Texas Agricultural Experiment Station
THE TEXAS A&M UNIVERSITY SYSTEM

# *'KEYS'* TO PROFITABLE GUAR PRODUCTION

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CONTENTS

# KEYS TO PROFITABLE GUAR PRODUCTION

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Guar, *Cyamopis tetragonoloba*, is a drought-tolerant summer annual legume. It was introduced into the United States in 1903 from India, where it is grown for export, 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, unlike 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 stiffner in soft ice cream, instant puddings and whipped cream substitutes. Such products use the most highly refined food grade guar gum, which accounts 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. Guar gum has been heavily imported from India and Pakistan as partially processed endosperm material.

The meal remaining after the extractions of gum contains about 35 percent protein. Of this about 95 percent is digestible, making it an excellent protein supplement for ruminants. It is equal or superior to cotton seed meal to make it an excellent feed pelleting material. Toasting improves its palatability 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 about 100,00 acres annually. About half of the planted acreage is harvested. The remainder is plowed under for its soil-building properties as green manure.

## 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. On the heavier soils of South Texas, guar has been grown successfully following flax when moisture is available.

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## Moisture Requirements

The guar is drought resistant; when moisture is short, growth stops until moisture becomes available. Such intermittent growth lengthens the growing season. Peak water use periods for 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 guar 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, vegetable and flax.

Increased yields can be expected from crops following guar because of increased soil fertility. When used in rotation with cotton. 15 percent yield increased of cotton have been measured.

In a 3-year test at the Chillicothe Experiment Station, cotton planted in two-in-four-out systems produced 250 pounds of lint cotton and 500 pounds of guar.

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

## Seeded Preparation

Prepare the seedbed for guar the same as for cotton, corn or grain sorghum. It should be firm and free of weeds, and the row surface should be above general ground level to facilitate harvest. Plants on slightly raised beds after the final cultivation insure maximum recover 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 (such as Texsel and Groehler) with improved varieties is important. Diseased Texsel or Groehler plants scattered through a field can cause the disease to spread. 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.

However, in recent years some guar fields have been showing early yellowing and defoliation. Plants in these fields exhibited very root nodules, indicating improper inoculation. Crops following in these fields exhibited very few root nodules, indicating improper inoculation. Crops following in these fields also failed to show the normal increased production. Extreme care should be taken to make sure the inoculum is alive when the seed is treated, and kept alive until planted. Seed should be treated in small quantities, for example, whatever amount can be planted. Seed should be treated in small quantities, for example, whatever amount can be planted into moist soil within 2 hours. Keep the inoculated seed in the shade to avoid high temperatures and drying before seeding. Seed which has been chemically treated should be double inoculated. Further information on proper inoculation procedures can be obtained from your county Extension agent.

## Planting Dates

Plant guar when continuous warm weather is assured. Guar must have higher temperatures than cotton for stand establishment. For rapid establishment, soil temperatures at planting time should be above 70 degress 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, late-planted seed frequently mature during lengthy periods of rainfall, which may cause straining 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. |

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

Guar should be planted 1 to 1 ½ inches deep.

## Planting Equipment

Guar is usually planted with equipment used for planting grain sorghum. Beveled or tapered holes on the bottom sides of plates crush guar seed and cause gumming or clogging. Straight holes cause fewer problems. Addition of graphite or a dry detergent to the seed box helps avoid the gumming problem. Reduce seed weight on the plates by filling the planter box only about one-third full. This will help insure more uniform stands.

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

## Recommended Varieties

The development of disease-resistant varieties since the early 1960's has increased guar yields and stabilized production more than any other single factor. During seasons of normal rainfall, these improved varieties allow increaed production die to better disease resistance and better harvest efficiency. Harvest efficiency and higher yields are due mainly to seed being set higher above groundline, and to the multiple branching of plants which produces more seed plots.

Brooks, released in 1964, was the first improved variety. It replaced Texsel and Groehler and has occupied about 95 percent of acreage since 1966. It is a high-yielding variety of resistant 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 seeds are of medium size, averaging 3 grams per 100. First pods are set higher above the ground level than those of old varieties.

Hall is a slightly later-maturing variety 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, weighing 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 blight and Alternaria leaf spot. Plants are short and have 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 much earlier than Mills.

Kinman, released in 1975, is an $F_9$ selection from the controlled natural-cross, Brooks X Mills. Kinman has glabrous leaves, stems and pods. Plants possess Brooks' fine-branching growth habit, diease tolerance and higher yielding ability. Kinman is slightly taller and coarser-stemmed than Brooks, but not as coarse or as tall as Hall. Racemes are small to medium-sized and well distributed on the main stem and lateral branches. Seed pods are medium in length and generally contain from seven to nice seeds per pod. Seed of Kinman are slightly larger than Brooks, averaging 3.3 grams per 100. Seed color is similar to Brooks and ranges from dull white to light gray. Kinman is about 7 days earlier in maturity than Hall, and of the same maturity as Brooks. Kinman appears to be well adapted to the guar growing area of Texas and Oklahoma. In 41 yield trials at 8 locations in Texas and Oklahoma during 1971 - 1976, Kinman produced 17 percent higher mean seed yields than Brooks, the leading guar variety. The chief advantages of Kinman are its high-yielding ability and its excellent regional adaptation.

