FACT SHEET

L-907

KEYS TO PROFITABLE GUAR PRODUCTION

R. J. Hodges, Murray L. Kinman, Norman W. Brints, Emory P. Boring III and James R. Mulkey, Jr.*

Guar, *Cyamopsis tetragonoloba,* is a drouth-tolerant summer annual legume. It was introduced into the United States in 1903 from India, where it is grown for exports, as a vegetable for human consumption, as cattle feed and as a green manure crop.

The guar seed (called a bean) has a rather large endosperm which sets it apart from most other legumes, which have little or no endosperm. The guar endosperm contains galactomannan gum which forms a viscous gel in cold water. Perhaps the best-known use of guar gum is as a stiffener in soft ice cream, whip and chill puddings and whipped cream substitutes. Such products use the most highly refined food grade guar gum, and account for only a small portion of total production. Larger volume uses of guar gum are in cloth and paper sizing, oil well drilling muds and ore flotation. Heavy imports of guar gum have been from India and Pakistan as partially processed endosperm material.

The meal remaining after the extraction of gum contains about 35 percent protein, of which about 95 percent is digestible, making it an excellent protein supplement for ruminants. It is equal or superior to cotton seed meal in amino acids. Enough gum remains in the meal to make it an excellent feed pelleting material. Toasting improves its palatability when fed to livestock.

Commercial production of guar began in the early 1950's in South Texas, but the center of production quickly moved to the sandy soils of the Rolling Plains area of Texas and Oklahoma. Official statistics are unavailable, but Texas farmers plant around 100 thousand acres annually. About half of the planted acreage is harvested. The remainder is plowed under as green manure for its soil-building properties.

SOIL REQUIREMENTS

Guar grows well under a wide range of soil conditions. It performs best on fertile medium-textured and sandy loam soils, with good structure and well-drained subsoils. Guar has been grown successfully following flax when moisture is available on the heavier soils of South Texas.

MOISTURE REQUIREMENTS

The guar plant is drouth resistant; when moisture is short, growth stops until moisture becomes available. Such intermittent growth lengthens the growing season. Peak water use periods of guar are not as critical as for grain sorghum. Guar responds to irrigation since adequate available soil moisture insures maximum production of forage and beans. It is best adapted to areas of 20 to 30 inches of annual rainfall. Excessive rain after maturity causes the seed to turn black and shrivel which lowers the quality of the beans. Dry fall weather for harvesting is preferred. Profitable seed production in areas of high rainfall and humidity is questionable; however, in such areas it might be used as a green manure crop.

ROTATIONS

Guar fits well into a crop-rotating program. It is a deep tap-rooted summer legume and is an excellent soil-improving crop. It works well in rotation with cotton, grain sorghum, small grains, vegetables and flax. Increased yields can be expected from crops following guar because of increased soil fertility. When used in rotation with cotton, yield increases of that crop of 15 percent have been measured.

When harvested for seed, guar still returns considerable dry organic matter to the soil surface as a mulch.

In a 3-year test at the Chillicothe Experiment Station, cotton planted in two-in-four-out systems produced 250 pounds lint cotton per acre. The same system, with the two center rows interplanted with guar, produced 220 pounds of lint cotton and 500 pounds of guar for a cash advantage exceeding $15 per acre.

SEEDBED PREPARATION

Prepare the seedbed for guar the same as for cotton, corn or grain sorghum. It should be firm, free of weeds and the row surface should be slightly

*Respectively, Extension agronomist, Texas A&M University; research agronomist, Crops Research Division, Agricultural Research Service, USDA; Extension area farm management specialist and Extension area entomologist, Vernon, Texas and assistant professor in charge, Texas A&M University Agricultural Research Station at Chillicothe.

Texas A&M University • Agricultural Extension Service • John E. Hutchison, Director • College Station

to well above general ground level to facilitate harvest. Plants on slightly raised beds after the final cultivation insure maximum recovery of low-set beans at harvest. Guar usually is planted in 36 to 40-inch rows; however, row spacings of 10 to 20 inches might increase yields if moisture is adequate.

