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Rice Insecticide Seed Treatments:
Is There Value to the Arkansas Rice Producer?

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Introduction

In 2005 with the loss of Icon (fipronil) seed treatment due to a voluntary withdrawal of the label by the company, rice growers had very few options for control of the major insect pests of rice, the grape colaspis (GC), *Colaspis brunnea*, referred to by many growers as the "lespedeza worm," and the rice water weevil, *Lissorhoptrus oryzophilus*. Both of these pests have the potential to substantially reduce plant stand and subsequent yield in any given year. Recently, new insecticides have been developed as seed treatments for rice which may help control these pests.

Grape Colaspis

For many growers, grape colaspis, or lespedeza worm, can reduce stand early in the season, resulting in a thin stand at flood stage (Figure 1).

Figure 1. Typical stand loss associated with GC.

Legumes such as soybeans are primary hosts of grape colaspis (GC) adults (Figure 2). Multiple generations are common in legumes, and the last generation of larvae overwinters deep in the soil (Figure 3). In the spring, larvae move upwards in the soil, seeking plants. Because soybeans are rotated with rice in the MidSouth, GC larvae often have only rice on which to feed (Figures 4-6). Some larvae complete development on rice. However, rice is not a host plant that adults use for oviposition. This is why GC is always worse in rice where soybeans were the previous crop (Figure 7).

Figure 2. Grape colaspis adult.

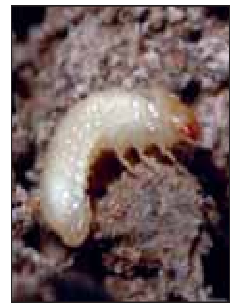

Figure 3. Grape colaspis larva magnified.

Other than seed treatments, control options or tactics for management of GC have included increased

Figure 4.Grape colaspis larva found in soil. Note plant above it is dying from root feeding.

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Figure 5. Grape colaspis larvae with a dime to show small size of larvae.

Figure 6. Rice seedling dead from grape colaspis feeding shows the unique girdling-type feeding of the larva.

Figure 7. Grape colaspis infestation causing "bean row" effect often associated with high populations.

seeding rate, increased nitrogen fertilization and foliar applications of pyrethroid insecticides.

Planting a higher seeding rate is typically done in an effort to compensate for stand loss by GC. Distributing additional nitrogen fertilizer and then flushing it in is done to help the rice "outgrow" GC damage. Neither increased seeding rate nor increased nitrogen fertilization has proven to be effective or increase yield (Bernhardt, personal comment) and can be very costly. Estimates of the cost of additional fertilizer and flushing the field can run as high as $50 per acre. Foliar pyrethroid applications followed by flushing depend significantly upon timing in order to be effective. Based on studies conducted the past three years and on observations in the field, none of these tactics are cost effective, and they are insufficient for achieving adequate GC control. Seed treatments appear to be the most efficacious and cost-effective method for control of GC.

Rice Water Weevil

Rice water weevil (RWW) is present in all rice-growing regions of the state. Much like the GC, this pest is a "silent threat" because the larval stage, which occurs below ground, is responsible for causing plant damage. In most cases, it appears that for rice growers "out of sight is out of mind." In other words, what they cannot see is not of importance. Rice consultants do not sample for larvae because of the difficulty and the fact that sampling is time intensive. As a result, decisions on whether or not to take action are based on the adult stage, although the larval stage is actually the damaging stage.

Rice water weevil adults, attracted to the water, come into rice fields at permanent flood. Before then the adults spend the winter hibernating (diapausing) in clump grasses, field trash and wood lines on the edges of fields. Usually RWW is worse in fields that have woods or tree lines bordering the field. When the adults enter the field, they will feed on rice leaves, causing distinctive feeding scars (Figures 8 and 9). This does not cause economic loss. However, these scars are used to determine whether or not remedial action is needed to control developing larval problems. Based on current thresholds for scarring in drill-seeded rice, when greater than 60 percent of new leaves in a field exhibit feeding scars, 10 larvae per soil core can be expected to occur 85 percent of the time (Figure 10). A core is a 4-inch diameter soil sample taken in the center of the drill.

Figure. 8. Rice water weevil adults and leaf-feeding scars.

Figure. 9. Feeding scars from adult rice water weevils.

Figure 10. Rice water weevil larvae floating in salt water solution.

Once the RWW female has fed and mated, she will insert white eggs into leaf sheaths under water. In 4 to 9 days, tiny (1⁄32 inch), white, slender, legless, C-shaped larvae or grubs hatch from eggs and develop through four stages (instars) for about 27 days until they are approximately ⅓ inch long (Figure 11).

