Managing Smutgrass

in Irrigated Pastures

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Small smutgrass (*Sporobolus indicus*) is a tufted perennial grass native to tropical America. It occurs as a weed in many different areas, but is most problematic in pastures in the southern and western United States. Because smutgrass is unpalatable to livestock, animals avoid grazing it, and it quickly dominates irrigated pastures causing significant reductions in livestock grazing capacity. Smutgrass is well adapted to the warm summer temperatures of the Sacramento Valley, particularly in irrigated areas. Its name is derived from a black fungus that often develops in its seed head in humid areas. This fungus has not been found in samples from the Sacramento Valley.

Understanding the biology of smutgrass is important to management

1. Smutgrass is a warm season perennial—it remains dormant in the winter, begins growing in spring, and produces seed from July to September depending on elevation.
2. Individual plants can produce up to 45,000 seeds per year.
3. Seed production takes place continually throughout the growing season, with flowering, immature seed, mature seed, and seed shattering occurring simultaneously on individual seed heads of the same plant (Mislevy 1999).
4. One study determined germination with the seed husks attached to be 1-9% (Currey 1972). However, when the husks were removed germination was 88% (Wilder 2009).
5. Seeds buried during experiments did not germinate (Wilder 2009).
6. Seeds survive in soil for more than 2 years (Currey 1972).
7. Germination occurs at temperatures between 68°F and 95°F (Wilder 2009).
8. Because seeds are very small, they are easily distributed by animals, wind, and water. The outside of the seeds are covered with a gelatinous mucilage that becomes sticky when moistened. This allows seeds to cling to bird feathers or animal hair.

Mature tall fescue can resemble smutgrass from a distance. However, smutgrass has a very distinct spike-like inflorescence (see photo above) that is not obviously branched. This characteristic makes it easy to distinguish smutgrass from other irrigated pasture grasses. Initial infestations with smutgrass in pastures generally occur when the soil has been disturbed and moisture is available. Invasion can occur from seeds transported in water from irrigation district canals, in hay, from livestock, or haying equipment. Some isolated fields that have isolated ground water wells that pump water have become infested, leading to the conclusion that birds or other transport systems are creating new infestations.

Smutgrass requires bare ground and sunlight for germination and establishment. A well-established pasture with ample canopy cover can reduce opportunities for smutgrass establishment. Overgrazing pastures or overwintering cattle on pasture can open bare ground areas that stimulate germination of smutgrass. Addressing initial infestations quickly is crucial given the high number of seeds produced per plant.

The tools available to manage smutgrass

1 || CHEMICAL

■ *Glyphosate (Roundup®) application with a Rotary Wiper*

Rotary weed wipers have been used successfully in the Southern US and countries in pasture weed control (Figure3). This equipment allows the operator to set the height of the rotating wiper above the desirable pasture plants and actively “wipe” the herbicide on the target weed. The wiper rotates on a drum that is driven by a belt connected to the tires. As the drum rotates while being pulled, it presses the herbicide saturated carpet material against the underside of the leaves it contacts. The wiper can be pulled by a moderate sized ATV or UTV with 12 volt auxiliary connection or a battery direct connection.

For this technique to work effectively, it is critical that the desirable plants be lower in stature than the target weeds. Grazing animals can be used to reduce the height of the desirable plants, which will increase the selectivity of the herbicide to smutgrass. Timing of application is critical. Annual weeds can be controlled with glyphosate throughout most of their life cycle, but particularly when they are young. Perennial weeds generally have significant root systems. To kill perennials, glyphosate should generally be applied after flowering when the plants are translocating sugars back to the roots or below ground reproductive structures (generally summer and early fall).

