TITLE:

Cotton Insect Pests and Natural Enemies in Conventional and Conservation Tillage Systems at AG-CARES, Lamesa, TX, 2003.

AUTHORS:

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INTRODUCTION:

Cotton is a major crop grown in Texas, with 5.8 million acres planted (4.6 million acre harvested) and 4.9 million bales of estimated lint produced in 2002. Simultaneous use of several cultural practices has greatly aided to sustainable cotton production in Texas. Adoption of the minimum tillage (conservation tillage) approach to cotton production in Texas has increased steadily over the last few years primarily due to its multiple advantages such as reduction in soil erosion, conservation of soil moisture, maintenance of soil structure, and decreased production costs. Similarly, the rate of adoption of transgenic cultivars, particularly those with herbicide resistant genes, has also increased in Texas cotton production. The adoption rate of transgenic cultivars with Bt gene has been about 10% in Texas, while the Texas High Plains plants 5-7% of its cotton acreage with Bt-cotton. Information on arthropod biology and behavior as affected by cultural practices such as cultivar selection, planting date, and tillage practices are lacking from the Texas High Plains cotton production system.

OBJECTIVES:

1. To characterize the abundance pattern of cotton pests and predators in cotton agroecosystems in the Texas High Plains.
2. To evaluate the influence of Bt transgenic cotton, conservation tillage system, and planting date on the seasonal abundance and distribution patterns of cotton pests and their associated arthropod predators.

MATERIALS AND METHODS:

Experimental site:	Agricultural Complex for Advanced Research and Extension Systems (AG-CARES) farm, near Lamesa, Texas
Experimental design:	Randomized complete block design with 3 replications
Treatments:	Three primary variables- Cultivars and planting date within each of two tillage systems
Tillage:	Conventional and conservation tillage
Cultivars:	Paymaster 2326BGRR (Bt cotton) and Paymaster 2326RR (non-Bt cotton)
Planting date:	May 8 (timely planting) and June 11 (late planting), 2003

Arthropod sampling duration and interval: Weekly from July 3 to September 19

Sampling methods:	Aphids were sampled by visual sampling method (randomly selected 10 upper and 10 lower leaves per plot) and predators were sampled by beat-bucket sampling method [Beat bucket (dia. 12”, ht. 15”): 12 plants/plot]
Row spacing:	40-inch
Plant density:	Approximately 40,633 plants per acre
Soil type:	Sandy loam

Insecticide application: None.

Irrigation:	Crop was irrigated by center pivot system equipped with LEPA (low energy precision application) nozzles.

Data analysis: Natural enemy data were summed together and converted to total number of predators per acre; cotton aphid data are reported as numbers/leaf. Data were analyzed using an analysis of variance and means were compared using the least significant difference method (SAS Institute 2000).

Arthropods sampled:

Predaceous bugs:
Minute pirate bug: *Orius* spp.
Damsel bug: *Nabis* spp.
Big-eyed bug: *Geocoris* spp.
Wheel bug: *Arilis cristatus*
Assassin bug: *Zelus renardii*

Predaceous beetles:
Lady beetle: *Hippodamia convergens*
Soft-winged flower beetle: *Collops* spp.
Scymnus beetle: *Scymnus loewii*
Hooded beetle: *Notoxus* spp.

Green lacewing: *Chrysoperla* spp.

Spiders: Predominantly *Misumenops s*pp.

Pest species:
Cotton aphids: *Aphis gossypii*
Cotton fleahoppers: *Pseudatomoscelis seriates*
Thrips: Western flower thrips, *Frankliniella occidentalis*
Plant bugs: *Lygus* spp. (*L. hesperus* and *L. elisus*)

RESULTS AND DISCUSSION:

Cotton aphids

Seasonal Abundance. Aphid activity was first observed on July 3 (55 days after planting) and the population increased rapidly to reach only one peak (range of 9-13 aphids/leaf) on September 3 both in conservation and conventional tillage plots (Figs.1 and 2). After this peak the population numbers crashed. A negative relationship was observed between cotton aphid abundance and predator abundance.

