Title

Evaluation of acetochlor (Warrant) + safeners on control of grasses and small seeded broadleaf weeds in furrow irrigated rice (FIR).*

Principle Investigator

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Objective

Determine the effectiveness of acetochlor for controlling common grass and broadleaf weeds in furrow irrigated rice as well as evaluating the utility of safeners for crop safety when applying acetochlor to rice.

Justification

Control of grassy weeds can be one of the most difficult tasks in rice production. Barnyardgrass and Amazon sprangletop are among the most problematic weeds in delayed flood production systems in Missouri. In FIR production, additional species such as crabgrass, goosegrass, and broadleaf signalgrass can also be detrimental to producing a clean crop. Additionally, small seeded broadleaf weeds such as Palmer amaranth can be more problematic in FIR. The herbicide Warrant (active ingredient Acetochlor) is used in corn, cotton, and soybeans for preemergence control of grasses and small seeded broadleaf weeds. In recent years the concept of overlaying soil residual herbicides in these crops has gained popularity. In this process, a preemergent (PRE) herbicide would be applied at or shortly after planting. A second soil residual herbicide, safe to apply over the top of the emerged crop, is then applied just before the residual activity of the PRE herbicide is expected to break. In this way, less pressure is put on our postemergence herbicides.

The need for additional modes of action is as evident in rice as any of our major crops in Southeast Missouri. Many rice fields have shown to have populations of barnyardgrass tolerant or resistant to propanil, Command, Facet, Clincher, Ricestar HT, and/or Newpath and Beyond herbicides. Additional species have also been noted to be tolerant to these and other herbicides used in rice production. The herbicide active ingredient pretilachlor (same family as acetochlor, metolachlor), has been employed for weed control in areas outside of the U.S. for many years. Many formulations include the herbicide safener fenclorim as a premix to prevent injury to the rice crop. A recent study in Arkansas looked to determine the efficacy and crop safety when acetochlor + fenclorim was applied preplant, preemergence and to spiking rice. This study would investigate the residual control and crop safety when acetochlor + fenclorim or acetochlor + dichlormid, another safener used with chloroacetamide herbicides, are applied at later rice growth stages as an overlapping residual following a PRE application of Command + Sharpen.

Procedures

Rice was drill seeded on 38” beds on May 18 at the MRRMC farm near Glennonville, Mo. A low rate of Command (8 fl.oz./ac.) was applied one day after planting to the study area. Treatments included two application rates of acetochlor formulated as Warrant herbicide (1.25 and 1.9 quarts/acre – low and high range on label for most crops) alone, and with the safeners fenclorim or dichlormid applied at 0-, 50-, 175-, and 300-grams active ingredient per acre (Figure 1). These applications were made at the 2-3 leaf rice growth stage when control from PRE Command applications began to break. These applications occurred on June 14. There were mixing and application issues with the fenclorim safener that potentially reduced the actual applied rate in those treatments.

Crop injury evaluations (stand reduction, stunting, chlorosis, necrosis) began 1 day following applications. A broad spectrum, non-residual herbicide program was employed at this time to evaluate the residual activity and duration of acetochlor on target species. Weed control evaluations began two weeks after applications and continued through canopy closure. Species evaluated included Palmer amaranth, entire leaf morningglory, and a mix of grass species that included barnyardgrass, crabgrass and broadleaf

signalgrass. NDVI measurements were made just before applications and at 1, 3, 7, and 14 days after application to determine if any differences in light reflectance, which may not be evident to human eyes, is occurring and to what extent. Plots were harvested for yield.

Results

Initial evaluations for crop response (1 and 3 DAT) from these applications revealed no adverse response in the form of chlorosis, necrosis, or crop stunting. However, by 7 DAT, stunting was evident although minor. No differences statistically were found. In fact, for all injury evaluations, only one treatment was observed to have higher incidence of stunting than any other treatment. Observations 14 DAT showed that applications of 1.9 qt./ac. of Warrant applied with the lowest rate of fenclorim produced the greatest amount of crop stunting – more so than when no safener was applied (Figure 2). If we compare the different rates of Warrant and just one safener, fenclorim, we see that this safener was able to reduce stunting when applied at the 300 g ai rate, especially with the higher rate of Warrant (Figure 3). No significant differences were noted when we looked at only the dichlormid treatments.

Residual control of the aforementioned weeds was exceptional in this study. Palmer amaranth and morningglory emergence was nonexistent following 2-3 leaf applications in the treated plot area, while border areas between plots and alleys had a fair amount of these species. Grass control was also good to great for the evaluation period. However, numerical differences in control were observed. No clear pattern of what caused these differences emerged (Figure 4). Similarly, no differences in crop yield were noted at the completion of this study.

