

# Yellow and green foxtail control in alfalfa

Jack P. Orr □ W. Michael Canevari □ Donald R. Colbert □ Ronald N. Vargas  
Russell W. Wallace □ Raymond C. Henning

## Control may require three-phase herbicide application

**B**y 1983, according to a University of California Cooperative Extension survey, yellow and green foxtail had become the number one summer annual weed complex in alfalfa hay in nine Sacramento and San Joaquin Valley counties. The survey of distribution and severity of the weed in California alfalfa hay found foxtail in 25 of 30 counties studied.

About 60 percent of the state's alfalfa, a \$635 million crop in 1982, is produced in the Sacramento and San Joaquin valleys, with the remaining production in the low desert, coastal valleys, and mountain counties. In California, alfalfa hay is fed primarily to dairy cows, but it is also fed to horses, beef cattle, and goats. Yellow foxtail (*Setaria glauca*) and green foxtail (*Setaria viridis*) may cause mouth ulcerations in animals, reduce feed palatability, and decrease milk production. To alfalfa hay producers, foxtail has meant lower yields, shorter stand life, lower protein, and discounted hay prices.

### Germination and life cycle

Field observations throughout the Central Valley have shown foxtail germinating as early as February 22 with 85 percent of the germination completed by the end of May. The rest of the plant population continues germinating into October (fig. 1).

UC researchers found in a yellow foxtail study that plants of the California bio-

type are abundant seed producers, and the seeds have a short dormant-period requirement (about four months). The plant can out-compete other summer annual grasses, including barnyardgrass (*Echinochloa crus-galli*), because of its ability to germinate earlier, profuse tillering, and prostrate growth allowing seed heads to escape the cutter bar. Plants produce viable seeds between normal cutting cycles of 28 to 30 days.

Yellow foxtail tiller growth began 10 weeks after February emergence. As the number of plant tillers increased, the prostrate growth habit became apparent.

With the increase in plant population from 8 to 120 plants per square foot, the number of tillers decreased from 6.6 to 2.1, and seedheads per plant decreased from 5.1 to 1.2.

Foxtail flowering began in the third week of June, 14 weeks after emergence. Seed maturity (shatter stage) was first observed four weeks after flowering.

Yellow foxtail showed only slight variations in the establishment period for plants emerging in February compared with those emerging in May. The only significant difference was in length of the vegetative growth stages. Plants that

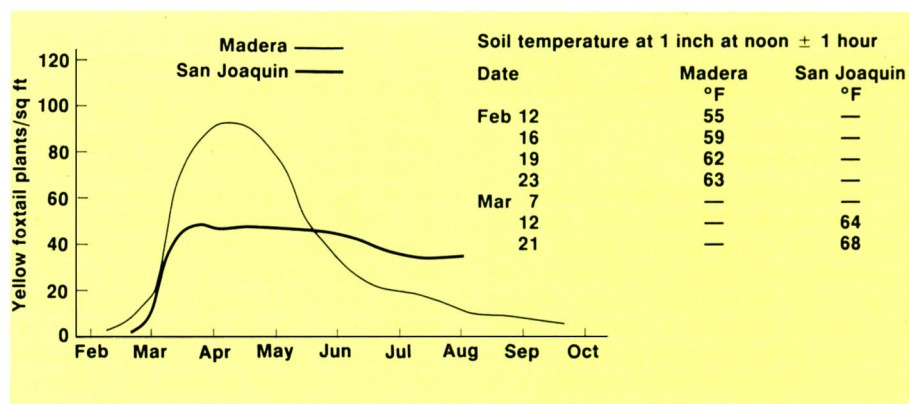


Fig. 1. Foxtail begins germinating in late February and is nearly complete by the end of May. Other plants continue germinating into October.



emerged in March and April reached the tillering growth stage within one week of those that emerged in February. Plants emerging in May reached the tiller stage in less time than those emerging earlier.

## Chemical control research

**Preemergence herbicides.** Soil-residual herbicides Velpar (hexazinone) and

Karmex (diuron) have been used in alfalfa hay production, primarily in the dormant period, to control winter annual weeds in the spring. These herbicides provide good control of winter annual weeds but do not control foxtail adequately. Further, a UC field study in Madera County indicated that removing winter weed vegetation with a contact herbicide or having a poor

alfalfa stand promoted earlier foxtail germination and increased the total established population of foxtail.