Esser, released in 1975, is an $F_{10}$ selection from progeny of the same natural cross, Brooks X Mills. It developed from four successive single-plant selections, a bulk generation in 1969, followed by an additional plan selection in 1970 (selection 3), all made at Chillicothe. Esser has glabrous leaves, stems and pods. Plants have Brooks' fine-branching growth habit, disease tolerance and high yielding ability. Esser has stronger main stems and fewer lateral branches than Brooks. Small racemes with medium-sized pods are well distributed on the main stem and lateral branches. Esser is similar to Brooks in plant height, seed size, seed color, and maturity. Esser has excellent disease tolerance but lacks the regional adaptation of Kinman. During the test period (1971 - 1976), Esser produced 17.3 percent higher men seed yields in Texas and 6.0 percent higher yields in Oklahoma than Brooks.

## Fertilization

Fertilize according to soil test results. Apply fertilizer to the side and below the seed at planting, or where preceding crops have been fertilized heavily, fertilizer 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. In the Rolling Plains, guar planted in late June usually has less week competition.

Trifluralin (Treflan ®) and profluralin (Tolban ®) have been registered for use on guar by the USDA. Label instructions should be followed closely as to rates for different soil types.

## Insects

The guar midge, *Contarinia texana* (felt), is the most important guar pest. Infestation levels of this pest vary greatly from year to year. Heavy midge infestations have caused up to 30 percent loss in guar seed production. Up to 90 percent bud destruction by this pest has been observed in some fields. Generally guar midge infestations are heavier in fields planted on sandy of sandy loam soils. Rainfall or sprinkler irrigation can reduce midge populations drastically, but field inspection should continue because midge infestation problems may increase again because of improved growing conditions.

Damage to guar is caused by the larvae which develop in the guar buds. Infested buds eventually dry up and fall from the plant. Many larvae have been found in a single bud, but the presence of a single larva will destroy the bud.

The adult female midge deposits her eggs in developing buds. Generally several eggs are deposited in a group within the buds. After larvae complete their development, they drop from the buds to the ground to pupate. There are several generations each year.

Research has shown that guar produces 75 percent of is buds between the $45^{th}$ and $90^{th}$ day after emergence. Control measures should be taken during this 45-day period, and when guar midge larvae can be found in 30 percent of the buds.

Another midge, *Asphondylia* sp., has been found in guar in South and West Texas, as well as in the Texas Rolling Plains and Oklahoma. This midge forms a gall in the buds and small pods of guar, and is generally not detected in fields until late in the growing season. This midge pupates in the gall on the plant. The gall midge is not considered an economic pest of guar.

Some of the occasional pests found on guar include three-cornered alfalfa hoppers, pea aphids,

cotton bollworms, white grubs, thrips and whiteflies. Leafhoppers, loopers and te cowpea aphid also have been observed in guar fields.

A stem horer, *Languria* sp., has damaged guar in the Uvalde area. The level of damage and control measures for this pest have not been determined.

Storage pests have not been a problem with guar.

## Diseases

*Alternaria Leaf Spot.* This fungus may become severe during periods of heavy dew and high humidity. Symptoms are 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 the entire plant to die. This is potentially the greatest disease hazard to guar.

*Southern Blight.* The symptom of thie fungal disease is a whitish 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 stalks die and turn brown. The lower Rio Grande Valley is the only area where the disease has caused serious losses. No control is now. Other viruses arrack guar but have not caused serious losses.

## Guar and Government Programs

In years when acres can be set aside or diverted, guar could be a dual purpose crop, depending on its use. If it is to be a conserving crop on diverted acres, first check with the county A.S.C.S. office.

## 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 moisture content is not more than 14 percent. Paraquat ® is now cleared as a harvest aid chemical to speed up drying prior to frost.

For harvesting, an ordinary grain combine may be used with a few adjustments. The cylinder should be 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, guar leaves 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 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 dry winter 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 firm have authorized dealers purchasing guar throughout the area. Both companies can be contacted for information concerning grower contracts.

Marketing demand for guar is expected to increase for the net several years. Reasons are: (1) the wide use of the galactommannan 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 the equivalent price of splits (ednosperm 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 production costs for guar vary from year to year and according to soil types. Production costs often vary widely between farms because of different fertilizer usage and chemical weed control practices. Production practices and rainfall received

during the growing season cause 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 comparing added costs and added returns due to new 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 should not be overlooked when considering guar as an alternative crop.

Refer to MP - 1321A, "Economics of Profitable Guar Production," available from your county Extension agent of the Department of Agricultural Communications, The Texas A&M University System, College Station, Texas 77843.