

Best Management for Grasses in Rice

Kassim Al-Khatib
University of California

California Rice Weeds - Grasses



Barnyardgrass
Echinochola crus-galli



Early Watergrass
E. oryzoides



Late Watergrass
E. Phyllopogon

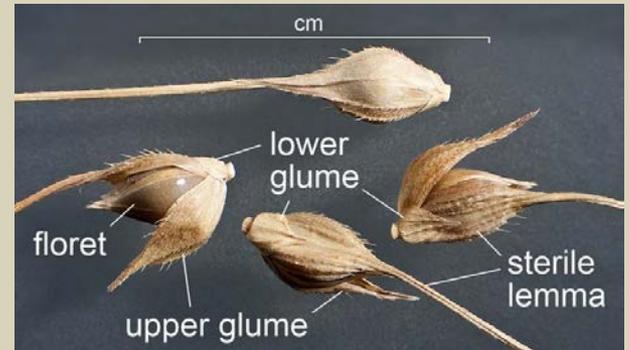


Bearded Sprangletop
Leptochloa fascicularis

Echinochloa crus-galli, Barnyardgrass



Echinochloa oryzoides, early watergrass



Echinochloa phyllopogon, late watergrass

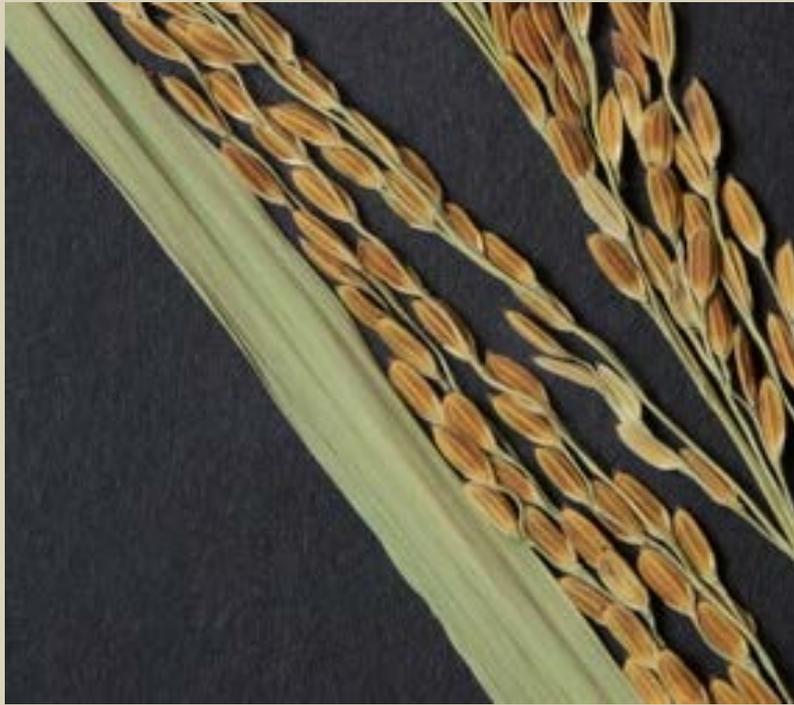


Echinochloa walteri, Walter's millet



Echinochloa muricata, rough barnyardgrass





Weedy rice

Grower samples tested for herbicide susceptibility 2015-2018

% of samples

Weed	# of samples	Thiobencarb	Butte	Cerano	Clincher	Granite	Propanil	Regiment
Barnyardgrass	139	73	13	2	45	67	4	60
Early watergrass	29	21	24	3	90	7	55	66
Late watergrass	94	61	1	7	61	53	15	67
Breaded sprangletop	98	15	2	15	30	-	-	-

Sprangletop plant growth and development as affected by water depth in rice field

Population	Water depth (in)	# tiller/plant	Plant height (cm)	Seeds/plant
Susceptible	2	4	88	1211
Resistant	2	23	94	1429
Susceptible	4	0	0	0
Resistant	4	6	41	1711
Susceptible	8	0	0	0
Resistant	8	0	0	0

Cultural methods

- Control grasses on levies
- Crop Rotation
- Water management
 - Water-seeded rice
 - Drill-seeded rice
- Soil leveling
- Use herbicide burn down treatment