We conducted field studies in Fresno, Madera, San Joaquin, and Sacramento counties. Herbicides were applied, before foxtail germination, to established alfalfa during the dormant winter period in soils ranging from sandy loams to clay loams. Treatments, in a replicated, randomized complete block design, included emulsifiable concentrate formulations applied with a backpack sprayer in 20 to 30 gallons of water per acre and granules applied with a hand broadcast applicator. Winter rainfall incorporated the herbicides into the soil.

Results seven to nine months after application showed that, at 2 pounds active ingredient per acre, Treflan (trifluralin) granular gave 91 percent foxtail control, Prowl (pendamethalin) 72 percent, and Surflan (oryzalin) 67 percent (table 1). At rates up to 4 pounds active ingredient per acre, no treatment caused any injury to alfalfa.

Research during the winter of 1983-84 investigated the best application times for initial and season-long foxtail control. Applications were on December 20, January 20, and February 20. December and January treatments consisted of Treflan 10 percent granular, Prowl emulsifiable concentrate, and Surflan aqueous suspension, each at 2 and 4 pounds active ingredient per acre. In the February treatments, a 1-pound rate was added. Rainfall was greater than 2 inches soon after the December treatment but was minimal after the January and February treatments. Foxtail started emerging on February 20.

Treflan provided 80 to 90 percent season-long control, and timing of applications was not critical. December applications of Prowl gave 85 percent control through June, which declined to 70 percent in September. Surflan resulted in poor foxtail control regardless of application time: 65 percent in June to 45 percent in September.

Herbicide applications at 4 pounds active ingredient per acre gave significantly better and longer lasting foxtail control than did lower rates. None of the herbicides caused alfalfa injury.

**Postemergence herbicides.** Experiments in 1983 and 1984 in Madera, San Joaquin, and Sacramento counties evaluated foxtail control and alfalfa tolerance with selective herbicides: Selectone (cloproxydin), Poast (sethoxydin), Fusilade (fluazifop-butyl or fluazifop-P-butyl), Verdict (haloxyfop-methyl), Assure (DPX-Y6202), Asulox (asulam), and American Cyanamid 263,499.

