# EFFICACY OF FLUTRIAFOL FUNGICIDE FOR CONTROL OF COTTON ROOT ROT IN ARIZONA IN 2012 AND 2013 FIELD TRIALS

**R. Norton**
**The University of Arizona Cooperative Extension**
**Safford, AZ**
**M. Olsen**
**The University of Arizona Cooperative Extension**
**Tucson, AZ**
**A. Mostafa,**
**The University of Arizona Cooperative Extension**
**Phoenix, AZ**

## Introduction

Flutriafol (Topguard) fungicide has shown efficacy for control of cotton root rot, caused by the soil borne fungus *Phymatotrichopsis omnivora*, in field trials in Texas. In 2012 and 2013, similar trials were conducted in Arizona in fields with histories of severe cotton root rot to evaluate the effectiveness of flutriafol under irrigated desert conditions. Several cotton growing regions of Arizona experience severe symptoms of root rot with variable levels of crop impact from year to year.

## Objectives

The objective of this study was to evaluate the effectiveness of flutriafol on the control of *Phymatotrichopsis* under irrigated conditions in Arizona. Application rate and technique were also evaluated over the two-year period.

## Materials and Methods

Field experiments were established in Arizona during 2012 and 2013 to evaluate the efficacy of flutriafol fungicide (Topguard) on the control of cotton root rot caused by the soil-borne fungus *Phymatotrichopsis omnivora*. Trials were established in grower cooperator fields in Marana, Solomon, and Arlington, AZ in 2012; and in Coolidge, Solomon, and Marana in 2013.

## 2012 Material and Methods

Trials were conducted at Marana (Tom Clark, grower), Solomon (Layton Farms) and south of Arlington (Enterprise Ranch) in fields that have a history of cotton root rot. Treatment plots were located in site-specific areas where root rot occurs routinely by using information from growers and Google Earth maps. In the Marana and Solomon fields, cotton was planted into moisture by standard practices. At the Enterprise site, seed was planted directly into no-till barley and irrigated up. The Marana site was planted on May 3, 2012 with Stoneville ST5458B2RF; the Solomon site on April 24, 2012 with ELS Phytogen PHY805RF; and the Enterprise site on May 24, 2012 with Deltapine DP1044B2RF.

Topguard was applied according to recommendations from the manufacturer, Cheminova, and Dr. Tom Isakeit of Texas AgriLIFE Extension. It was applied at 16 oz and 32 oz product/A in 4 gal water/A around the cotton seed as the seed was planted (Figure 2). Application was made using a T-band application from Teejet 80015 VS fan tip nozzles placed directly behind the disk 'V' openers and in front of the closer wheel so the fungicide was sprayed into the seed trench before it was covered. The nozzles were placed about 4 inches above the ground resulting in a 5-inch band in and around the seed, but not below the seed (Figure 1).


Figure 1. Images illustrating the application of flutriafol for trials in both 2012 and 2013 for the T-band and in-furrow treatments (IFT – not shown). A $CO_2$ pressurized spray system was attached to the planter (A) with nozzles attached in such a way as to apply a T-band over the seed trench (B). The system was calibrated at normal tractor operating speed to apply 4 gallons of material per acre with flutriafol rates of 16 and 32 oz/acre in 2012 and 32 oz/acre in 2013 (C).

Experimental design was a paired test in which each treated plot was paired with an adjacent non-treated plot. Each pair was arranged in a randomized design with six replications. Plots were 50 ft long. Replications were in two sets of three plots made by two passes of the planter with either 6 rows (Marana) or 4 rows (Solomon and Enterprise) at 38 inch spacing. In 2012, flutriafol was applied at 16 and 32 fl oz/acre as a 5-inch T-band spray directly over the seed trench at planting at both sites.

