Growth and Physiology of Diverse Guar Genotypes under Four Planting Times in New Mexico

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Introduction

Guar: A summer annual drought tolerant legume
Scientific name: *Cyamopsis tetragonoloba* L.
Primarily grown in India and Pakistan

Uses: Green pods as raw vegetable for human consumption, feed for cattle and green manure, and seed for guar gum.

Seed: Galactomannan Polysaccharides (Guar Gum)
High viscosity- relates to molecular weight of polymer
Used in cosmetic, pharmaceutical, food, and oil and natural gas industries.

Importance of Guar: Use of guar gum in oil drilling has resulted in an unprecedented increase in demand for guar gum by the US oil industry making US the biggest user and importer of the guar gum or seed in the world. For instance, guar exports from India to the US were worth $1 billion in 2011, $3.4 billion in 2012 and $1.6 billion in 2013.

Adaptability: Preliminary studies show that guar is adaptable in NM, USA. Information on high yielding genotypes of guar and their optimum planting time is needed.

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Objective

Evaluate growth and physiology of selected genotypes of guar under four different planting times in New Mexico.

Materials and Methods

Location: New Mexico State University Campus, Las Cruces, NM
Experimental Design: Split Plot Design
Main plot factor: Planting time (4)
1) April 25, 2014 2) May 15, 2014 3) June 16, 2014 4) July 1, 2014
Sub-plot factor: Genotypes (8)
Genotype 1, 2, 3, 4 , 5, 6, 7, 8

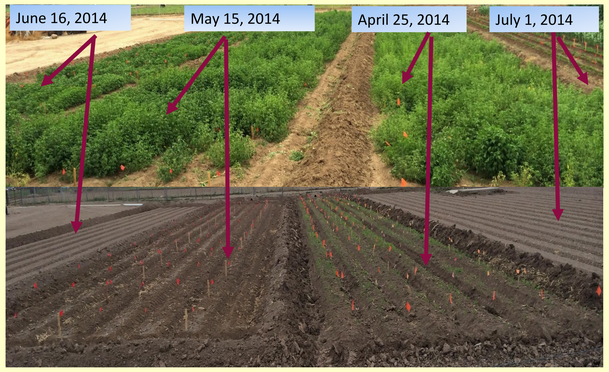

Fig. 1. Guar plots planted at four different planting times at germination (below) and flowering (above) stage at New Mexico State University Campus, Las Cruces, NM, USA

Observations: physiological (photosynthesis, stomatal conductance, dry biomass), number of days required for maturity, metrological (temperature, rainfall)

Analysis: Data were analyzed using Proc Mixed in SAS 9.4

Results

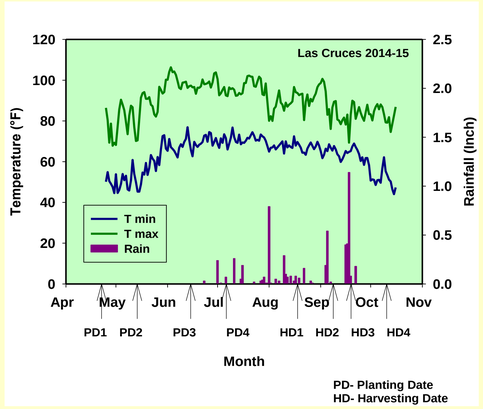

Fig. 2. Metrological trends at the study site during trial period in Las Cruces, NM during 2014-15.

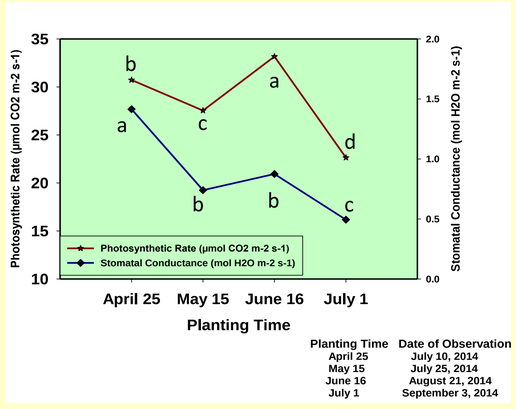

Fig. 3. Photosynthetic rate and stomatal conductance of guar at 4 different planting times in Las Cruces, NM during 2014-15