In 1983 yellow foxtail that was 2 to 3 inches tall and at tiller initiation was

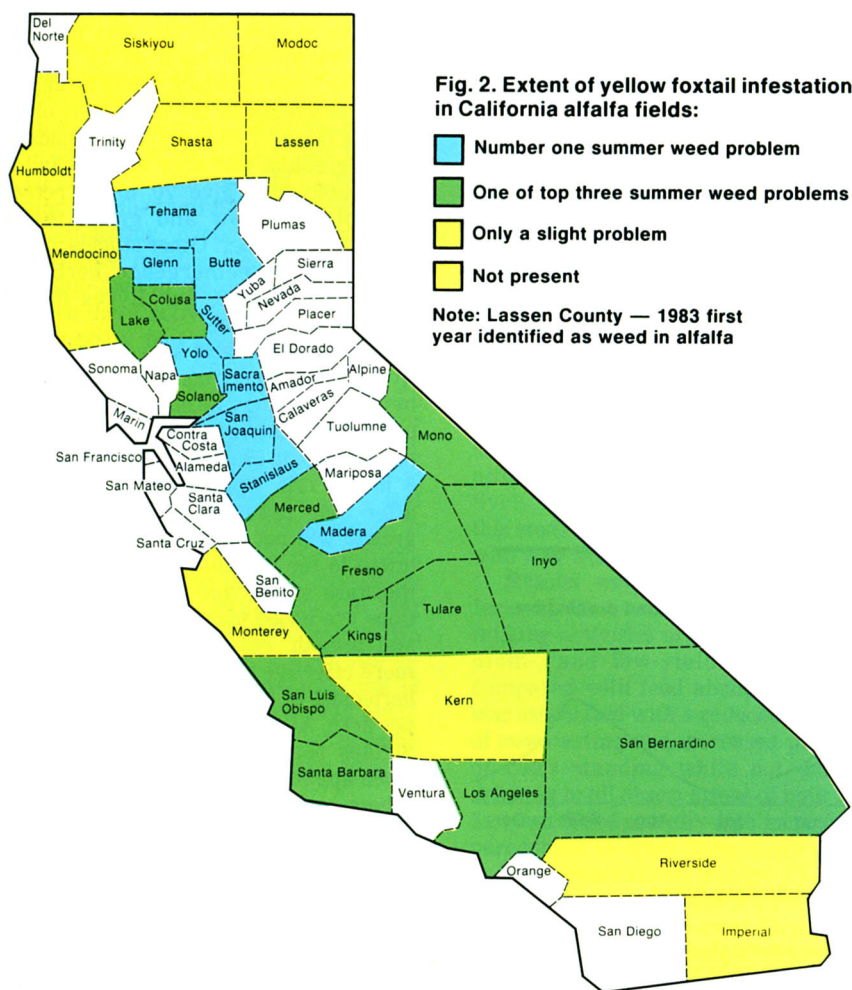


TABLE 1. Summary of foxtail control experiments in alfalfa using dinitroanilin preemergence herbicides

Treatment*	Rate	Control†‡		Crop injury (1-3 MAA)†
		Early (3-5 MAA)	Late (7-9 MAA)	
	lb/acre	%	%	
Pendimethalin (Prowl 4E)	1	86	39	0
	2	94	72	0
	4	98	95	0
Oryzalin (Surflan 4AS)	1	78	33	0
	2	87	67	0
	4	98	95	0
Trifluralin (Treflan 5G)	1	90	76	0
	2	94	91	0
	4	94	90	0

\*Applications made during or up to 4 days before rainfall and before emergence of yellow foxtail.

†MAA = months after application.

‡Number of trials = 6.

treated after the first cutting. Evaluations after a single application indicated fair to good (70 to 87 percent) early-season foxtail control with Selectone, Poast, and Verdict. Fusilade gave poor control.

Trials in 1984 showed good (80 to 86 percent) early foxtail control from Selectone and Poast at 0.38 pound active ingredient per acre. Control by Fusilade, Verdict, Assure, Whip (fenoxaprop-ethyl), and Asulox was fair to poor. Foxtail seed head counts in mid-July showed excellent control with Selectone and Poast (table 2).

Seed head production was increased greatly within a 60-day period when a second application was not made. The number of seed heads in the control plot increased from 82.6 to 302 per square yard. Selectone at 0.38 pound active ingredient per acre resulted in 15.6 seed heads per square yard after two applications, compared with 115.6 seed heads after one application, when evaluated in mid-September. Results with Poast, at the same rates, were 8.3 and 70.6 seed heads per square yard, respectively. Based on these results, two applications (one after the second cut-

ting and one after the fourth) will be necessary to produce clean hay.

Replicated trials in a fourth-year stand of alfalfa hay heavily infested with yellow foxtail (70 plants per square yard) compared the efficacy of various postemergence selective grass herbicides. All herbicides were applied in 20 gallons of water per acre with 1 quart of Surfel surfactant. Treatments were replicated four times in a randomized complete block design. Selectone and Poast at 0.38 pound active ingredient per acre gave 90 percent control of early foxtail, and Fusilade, Verdict, Assure, and Whip at 0.25 pound active ingredient per acre gave 30 to 40 percent control.

Another test compared the effectiveness of Selectone and Poast at 0.38 pound active ingredient per acre when applied in 5 versus 20 gallons of water per acre. Evaluations in August showed no difference in foxtail control resulting from rate of herbicide or water volume. Seed head counts in July, however, indicated a 50 percent reduction with 0.38 pound active ingredient per acre Selectone and Poast

when applied in 5 gallons of water, as compared with 20 gallons per acre.

None of the postemergence treatments caused any alfalfa stand or vigor reduction.

## Conclusions

Yellow and green foxtail start germinating during the last week in February and continue throughout the alfalfa growing season, producing seed for infestation the following year.

These studies indicate that preemergence herbicides, such as 10 percent granular Treflan (which would be applied by air or ground in the latter part of December or early January) at 2 pounds active ingredient per acre and rainfall-incorporated, can give 70 to 80 percent control of yellow and green foxtail through September. Other studies also indicate that preemergence herbicides Prowl, AC 263,499, and Rydex (prodiamine) show promise.