Rice Herbicide

Common name	Trade name	MOA
Benzobicyclon + halosulfuron	Butte	HPPD + ALS inhibitors
Bispyribac-sodium	Regiment®	ALS inhibitor
Orthosulfamuron	Strada	ALS-inhibitors
Penoxsulam	Granite®	ALS inhibitor
Clomazone	Cerano®, Bombard®	Carotenoid biosynthesis inhibitor
Cyhalofop-butyl	Clincher®	ACCase inhibitor
Pendimethalin	Prowl H2O®	Tublin inhibitor
Propanil	Stam®, SuperWham®	Photosystem II inhibitor
Thiobencarb	Abolish®, Bolero®	VLCFA (Very long chain fatty acids)
Thiobencarb + imazosulfuron	League MVP	VLCFA (Very long chain fatty acids) + ALS inhibitor

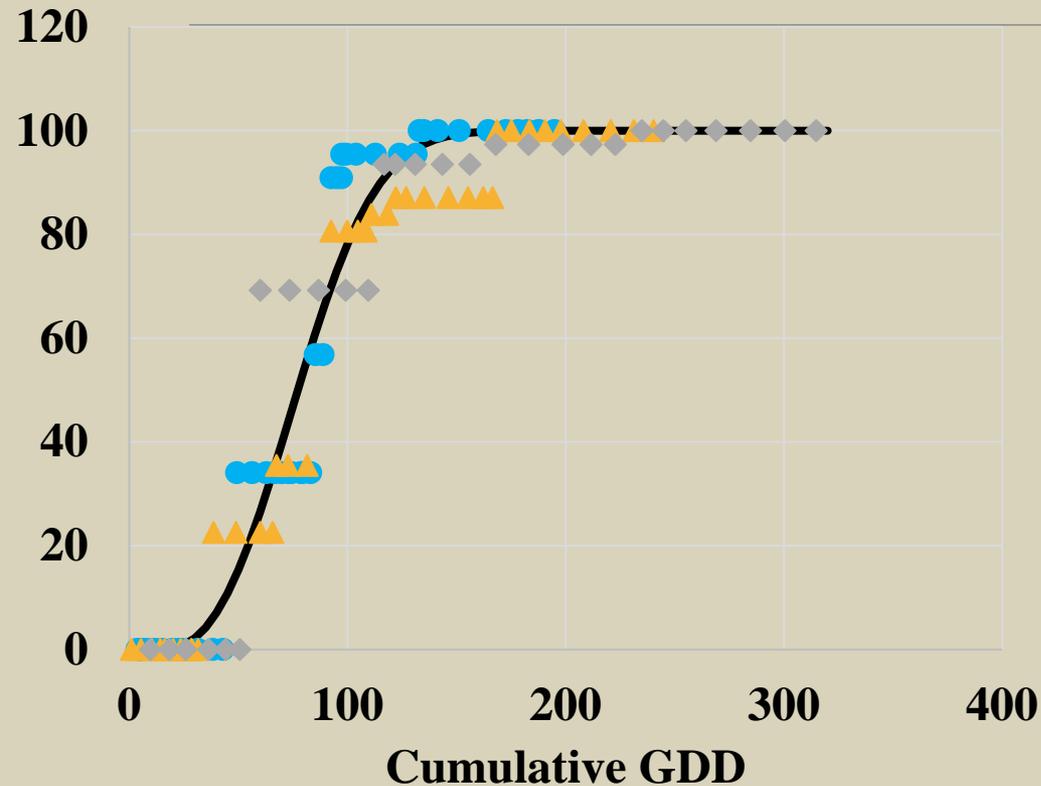
Herbicide residual activity

Herbicide	Residual (days)
Benzobicyclon/ Halosulfuron (Butte)	30
Bispyribac (Regiment)	0
Clomazone (Cerano)	5 (water)
Cyhalofop-butyl (Clincher)	0
Pendimethalin (Prowl)	5 (water), 20 (dry soil)
Penoxsulam (Granite)	30
Propanil (Stam, SuperWham)	0
Thiobencarb (Abolish)	20–25
Thiobencarb (Bolero)	20–25
Thiobencarb/imazosulfuron (League MVP)	20–25