QUALITY SEED

Use good-quality, preferably certified seed of recommended varieties. Planting seed should be of high germination, plump, true to variety and free from other crop and weed seed.

Since the inoculum of the bacterial blight disease can be seed-borne, the use of certified seed to eliminate admixtures of old varieties, Texsel and Groehler, with improved varieties is important. Diseased Texsel or Groehler plants scattered through a field can provide inoculum for spread of the disease. New guar varieties are resistant, but not immune, to the disease.

INOCULATION OF PLANTING SEED

Inoculate planting seed just before planting with a special guar inoculant or the cowpea (Group "E") inoculant. Sunlight, heat and excessive drying will impair or destroy effectiveness of the bacteria. Properly inoculated guar will fix atmospheric nitrogen in amounts similar to cowpeas or other legumes. For this reason, crops following guar in rotation generally benefit from the residual nitrogen.

PLANTING DATES

Plant guar when continuous warm weather is assured. It has higher temperature requirements than cotton for stand establishment. For rapid establishment, soil temperatures at planting time should be above 70 degrees F. A warm seedbed, adequate soil moisture and warm growing weather are essential. Seeding dates can range from March to August in the region of adaptation. Optimum seeding dates in South Texas are April 15 to May 31; in Central West Texas, May 15 to July 1. Although late plantings usually give satisfactory stands, seed frequently mature during lengthy periods of rainfall, which may cause staining and reduction of bean quality. Late plantings may be satisfactory for summer cover or soil-improving crops.

SEEDING RATE AND DEPTH

The following seeding rates (based on 85 percent germination) are suggested:

Single rows	4 to 6 lb. per A.
Double rows	6 to 8 lb. per A.
Broadcast	10 to 15 lb. per A.

Seeding rates, based on percent germination to assure a maximum of five plants per linear foot of row, are suggested. Broadcast plantings are not recommended where moisture is insufficient to support the greater plant population.

Guar should be planted 1 to 1½ inches deep.

PLANTING EQUIPMENT

Guar usually is planted with equipment employed in planting grain sorghum. Beveled or tapered holes on the bottom side of plates crush guar seed and cause gumming or clogging. Straight holes give less problems. Addition of graphite or a dry detergent in the seed box helps avoid the gumming problem. Reduce seed weight on the plates by filling the planter box only about one-third of capacity.

Equipment designed for seeding vegetable or oil seed crops has advantages for seeding guar. Special adapters designed for conventional planter boxes in seeding oil crops such as soybeans may be suitable also.

RECOMMENDED VARIETIES

The development of disease resistant varieties has stabilized and increased sufficiently to allow guar to become a crop of economic importance when adapted. During seasons of normal rainfall, these improved varieties permit production of maximum yields partially resulting from improved harvest efficiency because the pods are set higher above the ground level.

Brooks, released in 1964, was the first improved variety. It replaced Texsel and Groehler and has occupied about 95 percent of the acreage since 1966. It is a high-yielding variety of known resistance to the major guar diseases, Alternaria leaf spot and bacterial blight. It is medium late in maturity and of the fine-branching growth habit. Small racemes of medium-sized pods are well distributed on the main stem and branches. Leaves and stems are glabrous (free of hair). The seed are of medium size averaging 3 grams per 100. First pods are set higher above the ground level than those of old varieties Texsel and Groehler.

Hall is a moderately late-maturing variety, slightly later than Brooks. It is resistant to bacterial blight and Alternaria leaf spot. It is considered a full season variety. Plants are relatively tall, coarse and possess the fine-branching growth habit. Small racemes of medium-sized pods are well distributed over the main stem and branches. Leaves and stems are glabrous. Seed are average size averaging slightly less than 3.0 grams per 100. This variety appears best adapted to heavier soil types and higher elevations.

Mills is an early maturing variety which is resistant to bacterial blight and Alternaria leaf spot.

