Evaluating Cotton Seed Gland Initiation by Microscopy

Jennifer L. Tonos and Jodi A. Scheffler

Crop Genetics Research Unit, USDA-ARS, Stoneville, MS

INTRODUCTION

Gossypol a terpenoid aldehyde found in cotton (*Gossypium hirsutum* L) glands, helps protect the entire plant as well as the seed, from pests and disease. However, gossypol is toxic to many animals and is used mainly in cattle feed, as ruminants are tolerant to the effects of gossypol. In order to develop strategies to modify gossypol in cotton seed, it would be useful to better understand the development of the gossypol containing glands. This study focuses on determining the point in seed development where gossypol glands are initiated and filled with gossypol.

MATERIALS AND METHODS

The study used a VHX-600 Keyence Digital Microscope with a VH-Z20R (20X to 200X) lens to capture developing ovule (seed) images at 14, 16, 18, 20, and 22 days after flowering (DAF). Bolls were harvested from replicated field trials with ten cotton lines and two glandless varieties as controls. One boll per plot was harvested for each DAF time point and eight to ten different sets of time points were collected in each of two years. Developing bolls were picked from late July through mid August.

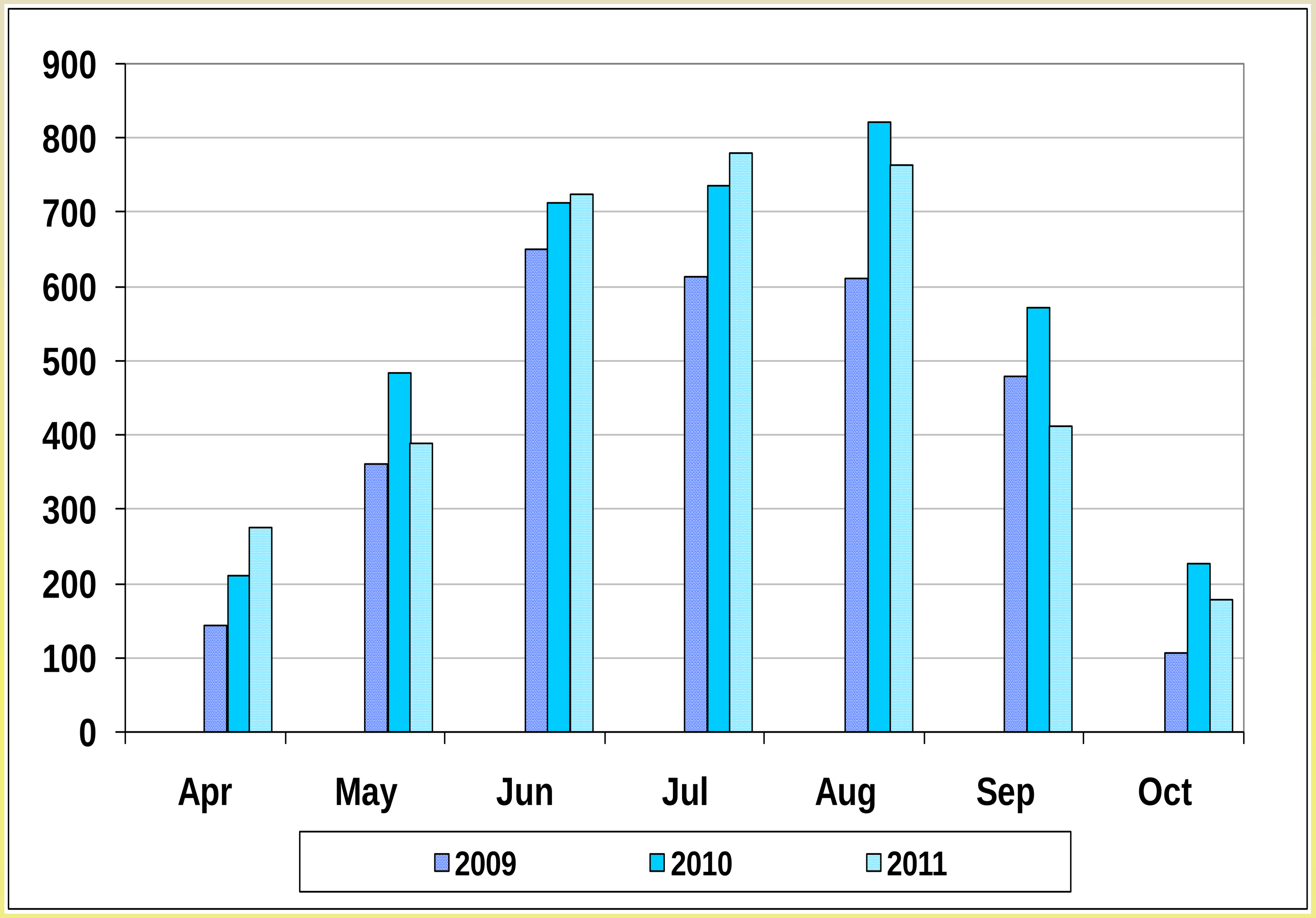

Figure 2: Monthly Cumulative DD60 for Growing Season 2009-2011

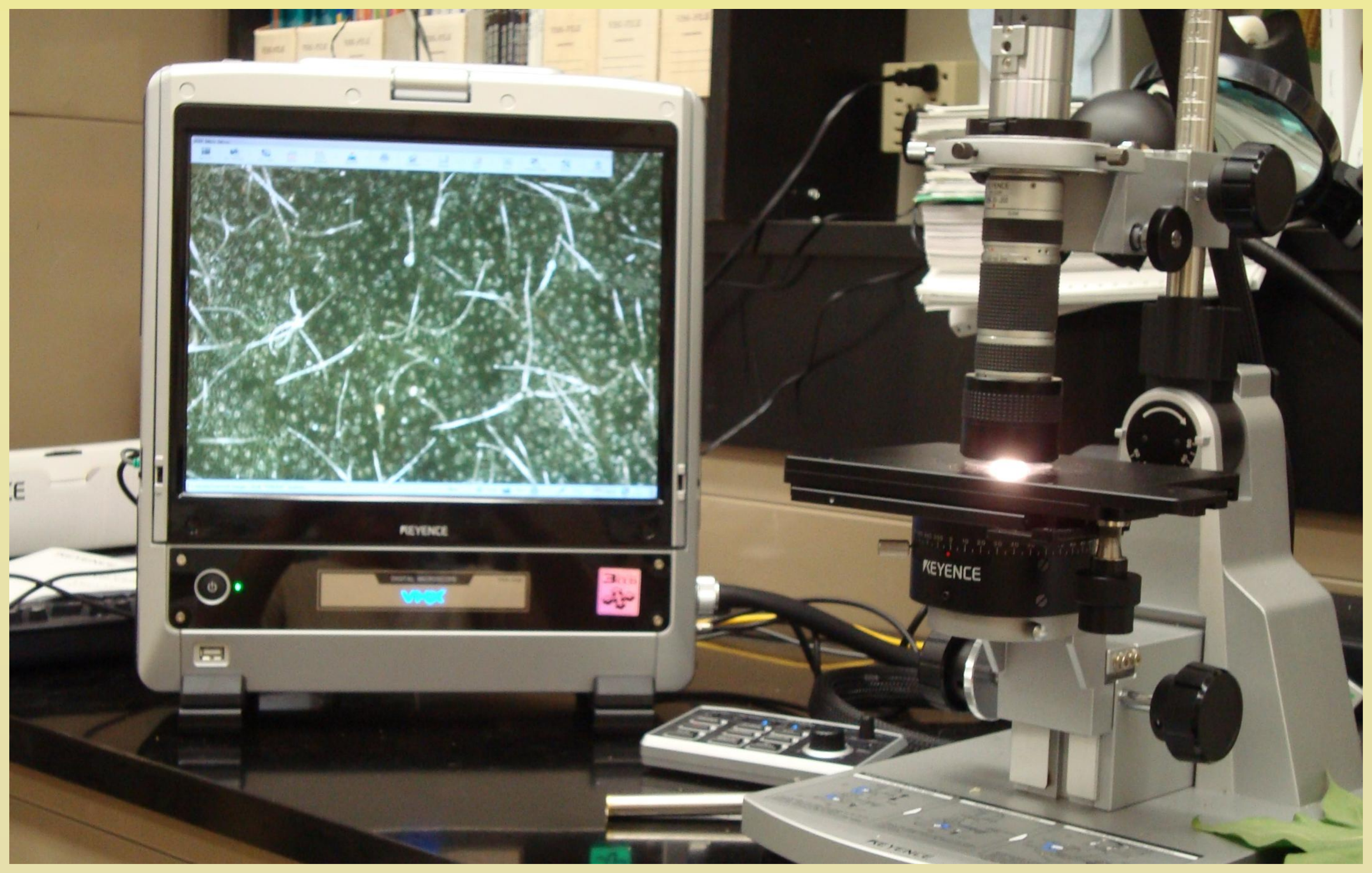

Figure 3: VHX-600 Keyence Digital Microscope

RESULTS

Imaging at 14, 16, 18, 20, and 22 days after flowering (DAF) revealed empty glands as early as 16 DAF, filled glands at 18 DAF for most varieties and as early as 16 DAF for ultra early lines (Figure 5). Empty glands first appeared on the ovule outer edge and eventually covered the entire ovule. The glands filled with gossypol starting on the outer surface. Filling began before the all the glands were formed. Gland initiation started later in 2009 which could be due to the cooler weather conditions as compared to 2010 and 2011 (Figure 2). There was variation among the three types, with the uplands often earlier than the Pimas and the Acalas, but the sample size is too small to draw definite conclusions.

