About Our Cover

Development of Texas Bluebonnets into Floricultural Crops

What is a bluebonnet?

The term "bluebonnet' is used by Texans to describe plants that most ornamental horticulturists would refer to as "lupines." There are six species of *Lupinus* native to Texas (Table 1) and all have official state flower status. *Lupinus subcarnosus* Hook. was originally made the state flower in 1901 via a resolution approved by the Texas Senate and House of Representatives (Andrews, 1986). Soon thereafter, however, confusion and controversy arose when Texans realized that more than one *Lupinus* species is native to the state. The controversy was finally resolved in 1971 when subsequent legislation designated all native *Lupinus* as the state flower.

The controversy surrounding the designation of the official state flower is indicative of the emotional attachment Texans have to bluebonnets. These flowers are unmatched in their ability to evoke feelings of state pride and loyalty. Indeed, the bluebonnet has become a symbol of Texas. Tourist, novelty, and gift shops abound with items such as t-shirts, stationery, postcards, towels, paintings, wall hangings, and pottery, all highlighting the bluebonnet. Because of the popularity of bluebonnets in Texas, we have undertaken two projects aimed at increasing the availability of these plants to the public. These projects have proven to be an excellent means of communicating the value of horticultural research and extension programs.

Lupinus texensis Hook. as a bedding plant

Lupinus texensis is the best known and most widely distributed member of the genus in Texas (Fig. 1). The Texas Dept. of Highways and Public Transportation has used this plant for many years as a direct-seeded roadside wildflower. The violet-blue flowers create impressive masses of color during March and April. Because of the popularity of bluebonnets and their wide adaptability, a project was begun in the mid-1980s to develop *L. texensis* as a low-maintenance bedding plant. Ideally, transplants would be produced during late summer into early fall and then sold during September and October. Retail nursery operators were particularly interested in this idea as a way to improve fall sales.

The initial roadblock to bedding plant production was the lack of a suitable, stable seed supply. To remedy this problem, vegetable growers in the San Antonio area increased seed supplies. Their primary incentive was the potentially strong demand for *L. texensis* seed by bedding plant growers and for highway seeding projects. Under the direction of the extension vegetable specialist in San Antonio, growers were able to produce dependable quantities of seed within 2 to 3 years. Unfortunately, the seed did not always yield the uniform germination and emergence required for bedding plant production. This deficiency appeared to be related to the hard-seeded characteristic typical of many legumes. Thus, experiment station and extension service scientists began a research project to investigate this seedling establishment problem. Experiments using a variety of commercial seedlots revealed significant variation among the seedlots in their need for acid scarification (Davis et al., 1991). These findings led to the recommendation that growers test the response of small seedlot samples before deciding on the length of scarification. Where this is not feasible, a 45-min acid treatment is recommended. This treatment promoted emergence in most seedlots without seriously damaging sensitive lots.

Concomitant with the development of technology for bedding plant production of *L. texensis*, J.M. Parsons initiated a breeding project with the primary objective of developing novel flower colors. Color variants are known to occur in nature, but they are rare. In Spring 1986, a small group of fewer than 100 pink-flowered plants was discovered near San Antonio. Seed from these plants was collected, and through recurrent selection for pink flowers, the first seed-propagated cultivar of *L. texensis*, 'Abbott Pink', was developed (Parsons and Davis, 1993). Numerous other color variants have since been identified and are being purified through recurrent selection. The second cultivar release from this project, 'Barbara Bush' (see cover photo), is described in this issue on p. 1202 (Parsons et al., 1994). Other flower color lines under advanced stages of development include red, maroon, and a bicolor composed of a violet-blue keel and a pink banner petal. These cultivars should be ready for release within 1 or 2 years.

