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plus Triclopyr
Combinations

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Introduction

Until the mid-1980's, 2,4,5-T [2,4,5-trichlorophenoxyacetic acid] was used successfully as a tank-mix partner with propanil for weed control in rice (*Oryza sativa* L.). Propanil controls a wide spectrum of problem weeds in rice, including barnyardgrass [*Echinochloa crus-galli* (L.) P. Beauv], bearded sprangletop [*Leptochloa fascicularis* (Lam.) Gray.], and hemp sesbania (*Sesbania exaltata* L.); 2,4,5-T controlled most broadleaf weeds such as pitted morningglory (*Ipomoea lacunosa* L.) and palmleaf morningglory (*I. wrightii*) (1, 6).

In the mid-1980's, 2,4,5-T application to rice was banned because of perceived health risks and was replaced with 2,4-D [2, 4-dichlorophenoxyacetic acid] and MCPA [4-chloro-2-methyl phenoxyacetic acid]. These phenoxy herbicides are also effective on broadleaf weeds in rice; however, rice is more sensitive to 2,4-D and MCPA during the early season than it is to 2,4,5-T, which limits their application to mid-season when rice internodes are from 0.5 to 1.3 cm in length (9).

Because propanil is used early season, its application timing does not correspond to either 2,4-D or MCPA and, therefore, it could not effectively be tank mixed.

In Mississippi, it is common for cotton (*Gossypium hirsutum* L.) to be grown adjacent to rice fields. The use of 2,4-D and MCPA resulted in more damage to cotton than from use of 2,4,5-T. Two reasons are that 2,4-D and MCPA are more volatile, and cotton is more sensitive to them than it is to 2,4,5-T (5). Therefore, many restrictions were placed on use of 2,4-D and MCPA to minimize drift (Mississippi Department of Agriculture and Commerce, Division of Plant Industry, Box 5207, Mississippi State, MS 39762).

For example, in Mississippi, these phenoxy herbicides cannot be applied to rice by airplane between April 1 and September 30. Applications may be made to rice by helicopter under special conditions. Restrictions include winds less than 5 mph, temperatures below 90 °F, and a one-half-mile buffer zone between application areas and sensitive crops. With these restrictions, many growers found themselves unable to apply 2,4-D or MCPA.

Triclopyr [3,5,6-trichloro-2-pyridinyloxyacetic acid] (Grandstand R[®], DowElanco, U.S. Crop Production, Indianapolis, IN) has been effective in controlling many broadleaf weeds in rice, including morningglory (*Ipomoea* sp.), hemp sesbania (*Sesbania exaltata* L.), northern jointvetch (*Aeschynomene virginia* L.) and Texasweed (*Caperonia palustris* L.) (4,7,10). Triclopyr is an auxin-type herbicide, which is readily absorbed by both the foliage and roots. It translocates throughout the plant and accumulates in the meristematic tissue. As with many of the auxin-type herbi-

cides, the exact physiological mechanism is not known (3).

Most varieties of rice show tolerance to triclopyr, and it may be applied from the 3-leaf stage to the one-half-inch internode elongation stage of growth (8,13). This allows the possibility of tank mixing with propanil to provide a broader spectrum of weed control early season in rice. In addition, triclopyr is less volatile and less injurious to cotton than either 2,4-D or MCPA, therefore, no special restrictions exist for its use (2, 4, 11).

Tank mixtures of herbicides have often been used to increase the spectrum of weed control. In some instances, the combination of chemicals results in greater weed control than either chemical acting alone. For example, tank mixing propanil at 2 or 3 lb/A with tridiphane [2-(3,5-dichlorophenyl)-2-(2,2,2-trichloroethyl)oxirane] at 0.5 lb/A or greater enhanced control of 3- to 4-leaf barnyardgrass in rice compared to propanil applied alone at 3 lb/A (12).

Quinclorac [3,7-dichloro-8-quinolinecarboxylic acid] (Facet 75[®] DF, BASF, Research Triangle Park, NC), included in this study for comparison, is a residual herbicide that is effective on barnyardgrass and many broadleaf weeds in rice. Rice has shown excellent tolerance to Facet. However, Facet is not effective on weeds such as sprangletop. In this situation, a grower may choose to apply a contact herbicide such as propanil.

Many times during the early part of the growing season, herbicide applications may be delayed because of rain or high winds blowing toward a susceptible adjacent crop. In these situations, weeds, especially broadleaf weeds, may become too large to control with propanil alone.