Water holding period after herbicide application

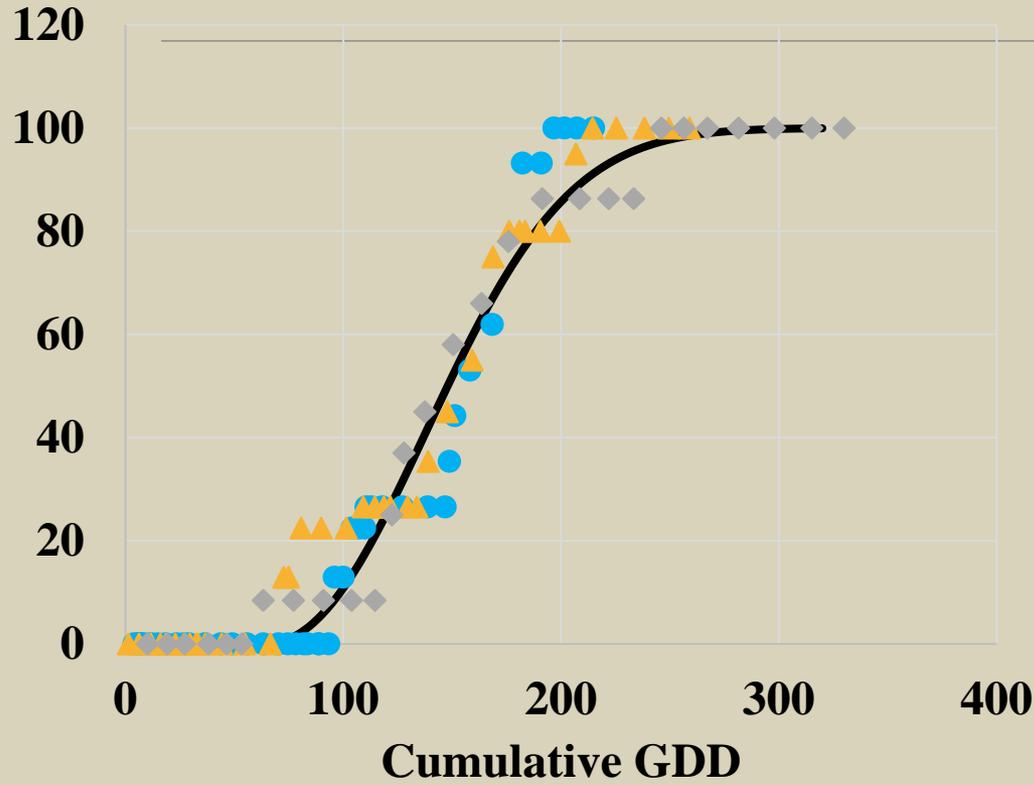
Herbicide	Water holding (days)
Butte	20
Cerano	14
Clincher	7
Granite (SC/GR)	0
Stam	7-days:less closed system
Abolish® 8EC	19 days
Bolero® UltraMax	30 days
League® MVP	30 days

Barnyardgrass Emergence Affected by Thermal Time



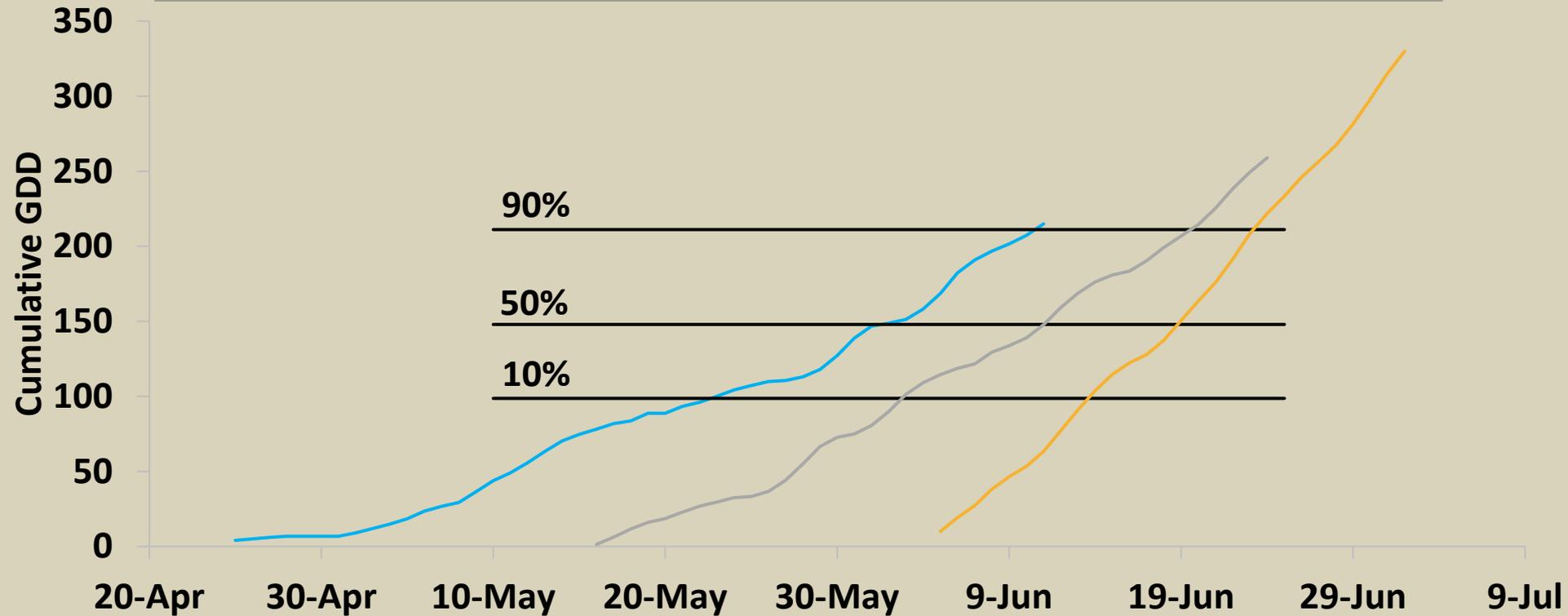
% Emergence	GDD
10	43.9
20	54.4
30	62.6
40	70.0
50	77.2
60	84.5
70	92.5
80	101.9
90	115.1