Normalized difference vegetative index (NDVI) measurements were made just prior to Warrant applications and at several intervals following applications. When analyzing the entire study, no differences were found in these measurements. If we look only at the fenclorim and no safener treatments, we see some minor, non-significant differences (Figure 5).

Conclusions

The use of Acetochlor as formulated in Warrant herbicide was found to be safe when applied to rice at the 1-2 leaf growth stage with or without the herbicide safeners fenclorim and dichlormid. The addition of a safener to applications before, during, or shortly after germination but before crop emergence would probably benefit from a safener more than applications after crop establishment – as was the case in this study. Due to no differences in weed control being observed, we can conclude that we did not safen the weeds to the herbicide – useful to know for overlapping residual applications *and* applications made during crop germination.

Figure 1. Treatment list

Treatment	Warrant Rate(qt./ac.)	Safener	Safener Rate (g ai./ac.)
1	1.2	-	0
2	1.2	Fenclorim	50
3	1.2	Fenclorim	175
4	1.2	Fenclorim	300
5	1.2	Dichlormid	50
6	1.2	Dichlormid	175
7	1.2	Dichlormid	300
8	1.2	-	0
9	1.9	Fenclorim	50
10	1.9	Fenclorim	175
11	1.9	Fenclorim	300
12	1.9	Dichlormid	50
13	1.9	Dichlormid	175
14	1.9	Dichlormid	300

Figure 2. Crop stunting on June 28 following applications of Warrant at 1.9 and 1.9 qt./ac. alone or with the safeners fenclorim or dichlormid at 50, 175, or 300g ai./ac. Rating scale is 0= no injury and 10=severe tissue damage/plant death. Data with the same letters are not statistically different.

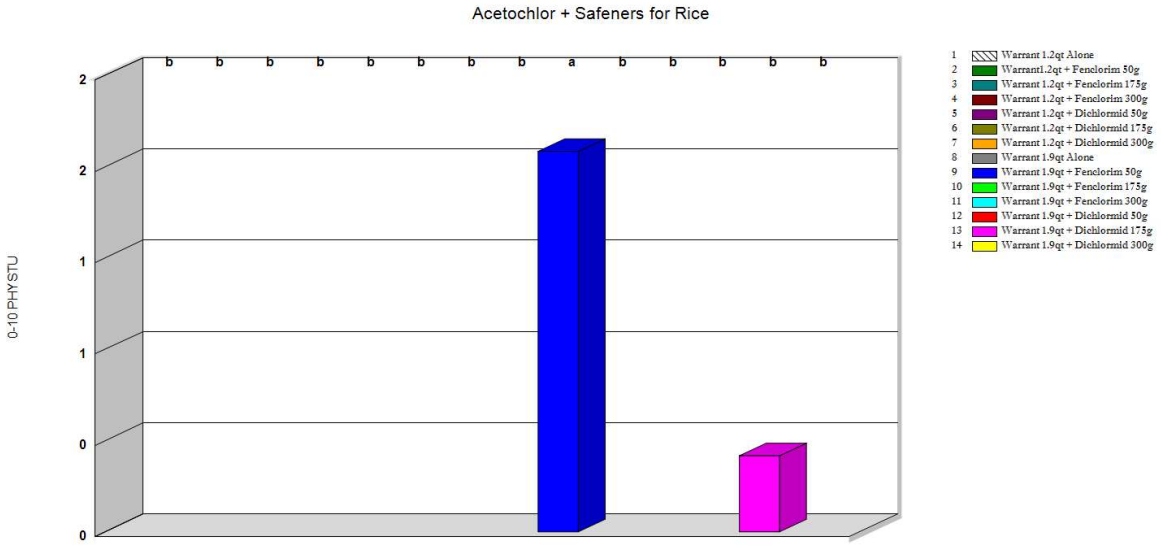

Figure 3. Crop stunting on June 21 following applications of Warrant with the safener Fenclorim applied at 0, 50, 175, or 300 g ai./ac. Rating scale is 0= no injury and 10=severe tissue damage/plant death. Data with the same letters are not statistically different.