**2013 Materials and Methods**

In 2013, flutriafol was applied at 32 fl oz/acre using different application techniques including T-band (at both sites) similar to the technique used in 2012 described above. At the Solomon and Coolidge locations, an at-planting in-furrow treatment (IFT) utilizing a seed-firming device from Schaffert Maufacturing Co. (Figure 2) was utilized to place the Topguard material along the walls of the seed trench. Figure 3 shows the 'Rebounder' attached to the seed tube and the 'y-knot' splitter that delivers the liquid to the seed trench wall. At the Solomon and Coolidge locations a pre-plant application of flutriafol was made at the time the rows were pulled up at each location. The flutriafol was injected approximately 10" below the top of the bed (Figure 3).

Figure 2. Image depicting the operation of the Schaffert Manufacturing "Rebounder" seed-firming system with application of material utilizing the "Y" splitter. This system delivers liquid material to the sides of the seed trench and was utilized in these trials to apply flutriafol in the modified in-furrow treatment in 2013 at both Coolidge and Solomon.


Figure 3. Evaluation of an alternative application technique was performed in 2013. Flutriafol was injected to a depth of approximately 6 inches below the planted seed at the time of listing utilizing an liquid injection implement (A). Equipment was calibrated at tractor field speed to deliver 32 oz/acre of flutriafol in a carrier rate of four gallons per acre (B).

Injected plots were established on 14 February and 4 March in Solomon and in Coolidge respectively. Comparisons for the T-band and IFT treatments were established at planting at each location. These dates were 9 April, 2 May, and 9 May in Coolidge, Solomon, and Marana respectively. Varieties planted in 2013 at each location included DP1044B2RF at Solomon and Coolidge, and PHY499WRF at Marana. Plots were arranged and established in a similar manner as in 2012 with a paired treated/untreated design with plots arranged in a completely randomized fashion with 6 replications in Coolidge and Marana and 8 replications in Solomon. The injected treatments were

established separately from the small plot IFT and T-band treatments in Solomon and Coolidge. Injected plots were placed in the field as to transverse known sections of root rot.

Treatment dates and rates along with planting dates and varieties planted are summarized in Table 1 for all locations and years. Plots, in all cases were evaluated by assessing the percentage of symptomatic plants in each plot. Linear feet of diseased plants were measured and then expressed as a percentage of the entire plot length.

Table 1. Treatment dates and rates and other cultural practices for each location in 2012 and 2013.

| Year Location | Injected Treatment (Rate) | T-band Treatment (Rate) | In-Furrow Treatment (Rate) | Planting Date | Variety |
|---|---|---|---|---|---|
| **2012** | | | | | |
| **Marana** | --- | 3 May (16 / 32 oz/a) | --- | 3 May | ST5458B2RF |
| **Solomon** | --- | 24 April (16 / 32 oz/a) | --- | 24 April | PHY805RF |
| **Enterprise Ranch** | --- | 24 May (16 / 32 oz/a) | --- | 24 May | DP1044B2RF |
| **2013** | | | | | |
| **Coolidge** | 4 March (32 oz/a) | 9 April (32 oz/a) | 9 April (32 oz/a) | 9 April | DP1044B2RF |
| **Solomon** | 14 February (32 oz/a) | 24 April (32 oz/a) | 24 April (32 oz/a) | 24 April | DP1044B2RF |
| **Marana** | --- | 9 May (32 oz/a) | --- | 9 May | PY499WRF |

Yield data was also collected at each location in which an evaluation was made in each year by harvesting the center rows of each plot with a mechanical harvester equipped with a basket for weighing seeded cotton as it was harvested. Sub samples were collected from each plot in 2013 to determine lint percentages and fiber quality for all treatments.

## Results and Discussion

### 2012 Results

Fields were observed in mid-June and late August for evidence of phytotoxicity by looking for differences in plant height, foliar necrosis or other symptoms suggesting chemical damage to plants. Cotton root rot was assessed in mature cotton in late September in Marana and in Solomon. The number of feet of row with plants dead/dying from cotton root rot was recorded in each of 4 rows in each plot. The total number of feet with dead/dying plants in each plot was used as the amount of disease in each plot in each treatment. The data was subjected to a paired t-test in each treatment. Figure 4 shows a representative response in disease suppression observed at all locations in both 2012 and 2013.