Bearded Sprangletop Emergence Affected by Thermal Time



% Emergence	GDD
10	98.7
20	113.4
30	125.5
40	136.8
50	147.9
60	159.7
70	172.7
80	188.5
90	211.1

Sprangletop Emergence Over Time



Clomazone (Cerano, 5 MEG)

- Rate: 8–12 lb.
- Reduced rate of 8 lb per acre may be used to control sprangletop and in certain soil types.
- Timing: preseeding to 1 lsr
- Mode of application: into water
- Controls watergrass populations that are resistant to other herbicides.
- May cause cosmetic injury to rice (bleaching, stunting, reduction in stand density), but no significant yield reductions have been observed.



Rice yield as affected by Cerano applied at day of seeding and after leathering

Herbicide program	Rate (product per acre)	Timing	Yield lb/A
Cerano	8 lb	DOS	8,350
Granite GR	13lb	5 LSR	
SuperWham + Grandstand	4 qt + 1 pt	Full Tillering	
Cerano	10 lb	DOS	7,891
Granite GR	13lb	5 LSR	
SuperWham + Grandstand	4 qt + 1 pt	Full Tillering	
Cerano	12 lb	DOS	8492
Granite GR	13lb	5 LSR	
SuperWham + Grandstand	4 qt + 1 pt	Full Tillering	
Cerano	8 lb	DOS	6162
Granite GR	13lb	5 LSR	
SuperWham + Grandstand	4 qt + 1 pt	Full Tillering	
Cerano	10 lb	DOS	5731
Granite GR	13lb	5 LSR	
SuperWham + Grandstand	4 qt + 1 pt	Full Tillering	
Cerano	12 lb	DOS	5092
Granite GR	13lb	5 LSR	
SuperWham + Grandstand	4 qt + 1 pt	Full Tillering	
Untreated control			4,507

Benzobicyclon/halosulfuron (Butte)

- Butte rate: 7.5-9 lb/A
- Apply at day of seeding to 4 true leaf rice, however, weed control efficacy can be significantly reduced at 4 true leaf rice stage
- Application to dry soils will provide minimal weed control.
- Average water depth at application should be a minimum of 4 inches with no bare soil.
- Minimum water hold period for BUTTE herbicide is twenty (20) days.
- Butte can only be used in rice that will be followed by rice the following year. Do not make more than one application or apply more than 9 lb of Butte (0.27 lb ai Benzobicyclon) and (0.058 lb Halosulfuron-methyl) per annual growing season.

Weed response to Butte applied at different growth stage

Weed Species	Average % control 3 WAT				
	pre-emergence	sprouting	1 leaf stage	3 leaf stage	5 leaf stage
Late watergrass	100	100	93	28	10
Barnyardgrass	100	100	95	53	13
Sprangletop	100	100	100	78	21

Thiobencarb

- Rate and timing:
 - Bolero UltraMax – 23.3 lb, 2-3 leaf stage
 - Abolish 8EC – 3 to 4 pt, 2 leaf stage
- Comments:
 - Mostly used for grass control but also provides some control of smallflower umbrella sedge and selected broadleaf weeds.
 - Both Abolish 8EC and Bolero UltraMax may be applied after the crop has emerged, but the window for rice safety and weed control is very narrow.
 - Because timing of thiobencarb to weeds and rice is so important, the following situations should be avoided:
 - Make postplant application when 70% of the rice seedlings have reached the 2-leaf stage. Rice is very sensitive to these formulations at the one-leaf stage and may be severely injured if it is applied too early.
 - Thiobencarb provides residual activity of about 25 days. It will not be effective on watergrass or barnyardgrass beyond the 3-leaf stage.
 - Do not use within 14 days of an application of a carbamate (such as carbaryl) or organophosphate (such as malathion).
 - Check with agricultural commissioner for water-holding requirements.