Figure 3. Rotary wiper

The rotary wiper application technique has some significant differences compared to traditional broadcast spraying. These include:

1. Pesticide drift is not an issue because the product is applied directly to the target plant.
2. The application solution is significantly more concentrated than broadcast mixes.
3. Desirable plants in the pasture should be grazed as close (low) as practical so only ungrazed target weeds are exposed to the wiper. Make sure the wiper is set above the height of the desirable plants to avoid wiping them. It may be necessary to heavily graze the area more than normal prior to treatment so that the wiper can be dropped low enough to contact more of the smutgrass plants.
4. The wipers tested by the authors have a push-button which activates the pump that sprays herbicide on the rotating carpet. Depending on the ground speed, the button needs to be depressed for 1 to 5 seconds to spray the complete surface of the carpet as it rotates. The time interval between pushing the button will depend on the density of weeds being wiped. While the tendency is to continually press the button, this will overfill the carpet causing the herbicide to drip from the carpet onto desirable vegetation.
5. The greater the density of weeds, the more herbicide mix will be used. The fewer the weeds, the less material needs to be applied.
6. The Roundup Original® label notes that application speed should not exceed 5 mph.

READ AND FOLLOW ALL LABEL INSTRUCTIONS. There are two sections of the label that are absolutely critical to read and understand fully. These are sections on application equipment and techniques (section 7.0 on the Roundup Original® Label) and the section on pastures (Section 10.4 on the Roundup Original® Label). Glyphosate is not a restricted material; however, it does require that a use report be turned into the Ag Commissioner. For more information, please call your local County Agriculture Commissioner's office.

Glyphosate comes in different concentrations.
Roundup Weather Max® (used in UC wiper applications) is 4.5 pounds/gallon, while original Roundup is 3 pounds/gallon. To get the same concentration we used in our tests, 1.5 times as much (4.5 / 3 = 1.5) standard Roundup will need to be added to the solution to match rates presented here. Thus, to reproduce the successful July treatment of 33% WeatherMax® (4.5 lbs/gallon) discussed below, a 50% mixture with original Roundup® would need to be applied.

The Roundup Original® label notes "for panel applicators, solutions ranging from 33 to 100% of this product in water may be used in panel wiper applicators." A 33% mixture would equate to 42 oz in one gallon of water. Table 1 outlines the amount of Roundup Original® to mix for panel (wiper) applicators.

Table 1- Amount of Roundup Original® 3 lbs/gal to Mix for Panel Wiper

Desired Volume	33%	50%	75%	100%
1 gal	0.33 gal (42 oz)	0.5 gal (64 oz)	0.75 gal (96 oz)	1 gal (128oz)
10 gal	3.3 gal	5 gal	7.5 gal	10 gal
15 gal	5 gal	7.5 gal	11.25 gal	15 gal

When using a wiper in a pasture situation, the Roundup Original® label notes the following grazing restriction: "For spot treatments or wiper application methods using rates of 3 quarts per acre or less, the entire field or any portion of it may be treated. When spot treatments or wiper applications above 3 quarts per acre, no more than 10 percent of the pasture may be treated at any one time. To achieve maximum performance, remove domestic livestock before application and wait 7 days after application before grazing livestock or harvesting."

The two areas of consideration for the effectiveness of glyphosate are the

1. Concentration of the wiped material
2. Timing of application

Smutgrass is a perennial plant. Perennial plants translocate sugars to the roots after flowering. If applied during flowering, glyphosate is carried with the sugars to the roots and kills the plant. A study by Kyser and Nader in 2010 with wiper-applied Roundup WeatherMax® (4.5 lbs/gal concentration) at two rates (16% and 33%), with 3 timings (July 12, August 18, September 15), demonstrated the July 33% treatment to be the most effective timing. It was estimated, based on timing of application, that the best time to apply a wiper application was in mid-summer. The late summer applications in August and September injured the smutgrass, but did not provide effective kill. We hypothesize that later in the season the upper seed stems, which is the main portion of the plant contacted by the wiper, is less active and did not absorb enough glyphosate to provide a lethal dose to the root system.