Figure 4. Typical response observed across years and locations with the application of flutriafol for the control of Phymatotrichopsis. This is representative of approximately 70% disease control in the injected treatment in Solomon in 2013.

Data from the fungicide treatments alone was used in ANOVA to determine if there was a significant difference between the 16 oz and 32 oz Topguard applications.

Difference in percent disease for the 16 oz and 32 oz treatments compared to non-treated controls was calculated for the Solomon and Marana sites. The number of diseased plants in all six plots of each of the treatments was added, and the percent change calculated from the difference in non-treated and treated divided by non-treated X100.

There was no root rot in the Enterprise site, and no data was taken. Symptoms of phytotoxicity were not observed in any plots at any of the three sites. Results of the amount of disease (percent of plot) in Marana and Solomon are shown in Table 2 (and Figure 5). A significant reduction of cotton root rot was observed at the Solomon site in both the 16 oz ($P=0.0001$) and 32 oz ($P<0.0001$) fungicide treatments (Paired T-Test). At Marana, the 16 oz treatment ($P=0.5758$) and the 32 oz treatment ($P=0.4846$) were not significant. There was no significant difference (ANOVA) between the 16 oz and 32 oz treatments at either Solomon ($P=0.2711$) or Marana ($P=0.9045$).

Table 2. Amount of disease (percent of plot) in Topguard treated and non-treated controls in 6 paired plots in cotton root rot areas in Marana and Solomon in 2012.

| **Marana** | **16 oz/acre** | **UTC (pair)** | **32 oz/acre** | **UTC (pair)** |
|---|---|---|---|---|
| Replicated Pair | | | | |
| 1 | 2.0 | 0.0 | 0.0 | 0.0 |
| 2 | 8.5 | 1.5 | 1.0 | 0.0 |
| 3 | 29.5 | 17.0 | 5.0 | 13.0 |
| 4 | 31.5 | 47.5 | 35.0 | 13.0 |
| 5 | 25.0 | 72.5 | 19.5 | 50.0 |
| 6 | 5.0 | 4.5 | 32.0 | 56.5 |
| **Mean[1]** | **16.9** | **23.8** | **15.4** | **22.2** |
| **OSL[2]** | **0.5758** | | **0.4864** | |
| **Solomon** | | | | |
| Replicated Pair | | | | |
| 1 | 22.5 | 52.0 | 28.5 | 34.5 |
| 2 | 21.5 | 30.0 | 16.5 | 50.0 |
| 3 | 28.0 | 33.5 | 25.5 | 47.5 |
| 4 | 24.5 | 43.5 | 22.5 | 37.5 |
| 5 | 34.5 | 52.0 | 24.0 | 50.5 |
| 6 | 30.0 | 44.5 | 14.0 | 61.5 |
| **Mean[1]** | **26.8** | **42.6** | **21.8** | **46.9** |
| **OSL[2]** | **0.0001** | | **<0.0001** | |

[1]Average of the percentage of diseased area within plots across all six replications
[2]Observed significance level. Differences between pairs or treated and UTC check plots are significant when OSL<0.005 according to a paired t-test.