When a sufficient number of *L. texensis* transplants were produced by bedding plant growers, marketing efforts were initiated under the auspices of the Coordinated Educational and Marketing Assistance Program, Texas Agricultural Extension Service. The overall goal of this program is to integrate research and extension activities to identify, test, refine, and market superior plant material for the Texas ornamental horticulture industry. In Fall 1989, an extensive media campaign using television, radio, and newspaper was developed for the north-central Texas area. This campaign was designed to provide the public with information about growing bluebonnets and to indicate where and when transplants could be obtained. Growers and retailers were apprised of the marketing efforts well in advance so that an adequate number of plants would be available. This coordinated effort resulted in fall transplant sales in the north-central Texas region of slightly more than 275,000. In addition, nearly 2200 kg of acid-scarified seed were sold through retail outlets. Similar results were obtained in the San Antonio area. Transplants of *L. texensis* are now routinely available at retail outlets each fall.

Lupinus havardii Wats. as a cut flower

Lupinus havardii, commonly known as the Big Bend or Chisos bluebonnet, is a showy winter annual that produces blue (see cover photo), fragrant flower spikes that are 0.5 to 1 m tall. This species is native to a narrow geographical range along the Rio Grande River in southwestern Texas (Fig. 1). Native populations vary greatly from year-to-year depending on quantity and distribution of rainfall. In moist years, plants are abundant from the desert floor to mountain slopes. In dry years, however, only a few plants are present, primarily along creek beds or adjacent to paved roadways where runoff supplements the sparse precipitation. Seedlings emerge following rains in late summer and early autumn. If soil moisture remains sufficient, plants begin blooming as early as November. The peak bloom period, however, is generally during February and March. Populations growing at high elevations (≈1200 m) can produce flowers as late as May.

(continued on p. 1211)

Table 1. *Lupinus* species native to the state of Texas (sources: Andrews, 1986; Correll and Johnston, 1970).

Species, authority	Common names	Approx ht (m)	Predominant flower color
concinnus Agardh.	Desert, annual, or bajada lupine	0.15	Reddish purple
havardii Wats.	Big Bend bluebonnet, Chisos bluebonnet	0.5–1	Blue
perennis L.	Perennial bluebonnet, sundial lupine	0.8–1.2	Blue
plattensis Wats.	Plains bluebonnet	0.7–1	Bluish purple
subcarnosus Hook.	Sandy land bluebonnet	0.3–0.7	Blue
texensis Hook.	Texas bluebonnet	0.3–0.7	Blue

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Front cover: (**clockwise from top**) 'Barbara Bush' bluebonnet (*Lupinus texensis* Hook.); Big Bend bluebonnet (*Lupinus havardii* Wats.) flower; former First Lady Barbara Bush receives a photo of the 'Barbara Bush' bluebonnet at the ceremony announcing the cultivar name; bouquet of Big Bend bluebonnets.

(continued from inside front cover)

The blue flower spike of *L. havardii* has considerable potential in the floral industry (see cover photo), particularly because there is a need for high-quality, durable, spike-type cut flowers. In addition, blue flowers are rare and *L. havardii* could help fill this important color niche in the floral market. Furthermore, a bluebonnet cut flower has tremendous consumer appeal in Texas. In fact, the research dealing with *L. havardii* as a cut flower has attracted considerable media attention, including television news stories in Dallas and in El Paso, and on a national television network. Based on the promising market potential, T.D. Davis and W.A. MacKay began a research project (funded in part by the Fred C. Gloeckner Foundation, Harrison, N.Y.) in 1990 with the aim of evaluating the cut flower potential of *L. havardii*.

Preliminary greenhouse trials indicated that *L. havardii* is adaptable to greenhouse culture. Individual plants produced 20 to 25 marketable flower spikes within 4 to 5 months from sowing. Vaselife of spikes from some plants was as long as 2 weeks. Based on these promising preliminary trials with native seed, W.A. MacKay and T.D. Davis initiated a breeding project in 1991. This project has moved forward rapidly because several crops can be grown and evaluated each year. In addition, as with *L. texensis*, recurrent selection rapidly results in pure lines of *L. havardii*.