These studies also suggest that effective postemergence control without injury to the alfalfa may be obtained with application of selective grass herbicides plus a nonphytotoxic crop oil when foxtail is 2 to 6 inches tall. Application is made soon after bale removal, so that alfalfa regrowth will not interfere with spray coverage to the foxtail. Foxtail is not under moisture stress, and sequential applications are based upon foxtail germination and growth. Selectone and Poast were more effective than other postemergence herbicides at 0.38 pound active ingredient per acre. At this rate in the tests, the herbicides reduced seed head production when applied in 5 gallons per acre water. (These pesticides are not presently registered for this use in this crop in California.)

The objective may not be to kill the foxtail plant but to reduce or eliminate seed head production, which is the main contaminant in the hay and source of the next season's infestations. A program of foxtail management might consist of preemergence application of Treflan between December 15 and January 15. Foxtail plants that escaped could be treated with a selective postemergence herbicide (when registered) after the second and fourth alfalfa cutting if necessary. If a preemergence herbicide had not been used, a postemergence selective grass herbicide could be applied after the second cutting (fig. 3).

*Jack P. Orr is County Director and Weed Science Farm Advisor, Cooperative Extension, Sacramento County; W. Michael Canevari is Field Crops Farm Advisor, San Joaquin County; Donald Colbert is Research Representative, American Cyanamid Company, Lodi, California; Ronald N. Vargas is field Crops Farm Advisor, Madera County; Russell Wallace is a student at Fresno State University, Fresno; and Raymond Henning is Research Representative, Chevron Chemical Company, Fresno.*

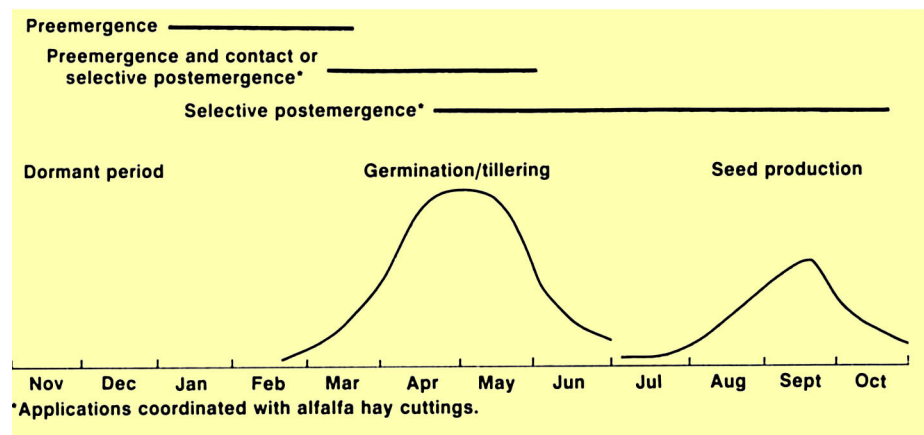


Fig. 3. Yellow foxtail life cycle and possible herbicide application times.

TABLE 2. Postemergence foxtail control in fourth-year alfalfa, Madera County, 1984

Treatments*	Rate lb/acre	Foxtail control		Seedheads per sq yd 7/16/84
		6/26/84	8/1/84	
Selectone	.25	8.3	8.6	1.5
Selectone	.38	8.6	9.0	.8
Selectone	.50	8.6	5.1	.3
Fusilade	.062	1.0	1.6	60.5
Fusilade	.125	1.6	2.2	85.0
Fusilade	.25	4.0	3.3	29.5
Poast	.25	8.0	8.5	2.6
Poast	.38	8.0	9.1	.1
Verdict	.125	3.6	2.1	35.0
Verdict	.25	5.0	3.0	10.3
Assure	.125	1.3	2.8	91.0
Assure	.25	4.6	3.0	24.1
Whip	.25	4.6	4.1	22.0
Whip	.38	6.3	5.6	31.0
Asulox	2.5	5.0	4.3	14.8
Asulox	3.3	6.3	5.3	12.6
Check	-	0	0	82.6

NOTE: Applications were 5/24/84, after second alfalfa cutting. At application, foxtail was 2 to 6 inches tall, with one to five tillers.

\* All plots received Surfel at 1 percent.