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Effects of Planting Depth and Soil Texture on the Emergence of Four Lovegrasses

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Abstract

We studied the emergence of 4 lovegrass accessions planted at 0.0, 0.5, 1.0, 1.5, and 2.0 cm depths in Pima silty clay loam, Sonoita silty clay loam, and Comoro sandy loam soils in a greenhouse. Catalina boer lovegrass (*Eragrostis curvula* var. *conferta* Nees) emergence was superior to A-84 boer lovegrass, A-68 Lehmann lovegrass (*Eragrostis lehmanniana* Nees) and Cochise lovegrass (*Eragrostis lehmanniana* Nees X *E. trichophera* Coss & Dur.) in all soils and at all depths. Approximately 75% of the radicles of germinating Lehmann and A-84 boer lovegrass seeds failed to penetrate the surface of the 3 soils when surface sown. Lehmann lovegrass seed planted below the surface failed to emerge in the 3 soils.

Cox et al. (1982) found that more than 250 accessions of 80 grass species had been seeded at 400 locations in the Southwestern United States and Northern Mexico between 1890 and 1980. The most easily established and persistent grasses were Lehmann lovegrass (*Eragrostis lehmanniana* Nees) accession A-68, boer lovegrass (*Eragrostis curvula* var. *conferta* Nees) accessions A-84 and Catalina, and Cochise lovegrass (*Eragrostis lehmanniana* Nees X *E. trichophera* Coss & Dur.).

Lovegrass emergence is highly variable and may be greater in average rainfall summers than in atypically wet summers. Establishment appears to be more influenced by rainfall distribution rather than total summer rainfall (Cox and Jordan 1983). Reduced grass emergence has been attributed to annual and perennial forb, grass and shrub competition (Klingman and Ashton 1975), evaporation (Stoddard et al. 1975) and inadequate precipitation amounts and distribution (Jordan and Maynard 1970).

Field observations have indicated that lovegrass emergence is also influenced by soil texture and planting depth. Currently recommended seeding depths for lovegrass are 0.5 to 0.7 cm (Jordan 1981), but interactions between seeding depths and clay fractions within various soils on accession emergence have not been investigated. This study was initiated to determine the effects of planting depths, soil texture, and clay fractions within similar soil textural classes on the emergence of 4 selected lovegrasses.

Materials and Methods

Soils with textural characteristics common to the desert regions of the Southwestern United States and Northern Mexico were collected in summer of 1982. Samples of Pima silty clay loam, Sonoita silty clay loam and Comoro sandy loam were collected in southeastern Arizona. All soils were collected from the 0 to 15 cm depth and each thoroughly mixed to simulate mechanical soil disturbance. The 3 soils are classified as thermic Typic Torrifluvents (Gelderman 1972). The clay content of both the Pima and Sonoita silty clay loam soils was 20%; however, the clay fraction of the Pima was 60% montmorillionite and the Sonoita was 80% kaolinite (USDA-Soil Conservation Service, personal communications).

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Soils were screened to 5 mm, thoroughly mixed and added to 15 × 15-cm tapered plastic pots to 12.7, 12.2, 11.7, 11.2, and 10.7 cm depths above the pot base. Twenty-five pure live seed of one lovegrass accession were sown on the soil surface on each pot. Soils were added to 12.7 cm depths in all pots; thus, seed were planted at 0.0, 0.5, 1.0, 1.5, and 2.0 cm depths below the soil surface.

Pots were subirrigated with distilled water to insure that the soil surfaces were moist and undisturbed during the 14-day study. Emergence was considered complete when the first leaf was 1.5 cm above the soil surface in those pots planted at depths of 0.5 to 2.0 cm, or when the first leaf was 1.5 cm above the soil surface and the seed radicle had penetrated the soil in those pots in which seed were sown on the surface. Seedlings were counted daily and summed for the 14-day experiment.

The study was a completely randomized block design, with 6 blocks. Each block contained 60 pots, 4 accessions, 3 soils, and 5 planting depths. Data were subjected to analysis of variance and a Duncan's new multiple range test (Steel and Torrie 1960) used to separate means ($P \leq 0.05$).

