Lehmann Lovegrass and Drought in Southern Arizona

Dan Robinett

Lehmann lovegrass (*Eragostis lehmanniana* Nees.) is a warm-season, perennial bunchgrass introduced from South Africa in 1932. Since 1950 Lehmann lovegrass has been seeded and established on over 170,000 acres and has spread to an additional 190,000 acres of rangeland in southern Arizona. It seems to be very well adapted to certain soils at elevations between 3,000 and 4,800 feet where summer rainfall averages about 8 inches or more. The ease of establishment, small seed size, low seed cost, productivity, persistence, and excellent soil protection make it a popular choice for seeding following brush mangement and on highway and utility right-of-ways. Unfortunately, this species is so well adapated to parts of southern Arizona that it has and continues to spread into mixed communities of desirable native perennial grasses (Cable 1971, Cox and Ruyle 1986).

Background

Dense stands of this species on deep upland soils have great utility to a typical ranch operation in southern Arizona. A "Lehmann's pasture" provides early spring forage, tremendous summer carrying capacities, and recovers rapidly from heavy grazing use, fire, or drought (Ruyle et al. 1988). "Lehmann" areas can be successfully used to carry grazing animals through the summer growing season, allowing native grass pastures to rest. A Lehmann pasture making up as little as 10 percent of a ranch's acreage can provide drought insurance as emergency forage for below-average rainfall years (Cable 1971).

Lehmann lovegrass is a very opportunistic perennial grass species. It has several characteristics which favor successful establishment under a variety of environmental situations. Established plants produce large amounts of viable seed each year. Seeds are very small (6.5 million per pound), need very little soil cover to sprout successfully, and are too small for native seed predators to utilize. Seeds need longer wetting periods for germination than some native perennial grasses and usually don't germinate and emerge until consistent rainfall results in sufficient soil moisture for seedlings to establish (Frasier et al. 1984). New plants can establish from seed and produce reproductive culms in one season. Seeds germinate at any time of year under a wide range of temperature conditions (Cox 1984, Martin and Cox 1984). One thing that may inhibit germination is lack of light (Roundy et al. 1991). Seedling emergence is limited in dense, mature stands of lovegrass where standing foliage and grass litter reduce red light reaching the seedbed. Disturbances which remove the canopy, such as fire or grazing, result in high seedling emergence (Sumrall et al. 1991).

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Three factors have been documented or observed which affect Lehmann lovegrass invasion of native grass stands. These include fire, grazing, and drought (Cox and Ruyle 1986).

In the winter of 1988 and spring of 1989, a drought occurred in Southern Arizona which resulted in the loss of much of perennial grasses including Lehmann lovegrass. This event and the sequence that followed were monitored on a loamy upland range site near Sasabe, Arizona (USDA-SCS 1989).

Key area before drought October 12, 1988.

A range transect located in a Key Area (USDA-SCS 1976) was installed in a 5,500-acre pasture where Lehmann lovegrass appeared to be encroaching on native grasses in the fall of 1985. Other data recorded included season of use, animal numbers, rainfall, percent utilization, and annual production. Photographs were taken yearly to provide a visual record of change.

The transect was installed in 1985 in an area where Lehmann lovegrass and native perennials, mainly black grama, existed in an even mixture. The purpose was to monitor the trend of Lehmann lovegrass in this pasture with normal grazing use under rest-rotation grazing.

The soil in the area is a deep, loamy soil of the Whitehouse series (USDA-SCS 1988). These soils have sandy-loam surfaces from two to five inches thick over clayey

