Growing Guar in Arizona

Robert E. Dennis and Duane L. Johnson, Extension Agronomist and
Plant Breeder, respectively

Summary

Guar is a warm-weather, drought tolerant, deep rooted, summer annual legume native to India and Pakistan. Most research with guar in Arizona has been at elevations below 3,000 feet and results indicate the crop is adapted for seed or green manure in these parts of the state. Guar yields have ranged from less than 1,000 to more than 1,800 lbs. of clean seed per acre.

Guar Plant. Guar plants have a central stalk and tap root. Guar plants do not tiller, but do develop branches as space permits. Flowers develop in the axils of leaves. A flower produces a pod 1½"-2" long, and each pod contains 6-9 seeds.

Guar Adaptation. Guar has been grown on all soil types in Arizona but stand establishment problems may occur on saline or alkali soils. While guar has performed best when planted in loam or sandy loam soils, good results have been obtained on fine textured soils, especially when irrigation schedules have been managed carefully. Guar plants are quite salt tolerant after plant height reaches 8" to 10".

Guar improves soil tilth and water infiltration. It may also reduce the incidence of certain diseases in crops that follow, notably cotton and wheat.

Varieties of Guar. Brooks: Plants of Brooks are of medium to late maturity, branch profusely, and leaves, stems, and pods are glabrous. Plants of Brooks are tolerant to Alternaria leaf spot and bacterial blight.

Kinman: Plants are slightly taller and coarser-stemmed than those of Brooks and have a fine-branching growth habit. Leaves, stems and pods are glabrous. Seeds are slightly larger than for Brooks and are dull white to light gray in color. Maturity is about the same as for Brooks. Plants have a high degree of tolerance to bacterial blight and Alternaria leaf spot.

Esser: Esser plants have glabrous leaves, stems and pods. Plants have a fine-branching growth habit, but a stronger main stem with fewer branches than those of the Brooks variety. Racemes of Esser are small and pods are medium-sized. Esser is similar to Brooks in height, in color and size of seed, and in maturity. Esser, like Kinman, has excellent tolerance to Alternaria leaf spot. Esser has greater tolerance to bacterial blight than Brooks and Kinman. The adaptation of Esser is more restricted than that of Kinman. The yield potential of Esser appears to be less than that of Kinman except where bacterial blight is a severe problem.

Use Quality Seed. Quality planting seed is essential for successful guar production. Ideally, seeds should have (1) high percent germination, (2) large size and full development and (3) uniformity. Certified seed is produced so as to maintain genetic identity.

Dates of Planting for Guar. Guar seeds germinate and seedlings emerge quickly when temperature at seed planting depth is 70^{o} or above. The most favorable dates are from mid-June to mid-July at elevations below 2,500 feet in Arizona. Information concerning best planting dates for higher elevations is limited. At the higher elevations, plant as early as possible, but after soil has warmed and after the average date of last killing frost.

Inoculation of Seed. Because of guar's use as a low water-requiring crop and high summer temperatures, inoculation has not been effective. No differences in yield from plants on inoculated and non-inoculated plots have been observed in University of Arizona trials. The use of 50-100 lbs. of nitrogen/acre is usually suggested.

Method of Planting Guar. Guar may be planted on beds or on the flat. Planting on 38- or 40-inch beds is preferred over flat planting in most situations, especially when planting late. One or two rows may be used on each bed, as for sorghum, with two rows per bed being preferred.

Beds for guar should be low, yet high enough to permit harvest of seed developing near the soil surface. Since guar seed is quite dense, weight of seed on planter plates may be a problem. Weight of seed on the planter plate may be kept from being excessive by filling the planter box no more than one-third full. Vegetable type planters, including beet seed attachments for flexi-planters, are excellent for use in establishing guar stands. A grain drill may be adapted to plant guar, but cultivation for weed control in such plantings is difficult or impossible.

Rate of Planting. Drop six guar seeds per foot of row so as to achieve a stand with plants averaging three to four inches apart in the row. The goal is to achieve uniform spacing of 40,000 to 50,000 plants per acre. Use a higher population for narrow and lower for widely spaced rows. Guar seeds are about the same size as those of sorghum. Planter plates used for sorghum are satisfactory for guar. Holes in planter plates with straight sides are preferred to those that are tapered or beveled. Clogging caused by gumming may be reduced by adding a small amount of dry detergent or graphite to the planter box.