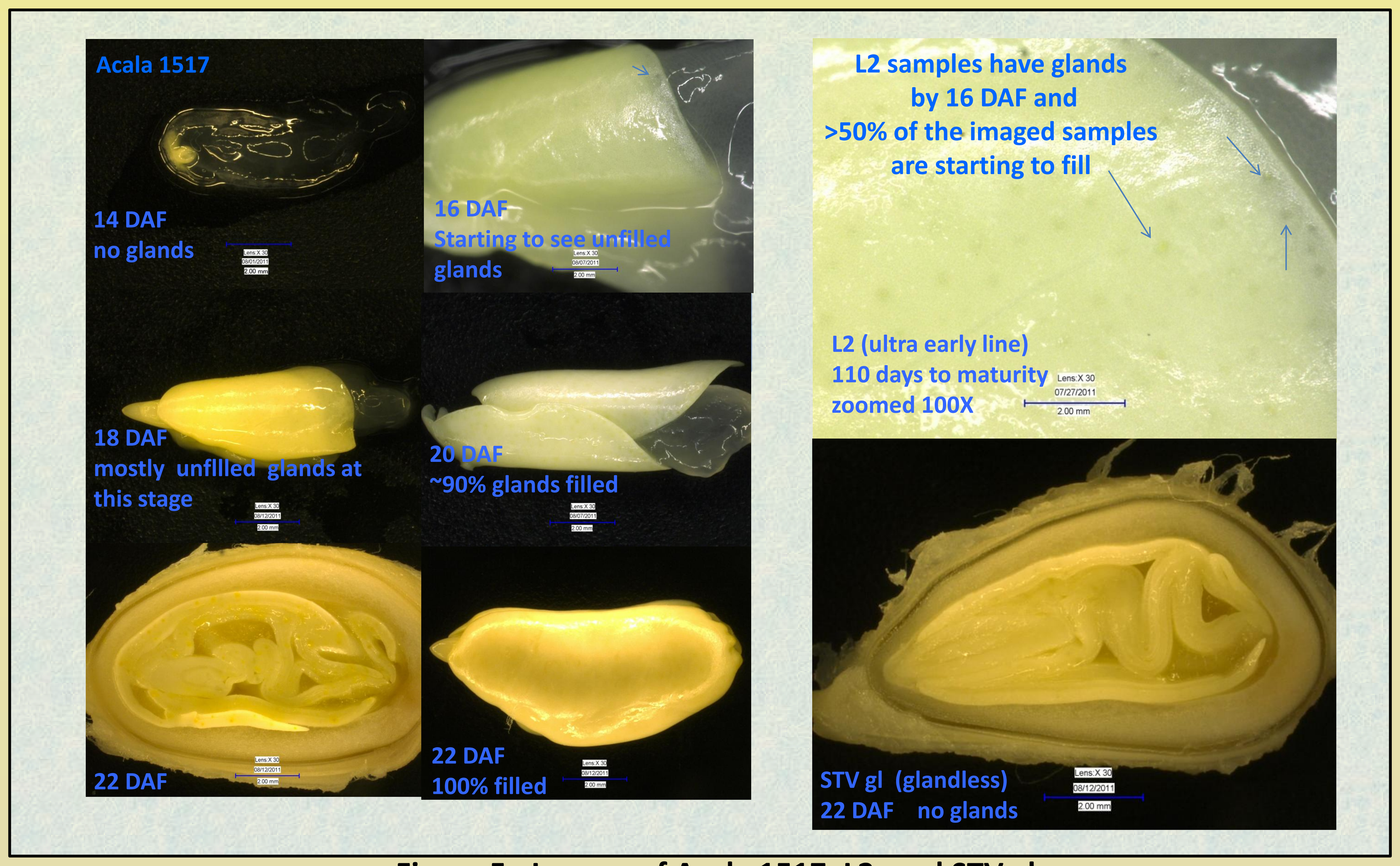

Figure 5: Images of Acala 1517, L2, and STV gl

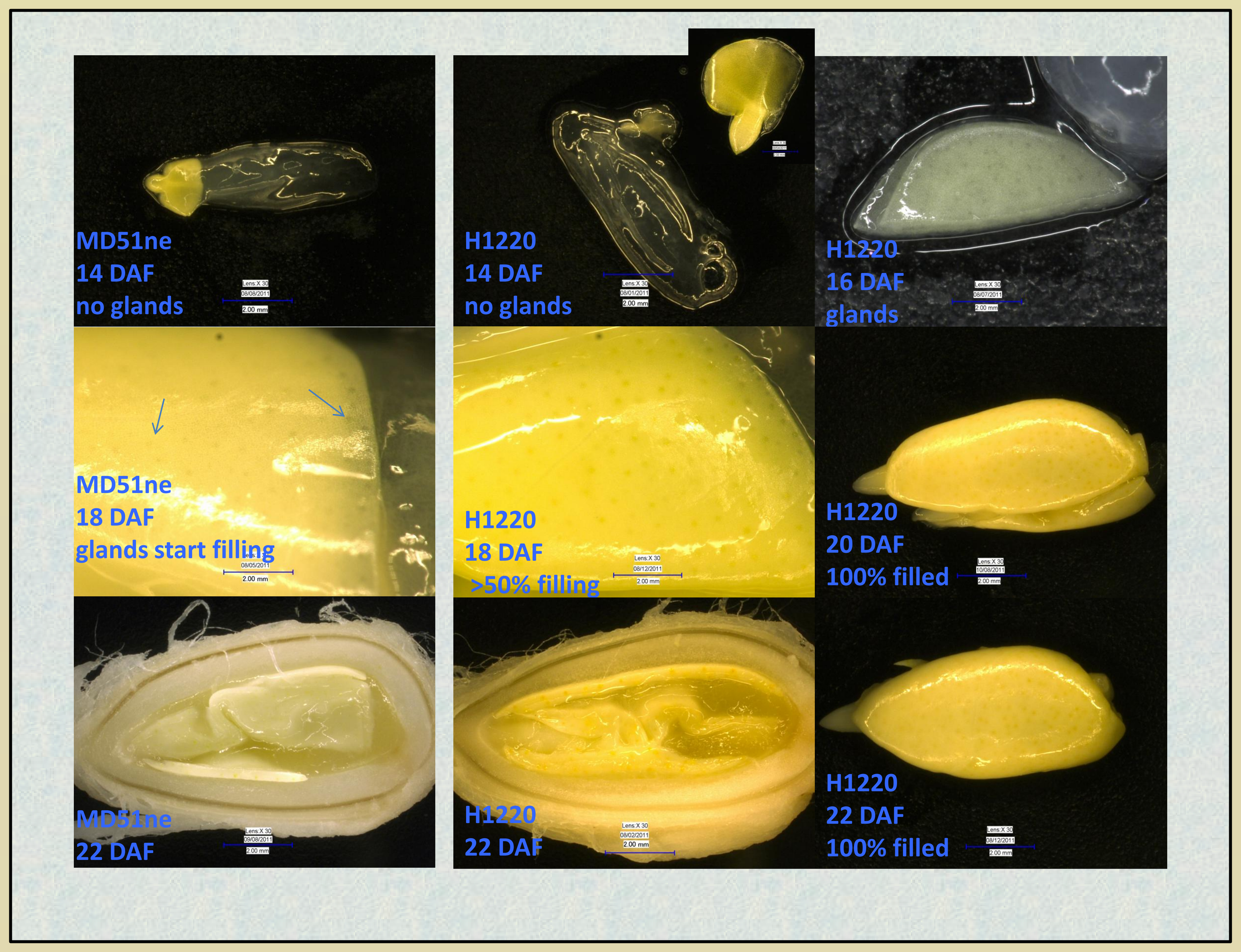

Figure 1: MD51ne and H1220 2011 Images

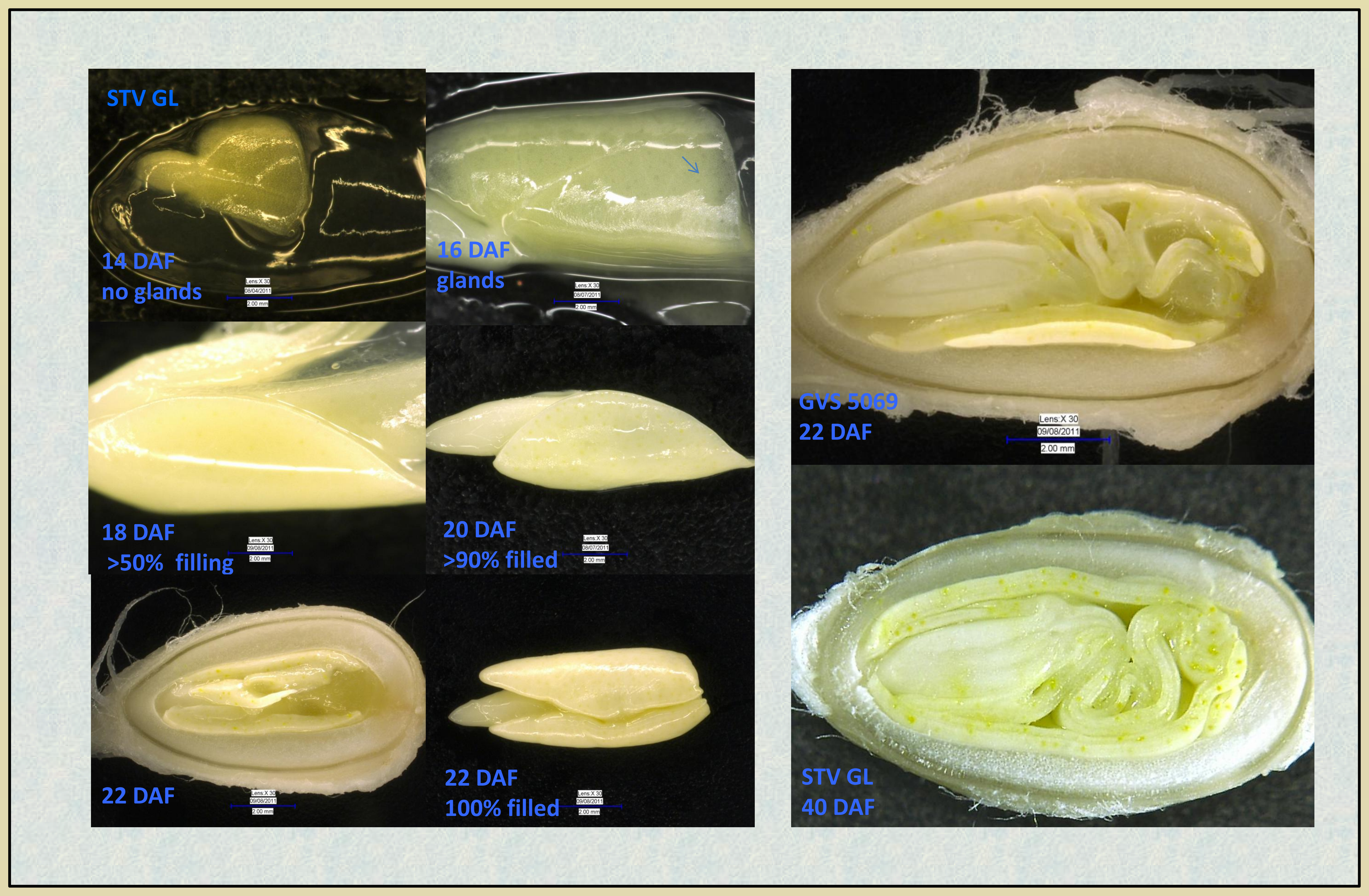

Figure 4: STV GL and GVS 5069 images