Propanil

- Stam 80 EDF, SuperWham!80DF: 3.75-7.5 lb/A
- Timing of application: from 3 to mid-tiller depending on formulation
- Early treatments control watergrass more effectively; however, application generally must be delayed 35 to 50 days after seeding to control emerged broadleaf weeds.
- If earlier watergrass control is desired under these conditions, a postplant treatment of thiobencarb is recommended.
- Use the low rate on young watergrass (30–35 days after seeding) in very shallow water to assure good coverage of the weed. Use the high rate when most watergrass is 6 to 9 inches above the water.
- Leaf injury (tip burn) may occur on rice when the temperature is above 85° to 90°F at the time of the application.
- Do not use propanil within 14 days of an application of a carbamate (such as carbaryl) or organophosphate (such as malathion).

Penoxsulam

- Two formulation: Granite (GR) – 15-18 lb, Granite SC – 2-2.8 fl oz.
- Timing Granite (GR): after 2.5 leaf stage; Granite (SC); 4 leaf to 60 days before harvest
- Granite GR (granular formulation) will control many weed species. It tends to stunt early root growth of rice.
- Granite SC (liquid suspension formulation) is generally applied on foliage at later stages of rice growth when floodwater is dropped for good exposure of weeds.
- Since Granite SC is usually applied later, it causes less phytotoxicity to the rice plant.

Bispyribac-sodium (Regiment)

- Rate: 0.53-0.8 fl oz/A
- Timing: 4 leaf stage to 1st tiller
- Good general weed control
- High rate is needed to control late water grass

Cyhalofop (Clincher)

- Rate: 13 to 15 fl oz/A
- Timing: Early application 1-2 leaf stage; late application 3 leaf stage to mid-tiller
- Used for grass control in situations where thiobencarb (Abolish/Bolero) cannot.
- Effective on susceptible watergrass and sprangletop.
- Safe to rice crop.
- Ground application is required in some areas because of sensitivity of fruit trees.
- Use low rate on grasses that have up to four leaves, before tillering.
- Use high rate on tillered grasses.

HERBICIDE PROGRAM	RATE/ACRE	TIMING
UNTREAED	-	-
Pyraclonil SuperWham + COC	14.9 lb 6 qt + 2.5% v/v	DOS 5 LSR
Pyraclonil Butte SuperWham + COC	14.9 lb 7.5 lb 6 qt + 2.5% v/v	DOS 1 LSR 5 LSR
Cerano Pyraclonil SuperWham + COC	6 lb 14.9 lb 6 qt + 2.5% v/v	DOS 1 LSR 5 LSR
Pyraclonil Bolero Ultramax SuperWham + COC	14.9 lb 23.3 lb 6 qt + 2.5% v/v	DOS 1.5 LSR 5 LSR
Pyraclonil SuperWham + COC Regiment + DyneAmic	14.9 lb 6 qt + 2.5% v/v 0.8 oz + 5 floz	DOS 5 LSR Early tiller
Pyraclonil Granite GR SuperWham + COC	14.9 lb 15 lb 6 qt + 2.5% v/v	DOS 2.5 LSR 5 LSR
Pyraclonil SuperWham + COC Loyant + MSO	14.9 lb 6 qt + 2.5% v/v 21.9 floz + 0.5 pt	DOS 5 LSR Mid-tiller

WEED CONTROL									
40 DAS					60 DAS				
WATERGRASSES	SPRANGLETOP	RICEFIELD BULRUSH	SMALLFLOWER	DUCKSALAD	WATERGRASSES	SPRANGLETOP	RICEFIELD BULRUSH	SMALLFLOWER	DUCKSALAD
-	-	-	-	-	-	-	-	-	-
91	74	50	55	100	99	79	45	26	100
98	100	94	99	100	96	100	100	83	100
99	99	63	55	100	100	100	61	19	100
99	100	100	100	100	94	100	96	100	100
100	94	64	69	78	100	86	66	54	100
100	85	99	100	100	75	66	100	96	100
97	91	94	94	100	100	89	98	95	100

Pyraclonil



Pyraclonil alone



Pyraclonil + Cerano



Pyraclonil + Regiment

Loyant, florpyrauxifen-benzyl



Non-treated control



Butte followed by Loyant



Bolero followed by Loyant



RebelEx followed by Loyant