This study was designed to assess the benefit of including Grandstand R in tank mixtures with propanil to increase weed control as well as compare these treatments with Facet. Trade names will be used throughout this manuscript for clarity, but rates will be expressed as active ingredient because formulations have changed.

Materials and Methods

Experiments were conducted at the Delta Research and Extension Center, Stoneville, MS in 1989, 1991, and 1992. Soil type was a Sharkey clay (Vertic Haplaquept) with 1.2% organic matter content and pH of 7.4. Plots were 8 feet by 15 feet and were overseeded each year with barnyardgrass, hemp sesbania, and morningglory prior to final land preparation and again immediately prior to seeding rice. 'Lemont' rice was drill seeded 0.75 inch deep in 8-inch rows with a seeding rate of 90 lb/A. Test design was a randomized complete block replicated four times. Standard rice production practices were used to maximize yield. Herbicide applications

were made pre-flood to 6- to 9-inch rice, 6- to 12-inch pitted and palmleaf morningglory, 6- to 10-inch hemp sesbania, and 4- to 6-inch barnyardgrass using a CO₂-pressurized backpack sprayer delivering 20 GPA (gallons per acre) carrier volume at a pressure of 26 PSI (pounds per square inch). Ratings included rice injury and weed control 7 and 14 DAT (days after treatment). Ratings were estimated visually on a scale of 0 to 100%, with 0% indicating no injury or weed control and 100% indicating dead rice or complete weed control.

Treatments consisted of propanil (Stam M-4®; Rhom and Haas Co., Philadelphia, PA) at 4 lb ai/A alone or in combination with Grandstand R at 0.1, 0.2, 0.3, 0.4, and 0.5 lb ai/A. These rates correspond to 0.25 to 1.3 pints of Grandstand R. Additional treatments of 0.38 lb ai/A Facet with and without 4 lb ai/A propanil were included for comparison. Not all treat-

ments were repeated all years, and not all weeds were present all years. Therefore, data were nonorthogonal. Tests were averaged over years and means were separated using least square analysis (Steel, R.G., and J.H. Torrie. 1980. Principles and Procedures of Statistics; A Biolchemical Approach. 2nd Ed. McGraw-Hill, Inc., New York, NY).

Results and Discussion

At 7 DAT, Grandstand R and Facet caused little or no injury (Figure 1). All treatments containing propanil were similar in injury, with ratings ranging from 13% injury for propanil alone to 16% injury for propanil plus 0.38 lb ai/A Facet.

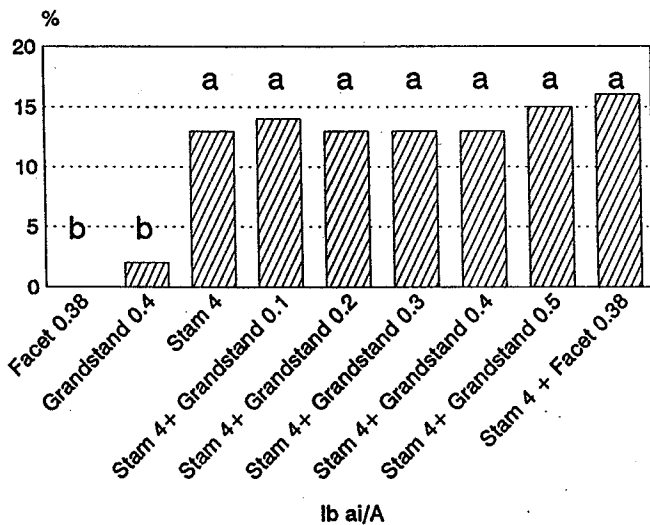


Figure 1. Injury to 6- to 9-inch rice 7 DAT (least square means, LSD $p = 0.05$).

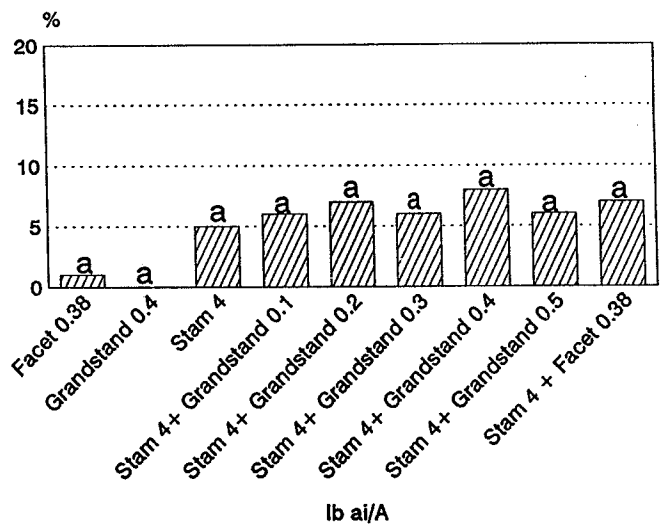


Figure 2. Injury to 6- to 9-inch rice 14 DAT (least square means, LSD $p = 0.05$).