There are about 13,000 seeds per pound for each of the presently used varieties of guar. Farmer experience indicates that seeding rates of 10-12 lbs. per acre are desirable with seed having 85% or better germination and in situations where two rows on 38- or 40-inch beds are to be used.

When guar plants are spaced closely, less branching and pod formation occurs near ground level, making combine harvest more efficient. However, if plant spacing is too close, loding may occur and result in yield losses. When stands are thin, weed problems are increased and yield potential is reduced.

Depth of Planting. Guar seeds should be placed 1½" to 2" deep when planting in moisture. If a rain occurs after planting, soil crusting may result in poor stands when seeds have been planted at this depth. When this occurs, surface soil should be kept moist by frequent light irrigations. For plantings to be irrigated up, plant no deeper than one inch and preferably not more than ½" to 3/4", especially if soil is fine textured.

Irrigation to Control Salt. When guar is grown in soils having a salt problem, irrigation practices may be varied so as to control salt. The irrigation of every other row in single row bed plantings helps to move salts out of the row area. When guar is planted with two rows per bed, every row should be irrigated so as to move salts to bed tops and therefore away from the plants.

Guar Irrigation. Farm experience at elevations below 2,500 feet indicates that good yields of guar may be obtained with 25-30 inches of applied water. Excessive irrigation for guar causes plants to be rank and unproductive. Guar may be grown under minimum irrigation regimes at elevations below 2,500 feet in Arizona. When this is done it is likely that about 12" of water will be required to obtain a stand. Then additional irrigations of about 6" each will be required when plants are 8"-10" high and also about 30 days after first blooms occur. This would be a modified dryland culture and would be expected to result in lower yields. Where water costs are very high, use of minimum irrigations may be the most profitable course to follow. University trials at Mesa and Yuma have not shown yield differences when total irrigation water has varied from 18" to 24".

Weed Control. Guar is not a good competitor with weeds during establishment. Weed problems are greater when guar is irrigated up than when planted in moist soil. Weed control in poor or late planted stands of guar is especially difficult.

Weeds have been a serious problem in Arizona guar plantings. Treflan is approved for use for the control of weeds in guar. It should be used as indicated on the label. Certain weeds, such as groundcherry, will not be controlled with Treflan. Several other herbicides are effective but have not been approved for use in guar.

Where weeds are expected to be a problem it is usually advisable to plant guar in rows so that it may be cultivated. Take care not to throw excessive amounts of soil against the base of guar plants during cultivation (see discussion concerning Southern blight) and do not cultivate too close, too deep or too late in the season.

Insect Pests of Guar. Insect damage in Arizona's crops, especially that caused by midges, has not been serious. When plants are blooming adequately, no insecticide applications are usually necessary.

Two species of midges have caused economic damage to guar in Texas and Oklahoma. White flies have been observed to cause damage at Yuma and stink bug infestations may lower yields in some areas. Occasionally the alfalfa leaf hopper may damage guar plants by girdling stems and branches. A few galls of *Asphondylia* sp. have been found in the vicinity of Casa Grande.

Diseases of Guar. Guar is susceptible to several diseases. Use disease tolerant varieties (see variety description), disease free seed and cultural practices that encourage the development of strong, healthy plants to reduce damage caused by disease.

Bacterial blight: Bacterial blight is seed-borne and may cause the death of plants as seedlings or at any stage of growth. Affected plants have irregular lesions on the tops of leaves and later black streaking of stems. The part of the plant infected or the entire plant may die. Use of disease-free seed is the best and only control for bacterial blight. In Arizona, blight appears during wet, cool conditions.

Southern blight: Southern blight is caused by a fungus. Superficial growth of the fungus may be observed as a white mass at the crown of infected guar plants. With time, seed-like structures may develop in the white fungus growth. These are very small and dark in color. Infected plants die quickly.

Good field sanitation and crop rotation are the best controls for Southern blight. Throwing excessive soil to the base of plants during cultivation increases losses caused by Southern blight.