Results and Discussion

Germination of the lovegrass accessions on soil surfaces ranged between 92 and 96%. The emergence of Catalina boer lovegrass was greatest, Cochise lovegrass was intermediate, and A-68 Lehmann and A-84 boer lovegrass were least on soil surfaces (Table 1).

Table 1. Mean[1] emergence (%) of four lovegrass accessions sown at five soil depths (cm).

	Emergence from depths				
Accession	0.0[2]	0.5	1.0	1.5	2.0
A-68	24^{c}	0^{c}	0^{c}	0^{c}	0^{c}
Cochise	48^{b}	20^{b}	11^{b}	11^{b}	9^{b}
A-84	26^{c}	20^{b}	13^{b}	0^{c}	0^{c}
Catalina	71^{a}	47^{a}	32^{a}	31^{a}	24^{a}

[1]Each mean is the average of six replications of 25 pure live seed.
[2]Means within a column followed by the same superscripts are not significantly different ($P \leq 0.05$).

Lehmann and A-84 boer lovegrass seed radicles grew horizontally; less than 28% penetrated the soil surfaces, and those which did not penetrate the surface died within 48 h.

A-68 Lehmann lovegrass failed to emerge when planted at 0.5 cm or greater depths, and A-84 boer lovegrass failed to emerge when planted at 1.5 and 2.0 cm depths (Table 1). The emergence of Catalina boer lovegrass was more than 50% greater at 0.5 to 2.0 cm depths than that of the other lovegrasses.

The emergence of Catalina boer lovegrass was significantly ($P \leq 0.05$) greater in the 3 soils, as compared to the other lovegrasses

Table 2. Mean[1] emergence (%) of four lovegrass accessions sown in three soils.

Accession	Emergence from soils		
	Pima[2]	Sonoita	Comoro
A-68	2[c]	5[c]	6[c]
Cochise	10[b]	23[b]	26[b]
A-84	5[c]	14[bc]	19[b]
Catalina	22[a]	47[a]	54[a]

[1]Each mean is the average of six replications of 25 pure live seed.
[2]Means within a column followed by the same superscripts are not significantly different ($P \leq 0.05$).

(Table 2). Emergence means for the respective accessions were generally equivalent in the Sonoita and Comoro soils and at least 50% less in the Pima soil, with the expanding clay fraction.

Our results demonstrate the importance of planting depth, soil texture, and the clay fraction on the emergence of 4 lovegrasses. Our most important finding is that Lehmann lovegrass must be surface sown and will not emerge when planted at 0.5 cm or greater depths in these 3 soils.

Greater emergence of surface sown seed can be expected; however, the soil surface dries rapidly in summer and it is desirable to plant seed below the surface where moisture persists longer (Tadmore and Cohen 1968). The number of Catalina boer lovegrass seedlings emerging from the 5 depths within 3 soils indicates a greater emergence potential as compared to A-68 Lehmann, A-84 boer, and Cochise lovegrasses.

Silty clay loams with expanding clay fractions are often, but not always found in alluvial plains and sandy loams are found near mountainous or foothill areas in the Southwestern United States (Gelderman 1972, Turner, 1977, Richardson et al. 1979). Summer storm intensities and duration usually decrease with decreasing elevation (Jordan 1981). Therefore, seeding failures are assumed to be associated with the lack of precipitation, and proper emphasis has not been given to soil texture, expanding clays, and planting depth.

Conclusions

Range managers should not incur the costs associated with seedbed preparation if lovegrasses are to be sown on or in expanding silty clay loams with expanding clay fractions, regardless of elevation, and A-68 Lehmann lovegrass should be surface sown. Catalina boer lovegrass should be included in the seed mix when seeding in semidesert grasslands and seed may be planted to 0.5 cm depths.

Initial emergence and stand densities, under rangeland conditions, of Catalina boer lovegrass and Cochise lovegrass may be greater than or equal to A-68 Lehmann lovegrass and A-84 boer lovegrass (Wright and Jordan 1970, Holzworth 1980). However, emergence may not be related to long-term survival and production (Herbel et al. 1973, Cox and Jordan 1983).

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