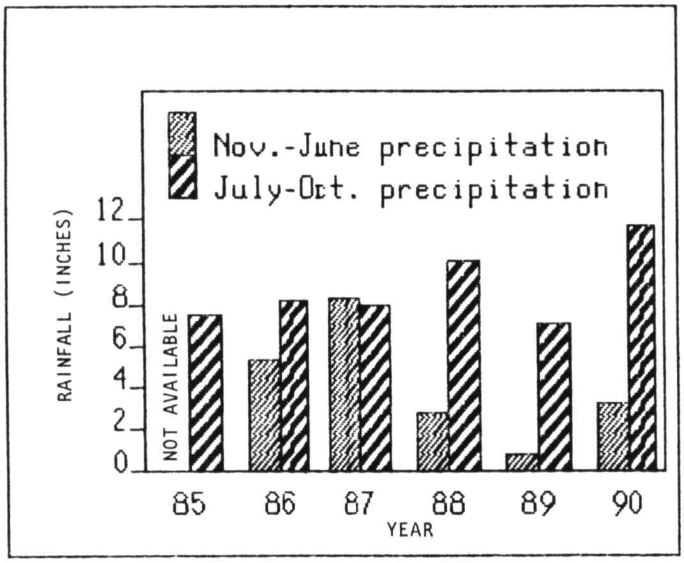

Fig. 1. *Rainfall 2.5 miles east of a Key Area in Pima County, Arizona.*

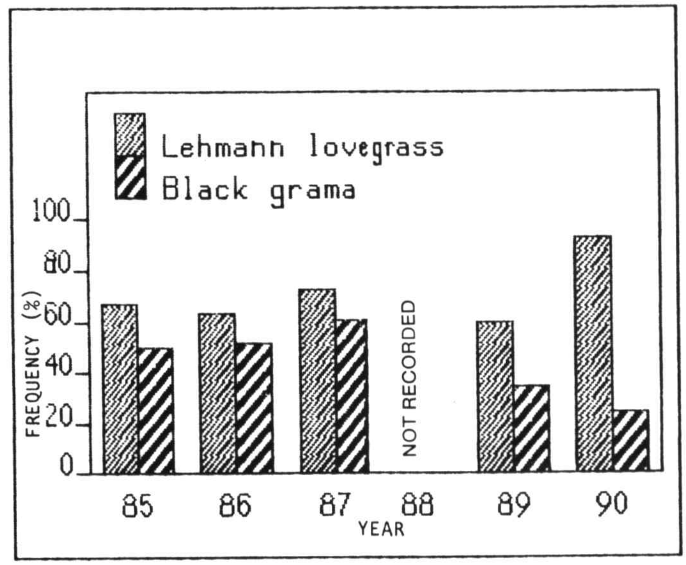

Fig. 2. *Frequency of perennial grasses at a Key Area in Pima County, Arizona.*

subsoils. A rain gauge was located two and one half miles east of the transect.

Drought

Rainfall in the area was less than 0.80 inches from November 1, 1988, to July 15, 1989, compared to 4.5 inches normally received during this period. There was no measurable precipitation in the months of December 1988, and January, February, April, May, and June of 1989. This drought followed several years of average or above average rainfall, 1983–1988 (Fig. 1).

Large, irregular shaped patches of grass ranging in size from a few feet to nearly 50 feet across died. Dead patches occurred where the surface sandyloam layer was thinnest over the clayey subsurface horizons. These patches produced runoff onto the adjacent areas with thicker surfaces allowing plants to survive. An equally devastating winter-spring drought in 1970–71 resulted in similar conditions near Elgin, Arizona, in Santa Cruz County. Blue grama patches died on similar soils, and the same relationships were noted between surface thickness, microrelief and mortality (Schickedanz 1974).

One-third to one-half of the acreage was affected. Black grama and Lehmann lovegrass had similar mortality (Fig. 2). Grazing utilization appeared to have no effect on mortality. Visual observations indicated that grazed and ungrazed plants died in equal amounts. Grazing utilization of these two species had been consistently light and was similar for both species (Fig. 3).

Several thousand acres of adjacent rangeland on this ranch and on nearby ownerships, were similarly affected. The summer rainfall in 1989 was below average but enough to allow surviving patches to recover. Rainfall amounts were light over the three growing season months: 1.19 inches in July, 1.97 inches in August, and 1.45 inches in September. Observations near the end of September showed an absence of plant growth in the dead grass patches.

In October, 2.49 inches of rain fell. With cooler temperatures Lehmann lovegrass germinated with hundreds of small plants in the dead patches. When the transect was read in November, these seedlings had thinned but survivors had become well established and a few of the plants had produced flower heads. No native grass seedlings were noted in the dead patches. Seedling plants were not counted in transect readings until they produced seedheads, so the 1989 readings did not reflect the increase in lovegrass. By the fall of 1990 the dead patches had filled in completely with mature Lehmann lovegrass plants. Transect reading in October 1990 clearly showed the effect of the drought and the opportunistic increase of Lehmann lovegrass at the expense of black grama (Fig. 2). Other native perennial grasses at this area also declined significantly. These species included red threeawn, mesa three-

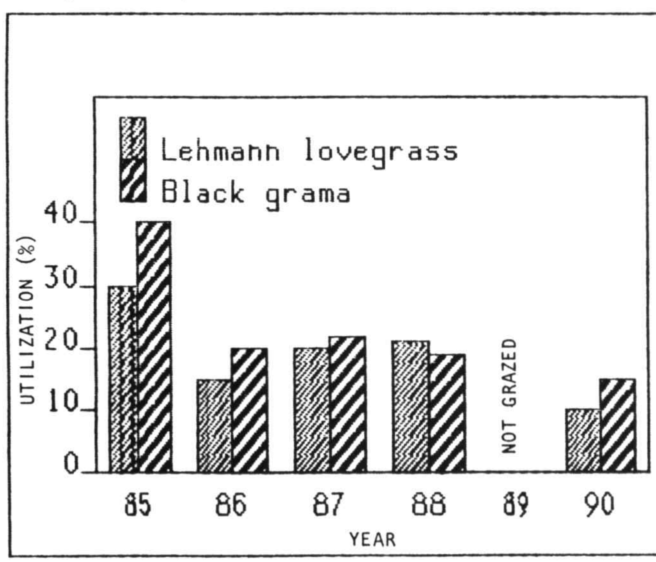

Fig. 3. *Utilization of perennial grasses at a Key Area in Pima County, Arizona.*

Key area during drought November 11, 1989.