Effect of tillage, planting date, and variety. Cotton aphid abundance was significantly influenced by tillage system and cotton cultivar, but not by planting date. Significantly higher numbers of aphids were found in non-transgenic cotton cultivars (Paymaster 2326RR) and in conservation tillage cotton (Fig. 3)

Arthropod predators

Seasonal abundance. Predator activity began during the cotyledon stage. The total predator population increased, as plants grew older and the number of insect pests increased. The total predator population exhibited three population peaks, the first peak in July 17-31, second in August 14-21 and the third peak on September 11 (Figs. 4 and 5).

Effect of tillage, cultivar and planting date. Cotton cultivar and planting date had no significant effect on foliage-dwelling predatory arthropods. Conventional tillage plots had significantly higher number of total predators (21,740 per acre) compared to conservation tillage plots (17,421 per acre; Fig. 6.)

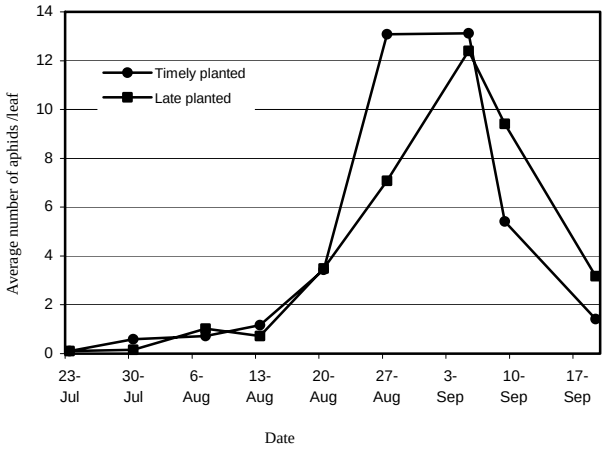

Fig. 1. Seasonal abundance patterns of cotton aphids in conservation tillage plots at Lamesa, Texas. 2003.

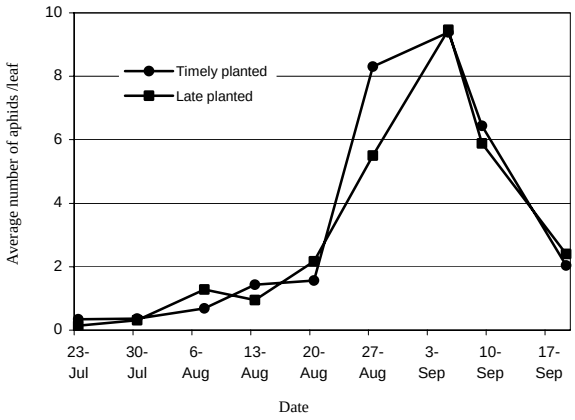

Fig. 2. Seasonal abundance patterns of cotton aphids in conventional tillage plots at Lamesa, Texas. 2003.

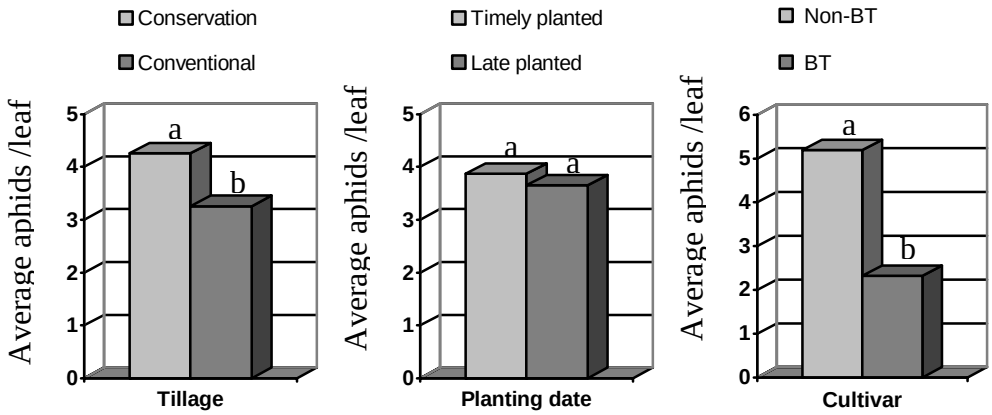

Fig. 3. Average number of aphids per leaf as affected by tillage, planting date and cotton cultivars at Lamesa, Texas-2003.