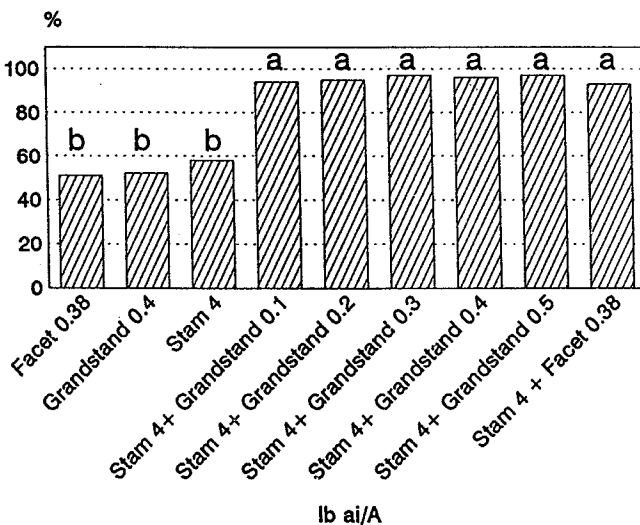


Figure 3. Injury to 6- to 10-inch pitted morningglory 7 DAT (least square means, LSD $p = 0.05$).

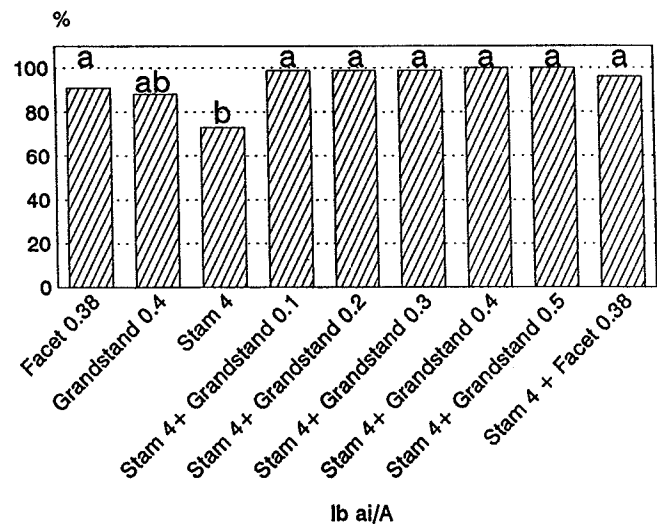


Figure 4. Injury to 6- to 10-inch pitted morningglory 14 DAT (least square means, LSD $p = 0.05$).

By 14 DAT, plants had recovered sufficiently so that there was no difference in injury among treatments with no visible injury greater than 8% (Figure 2).

Pitted morningglory control at 7 DAT was greater with tank mixtures of propanil plus Grandstand R (all rates) and propanil plus Facet than control with Facet, Grandstand R, or propanil alone (Figure 3).

At 14 DAT, Facet and 0.4 lb ai/A Grandstand R treatments were similar in control to tank mixtures of propanil plus Grandstand R and propanil plus Facet (Figure 4). Pitted morningglory control with propanil increased with the addition of 0.1 lb ai/A Grandstand R from 73% to 99%. There was no additional benefit for increasing rates of Grandstand R with propanil for pitted morningglory control.

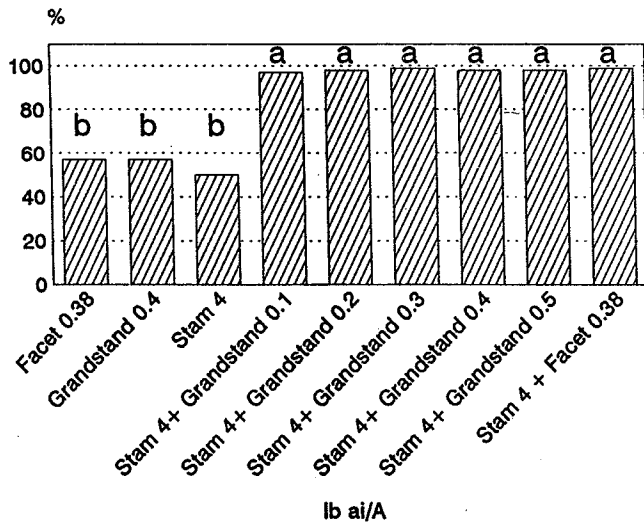


Figure 5. Injury to 6- to 10-inch palmleaf morningglory 7 DAT (least square means, LSD $p = 0.05$).