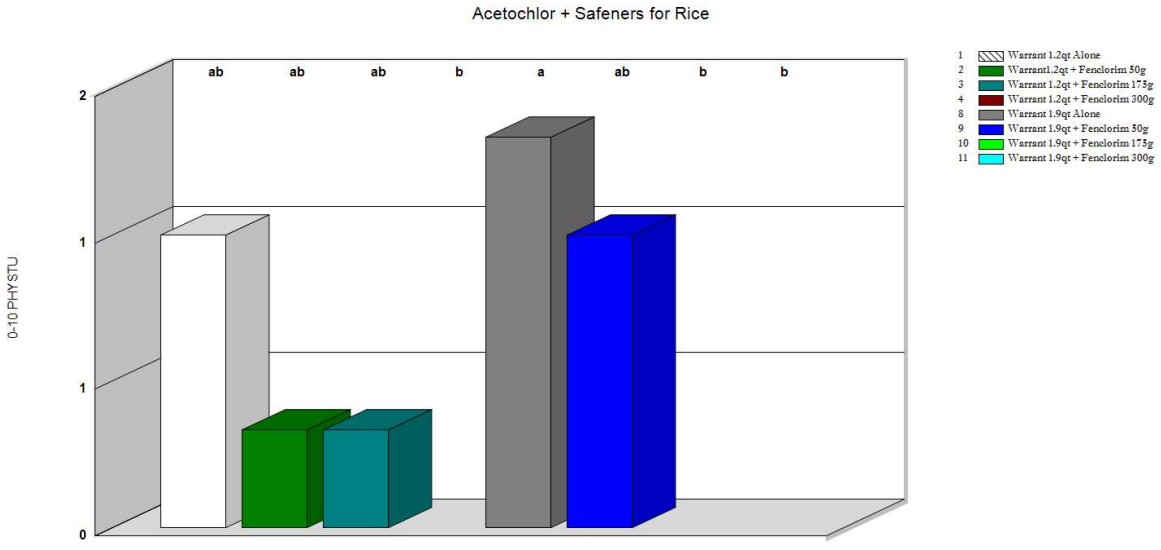

Figure 4. Control of grasses (barnyardgrass, crabgrass, and broadleaf signalgrass) when Warrant was applied at 1.2 or 1.9 qt./ac. with 0, 50, 175, 300 g ai./ac. of either Fenclorim or Dichlormid safeners. No significant differences in grass, Palmer amaranth, or entireleaf morningglory were observed at any timing in this study.

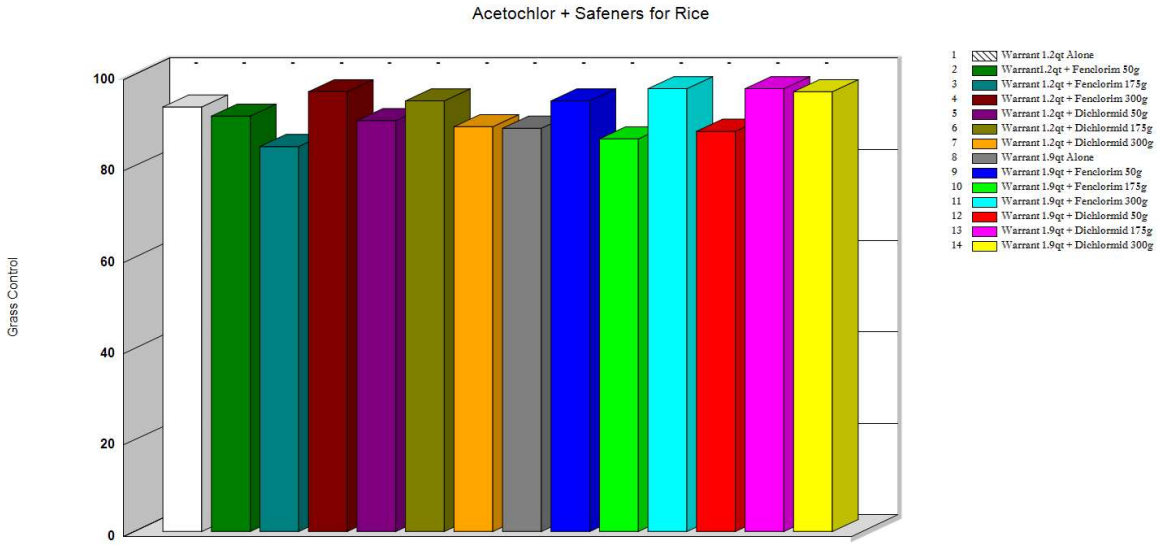

Figure 5. Normalized difference vegetative index (NDVI) measurements on June 15 (1 DAT) following applications of Warrant with the safener Fenclorim applied at 0, 50, 175, or 300 g ai./ac. Data with the same letters are not statistically different.