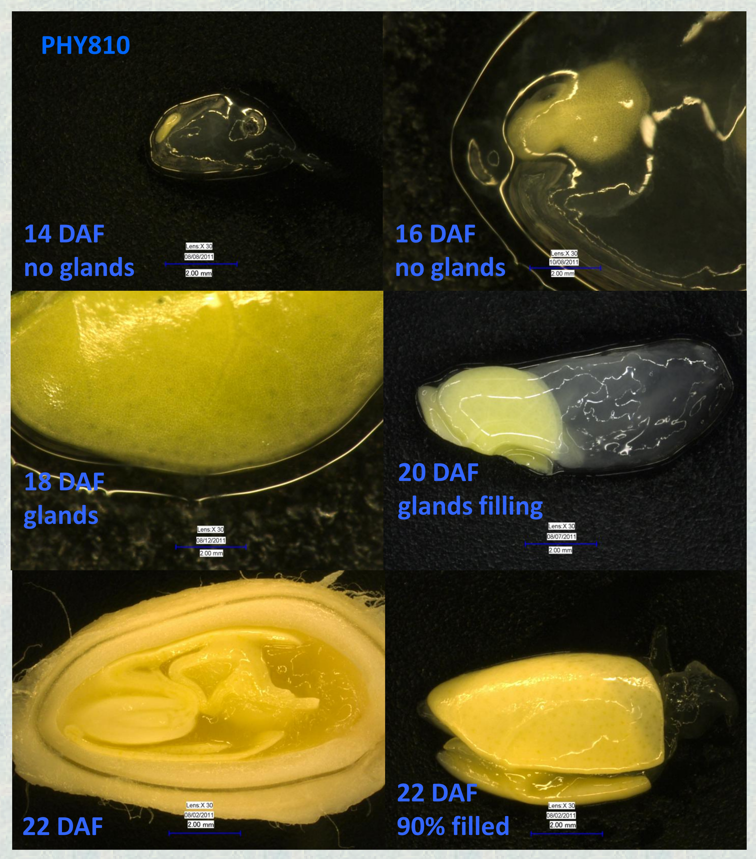

Figure 6: PHY810 Images

Summary Table

Gland Initiation as Days after Flowering

	Name	Entry	2009	2009 greenhouse	2010	2011
1	Upland	GVS 5069				16
2	Upland	H1220	22	22	18	16
5	Upland	L2			<18	16
6	Upland	MD51ne	20-22	22	18	18
7	Upland	STV GL	20-22	24-26	16-18	16
8	Upland	STV gl	nd	nd	nd	nd
9	Acala	Acala1517			18	16-18
10	Acala	MAXXA GL	20	22	16-18	16
11	Acala	MAXXA gl			nd	nd
12	Acala	PHY 72			<18	16-18
13	Pima	PHY 810			18	18-20
14	Pima	PIMA S7			18	18

nd= no glands detected

Days after flowering (DAF) that glands were first visible in the developing ovule (seed)

ACKNOWLEDGEMENTS

The authors wish to thank Robert Kersh and Kenneth Courtney for help in boll collection, especially on rainy days.

Jodi.Scheffler@ars.usda.gov