Key area after drought October 10, 1990.

awn, hairy grama, and sprucetop grama. One native perennial, Aparejo grass, was seemingly unaffected by this winter-spring drought. It remained at about a 50% frequency level in the transect area from 1985 through 1990, suggesting that it may not have been growing in the thin soil surface areas where grass mortality occurred.

Similar results were noted at similar elevations and on similar soils on the Santa Rita Experimental Range south of Tucson, Arizona. A hot June fire in 1963 killed 98% of the Lehmann lovegrass plants and 90% of the black grama plants in an exclosure. The fall following the fire showed no new black grama seedlings while Lehmann seedlings ranged from 17 to 13 plants per square foot. Six years later the area was nearly a pure stand of Lehmann lovegrass (Cable 1965; 1971).

Ecological Implications

Lehmann lovegrass has become naturalized in southern Arizona. Rangeland users and managers need to understand its opportunistic nature, the mechanisms by which it spreads and becomes dominant, the soil and climatic conditions it favors, and its environmental limitations. Some of these things have been identified and/or quantified in recent and ongoing research into this species both here in Arizona and in southern Africa. The environmental limitations of this species are being studied and it may have a broader range of adaptation than previously considered. These studies plus visual observations and monitoring on ranches indicate that Lehmann lovegrass is spreading onto different range sites and into new areas in southeastern Arizona. If, as some researchers have predicted, the spread of Lehmann lovegrass is limited only by the absence of its seed, the environmental (elevation, temperatures, rainfall) limitations of this species are probably untested—at least the upper limits.

The presence of a seed source of Lehmann lovegrass in an area, or a mechanism for the spread of its seed into areas, are new elements of risk which must be evaluated when changes in land management and land use are proposed or range practices are being considered. Its opportunistic nature in response to drought and fires is known. Natural seed dispersal of this species is probably limited to within existing stands and along the immediate edge of established stands. The most prominent mechanism for widespread seed dispersal of this species are humans actually seeding it. Another mechanism which may be important is vehicle use of rangeland roads and trails causing seed dispersal from existing stands into new areas. Livestock do not appear to be a means of seed dispersal.

Lehmann lovegrass should probably not be seeded in the higher elevation grasslands of southeastern Arizona. Practices with right-of-ways which could be used for vehicular traffic like fences and pipelines should be designed to restrict such use in the better native grass areas. Also practices requiring new vehicular access for construction or implementation should have provisions to eliminate future vehicle use, especially in native grasslands where Lehmann lovegrass is not present.

Most of the Lehmann lovegrass seeding that has been done on rangeland in southeastern Arizona was to provide forage production and soil protection after brush management. Areas with dense stands of woody plants like mesquite, creosotebush, and tarbush have been converted into productive grasslands with no erosion. In many areas the original desert grassland plant communities have changed in this century from grass to shrubs, trees, and cacti. In these areas Lehmann lovegrass may be the only perennial grass able to compete with the woody vegetation and persist over time, producing herbaceous forage for livestock and wildlife and providing cover to protect soils from erosion.

Lehmann lovegrass has its place in southern Arizona's rangelands. It is here and land managers need to learn to take advantage of it where it presently occurs and try to limit its encroachment into the native grassland areas to protect their richness, diversity, and productivity.

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Mystery grass turns into business

David Eaheart

Dan Shepherd sells eastern gamagrass seed, buffalo meat and pecans from a store on his farm. Photo by David Eaheart.

Dan Shepherd did not expect the dark green patch of grass he noticed across the ditch would lead to a profitable seed business back in 1980 when Missouri experienced one of its worse droughts. Above-normal temperatures day-after-day quickly scorched Shepherd's cool-season grass pastures. His buffalo were quickly running out of something to graze on his Clifton Hill, Missouri, farm.

He had been experimenting with switchgrass, a warm-season grass, but he wasn't happy with it. It just wasn't performing up to his expectations. He noticed across the ditch a small patch of grass had mysteriously appeared and was withstanding the blistering drought.

Shepherd had trouble identifying this unknown grass. After some research it was finally identified as eastern gamagrass. Shepherd looked for more information and learned it was a palatable forage for livestock and high in protein. Best of all this native, perennial, warm-season grass was suited for deep, fertile soils with good moisture conditions and might work on his farm. It was obviously withstanding the drought.

Shepherd decided to plant a pasture to eastern gamagrass. Seed was located at the Soil Conservation Service Plant Materials Center (PMC), Manhattan, Kansas. Since seed was in short supply, he decided to plant a few extra acres to raise some seed.

Today, Shepherd raises more than 550 acres of the grass and sells seed in the United States, Mexico and Canada.

It is not uncommon for his customers to visit the farm to discuss eastern gamagrass production. Shepherd runs the seed business from a new building on the farm, which houses a store and office. The building also serves as headquarters for his buffalo meat and pecan enterprises. Visitors to the farm learn from Shepherd's experience and see directly the results of his management and production practices.

Shepherd notes that gamagrass requires some management to maintain a healthy stand. Nitrogen boosts the production of the grass the most of any practice. Shepherd works with

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