Alternaria leaf spot: This leaf disease is caused by a fungus. It is more severe when humidity is high, as during the period of summer rains in Arizona. Lesions of this leaf spot begin as brown spots. Affected areas enlarge and may then cause the leaf to drop.

Texas Root Rot: Guar is highly resistant to Texas root rot, Phymatotrichum omnivorum. While the fungus causing Texas root rot disease may attack guar, damage is usually not of economic importance.

Other Diseases: Several viruses attack guar but losses have not been serious in Arizona. One disease called top necrosis virus has resulted in significant losses in the Lower Rio Grande Valley of Texas. This virus causes terminals to turn brown and then die. Guar is susceptible to the following root rot diseases: Sclerotium rot, Sclerotium rolfsii; Fusarium root rot, Fusarium sp.; and Black root rot, Rhizoctonia solani. Guar does appear to inhibit certain root rots of wheat and cotton and therefore may benefit these crops when they follow it in the rotation.

Harvesting Guar. Harvest of guar is usually by direct combining. Plants are ready for harvest when seed pods are brown and dry and when moisture content does not exceed 14%.

In Arizona, where green weed growth is not a problem, harvesting has usually been delayed until plants mature and defoliate naturally or until after frost. When necessary, paraquat may be used as a desiccant. Be sure to follow label recommendations when paraquat is applied. When combining guar, remove alternate reel slots to reduce stripping and shattering. Some combine operators report good results when reel slots are replaced with 1" steel rods or conduit. The reel should be set so as to run 6"-12" ahead of the cutter bar and reel speed should be slightly faster than ground speed. When reel speed is too slow or too fast, shattering may be increased.

Cylinder speeds must be slow to minimize seed damage. Concave clearance should start at 3/4" and the cleaning shoe should have full air. A high fan speed may be used to remove foreign material since guar seeds are quite dense. Shattering caused by breaking of pods has been a serious problem in Arizona.

The Physiology of Wild Gourd

Gerri Foote and A. K. Dobrenz, Department of Plant
Sciences, University of Arizona, Tucson

Summary

Experiments have been conducted to determine some of the physiological characteristics of the Buffalo gourd (C. foetidissima). Seedling respiration rates of two open pollinated varieties and two hybrids were determined. These rates were later correlated with photosynthetic and photorespiration rates of the same varieties under controlled environmental conditions.

****

The buffalo gourd (Cucurbita foetidissima) is a wild xerophytic plant that grows mainly in the southwestern U.S. In recent years, efforts have been made to domesticate the buffalo gourd because of its high potential as a food and fuel crop grown in arid regions. A multidisciplinary team headed by Doctors W. P. Bemis, J. W. Berry, and C. W. Weber studied the agronomic characteristics and possible utilization of the plant. The buffalo gourd has many desirable qualities including a large tuberous root containing high starch levels, and seed yielding high quality vegetable oil and protein.

Recent studies have tested the physiological characteristics of the plant. An initial experiment was conducted to ascertain which temperature would be most beneficial for seedling growth (Figure 1a). The respiration rate reached its highest value under a 30°C regime. Under all these regimes, the values began to taper off by the 8th day due to lack of cotyledonary reserves.

After the optimum temperature was established, four lines, of which two are hybrids [250 x 300 and (140 x 156) x 300] and two are open pollinated varieties (synthetic and 300) were tested to determine the respiration rates under a uniform temperature regime (Fibure 1b). The two open pollinated lines had the highest respiration rates while the two hybrids had the lowest. Also, there was a 50% difference in respiration rates between 300 and [(140 x 156) x 300]. A third experiment was performed utilizing young plants grown from the four seed sources. These plants were surveyed monthly under controlled environmental conditions to determine their photosynthetic rates. It was noticed that the lines with the lowest respiration rates as seedlings, had the highest photosynthetic rates (Figure 2).

Many species of plants which exhibit low respiration levels and high photosynthetic rates generally have higher quantities of carbohydrate reserve. This reserve energy may result in more abundant plant growth and/or higher yields of various plant products. Future studies will determine whether this pattern holds true for wild gourd under field conditions.