

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

and

AGRICULTURAL RESEARCH SERVICE

and the

UNIVERSITY OF ARIZONA AGRICULTURAL EXPERIMENT STATION

NOTICE OF SELECTION AND RELEASE OF
'STEVAN' PLAINS BRISTLEGRASS (*SETARIA LEUCOPILA*)

The U.S. Department of Agriculture, Soil Conservation Service and U.S.D.A. Agricultural Research Service and the University of Arizona Agricultural Experiment Station announce the selection and release of 'Stevan' plains bristlegrass [*Setaria leucopila* (Scribn. & Merrill) K. Schum.] for commercial production and marketing of seed and plants.

Origin:

Stevan plains bristlegrass is a population of 13 accessions selected from the 1975 Critical Area and Range Improvement Grass Initial Evaluation Planting (IEP) (Briggs 1975). The population is comprised of the following accessions:

1. A-14266 (PI 421049): Collected August 1973, Kansas Settlement Rd., Willcox, AZ;
2. A-14539 (PI 421050): Collected August 1973, Jct. Hwy. 89 & Montezuma's Well;
3. A-16535 (PMT-269): No collection date, Reproduced at the Spur Texas PMC, Odessa, TX;
4. A-17004 (PI 229127): Collected in 1962, Originally collected in New Mexico, received from the Pleasanton PMC;
5. A-18170 (PI 399281): Collected on 01/09/72 by L. Humphrey, Hillburn Farm, 2 miles NW of Bowie, AZ;
6. A-18171 (PI 399282): Collected on 10/17/72 by M. Lamoreaux, 1.8 miles into Willow Springs Ranch;

7. A-18172 (PI 399283): Collected on 10/13/72 by D. Robinett, 9.8 miles on Hwy. 666, north of I-10, 1/4 mile east of the road;
8. A-18173 (PI 399284): Collected on 10/13/72 by J. Everett, 4 miles east of Klondyke, AZ on Carl Botts property;
9. A-18174 (PI 399285): Collected on 10/12/72 by M. Lamoreaux, 1 mile east of Sasabe, AZ;
10. A-18176 (PI 399287): Collected on 10/11/72 by D.J. Somerville, 1/2 mile east of Moson Rd., NW 1/4 of Sec. 35, T22S, R21E, Arizona;
11. A-18294 (PI 421058): Collected in August 1973 by H. Nessmith, Odessa, TX;
12. A-18309 (PI 421059): Collected in August 1973 by D. Somerville, near Douglas, AZ;
13. A-18312 (PI 421060): Collected in August 1973 by E. Everett, Sec. 27, T7S, R20E, Arizona;

Identification Numbers Used:

Stevan plains bristlegrass has been evaluated under the following reference numbers:

9003939, 04-19916, A-19916: Tucson, Arizona USDA-SCS Plant Materials Center

Stevan plains bristlegrass has been assigned the following identification numbers:

PI _____: USDA Plant Introduction Number

NSSL _____ National Seed Storage Laboratory
Serial Number

Description:

Stevan plains bristlegrass is a C4, native, perennial, warm-season bunchgrass with glabrous herbage and stiffly erect or occasionally geniculate culms mostly 50-100 cm tall. Culms infrequently branched above, scabrous and often somewhat pubescent below the nodes. Sheaths villous along upper margins. Ligule fringed with hairs 1-2 mm long. Blades mostly flat, some folded, 15-30 cm long, sometimes longer, typically 2-5 mm broad but occasionally broader, glabrous. Panicles

densely flowered, at least some 6-15 cm long, 0.5-1.0 cm in diameter. *Panicle axis* scabrous. *Bristles* mostly 4-10 mm long, usually solitary below each spikelet. *Spikelets* 2-3 mm long at maturity. *Palea* of the lower floret one-half to three-fourths as long as lemma. *Lemma* and *palea* of upper floret finely rugose and with transverse wrinkles, the palea flat or slightly convex, not gibbous. *Chromosome numbers* reported, $2n=54$.

Emery (1957a, 1957b) recognized that *Setaria leucopila* envelopes at least three different somatic chromosome numbers. He also stated that the 54- and 68-chromosome forms reproduce asexually by apomixis whereas the 72-chromosome form reproduces sexually. The 54-chromosome form is found in western Texas, New Mexico, Colorado, Arizona, and northern Mexico. The 68- and 72-chromosome forms are restricted to the counties of central southern Texas (Rominger 1962).