Figure 4 shows smutgrass treated plants 56 days after the July 12 application with 33% glyphosate. After the crown turned brown and appeared dead, the plant initiated yellowish-green shoots, most of which later died. Reemerging shoots in an adjacent section treated with 10% glyphosate were darker green in color. In an October evaluation, we estimated control at 95% in the 33% glyphosate and 90% in the 10% glyphosate plots. Figure 5 shows the progression of smutgrass death compared with an untreated green area around an irrigation value in the front of the field. We estimate that two additional years of control will be required to reduce the seed bank.

Figure 4. Green shoot emerging 56 days after July glyphosate wiper application

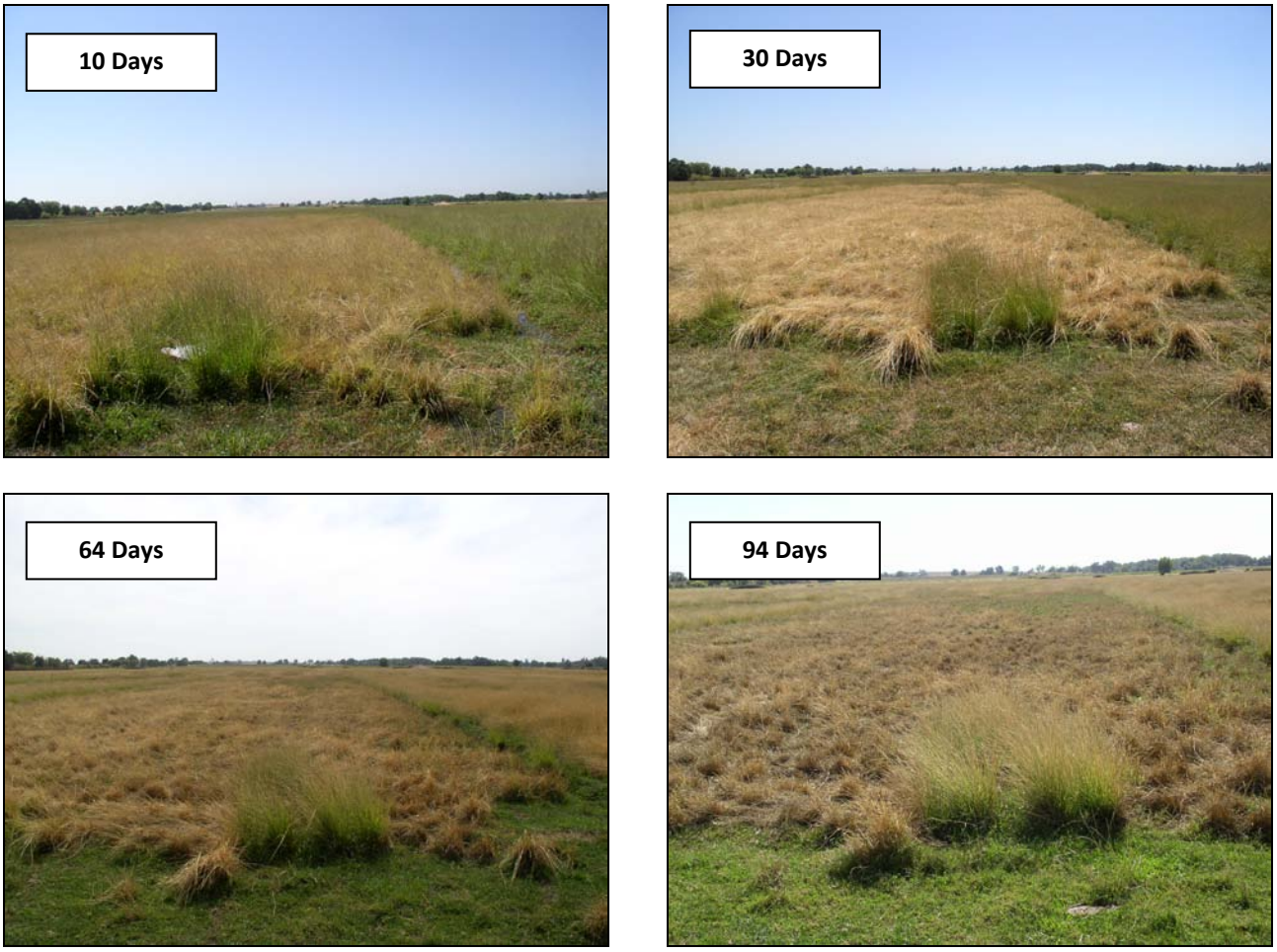
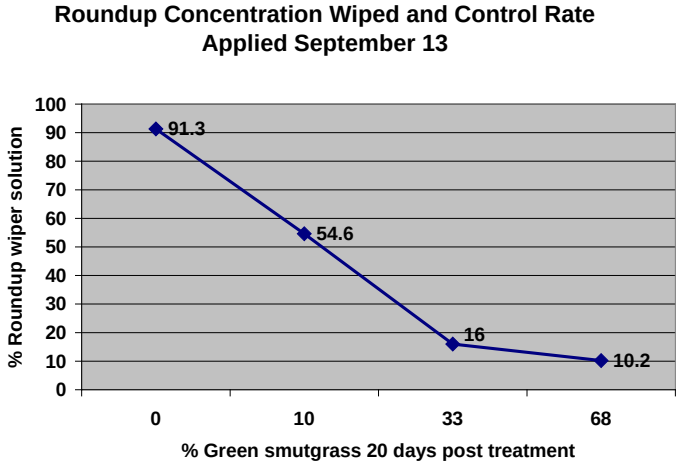