Table 1. Planting time effect on total number of days required to attain different growth stages and dry plant biomass (kg/ha) of guar at Las Cruces , NM for year 2014-15

Planting time	Days to emergence	Days to flowering	Days to maturity	Dry Biomass (kg/ha)
April 25, 2014	15.3 a	35.4 a	105.5 a	29416.8 a
May 15, 2014	11.1 b	29.8 b	98.0 bc	24634.9 ab
June 16, 2014	5.5 c	26.3 c	92.4 c	21312.5 ab
July 1, 2014	4.9 c	27.6 c	103.1 ab	16391.9 b
Genotype				
1	8.2 e	29.3 b	97.9 cd	19642.7 cd
2	8.5 e	28.3 c	95.7 d	19392.5 cd
3	9.0 d	29.3 b	97.1 d	22667.0 bcd
4	9.5 bc	30.6 a	101.1 ab	15201.1 d
5	9.4 cd	30.5 a	102.2 ab	31479.3 a
6	10.0 a	30.7 a	103.0 a	25120.7 abc
7	9.2 cd	29.0 bc	99.9 bc	20066.0 cd
8	9.9 ab	30.5 a	101.1 ab	29942.0 ab

Values within column followed by same letter are not significantly different at P≤ 0.05
Plant time × Genotype interaction is non significant at P≤ 0.05 for all variables

- Planting time had a significant effect on the measured growth and physiological parameters.
- July planting of guar took least time to emerge, while April planting required highest number of days to emerge (Table 1).
- June planting required least number of days to flower and mature, while April planting needed maximum number of days to flower and mature (Table 1).
- June planting had maximum photosynthetic rate followed by April, May and July planting; while April planting had maximum stomatal conductance followed by June, May, and July plantings (Fig. 3).
- April planting had maximum dry plant biomass, but not significantly different from May and June plantings, while July planting had minimum dry plant biomass (Fig. 4).
- Genotypes varied significantly in days taken to emerge, flower and mature and in producing dry biomass (Table 1) . Genotypes 5, 6, and 8 had significantly higher dry plant biomass than other genotypes, but genotype 5 had maximum dry plant biomass (Table 1).
- Photosynthetic rate did not differ significantly among the tested guar genotypes.

Results

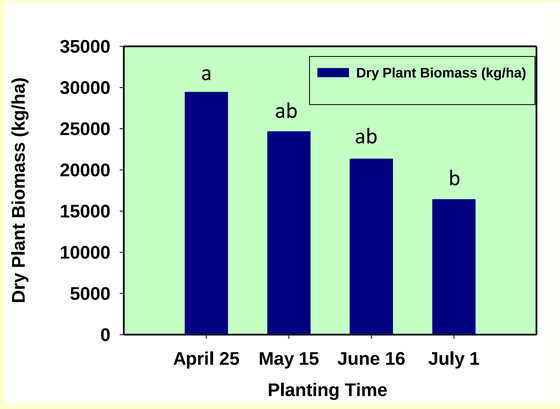

Fig. 4. Plant biomass at 50% pod formation of guar at 4 different planting times in Las Cruces, NM during 2014-15.

Conclusions

- Guar could be planted from spring to mid-summer in New Mexico. Planting in Mid May - Mid June resulted in less number of days to mature while producing optimum dry biomass.
- Significant genotypic variability was observed for their growth and biomass production.
- Generally, genotypes (5, 6, 8) producing higher biomass took longer to mature than low biomass producing genotypes (1, 2, 3) with an exception of one genotype (4).
- Research is in progress and it would be interesting to see how these planting dates and genotypes perform in respect of seed yield and yield attributing characters.

Fig. 5. Guar seeds and dry pods

Acknowledgements

- Agriculture Experiment Station, New Mexico State University,
- Graduate Research Enhancement Grant
- (GREG) Award –Office of Vice President for Research, New Mexico State University,
- New Mexico Department of Agriculture
- Agricultural Science Center, Clovis, NM