Multiple seed production blocks of *Setaria leucopila* have been established on the Tucson Plant Materials Center (TPMC) farm since 1975. All plants have consistently shown uniformity in terms of growth form and flowering periods. No evidence of cross-pollination which may result in "off-type" plants has been observed by TPMC personnel. The original collection sites are located in the areas where the 54-chromosome form is stated to be found, this indicates that the Stevan population is most likely comprised of the 54-chromosome form.

Until the fall of 1991 the documentation for this population stated that the species was identified as *Setaria macrostachya*. After consulting with Dr. John Reeder (ret.) at the University of Arizona Herbarium and Dr. James Rominger (ret.) in Flagstaff, Arizona (a noted authority on the *Setaria macrostachya* complex), both gentlemen examined specimens of the TPMC population and determined that the species is actually *Setaria leucopila*. Dr. Rominger stated: "... all specimens appear to be *Setaria leucopila* (Scribn. & Merrill) K. Schum. This is the most common and most widespread perennial species of *Setaria* found in the southwestern U.S. It was Emery in 1957 who recognized this taxon as distinct from *Setaria macrostachya*. I support this concept in my monograph of 1962."

The two taxa are very closely related and sometimes it is difficult to distinguish between the two. One characteristic, not mentioned in the documentation, described by Dr. Rominger, is that the seed of *Setaria leucopila* is of a more elliptical shape than the seed

of *Setaria macrostachya* which is more rounded like a small sphere.

Development and Use:

No significant differences between the 13 accessions of plains bristlegrass were observed in the 1975 Critical Area and Range Improvement Grass IEP. This IEP was conducted from 1975 through 1979. All of the accessions were then blended together into one lot and assigned accession number 9003939 (Williams 1979).

The Stevan population has not been subjected to any genetic manipulation.

Stevan plains bristlegrass was included in plantings on the Santa Rita Experimental Range from 1982-1986 (Briggs 1982, Munda & Pater 1989). The 1983 planting evaluation stated that the plains bristlegrass showed good emergence and establishment. The 1985 planting evaluation data showed Stevan as having germinated and a 10% stand as being established. The 1985 summer was noted as being drier than normal and that the germination and growth was considered to be minimal. By February, 1986, only three plains bristlegrass plants were located within the study plot. All other plantings (1982, 1984, 1986) failed due to a lack of adequate precipitation on the study site.

Stevan was included in plantings on the W.F. Cattle Company near Kingman, Arizona in 1983 and 1986. Both of these plantings failed. The failures were attributed to a lack of adequate precipitation on the planting site.

In August of 1993 Stevan was included in a planting in Avra Valley, Arizona. The soils on this planting site are classified as a Mohave sandy clay loam. The purpose of this planting was to evaluate seedling emergence and establishment from three different planting depths: 0.5", 1", and 1.5". Stevan exhibited a higher seedling emergence percentage and average number of seedlings per foot at the 1.5" planting depth. However, it was not significantly higher ($P < 0.05$) than emergence and establishment from the 0.5" and 1" planting depths (Fig. 1).

A commercially available population of *Setaria macrostachya* was also included in this planting. This commercial population exhibited a slightly higher number of seedlings per foot at the 1" planting depth. This was however not significantly different ($P < 0.05$) than the 0.5" and 1.5" planting depths (Fig. 2).

