

Summary of Control of Herbicide Resistant Watergrass in Northern California Rice with Regiment™

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Introduction

Watergrass and barnyardgrass are serious weeds in California rice culture. There are four forms of watergrass and barnyardgrass indigenous to California that infests rice. The early form of watergrass, *Echinochloa oryzoides*, blooms about 40 days after flooding. Its' spikes are heavily awned and the heads are drooping or pendant. A similar form of watergrass is *Echinochloa crus-galli var. oryzicola*. *Echinochloa phyllopogon* is a late blooming form that upright foliage, erect panicles and awnless spikelets. It begins flowering at the same time as rice, about 90 days after flooding. This species resembles rice in the vegetative stage of growth and is an example of a weed mimic. Barnyardgrass, *Echinochloa crus-galli var. crus-gali* is common throughout the rice growing areas of California. Barnyardgrass is small seeded and quite variable in appearance. It is especially prevalent in fields where intermittent (pinpoint and leathers) flood-culture is utilized.

Over the last 5 years, many growers and PCAs in the Sacramento valley have experienced difficulty controlling watergrass species in various fields. Late watergrass (rice mimic) was identified as the major problem, however, control failures of barnyardgrass and early watergrass have also been observed. The major geographical area of concern is near the town of Princeton (Glenn County) where numerous growers have reported herbicide failures. The problem however, is not limited to the Princeton area, control failures have been documented throughout the Sacramento valley.

Watergrass control problems were observed with maximum label rates of thiobencarb (Bolero® and Abolish®), molinate (Ordram®) and fenoxaprop-ethyl (Whip®). Failures were observed with singular and sequential applications of the above mentioned herbicides. In 1998, Dr. Albert Fischer, UC-Davis, conducted greenhouse studies to confirm that resistance to thiobencarb, molinate and fenoxaprop-ethyl had developed in all three forms of *Echinochloa species* indigenous to California. His findings were based on bioassays of watergrass and barnyardgrass grown from seed samples collected from suspected resistant fields the previous fall. His findings also indicate that resistance to all three herbicides is probably due to enhanced degradation.

Summary

Regiment 80 WP (bispyribac-sodium) is a post-emergence herbicide that has excellent efficacy against certain grasses, sedges and broadleaf weeds with selectivity for rice. It inhibits the plant enzyme acetolactate synthase (ALS), thus blocking branched-chain amino acid biosynthesis.

Regiment 80 WP has a wide application window for control of barnyardgrass and watergrass. The herbicide can be applied to watergrass and barnyardgrass from the 1 leaf to 2-3 tiller stages for growth. Use rates range from 10 to 18 grams ai/Acre. Optimum use rates for non-resistant watergrass and barnyardgrass are 10 to 12 grams ai/A with the grass being in the 3 to 5 leaf stage. Higher use rates, up to 18 grams ai/A, are required

for herbicide resistant grasses. Best timing for these biotypes is the 1 to 2 tiller-growth stages. A non-ionic silicone based surfactant is required for optimum efficacy.

Valent USA first tested Regiment™ (V-10029) in California in 1995. In 1996, a small plot test was established in a field where the grower had experienced total herbicide failure. Results were promising and in 1997 full scale testing was initiated in the problem watergrass areas.

By the end of 1999, a total of 10 trails had been conducted on herbicide resistant watergrass (Table 1). Eight of the trials were conducted on late watergrass and 2 on early watergrass. All trials were established in fields containing herbicide resistant grass as confirmed by Dr. Fischer at UC-Davis. In all cases, the trial locations had histories of multiple herbicide failures.

Table 2 is a summary of efficacy data resulting from early and late applications of Regiment for control of late watergrass (*E. phyllopogon*) in rice. Early application timing was made at the 4 to 5 leaf stages and the late application timing was made at 1 to 2 tillers.

TABLE 2. Control of Herbicide Resistant Late Watergrass with Regiment.

RATE	10 GM	12 GM	14 GM	15 GM	18 GM	24 GM
TIMING	AI/A	AI/A	AI/A	AI/A	AI/A	AI/A
EARLY						
4 TO 5	56.3	77.7	84.3	30	88.9	86.5
LEAF	(2)	(4)	(3)	(1)	(5)	(1)
LATE						
1 TO 2	74.2	78.3	90.7	95.0	94.2	97.7
TILLER	(3)	(4)	(3)	(1)	(6)	(2)

All Regiment treatments had a silicone-based surfactant @ .125 to .25% v/v.

() Number of trials.

The data clearly indicate that Regiment at 14 grams ai/A and higher provided economic control of resistant late watergrass. The late timing, 1-2 tiller, gave better control than the early timing. The difference in control between early and late application is probably a result of coverage, susceptibility or subsequent watergrass emergence. Better control at the later application timing was consistently observed in all trials.

Table 3 is a summary of Regiment data at 18 grams ai/A compared to the standard treatments for control of late watergrass. Of the three standards in the trials, SuperWham provided the best control when compared to Ordram and Whip. SuperWham was the most consistent performer of the three standards but did not control the late watergrass at the same level as Regiment. With the exception of one trial, Ordram and Whip did not provide economic control of late watergrass.

TABLE 3. Control of Herbicide Resistant Late Watergrass with Regiment vs. the Standard herbicides.

RATE TIMING	SUPER WHAM 6 QT/A	WHIP 1.2 PTPR/A	ORDRAM 4 LBS AI/A	REGIMENT 18 GMAI/A
EARLY 4 TO 5 LEAF	79.5 (5)	90 (1)	56.7 (1)	88.9 (5)
LATE 1 TO 2 TILLER	83.3 (4)	48.2 (5)	56.7 (1)	94.2 (6)

All Regiment treatments had a silicone-based surfactant @ .125 to .25% v/v.

() Number of trials.

Table 4 is a summary of efficacy data for control of early watergrass (*E. oryzides*) comparing Regiment to the standards, SuperWham, Ordram and Whip. Regiment application was made at either the 4 to 5 leaf or the 1 to 2-tiller growth stage of rice.

TABLE 4. Control of Herbicide Resistant Early Watergrass with Regiment.

RATE TIMING	10 GM AI/A	12 GM AI/A	15 GM AI/A	18 GM AI/A	ORDRAM 4 LBS AI/A	WHIP 1.2 PT PR/A	SUPER WHAM 6 QT/A
EARLY 4 TO 5 LEAF	81.3 (1)	90.0 (1)		88.0 (1)	65.0 (1)		
LATE 1 TO 2 TILLER	90.5 (1)	98.0 (1)	94.3 (2)	86.2 (3)		49.1 (3)	69.4 (2)

All Regiment treatments had a silicone-based surfactant @ .125 to .25% v/v.

() Number of trials (data points).

The data clearly indicate that Regiment at 12 grams ai/A and higher provided economic control of early watergrass. The late timing, 1-2 tiller, provided slightly better control than the early timing. None of the standards, Ordram, Whip or propanil gave adequate control of resistant early watergrass.

Early watergrass appears to be more sensitive to Regiment than the late species. Furthermore, application timing does not appear to be as critical to the control of early watergrass as it does to the late species.