Figure 11. Rice water weevil larva on roots.

Larvae then pupate within a watertight, oval mud cell attached to the roots and emerge as adults 5 to 7 days later. Adults emerge throughout the reproductive stage of rice development and feed on leaves before leaving the field in late summer and fall. Development from egg to adult normally occurs within 35 days. Larval feeding reduces root volume and can result in decreased ability of plants to acquire, translocate and utilize available nutrients. Damaged plants most often will not show any symptoms unless root damage (pruning) is severe. Severely damaged plants become yellow and stunted and will have delayed maturity and reduced yield. Occasionally, root pruning will be so severe plants cannot remain anchored in the soil and, when disturbed, will float on the water surface.

RWW adults are also attracted to thin stands, so growers who experience stand loss from GC earlier in the season face a double jeopardy of having worse than average RWW infestations (Figure 12).

Figure 12. Reduced stand from grape colaspis and increased rice water weevil problems resulting.

In the absence of a seed treatment, control tactics for RWW are limited to draining the field or foliar applications to reduce adult numbers in the field.

Draining the field refers to removing the initial flood and allowing the soil to dry until the soil cracks to reduce the number of RWW larvae and prevent excessive damage to the roots. For this tactic, draining and drying should begin at 2 weeks after initial flood for best results. However, with recent increased fuel costs, draining and drying increases irrigation costs to the point that growers find it cost prohibitive. Also, this practice may increase herbicide, labor and fertilization costs.

The second approach is to spray insecticides targeting adults. There can be a major problem with this approach. Targeting the adult stage when the larval stage is the one causing the damage can be challenging. This makes timing of the foliar application very important. The window for the application is generally considered to be about 5 days after initial flood. However, on many fields the number of days that it takes to get the flood on the field may vary from just a few days to over 2 weeks or even longer. This means that by the time the lower portion of the field is flooded up, the upper part has had the flood on for several days and timing an application is simply not possible. In our trials, we have seen more often than not that the foliar application has had no impact on RWW even when the timing was right (Figure 13).

Seed Treatments

Cruiser® 5FS (Syngenta Crop Protection) and Dermacor® X-100 (DuPont Crop Protection) insecticide seed treatments were granted full labels for use during the spring of 2010. In the U.S. prior to 2010, an extensive testing program was conducted through experimental use permits. In 2008, Arkansas received a Section 18 with Louisiana and Mississippi for Dermacor, and we were able to observe the product in large block trials. In 2009, Dermacor received a full label, and Arkansas was the only state granted a Section 18 for Cruiser. We were able to compare Cruiser to Dermacor and untreated checks in several locations across the rice-growing area of the state in large and small plot trials. In 2011, a third seed treatment, NipsIt INSIDE, became available on limited acreage; an EUP was granted on 40,000 acres, of which 20,000 was allotted in Arkansas. We had the opportunity to evaluate this product in small plots as well as on grower fields across the state, providing us with a good opportunity to evaluate the product on large plot trials in the state. NipsIt INSIDE (Valent U.S.A. Co.) received a full label for use in the fall of 2012. In 2011, the Cruiser formulation was changed to CruiserMaxx Rice, which is a premix of Cruiser and fungicides.

Experiments and demonstrations were conducted from 2007 to 2012 on numerous grower fields across the state and the Pine Tree Experiment Station, Colt, Arkansas. These trials consisted of small-plot replicated experiments and large-plot demonstration trials, and the comments on these seed treatments herein are based on these observations. In these trials, we have used seeding rates ranging from 20 lb/acre to 120 lb/acre. We have observed these seed treatments on conventional, Clearfield and hybrid rice cultivars. Locations were selected based on field history of problems with either GC or RWW. However, we did not experience insect problems in every field.

Observations on Seed Treatments

Throughout testing, we have seen a general trend for seed treatments to improve stand count and vigor in many fields. Seed treatments have increased stand