Figure 5 – Control of smutgrass at 10, 30, 64 and 94 days after a 33% glyphosate treatment in July.

Below are the application rates and the percent green smutgrass 20 days after wiper treatment with Roundup PowerMax® (4.5 lbs/gallon) in a study conducted by Davy and Karle. The application was made September 13, 2010. The graph shows a clear rate response, with 33% percent providing far better control compared to 10%, but nearly the same control as 68%. Plants that survived treatments with higher rates tended to be lower growing, thus escaping contact by the wiper.



■ *Spot treatment with Glyphosate (Roundup®)*

Spot spraying of isolated plants during the start of infestation is a good practice. Applications with solutions of 1.5% to 2% Roundup® in late September effectively controlled smutgrass. The spike-like seed head makes isolated plants easy to recognize in the pasture.

The Roundup Original® label (Table 2) notes typical label rates for mixing for hand-held sprayers.

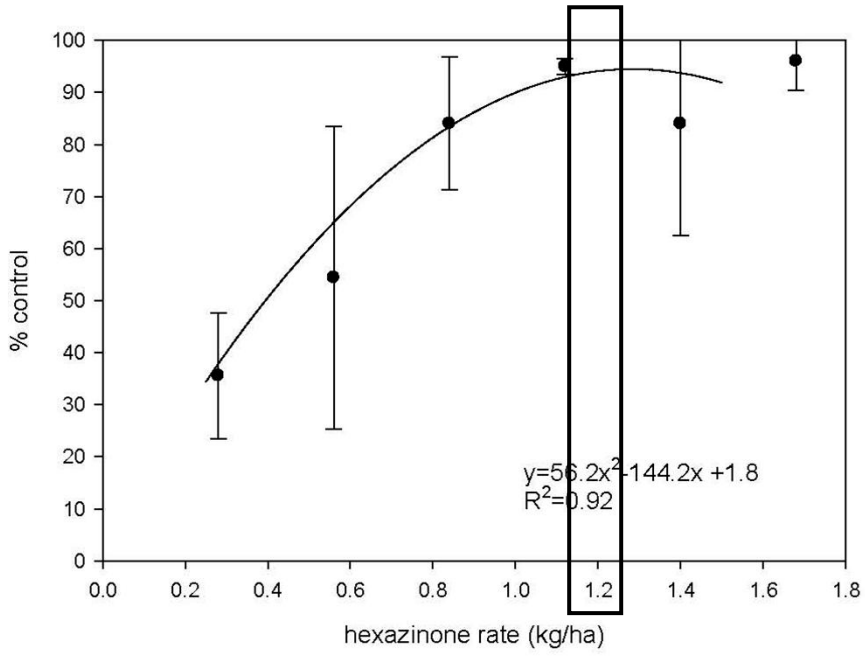
Figure 6. Late September glyphosate spot treatment of new infestation