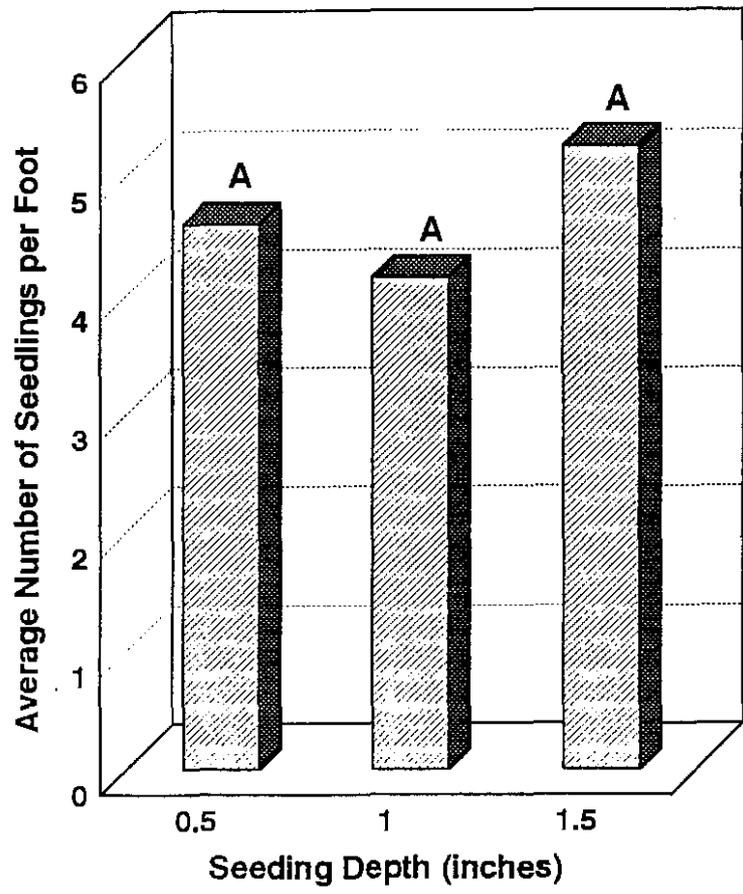


Fig. 1: Average number of seedlings per foot for *Setaria leucopila* at 3 planting depths. Means with the same letter are not significantly different at the 0.05 level of significance

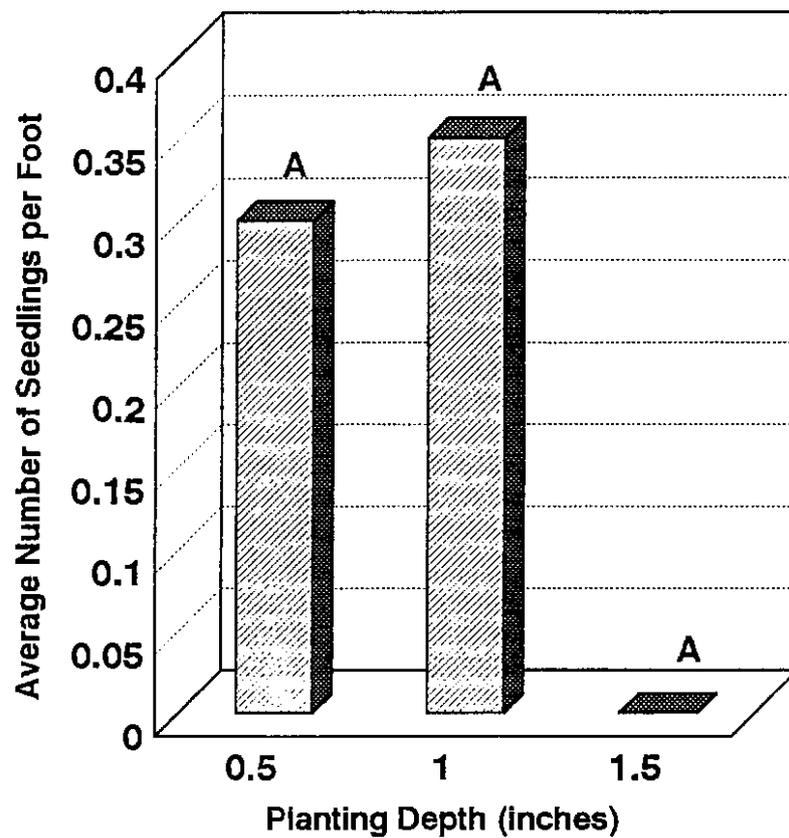


Fig. 2: Average number of seedlings per foot for *Setaria macrostachya* at 3 planting depths. Means with the same letter are not significantly different at the 0.05 level of significance.

In comparison, the Stevan population exhibited a significantly higher emergence percentage ($P < 0.05$) than the commercial population (Fig. 3). In comparison of the number of seedlings per foot there was no significant difference ($P < 0.05$) between the two populations at the 0.5" planting depth, but there was a significant difference between the two populations at the 1.0" and 1.5" planting depths (Fig. 4).

Studies conducted by Tapia and Schmutz (1971) indicated that due to the hard seed coat, plains bristlegrass requires six to nine days of good moisture to germinate and become established. They also stated that plains bristlegrass tended towards increasing germination with increasing periods of darkness and in order to achieve optimum germination and establishment, plains bristlegrass requires a deeper planting. The authors also stated that plains bristlegrass appeared to be quite resistant to physiological drought since germination was not appreciably affected until osmotic tensions exceeded 12 atm (12.2 bars, 1.22 MPa).