Control of palmleaf morningglory at 7 DAT was similar to control of pitted morningglory at 7 DAT. Propanil plus Grandstand R or Facet offered greater control than Facet, Grandstand R or propanil alone (Figure 5).

By 14 DAT, palmleaf morningglory control with Facet had increased from 57% to 94% and was similar to control by tank mixtures of propanil plus Grandstand R and propanil plus Facet (Figure 6).

Grandstand R at 0.4 lb ai/A did not control pitted morningglory (89%) as well as tank mixtures of propanil plus Grandstand R or propanil plus Facet which resulted in 98% or greater control. Pitted morningglory control with propanil (50%) was less than all other treatments evaluated.

All treatments controlled hemp sesbania at 7 DAT (Figure

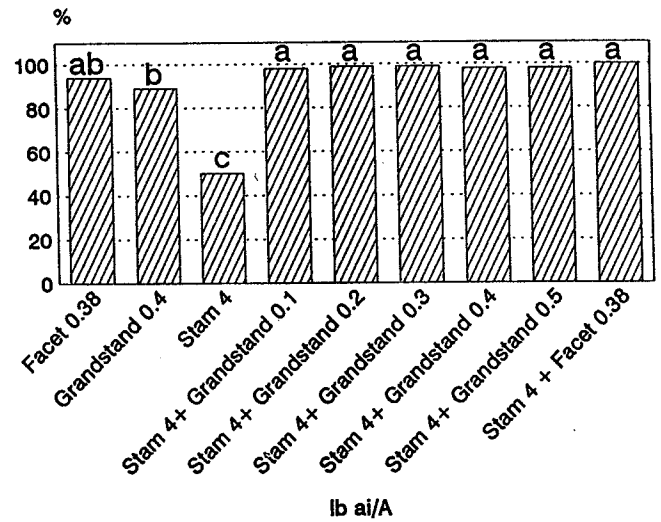


Figure 6. Injury to 6- to 10-inch palmleaf morningglory 14 DAT (least square means, LSD $p = 0.05$).

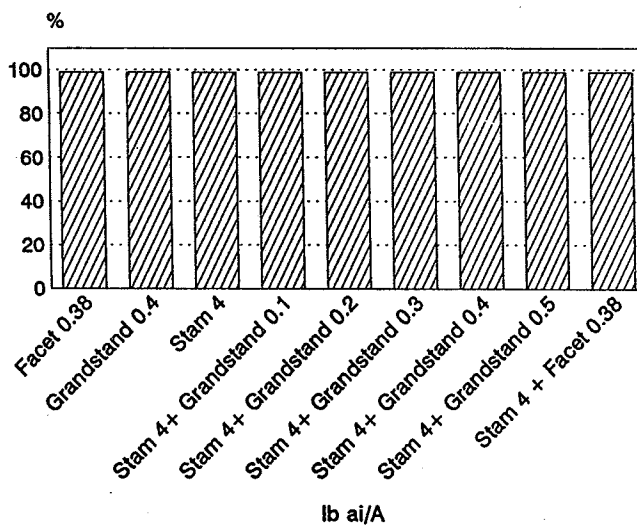


Figure 7. Injury to 6- to 10-inch hemp sesbania 7 DAT (least square means, LSD $p = 0.05$).

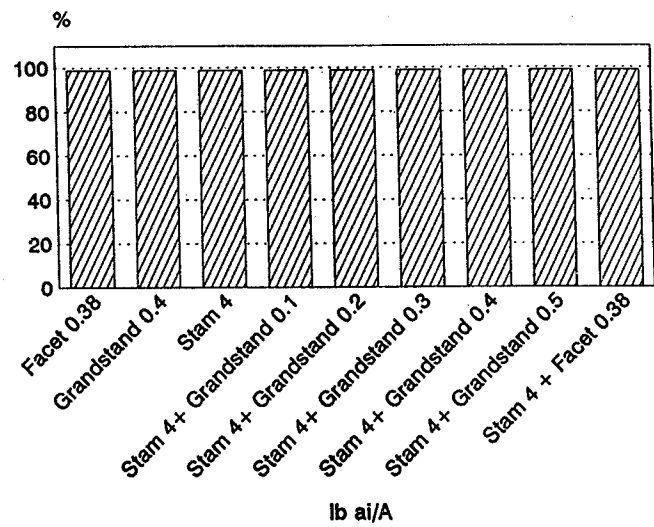


Figure 8. Injury to 6- to 10-inch hemp sesbania 14 DAT (least square means, LSD $p = 0.05$).