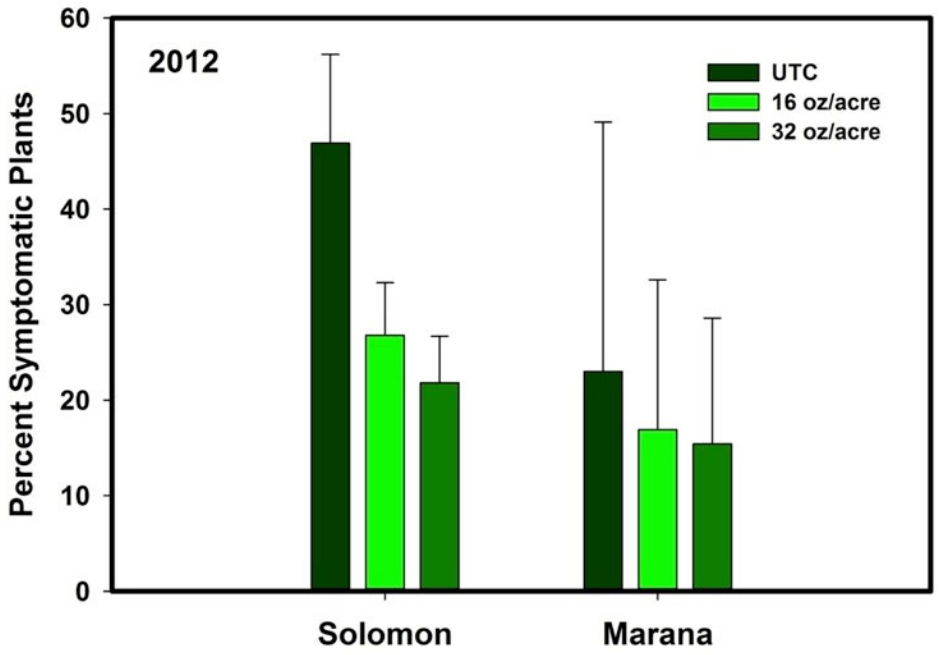


Figure 5. Percent symptomatic plants for each of the two locations in 2012. Colored bars represent untreated control (UTC), 16 and 32 oz/acre treatments.

It is not known why the Topguard treatments reduced the amount of cotton root rot significantly at Solomon but not Marana. One reason may be the distribution of disease since the plots in Solomon had more uniform distribution and the entire study was in an affected area, while in Marana there were plots with no disease. This is a typical scenario for cotton root rot since, although the disease occurs in the same general areas in infested fields every year, the distribution and severity often varies considerably from year to year. Although treatments were not significant at Marana for either treatment, the percent reduction in disease shows a trend for some control in both treatments. Yield data was not significant at either site, and differences between treated and non-treated cases in each treatment were inconsistent. Plots were kept small since all treated cotton had to be destroyed, and there is always difficulty in using small plots for yield data.

**2013 Results**

Differences in disease incidence were observed at two of three treated locations in 2013. No disease was observed at the Coolidge location, and no data was taken. Significant differences were observed between the control and the 32 oz/acre T-band treatment at Marana (Table 3 and Figure 6). Differences were significant at the 0.0057 level with a reduction of approximately 68.5% in disease incidence. A comparison of application technique was conducted at the Solomon location comparing the IFT and T-band with no significant difference observed in disease suppression (OSL=0.6723). Differences between either T-band or IFT were significant when compared to the control treatment (OSL<0.0001; Table 2). The magnitude of disease suppression was similar in Solomon to that of Marana with 71% and 68% for the T-band and IFT treatments respectively.

Table 3. Amount of disease (percent of plot) in Topguard treated and non-treated controls in 8 and 6 paired plots in cotton root rot areas in Solomon and Marana respectively in 2013.