The initial focus of the breeding work was to improve uniformity and to select novel flower colors. This effort has resulted in four separate color lines that continue to be refined into cultivars: dark blue, pink, white, and light blue. Current breeding objectives for these lines are to improve uniformity, yield, flower quality, and vaselife further. We hope to release the first cultivar within the next one to two years.

Additional research is being conducted to refine technology for growing the crop. Because little is known about the floral biology of this plant, information is needed regarding the factors that regulate flower production. In collaboration with Roy A. Larson, experiments are underway at the Southeastern Environmental Plant Laboratory on the campus of North Carolina State Univ. Preliminary results suggest that flowering can occur at most daylengths, but timing and the number of flowers produced may vary with photoperiod. Additional experiments are being conducted to determine the effect of vernalization on growth and flowering. Work with *Lupinus* species used for agronomic purposes indicates that vernalization can dramatically reduce variation in crop performance (Putnam et al., 1993).

A modern-day cut flower must be able to withstand the rigors of shipping and handling. Accordingly, research is underway to evaluate the effect of various conditioning and handling treatments on the vaselife of flower spikes. Results obtained thus far indicate that preconditioning with silver thiosulfate (STS) dramatically reduces floret abscission and extends vaselife by several days (Davis et al., 1994). Storage of STS-preconditioned spikes in water at 5C for 72 h only decreased vaselife by ≈1 day compared to nonstored controls. Further, STS-preconditioned spikes stored dry at 5C for 72 h still had a vaselife of ≈8 days. Thus, *L. havardii* flower spikes seem amenable to storage. The use of STS, however, will likely be restricted in the future because of environmental concerns (Nell, 1992). Thus, other conditioning alternatives are being evaluated. Also, breeding for improved postharvest qualities appears feasible and should reduce the need for conditioning treatments.

Flower spikes of *L. havardii* have been shipped successfully via overnight air express. Although spikes are wilted upon arrival, they rehydrate rapidly when recut and placed in water. Thus, shipping appears to have little adverse effect on vaselife.

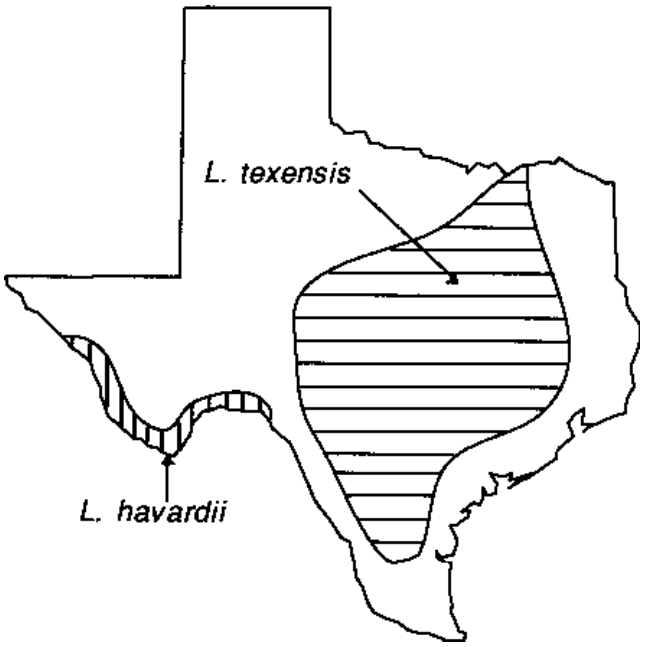

Fig. 1. Approximate natural distribution of *Lupinus havardii* and *L. texensis* in the state of Texas.

Future

Texas bluebonnets have considerable consumer appeal in Texas. Horticultural research and extension programs have been and will continue to be aimed at making *L. texensis* and *L. havardii* more widely available to the public as bedding plants and cut flowers, respectively. These plants, particularly *L. havardii* as a cut flower, may also prove useful in many areas outside of Texas. Research dealing with genetic improvement and technology for growing the crop will continue. Extension efforts will continue to ensure that plants and flowers are available at appropriate times and that the consumer is well educated regarding these products.

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