7) and 14 DAT (Figure 8). Hemp sesbania is easily controlled with propanil, thus, tank mixing another compound with it is generally not beneficial for hemp sesbania control.

Propanil alone, Facet alone, and all levels of Grandstand R mixed with propanil resulted in similar control of barnyardgrass, ranging from 64% control to 81% control (Figure 9). Grandstand R at 0.4 lb ai/A controlled barnyardgrass only 7%.

At 14 DAT, all treatments, except for Grandstand R at 0.4 lb ai/A, had similar barnyardgrass control, ranging from 76% to 86% (Figure 10). Grandstand R had little control at 7%.

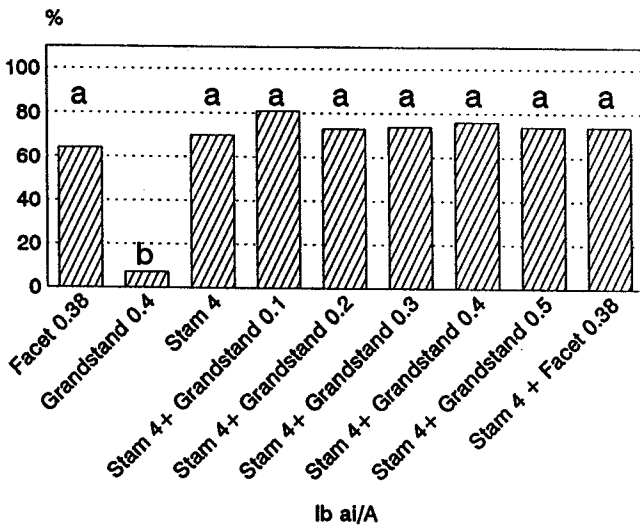


Figure 9. Injury to 6- to 10-inch barnyardgrass 7 DAT (least square means, LSD $p = 0.05$).

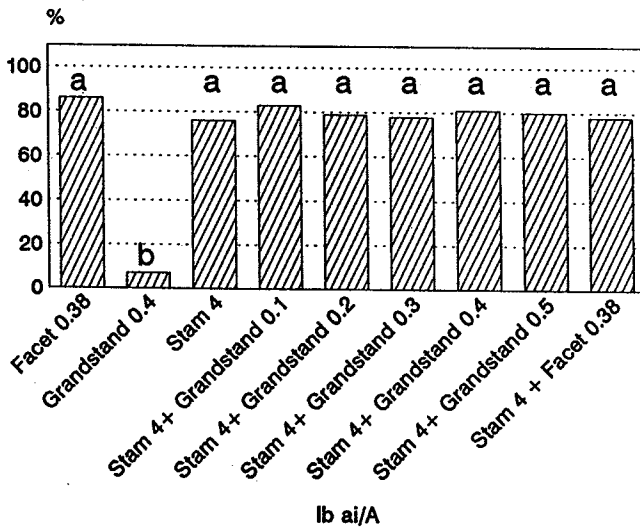


Figure 10. Injury to 6- to 10-inch barnyardgrass 14 DAT (least square means, LSD $p = 0.05$).

Summary

No treatment caused excess injury to rice. The propanil plus Grandstand R tank mixtures did not increase the efficacy of propanil for the control of hemp sesbania or barnyardgrass. However, the addition of 0.1 lb ai/A Grandstand R to propanil significantly increased control of pitted and palm-leaf morningglory.

There was no benefit to increasing rates of Grandstand R in excess of 0.1 lb ai/A when tank mixed with 4 lb ai/A propanil for pitted and palmleaf morningglory control. The mixture of propanil at 4 lb ai/A plus 0.1 lb ai/A Grandstand R was similar in control to Facet for all weeds evaluated in this study.

The limitations to use of 2,4-D as a replacement for 2,4,5-T in tank mixtures with propanil because of cotton sensitivity, volatility, and injury of early season rice are not seen with Grandstand R. Cotton is less sensitive to Grandstand R than 2,4-D, thus the potential for off-target injury to adjacent crops is minimized. Grandstand R plus propanil mixtures maintain excellent control of barnyardgrass while adequately controlling weeds such as morningglory. Therefore, Grandstand R can serve as an adequate replacement for 2,4,5-T in tank mixtures with propanil for control of weeds in rice.

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