What is guar?

- Guar or cluster bean (Cyamopsis tetragonoloba) is a drought tolerant legume crop traditionally grown for centuries in south Asia including India.
- The word “Guar” comes from Hindi, meaning “cow food”.

What is guar gum?

- Guar gum is obtained from the powdered endosperm of the guar seed.

Why guar gum?

- The high molecular weight polysaccharides of galactomannan give guar gum unique biochemical properties including high viscosity.
- More water-soluble than other gums
- Better emulsifier
- 8 times higher water-thickening potency of cornstarch
Why guar gum?
• Guar gum is widely used as an emulsifying or stabilizing ingredient in range of food products and cosmetics (small quantities).

Products containing Guar Gum

Why guar gum?
• More recently, unique viscosity properties of guar gum have proven effective in stabilizing water and sand mixture in the oil extraction technique of hydraulic fracturing or ‘fracking’ through horizontal oil drilling.

U.S. dry natural gas production: history and projections

Future potential of guar
• Newly found use of guar gum in oil drilling has resulted in an unprecedented increase in demand for guar gum by the US oil industry making the US the biggest user and importer of the guar gum or seed in the world.
• US imported guar gum or seed worth $1 billion from India in 2011.

Future potential of guar
• FTS International-1700 tons of guar gum a month (3-4 times annual US production).
• Halliburton- guar gum was 30% of material cost to frac a well.

Fig. The Orion Drilling Co.’s Perseus drilling rig stands near Encinal in Webb County, TX.
Future potential of guar
- To supply the 19,000 wells drilled in 2012 would require in excess of 90,000 tons of guar gum (20,000 lb/well) or
- the equivalent of 500,000 acres of domestic guar production just for the U.S. petroleum industry.

Growing guar in New Mexico
- Low water needs – 8.5 inches
- Drought tolerant
- Best grown in 20-30" of rainfall
- In southern NM, with supplemental irrigation

Growing guar in New Mexico
- Guar can be adapted to semi-arid region of desert southwest including New Mexico due to its ability to tolerate heat and water stress.
- Preliminary Research at NMSU shows its adaptability

Guar gum testing in lab
Performance of selected guar genotypes under different planting dates in southern and eastern New Mexico

Photosynthetic rate ($P_n$), leaf area index (LAI), and SPAD value of eight guar genotypes under four planting dates at Las Cruces, NM.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_n$ (µmol m$^{-2}$ sec$^{-1}$)</td>
<td>28.1a</td>
<td>28.1a</td>
<td>28.3a</td>
<td>29.7a</td>
<td>28.2a</td>
<td>29.3a</td>
<td>28.2a</td>
<td>28.7a</td>
</tr>
<tr>
<td>LAI</td>
<td>5.2a</td>
<td>5.5a</td>
<td>4.1c</td>
<td>4.9ab</td>
<td>5.2a</td>
<td>4.8abc</td>
<td>5.5a</td>
<td>4.4bc</td>
</tr>
<tr>
<td>SPAD Value</td>
<td>60.8a</td>
<td>64.7a</td>
<td>60.8a</td>
<td>66.3a</td>
<td>51.8a</td>
<td>62.9a</td>
<td>60.5a</td>
<td>62.0a</td>
</tr>
</tbody>
</table>

†Means within a column and particular effect followed by the same letter do not differ at $\alpha = 0.05$.

‡ns, not significant

Evaluation of guar genotypes under different plantings at Clovis in eastern New Mexico

Number of days needed for guar maturity - Las Cruces

Guar seed yield - Las Cruces, NM

<table>
<thead>
<tr>
<th>Planting Date</th>
<th>Planting Date × Genotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>NS</td>
</tr>
<tr>
<td>2015</td>
<td>NS</td>
</tr>
<tr>
<td>2014</td>
<td>NS</td>
</tr>
<tr>
<td>2015</td>
<td>NS</td>
</tr>
</tbody>
</table>

Means within a plant date followed by the same letter are not significantly different at $\alpha = 0.05$.
Photosynthetic rate ($P_n$), leaf area index (LAI), and SPAD value of four guar genotypes at 50% flowering stage at Clovis, NM:

<table>
<thead>
<tr>
<th>Genotype</th>
<th>$P_n$ (µmol m$^{-2}$ sec$^{-1}$)</th>
<th>LAI</th>
<th>SPAD Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HES 1123</td>
<td>26.3ab</td>
<td>1.2a</td>
<td>61.5a</td>
</tr>
<tr>
<td>Kinman</td>
<td>24.3b</td>
<td>1.3a</td>
<td>56.9a</td>
</tr>
<tr>
<td>Lewis</td>
<td>26.8ab</td>
<td>1.4a</td>
<td>61.3a</td>
</tr>
<tr>
<td>Matador</td>
<td>28.5a</td>
<td>1.3a</td>
<td>61.3a</td>
</tr>
</tbody>
</table>

Interaction ($P_n$ x Genotype)

Seed yield attributing characteristics of guar at Clovis, NM:

<table>
<thead>
<tr>
<th>Planting Date</th>
<th>Clusters per plant</th>
<th>Seeds per plant</th>
<th>1000 seed weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-June</td>
<td>11.10</td>
<td>101.4</td>
<td>35.7a</td>
</tr>
<tr>
<td>Early-July</td>
<td>11.10</td>
<td>101.4</td>
<td>35.7a</td>
</tr>
<tr>
<td>Late-July</td>
<td>11.10</td>
<td>101.4</td>
<td>35.7a</td>
</tr>
</tbody>
</table>

Summary

- Guar planted in June performed better than other plantings under both locations.
- Guar genotype performance differed depending upon planting time:
  - At Las Cruces in southern New Mexico, planting of Matador and NMSU-15-G1 during the window of late-April to mid-May could bring higher seed yield.
  - At Clovis, any of the tested genotypes planted in mid-June will bring higher seed yield compared to later plantings.

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