed to poor seed quality. Adverse heat and moisture stress during the reproductive phase significantly reduces grain and pod yields and decreases seed quality of some agricultural crops (Vara Prasad et al., 1999; Fougereux et al., 1997; Schoper et al., 1987).

## CONCLUSION

Accessions 432400, 9107804, 9107813, 9107834, and 9107848 had the highest percent survival and persistence compared to the other 19 accessions of western wheatgrass. Due adaptability and survival exhibited by these accessions at the PMC, a decision was made to discontinue the evaluation and close the study. Seed collections of western wheatgrass accessions will be stored in a controlled environment for future germplasm screening by interested entities.

## LITERATURE CITED


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Table 1. Western wheatgrass collections evaluated at the USDA-NRCS James E. “Bud” Smith Plant Materials Center, Knox City, TX 2011-2013.

| Accn. No | County |
|---|---|
| 9107804 | Castro |
| 9107805 | Hemphill |
| 9107806 | Ochiltree |
| 9107807 | Hartley |
| 9107808 | Kent |
| 9107809 | Dickens |
| 9107810 | Dickens |
| 9107811 | Lubbock |
| 9107812 | Gray |
| 9107813 | Hansford |
| 9107815 | Wheeler |
| 9107816 | Lipscomb |
| 9107817 | Donley |
| 9107818 | Moore |
| 9107820 | Swisher |
| 9107821 | Swisher |
| 9107822 | Throckmorton |
| 9107823 | Roberts |
| 9107824 | Sherman |
| 9107827 | Bailey |
| 9107828 | Motley |
| 9107830 | Throckmorton |
| 9107831 | Parmer |
| 9107834 | Collingsworth |
| 9107840 | Lynn |
| 9107848 | Potter |
| 9107850 | Briscoe |
| 9110686 | Palo Pinto |

*RED indicates that collections were not successful outside of the greenhouse

Table 2. Summary of western wheatgrass collections evaluated at the USDA-NRCS James E. "Bud" Smith Plant Materials Center, Knox City, TX 2011-2013.

| | Survival (%)[1/] | | | Height (in)[2/] | | Seed Maturity[3/] | | Growth Habit[4/] | | Seed Production[5/] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Accn. No | 2011 | 2012 | 2013 | 2011 | 2012 | 2011 | 2012 | 2011 | 2012 | 2011 | 2012 |
| 432400 | 60 | 60 | 10 | 22 | 25 | Mid | Mid | Erect | Erect | 4 | 2 |
| 9107804 | 40 | 50 | 10 | 11 | 16 | Mid | Mid | Erect | Erect | 9 | 9 |
| 9107805 | 10 | 10 | 0 | 25 | 30 | Mid | Mid | Erect | Erect | 9 | 9 |
| 9107806 | 10 | 10 | 0 | 9 | 11 | Mid | Mid | Erect | Erect | 9 | 9 |
| 9107809[6/] | | | | | | | | | | | |
| 9107811[6/] | | | | | | | | | | | |
| 9107812 | 10 | 20 | 0 | 8 | 11 | Mid | Mid | Erect | Erect | 9 | 9 |
| 9107813 | 40 | 50 | 10 | 11 | 18 | Early | Early | Erect | Erect | 9 | 8 |
| 9107815 | 20 | 30 | 0 | 14 | 14 | Mid | Mid | Erect | Erect | 9 | 9 |
| 9107816 | 20 | 20 | 0 | 16 | 15 | Mid | Mid | Erect | Erect | 9 | 9 |
| 9107817 | 10 | 10 | 0 | 22 | 24 | Early | Early | Erect | Erect | 9 | 8 |
| 9107818 | 30 | 30 | 0 | 20 | 21 | Early | Mid | Erect | Erect | 9 | 9 |
| 9107820 | 40 | 20 | 0 | 17 | 20 | Early | Early | Erect | Erect | 9 | 7 |
| 9107821 | 40 | 40 | 0 | 13 | 18 | Early | Early | Erect | Erect | 9 | 7 |
| 9107822 | 20 | 10 | 0 | 15 | 17 | Mid | Mid | Erect | Erect | 9 | 9 |
| 9107823 | 40 | 30 | 0 | 19 | 20 | Mid | Mid | Erect | Erect | 6 | 4 |
| 9107824 | 20 | 20 | 0 | 16 | 21 | Mid | Mid | Erect | Erect | 6 | 5 |
| 9107827 | 10 | 10 | 0 | 16 | 17 | Mid | Mid | Erect | Erect | 9 | 9 |
| 9107828[6/] | | | | | | | | | | | |
| 9107830 | 20 | 30 | 0 | 20 | 23 | Early | Early | Erect | Erect | 9 | 9 |
| 9107831[6/] | | | | | | | | | | | |
| 9107834 | 30 | 50 | 20 | 18 | 23 | Early | Early | Erect | Erect | 6 | 6 |
| 9107840 | 10 | 10 | 0 | 15 | 11 | Mid | Mid | Erect | Erect | 9 | 9 |
| 9107848 | 70 | 60 | 20 | 14 | 16 | Early | Early | Erect | Erect | 9 | 9 |
| 9107850 | 10 | 10 | 0 | 12 | 12 | Mid | Mid | Erect | Erect | 9 | 9 |
| Barton | 40 | 30 | 0 | 19 | 17 | Early | Early | Erect | Erect | 9 | 8 |
| Arriba | 10 | 10 | 0 | 16 | 15 | Mid | Mid | Erect | Erect | 9 | 9 |
| Rosana[6/] | | | | | | | | | | | |

1/ Percent of plants survived taken in April
2/ Maximum plant height in inches taken in June
3/ Seed Maturity ratings (Early: early to mid-spring--- Mid: late spring to early summer--- Late: mid to late summer)
4/ Growth Habit (Erect grows at 90° angle; prostrate grows flat at 0° angle). Taken in June
5/ Seed production is visual for potential yield on a scale 1-9 (1=good, 9=poor) Taken in early June
6/ Plants did not survive 2012 growing season