Plants are short in stature and possess the fine-branching growth habit. Small racemes of above average-sized pods are well distributed on the main stem and branches. Leaves and stems are pubescent (hairy). Seed are above average in size, averaging about 3.4 grams per 100. In dry seasons, Mills does not grow tall enough for efficient harvest. Yields generally are lower than those of Brooks and Hall and the variety has not gained much grower acceptance. When diseases cause defoliation and premature death, susceptible varieties may be ready for harvest considerably earlier than Mills.

Cultural Practices, Usual Dates, Times Over and Hours Per Acre For Production and Harvesting of Guar

Cultural practices	Usual dates	Times over	Hr. per A.
Chisel or hoeme	March - May	1	0.4
Harrow	April - May	1	0.2
Bed land	April - May	1	0.3
Knife or sweep beds	May	1	0.3
Plant & fertilize	May - June	1	0.3
Cultivate	June - July	3	0.9
Combine	Nov. - Dec.	Custom	
Hauling		Custom	
Total			2.4

FERTILIZATION

Fertilize according to results of a soil test. Apply fertilizer to the side and below the seed at planting or below the seed before planting. On fertile land or where preceding crops have been fertilized heavily, fertilizer requirements for guar can be reduced or omitted. Guar, like most legumes, requires high levels of phosphorus. In lieu of a soil test, consider using 20 to 30 pounds of phosphorus (P_2O_5). Fertilizer applied to guar should increase yields of following crops.

WEED CONTROL

Guar seed yields can be reduced greatly by weed competition. Also, weedy fields create harvesting problems. Do not seed guar in fields heavily infested with Johnsongrass. Early preparation of land and mechanical cultivations during the growing season will be helpful. Avoid covering the lower branches during cultivations to prevent development of southern blight. Usually in the Rolling Plains, guar planted in late June has less weed competition.

Trifluralin (Treflan) has been registered for use on guar by USDA. Instructions on the label should be followed closely.

INSECTS

Field or storage insects have not been a major problem in guar production. Farmers should watch their fields closely and contact the local county agent for assistance if infestations occur.

Up to six larvae belonging to the genus *Contarinia,* a close relative of the sorghum midge, were observed in unopened flower buds of guar in September, 1969. On heavily infested plants, bean set was poor. This insect possibly reduced yields in Knox and Haskell counties and occurred in several other Rolling Plains counties. Currently, effective control measures for the pest are unknown.

DISEASES

Alternaria leaf spot. This fungus may become severe during periods of heavy dew and high humidity or similar conditions. Symptoms are expressed by a brown zonate or target-like lesion on the leaf. Lesions enlarge, join and cause the leaf to drop off.

Bacterial blight. This seed-borne disease causes loss of plants from the seedling stage until maturity if environmental conditions are favorable. Symptoms include large angular lesions at the tops of leaves which cause defoliation and black streaking of the stems. This causes the affected branches or entire plant to die. This is potentially the greatest disease hazard to guar.

Southern blight. Symptoms of this fungus disease are whitish fungus growth at the base of the infected plant. Small seed-like structures *(sclerotia)* which turn dark with age and resemble radish seed are found in these fungus growths. The disease usually causes rapid death of the plant and is suggestive of a wilt disease. Sanitation is important in controlling southern blight. Planting essentially flat or in shallow furrows and avoiding covering parts of the lower branches during cultivation will help control this disease. Practice rotation with disease-resistant crops such as grain sorghum and pasture grasses over a 3 to 4-year period. No resistant varieties are known.

Cotton root rot. Guar is resistant but not immune to cotton root rot. The cotton root rot fungus attacks guar, but seldom is lethal.

Top necrosis virus. Leaves drop off and terminal ends of the stalk die and turn brown. The Lower Rio Grande Valley is the only area where the disease has caused serious commercial losses. No control is known. Other viruses attack guar but have not caused serious losses.

GUAR AND GOVERNMENT PROGRAMS

Guar is approved as a cover crop on conserving base acreage. Guar also is classified as an alternate crop and may offer opportunities for planting on diverted acres. Since the harvest of guar planted on diverted acres is treated differently each year, plans to do so should be cleared with the county ASC office annually.