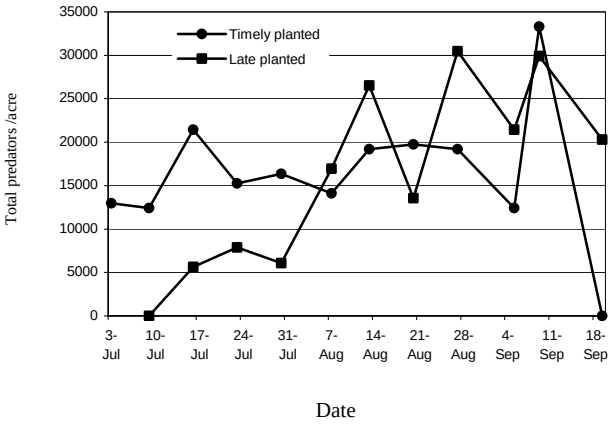

Fig. 4. Seasonal abundance patterns of total predators in conservation tillage plots at Lamesa, Texas. 2003.

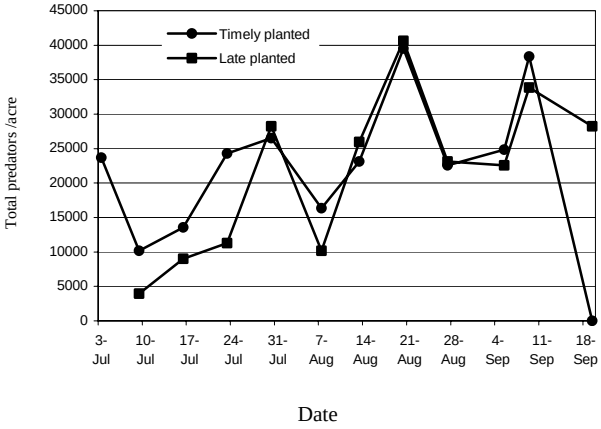

Fig. 5. Seasonal abundance patterns of total predators in conventional tillage plots at Lamesa, Texas. 2003.

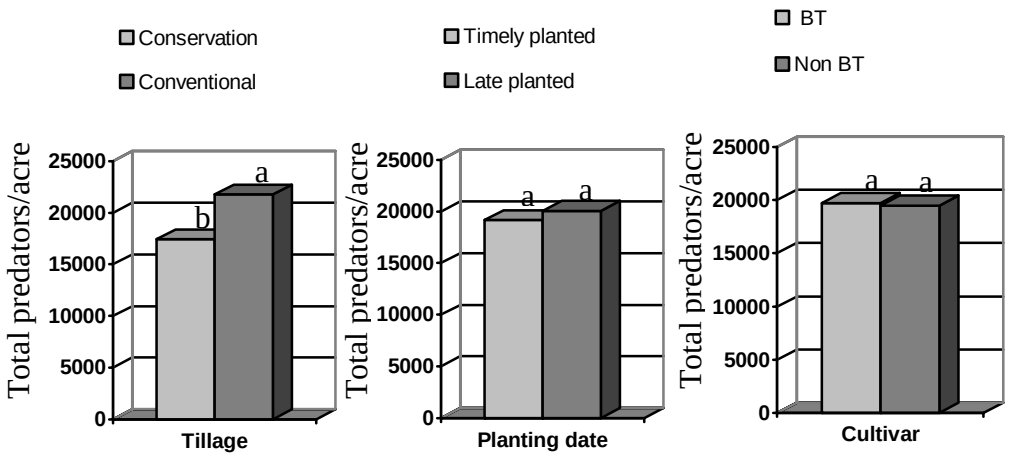

Fig. 6. Average number of total predators per acre as affected by tillage, planting date and cotton cultivars at Lamesa, Texas-2003.