Table 2- Mixing for Hand-Held Sprayers-Roundup Original (3 lbs/gal)

Desired Volume	0.50%	1%	1.5%	2%	5%	10%
1 gal	0.7 oz	1.3 oz	2 oz	2.7oz	6.5 oz	10 oz
25 gal	1 pt	1 qt	1.5 qt	2 qt	5 qt	10 qt
100 gal	2 qt	1 gal	1.5 gal	2 gal	5 gal	10 gal

■ *Velpar®*

Based on research conducted in Florida, some agencies are recommending the herbicide Velpar L® (hexazinone) at 4.5 pt/acre for control of smutgrass. Hexazinone is a soil-residual herbicide which is taken up by plant roots and foliage. Graph 2 shows the results of varying rates of Velpar L® and percent control of smutgrass from a 2009 Florida study. (For reference, 1.2 kg/ha is about 4.5 pt/acre.)

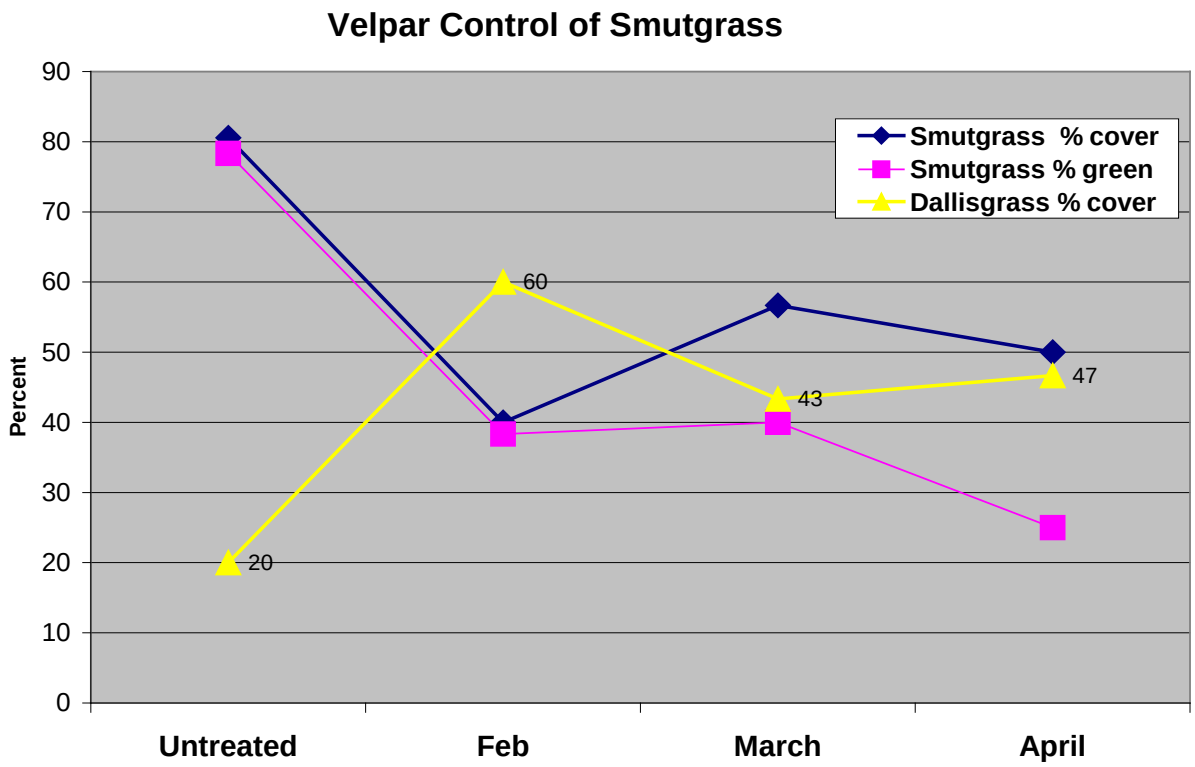


Graph 2. Control of small smutgrass in Florida by different rates of Velpar L® (Wilder 2009)