HARVESTING

Even when guar is planted as a full-season crop, harvest usually is delayed until after frost. In dry seasons it may be possible to harvest early planted guar before frost. Guar usually does not shatter and will stand quite well in the field; but for best quality, it should be harvested as soon after maturity as possible. Harvest when the seed pods are brown and dry and when a moisture content is not more than 14 percent.

For harvesting, an ordinary grain combine with few adjustments may be used. The cylinder should be slowed and the combine speed reduced to a rate that will permit proper threshing of the beans. Since guar beans are heavy (60 pounds per bushel), a high fan speed can be used to clean out foreign material. The heavier the yield, the slower the machine must move. Reel speed should be slightly greater than the combine ground speed. Excessive or inadequate reel speed can cause shattering of seed pods. Reels should run just deep enough in the guar to control the stalks, and should be about 6 to 12 inches ahead of the cutterbar. Some operators replace the wooden reel bats with ½-inch steel rods to reduce shattering.

When harvested for hay, leaves of guar shatter readily unless extreme care is taken during the curing process. For hay, the crop should be cut when the first lower pods turn brown. Other crops are available which are better suited for hay production.

Guar used for green manure should be turned under when the lower pods begin to turn brown. Maximum tonnage is available at this stage of growth.

Guar has been grazed, but other crops are better suited for this purpose. To reduce bloat problems, guar usually is grazed after frost. It makes good winter dry forage. Cattle and sheep relish the straw and do well when allowed to graze dry guar stubble after harvest.

MARKETING

There are two market outlets for guar beans in the Rolling Plains. These firms have authorized dealers purchasing guar throughout the area. Both companies offer grower contracts.

Market demand for guar is expected to increase for the next several years. Reasons are (1) the wide use of the galactomannan gum of the guar bean in a growing number of different products, and (2) efforts by both companies to obtain a larger percentage of their total guar supply from domestic production.

The market price of guar beans is based on equivalent price of splits (endosperm portion of seed with hull and germ removed) imported from Pakistan and India.

Official grain standards for guar beans have not been established by the U. S. Department of Agriculture. However, commercial companies have standards establishing prices paid for beans. Grade factors considered by the purchaser are the moisture, foreign material and weight per bushel.

ECONOMICS OF PRODUCTION

Income and expense for guar vary from year to year and according to soil types. Production costs often vary widely between farms because of fertilizer usage and chemical weed control practices. Production practices and rainfall received during the growing season cause harvested yields to vary from about 300 pounds to more than a ton per acre.

Increased production efficiency is possible by adopting practices proved profitable through research and result demonstrations. Decisions to adopt improved production practices are made by considering added cost and added returns due to change in practices. Adequate records and accounts are necessary for measuring progress and making changes.

The value of guar as a soil builder to increase yields of succeeding crops is not shown in the following estimate of income and expense, but should be considered.

Estimated Income and Expense Per Acre For Dryland Guar

Item	Unit	Price	Quantity	Amount
Income:				
Guar beans	Lb.	$ .046	800	$36.80
Preharvest cost:				
Seed and inoculant	Lb.	.95	6	$ .57
Fertilizer—P_2O_5[1]	Lb.	.10	30	3.00
Machinery	Hr.	2.40	1.73	4.15
Hired Labor	Hr.	1.50	1.50	2.25
Total specified preharvest cost				$ 9.97
Combine	A	4.00	1	4.00
Hauling	Cwt.	.10	8	.80
Total harvest cost				$ 4.80
Total specified cost				$14.77
Income over specified cost				$22.03

[1]Fertilizer usage should be determined by soil test.

The authors gratefully acknowledge suggestions and critique of manuscript by Orbie C. Cannedy, plant manager, Stein, Hall & Co., Inc., Vernon, Texas and H. H. Partridge, field agronomist, General Mills, Inc., Munday, Texas.

Cooperative Extension Work in Agriculture and Home Economics, Texas A&M University and the United States Department of Agriculture cooperating. Distributed in furtherance of the Acts of Congress of May 8, 1914, as amended, and June 30, 1914.
12M—3-70 AGR 5