| **Solomon** | **32 oz/acre (T-band)** | **UTC** | **32 oz/acre (IFT)** |
|---|---|---|---|
| Replicated Pair | | | |
| 1 | 6.5 | 16.3 | 3.5 |
| 2 | 8.3 | 30.1 | 5.5 |
| 3 | 6.5 | 19.0 | 1.8 |
| 4 | 5.3 | 32.5 | 14.8 |
| 5 | 9.5 | 32.8 | 21.3 |
| 6 | 7.8 | 28.8 | 10.3 |
| 7 | 10.8 | 32.4 | 4.8 |
| 8 | 7.8 | 26.6 | 7.8 |
| **Mean[1]** | **7.8** | **27.3** | **8.7** |
| **OSL[2]** | **<0.0001** | | **<0.0001** |
| **Marana** | | | |
| Replicated Pair | | | |
| 1 | 11.1 | 15.3 | |
| 2 | 11.5 | 28.4 | |
| 3 | 8.2 | 27.0 | |
| 4 | 8.5 | 36.5 | |
| 5 | 1.2 | 5.8 | |
| 6 | 2.4 | 19.2 | |
| **Mean[1]** | **6.8** | **21.6** | |
| **OSL[2]** | **0.0057** | | |

[1]Average of the percentage of diseased area within plots across all six replications

[2]Observed significance level. Differences between pairs or treated and UTC check plots are significant when OSL<0.005 according to a paired t-test.

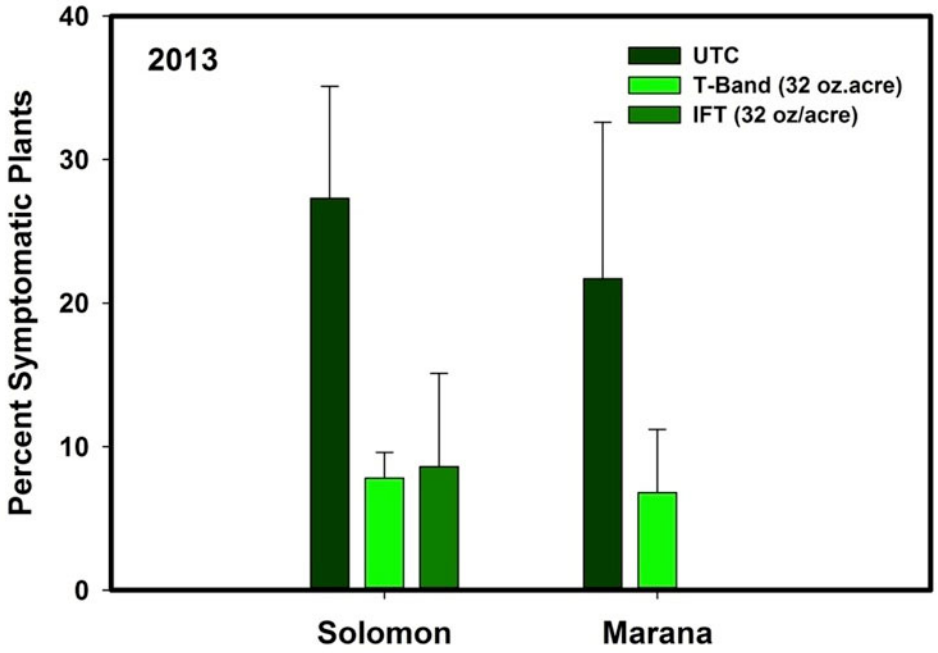


Figure 6. Percent of symptomatic plants for each of the two locations in 2013. Colored bars represent untreated control (UTC), T-band treatment and in-furrow treatment (IFT – Solomon only) at 32 oz/acre.

The injected treatment was implemented only at the Solomon and Coolidge locations and due to the lack of disease in Coolidge an evaluation of this technique was made only at the Solomon location. Observations made in Solomon showed similar reduction in disease compared to both the IFT and T-band treatments. Since the design of the evaluation did not allow for replicated treatments, no statistical data is presented. However, similar levels of disease suppression (approximately 70%) were observed between the injected rows compared to adjacent untreated rows.

## Conclusions

Disease levels were suppressed with flutriafol applications across years and locations regardless of application technique. In 2012 disease reductions observed were approximately 50% in Solomon and 30% in Marana. Suppression levels were higher in 2013 with 70% reductions observed at both Solomon and Marana. Despite disease suppression success, significant differences in yield were not observed. However, trends in higher yields were observed with flutriafol application.