Studies conducted by Toole (1941) stated that the seed of plains bristlegrass germinated best at alternating temperatures of 10 to 35 °C or 35 to 10 °C. Germination was enhanced by prechilling or by pretreating with approximately 71% (by volume) sulfuric acid for 15 to 30 minutes. The use of a 0.2% solution of potassium nitrate and water also improved germination.

At the TPMC, Stevan plains bristlegrass is most efficiently harvested using a Woodward Flail-Vac Seed Harvester. The optimum brush speed for harvesting Stevan appears to be 300-400 rpm. Harvesting plains bristlegrass using a combine is also an effective method. The best harvesting time appears to be when the majority of seedheads turn almost "straw-colored" yet a green tint is still evident. If the seed is allowed to turn completely "straw-colored" before harvest, the majority of the seed will have already shattered. The harvested material is allowed to air-dry for approximately 5-7 days before conditioning.

The seed conditioning process at the TPMC is as follows: The material is first processed through a Westrup Brush Machine using a #12 screen (mantle) at a brush speed of 7-8. The resulting material is then processed through an Office Clipper (Dual Air Screen Separator). The process using the Office Clipper is done twice. Both steps are done using a #7 top screen and a 34x34 bottom screen. It should be noted that variation in harvests will result in slightly different

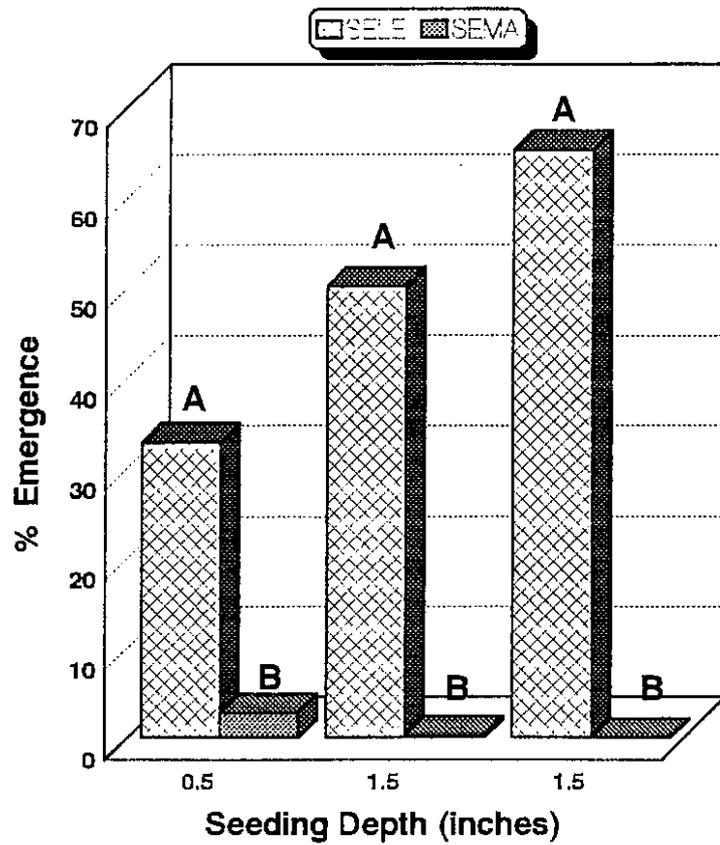


Fig. 3: Average % emergence for *Setaria leucopila* and *Setaria macrostachya* at 3 planting depths. Means with different letters are significantly different at the 0.05 level of significance.