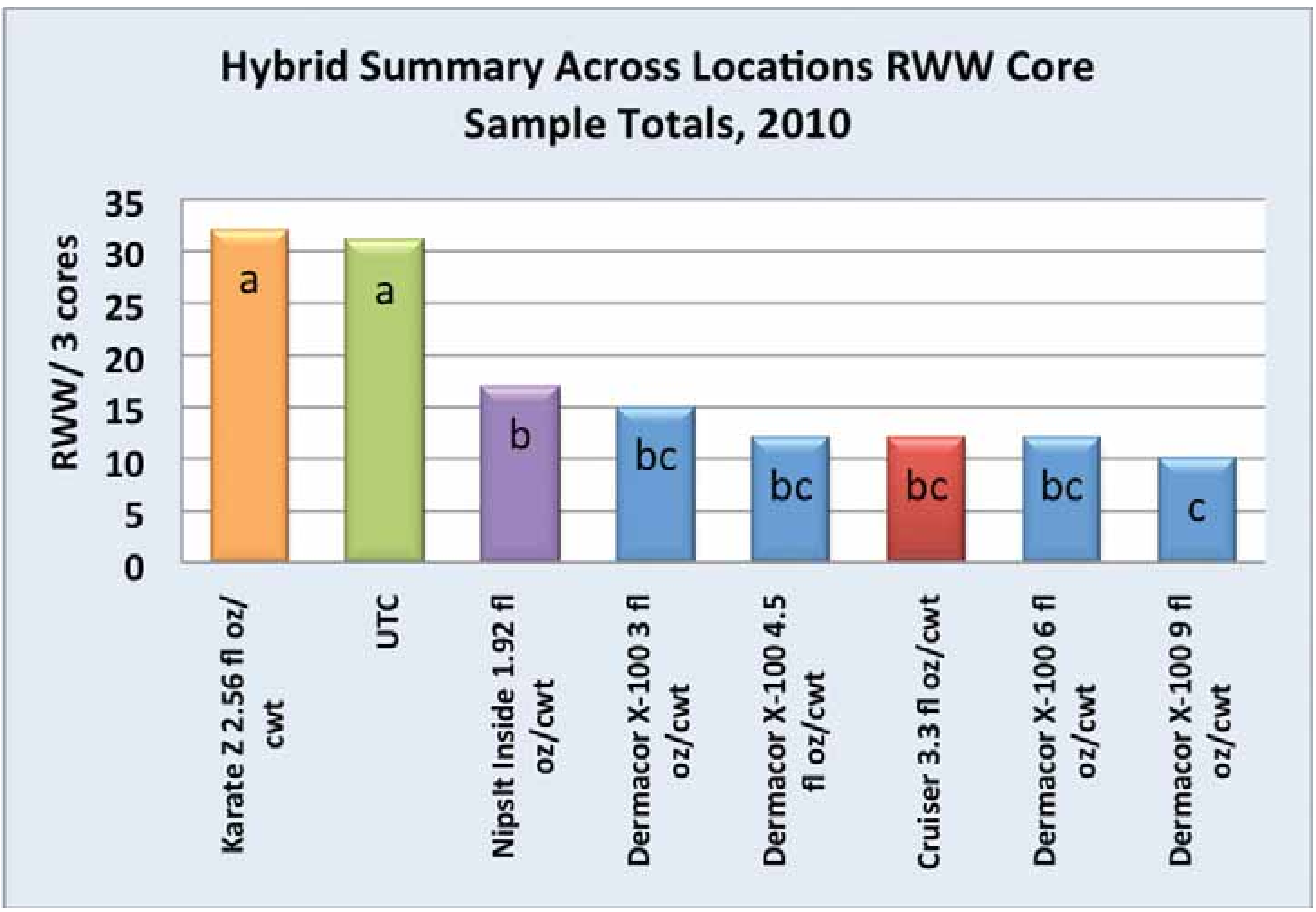

Figure 13. Hybrid trial across 3 locations showing lack of control with foliar applications for rice water weevil (RWW) control, 2010. This has been a common observation in our trials. Also shows the effectiveness of seed treatments for RWW control.

counts in many trials as much as 10 to 20 percent above the untreated checks (Figure 14). We have also documented increased plant height in some fields. The amount of vigor seen may be dependent on many factors including pest pressure, environmental conditions and seed quality. Many times we have observed under stressful conditions the seed treatment helped to moderate or buffer stress.

Root core samples (4-inch diameter) were collected at 3 to 5 weeks post flood and transported to the laboratory. Samples were washed through a ¼-inch screen into a 40-mesh sieve to collect RWW larvae. The sieves were placed in a 5 percent salt water solution, and the number of larvae that floated to the surface were counted. At the end of the season, plots were harvested and yields were measured and converted to bushels per acre. Percent control over the past 3 years has ranged from 0 to 100 percent control, depending on initial larval densities. In general, little benefit is observed from either seed treatment when RWW densities are low. Seed treatments provide good control when moderate populations of RWW are present on roots. When higher populations occur (>20 larvae per core), NipsIt INSIDE, Dermacor and Cruiser each provide control. Each of the seed treatments provides significant benefits in terms of yield. Over the 5-year period, Dermacor provided a 7 bu/acre yield increase, Cruiser provided a 6 bu/acre yield increase and NipsIt INSIDE provided a 6 bu/acre increase. Based on the yield results shown in the figure below, Dermacor, Cruiser and NipsIt provided a 75 percent, 73 percent and 81 percent probability of a net return, respectively.