Velpar L® has a "Danger" signal word and is a restricted use pesticide. It is potentially damaging to oaks and other tree and shrub species. As such, applicators must leave a buffer zone between treated areas and trees. It also should not be applied in areas where it could leach into groundwater, or in situations where treated soil

could wash away. The list price for Velpar L® is $320 per gallon, but it is available for $50-$80 per gallon. In the authors experiment, we applied 4.5 pt/acre of Velpar L® at three timings, February, March, and April 2010. This trial was conducted in irrigated pasture at a ranch at Marysville, California. The label requires that cattle not graze treated pastures for 60 days after applying. To comply with the label restrictions of no grazing for 60 days post-treatment, our early treatment dates minimized the loss of grazing, which on most irrigated pastures starts in April to May.

Treatment results are shown below. Unlike the Florida experiments, we achieved only 30-50% control (reducing smutgrass cover from 81% to 40-57%), with little difference among timings. The treatments did succeed in doubling or tripling dallisgrass cover. Velpar L® seemed to remove curly dock, but we did not observe injury to the trefoil.



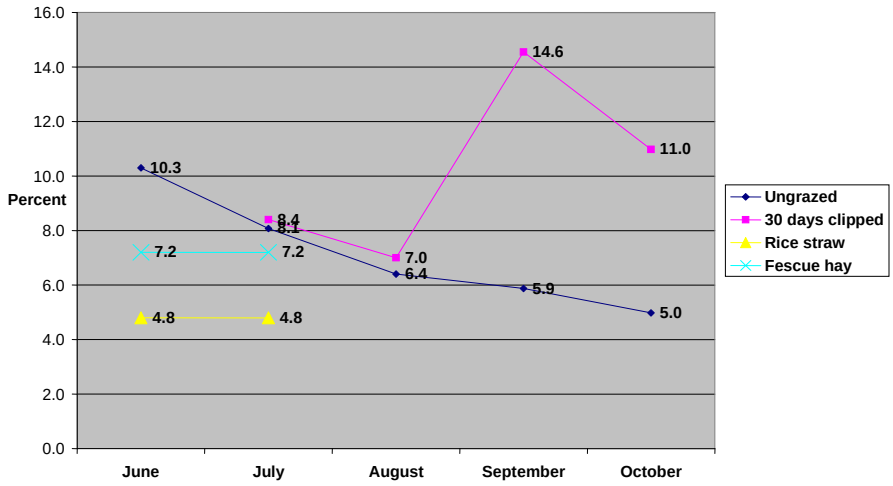
Graph 3. Smutgrass cover with Velpar® at three application times.

The difference in results between Florida and Marysville may be due to soil texture. In fine-textured or high organic matter soils, hexazinone binds more tightly to the soil grains and is not as available for root uptake. The Florida experiments were conducted on sandy soils with low organic matter. The Marysville ranch, on the other hand, has Hollenbeck silty clay loam with 1.5% organic matter. The 4.5 pt/acre rate of Velpar L® may not be the solution to smutgrass problems, at least in fine-textured soils of the Central Valley.