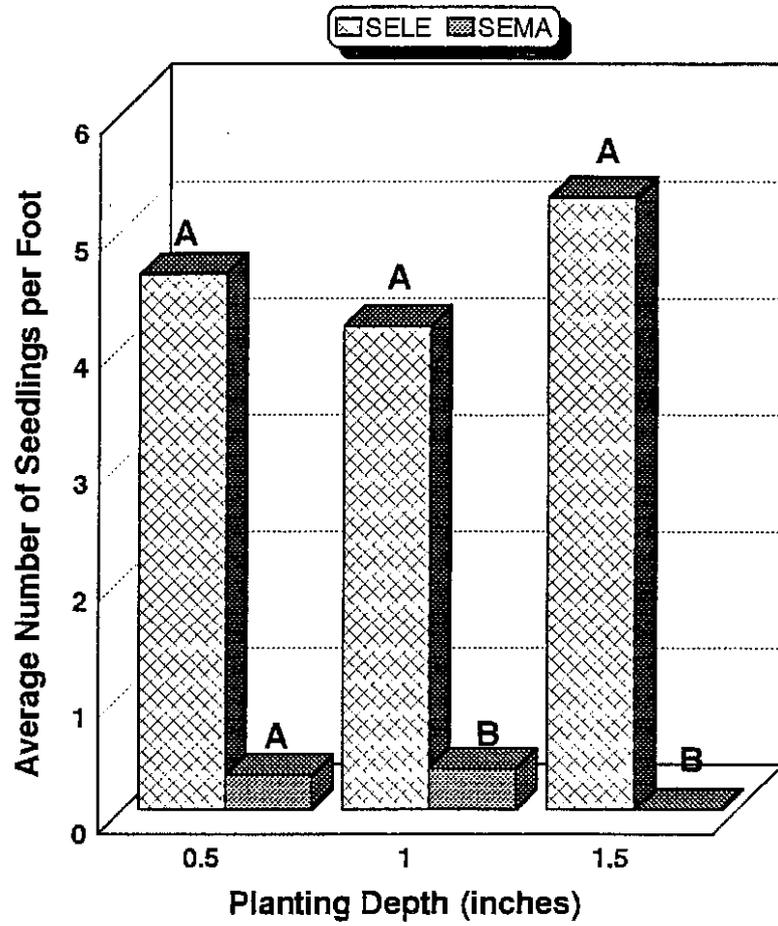


Fig. 4: Comparison of the average number of seedlings per foot for *Setaria leucopila* and *Setaria macrostachya* at three different planting depths. Means with different letters are significantly different at the 0.05 level of significance.

screen size requirements for the cleaning processes. These changes in screen sizes are generally minimal, depending on the condition of the harvested material and the degree of clean seed that is desired. Stevan plains bristlegrass has approximately 305,000 seeds per pound.

For best results, Stevan plains bristlegrass seed can be drill-seeded at a depth of 1-1.5 inches into a well prepared seedbed. Good seed-soil contact is required for optimum germination and establishment. The recommended seeding rate is 3-4 pure live seed (PLS) pounds per acre. In Arizona, MLRA's 41-2 and 41-3, plantings should be conducted after the onset of summer rains. Spring plantings can be conducted only if spring rains appear to be above average in frequency or irrigation water is available. Spring plantings are generally not recommended. In Texas and southeastern New Mexico, MLRA's 42, 77, 78-A, 78-B, and 81-A, plantings should follow local guidelines. Plantings should be managed to prevent young seedlings from being grazed to insure establishment (normally 1-2 years of rest).

It is recommended that Stevan be utilized as part of a seeding mixture comprising roughly 20-30% of the total mix. However, the percent composition can vary depending on the seeding objective.

When seeding on sites subject to erosion, mulching is recommended to conserve moisture, prevent surface compaction or crusting, reduce surface runoff and erosion, control weeds, and help establish plant cover.

The potential conservation uses for Stevan plains bristlegrass include revegetation of eroded rangelands, retired croplands and critical areas, and to provide a degree of forage for wildlife and livestock use.

Currently, there are no released cultivars of *Setaria leucopila* however, commercial seed is available in certain states.

Area of Adaptation:

In Arizona, the Stevan population is best adapted to Major Land Resource Areas (MLRA) 41-2 and 41-3. MLRA 41 is located in the southeastern corner of Arizona. The soils vary from fine-textured, sometimes salty soils in the valleys to stony and shallow soils in the mountains. Soils are frequently underlain with

caliche. Precipitation ranges from 203-508 mm (8-20 in) annually (Jordan 1981).

Jordan (1981) describes MLRA 41-2 as the Chihuahuan desert shrub zone. This zone is characterized by long, gently to strongly sloping old alluvial fans and stream terraces with deeply incised drainageways and broad, nearly level valley floors. Steep rocky hills border the valleys. Elevations vary from 762-1,372 m (2,500-4,500 ft). The climate is warm and semiarid. Mean temperatures of the hottest and coldest months are 28.3 °C and 6.6 °C (83 °F and 44 °F), respectively. Average annual precipitation varies from 203-305 mm (8-12 in), of which 55% is distributed from June through September.

In MLRA 41-2, Stevan should perform best on sandy bottoms and sandy loam uplands. This population should also perform well on clay bottoms and uplands, clay loam uplands, limy slopes, loamy bottoms and uplands, and saline bottoms. Heavier soils may require a more shallow planting depth (0.75-1.00") as compared to lighter textured soils (1.0-1.5").