Based on these results, insecticidal seed treatments are recommended for rice water weevil control in Arkansas. Cruiser and NipsIt INSIDE are recommended for grape colaspis control and Dermacor for suppression of grape colaspis. Also, Dermacor will provide control of true armyworms that move from adjoining wheat fields into seedling rice.

Reference

Rice Water Weevil. http://insects.tamu.edu/fieldguide/bimg205.html

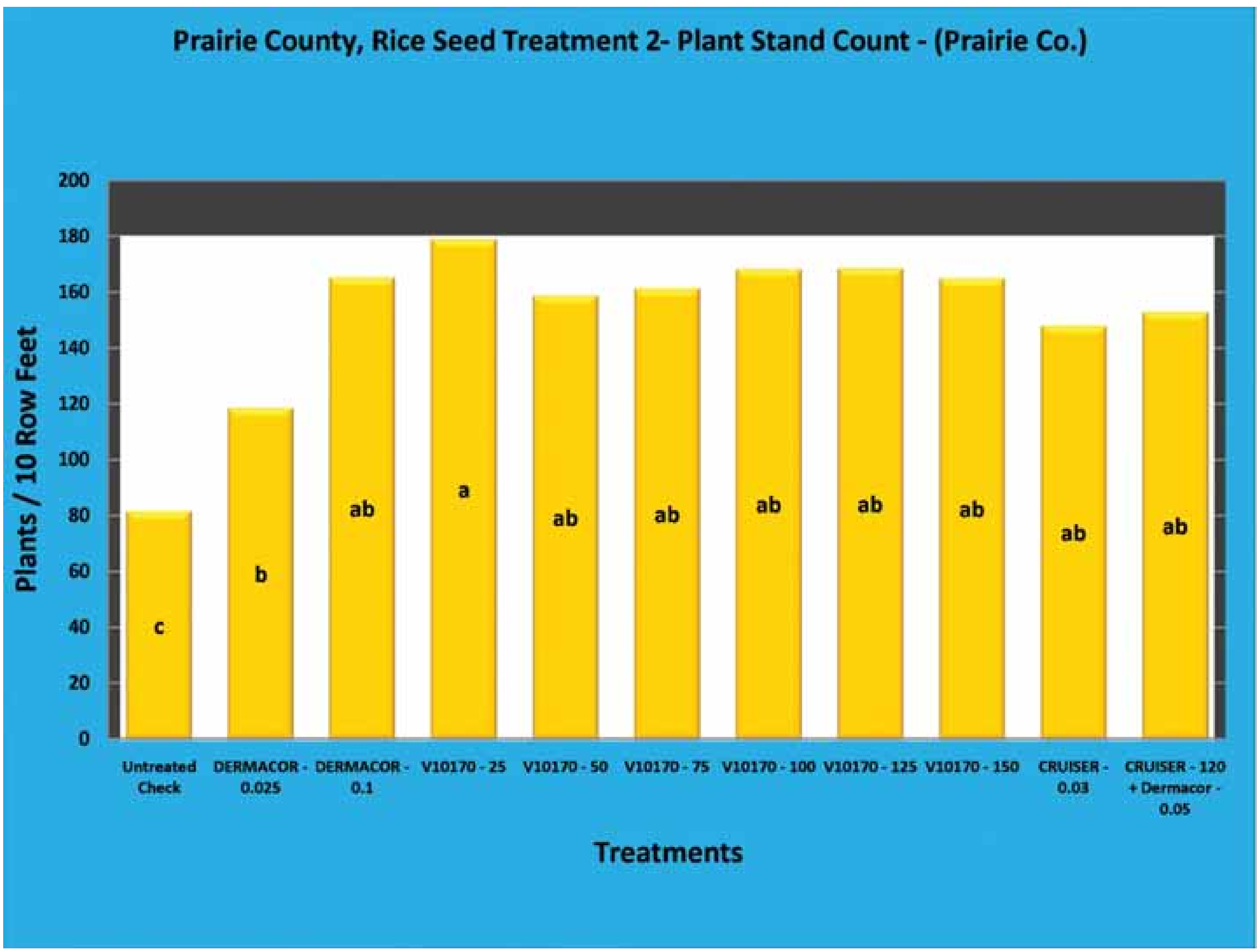

Figure 14. Stand count increase of seed treatments compared to untreated check (V10170 is NipsIt).

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