2 || GRAZING MANAGEMENT

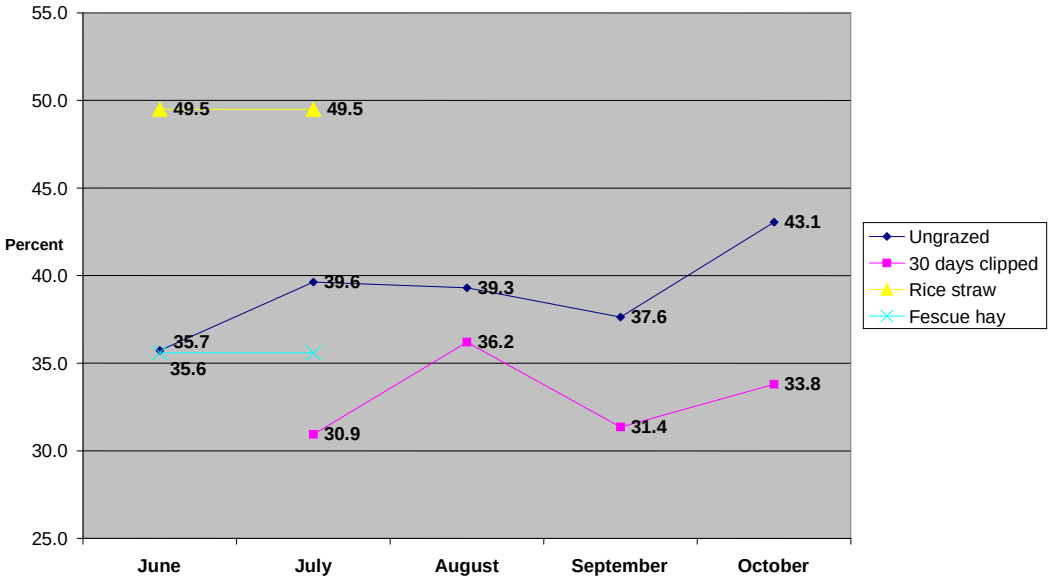
It is not understood why livestock avoid grazing smutgrass. We speculate that grazing is limited by the plant's low nutritional content, the very coarse leaves, and/or perhaps a secondary compound (e,g., alkaloids). Samples were taken from one ranch during the 2010 growing season to determine if consumption of smutgrass is limited by its low nutritional content.

Graph 4 Protein % of ungrazed and clipped Smutgrass as compared to rice straw and fescue hay



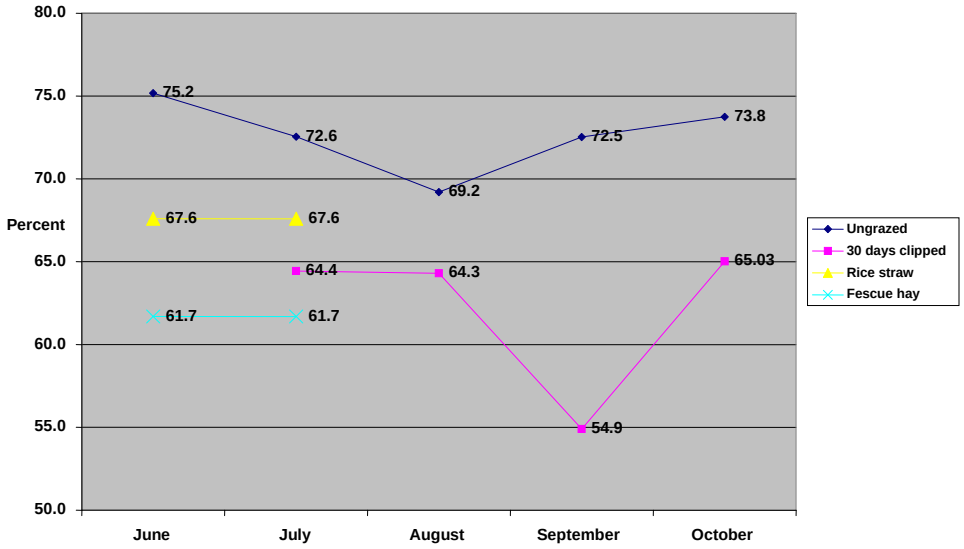
Protein concentration in June starts out at acceptable levels, but in the absence of grazing it soon declines to levels near the value of rice straw. These levels would not nutritionally support even dry (non-lactating) cows. Clipping smutgrass every 30 days caused a September increase in protein levels, but protein did drop back down in October, likely due to the onset of dormancy.