Jordan (1981) describes MLRA 41-3 as the Chihuahuan semidesert grassland. This zone is characterized by gently to strongly sloping, dissected old alluvial fans and nearly level, broad valley floors. Steep, stony and rocky hills border the valleys. Soils on the fans from limestone hills are calcareous and indurated layers may also be present. Otherwise, soils are slightly acid to neutral. Elevations vary from 1,067-1,676 m (3,500-5,500 ft). The climate is warm and semiarid. Mean temperatures of the hottest and coldest months are 27 °C and 5.5 °C (81 °F and 42 °F), respectively. Average annual precipitation varies from 305-406 mm (12-16 in), of which 65% is distributed from June through September.

In MLRA 41-3, Stevan should perform best on deep sandy loams and shallow uplands. It should also perform well on clay and clay loam uplands, limestone hills, limy uplands, loamy bottoms and uplands, sandy bottoms and sandy loam uplands. Heavier soils may require a more shallow planting depth (0.75-1.00") as compared to lighter textured soils (1.0-1.5").

In Texas, the Stevan population may be best adapted to MLRA's 42, 77, 78-A, 78-B, and 81-A. These areas encompass the Southern Desertic Basins, Plains, and Mountains; the Southern High Plains; the Central Rolling Red Plains; and the Edwards Plateau.

The average annual precipitation in MLRA 42 ranges from 200-325 mm (8-13 in) with a mean annual temperature range of 13-18 °C (55-64 °F). The elevation ranges from 800 to 1500m (2,624-4,920 ft) in basins and valleys, but is more than 2,600 m (8,528 ft). Broad desert basins and valleys are bordered by gently sloping to strongly sloping fans and terraces. Scarce surface water and low precipitation are severe limitations to use of the area for range. Maximum precipitation is from mid-spring to mid-autumn.

In MLRA 42, most of the soils are Argids and Orthids. They are well drained and medium textured. Stevan should perform on these soils types.

Average annual precipitation in MLRA 77 ranges from 375-550 mm (15-22 in) with maximum precipitation occurring from late in spring through autumn. The mean annual temperature ranges from 13-17 °C (55-63 °F). The elevation ranges from 800-2,000 m, increasing gradually from the southeast to northwest. These smooth high plains are gently sloping.

In MLRA 77, most of the soils are Ustolls and Ustalfs. Stevan should perform well on these deep, fine, and medium textured and coarse textured soils.

Average annual precipitation in MLRA 78-A and 78-B ranges from 500-650 mm (20-26 in) with the majority of the precipitation occurring in the spring. The mean annual temperature ranges from 14-18 °C (57-64 °F). The elevation ranges from 500-900 m, increasing gradually from east to west.

In MLRA's 78-A and 78-B, the major soils are Ustolls, Ustalfs, and Ochrepts. Stevan should perform well on these soils.

MLRA 81-A has an annual precipitation range of 375-450 mm (15-18 in). About three-fourths of the precipitation falls during the growing season. The mean annual temperature ranges from 18-20 °C (64-68 °F). The elevation ranges from 200-500 m (656-1,640 ft) on valley floors. On hills and plateaus it ranges from 400-1,200 m (1,312-3,936 ft), increasing gradually from east to west.

In MLRA 81-A, most of the soils are Ustolls. They are stony and moderately textured and fine textured. Stevan should perform well on these soils.

Environmental Consideration:

This release is an indigenous population originating from 13 collection sites throughout the species' native range of adaptation. This species is documented as having beneficial qualities, and no negative impacts on wild or domestic animals. The USDA-SCS Range Site Description Handbook states this species as having beneficial qualities in terms of diet for: mule deer, pronghorn antelope, javalina, blacktail jackrabbit, antelope jackrabbit, desert cottontail, silky pocket mouse, bannertail kangaroo rat, white throated woodrat, Gambel's quail, and scaled quail. The test plots supporting this release were made in close proximity to natural and induced plant ecosystems. There was no evidence of negative impacts or invasion into these ecosystems.

Seed Source:

The Tucson Plant Materials Center will be responsible for maintaining a supply of foundation and breeder seed. Foundation seed will be available for establishing seed source nurseries for commercial production through the Arizona Crop Improvement Association. Standards for all classes of seed will be included in the Arizona Seed Certification Handbook.

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