

HOST PLANT RESISTANCE STUDIES AT NARRABRI AGRICULTURAL RESEARCH STATION

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Introduction

Over the last quarter of a century, as problems in relying completely on pesticides for control of insects have become apparent, there has been renewed interest in the possibility of breeding cottons less susceptible to pests i.e. "host plant resistance". This paper describes some of the studies being undertaken at N.A.R.S. on this subject.

## Resistant Plant Characteristics and their Pest Effects

A number of plant characteristics affecting insects have been identified by researchers as the following table shows.

## Pest-Resistant Plant Characters and Pests Effectuated

<u>Plant Character</u>	<u>Category of Pests Effectuated</u>
<u>Morphological</u>	
Pubescence	Plant bugs particularly jassids boll weevil
Frego bract	Boll weevil, bollworms
Red plant colour	Boll weevil, spidermites
Glabrousness	Bollworms
Nectarlessness	Plant bugs, bollworms
Okra, superokra leaf	White flies, bollworms, weevils, mites
Yellow pollen	Bollworms
Hard boll wall	Bollworms
<u>Phenological</u>	
Short season (early maturity)	Boll weevil, bollworms
<u>Chemical</u>	
High terpenoid (Gossypol, Hellicides)	Plant bug, bollworms
Condensed tannins	Plant Bugs, bollworms, spider mites

Besides earliness, we have mainly been working with the simply inherited characteristics of glabrousness, nectarilessness, frego bract and okra leaf since we saw these as offering the quickest route by which we could provide some "built-in" insect resistance to commercial varieties, before tackling the more complexly-inherited characteristics.

#### Early observations at Narrabri Agricultural Research Station

Work on host plant resistance has been done for a number of years at NARS. Our first season there co-incided with the Heliothis plague that ravaged crops in eastern Australia. It was significant that, under the heavy damage sustained despite intensive spraying, a normally poor yielding frego bract line topped our main variety trial and outyielded Deltapine 16 by 40%.

In subsequent years a number of varieties containing resistance traits were tested for performance under different levels of pest protection. In general the work showed that the resistance characters often were advantageous, but response differed depending on the particular complexes and pressures of insects encountered. A further difficulty was that the resistance factors were incorporated in a number of varietal backgrounds thus preventing direct comparisons of their effects.

#### Recent Studies

We incorporated genes for nectarilessness, okra leaf, glabrousness and frego bract into the high yielding Deltapine 61 background. This gave rise to 16 lines only differing in resistance factors from each other as follows:



	Leaf and Stem Hairiness	Bract Type	Nectary Status	Leaf Type
1	Normal	Normal	Normal	Normal
2	"	"	"	Okra
3	"	"	N'less	Normal
4	"	"	"	Okra
5	"	Frego	Normal	Normal
6	"	"	"	Okra
7	"	"	N'less	Normal
8	"	"	"	Okra
9	Glabrous	Normal	Normal	Normal
10	"	"	"	Okra
11	"	"	N'less	Normal
12	"	"	"	Okra
13	"	Frego	Normal	Normal
14	"	"	"	Okra
15	"	"	N'less	Normal
16	"	"	"	Okra

We then grew them for three seasons under two spray regimes - heavy (in which insect control was nearly complete) and light (in which pest control was only intermittent).

#### Results

The overall mean results for yields combined across genotypes on a with:without character basis are as follows:

Yield of "Pest-Resistant" Types  
as % of their NORMAL COUNTERPARTS  
MEANS OVER THREE SEASONS

Character	Spray Regime		Increase (+) or Decrease (-) (Relative to the normal) under light spraying
	Heavy	Light	
Okra	100	110	+ 10
Nectariless	100	103	+ 3
Glabrous	102	91	- 11
Frego	97	92	- 5

Okra leaf showed as being best able to resist the depredations of insects. Nectariless also helped whereas both glabrousness and frego bract gave less yields when insect damage was allowed. It may seem surprising then that we refer to the latter two as "resistant" characters. However almost certainly their poor showing reflects their susceptibility to plant bugs (which tended to be the most important component of the pest spectrum in our trials) whereas their "resistance" refers to their effects on Heliothis.

What happens for various combinations of these factors? There are too many to discuss in this brief account but the following results tell part of the story.

Characters	Spray Regime		<u>Z Light</u>
	Heavy	Light	Heavy
	(Yield kg/ha)		
glabrous frego	1991	1712	86
+ okra	2010	1882	94
+ okra + nectariless	1951	1958	100

The bug sensitivity of glabrous frego was largely overcome by okra alone and completely overcome when nectariless was added as well.



## Effects on Pests

In 82/83 we recorded the effects of these characters on the abundance of pests. Last season (83/84) the 16 combinations were again grown under the light spray regime and pest numbers recorded.

## Some Results

In both seasons about 40% less Heliothis eggs were laid on the glabrous genotypes resulting in about 30% less Heliothis larvae. Less (44% in 82/83 and 20% in 83/84) larvae also occurred on frego bract cotton (although egg numbers were less for this trait only in 83/84). In both seasons a slight (15%) but statistically significant reduction of mites occurred with okra leaf and in 82/83 okra leaf also had significantly less aphids. In both seasons there were about 30% less apple dimpling bugs (small mirids) on glabrous leaf but significantly more on frego bract.

Discussion

We consider that so far we have only touched the "tip of the iceberg" in the complex field of Host Plant Resistance. We do not feel that we can be dogmatic in our views as yet. Both the glabrous and frego genes do appear as Heliothis resistance factors by their effects on egglay and larval numbers: and the frego gene has been shown to improve spray penetration. However their apparent hypersensitivity to the bug complex is a matter of concern, preventing their being used in a simple way to reduce spraying. The okra character appears to "part-neutralize" this sensitivity and the further addition of nectariless appears to do so completely. Even by itself okra leaf does appear to offer considerable advantages - another 'bull point' for SIRDKRA!