Graph 5 Acid Detergent Fiber % of ungrazed and clipped Smutgrass as compared to rice straw and fescue hay



Acid detergent fiber (ADF) is a chemical test that can be used to estimate the energy levels of feeds. The higher the level of ADF, the lower the energy available to the animal. Ungrazed smutgrass has much less ADF than rice straw, and is about the same as fescue hay. Clipping it every 30 days further reduced fiber content and thus increased its available energy content.

Graph 6 Neutral Detergent Fiber % of ungrazed and clipped Smutgrass as compared to rice straw and fescue hay



Neutral detergent fiber (NDF) includes the entire fiber fraction captured in ADF with the addition of hemicellulose and is used to estimate intake by animals. The ungrazed smutgrass had a higher NDF than rice straw and fescue hay. The clipped smutgrass had a much lower fiber fraction and a marked reduction in September. The lower the NDF value is, the higher the available energy and estimated intake of forage by grazing animals.

Some producers have used intensive grazing to reduce the animals' grazing selectivity. One producer uses a stocking rate of 42 cows/acre on 2.5 acre pastures with an average 21-day rotation. The results can be seen in Figures 6 and 7. If the infested field is hayed in the spring and kept grazed down and more vegetative, then the nutritional value of smutgrass increases. This method does not eliminate or reduce the weed, however, it does make somewhat diminish its negative effects on pasture intake.

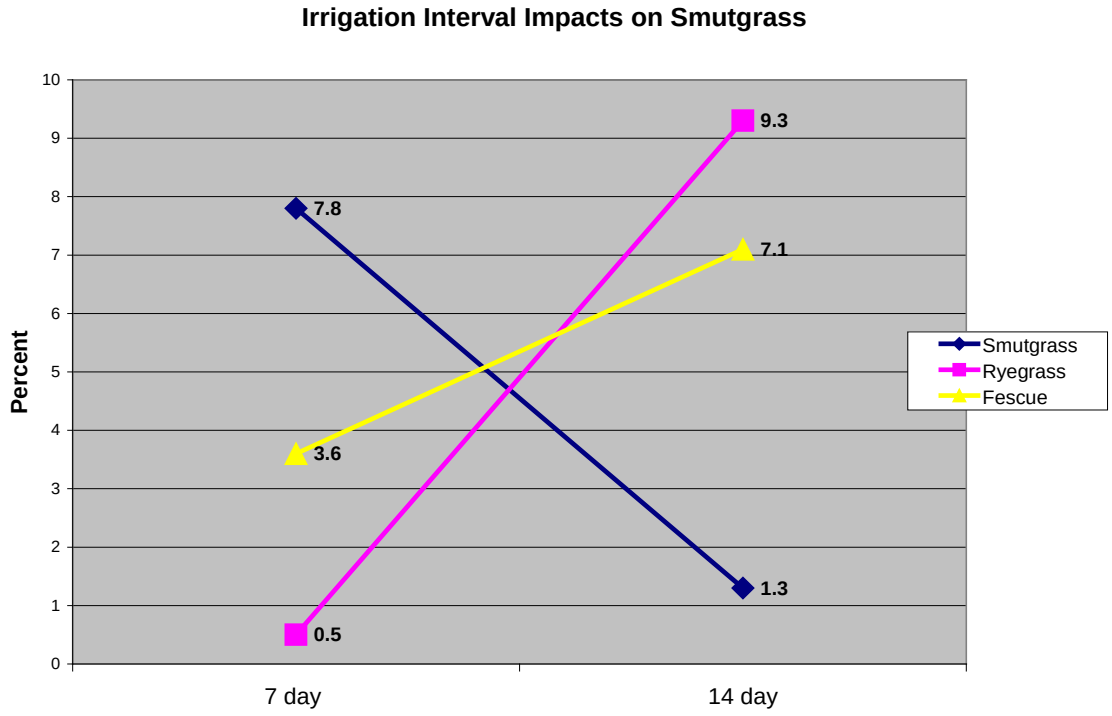
Figure 7. Intensively grazed pasture with smutgrass. An electric fence in the middle divides grazed and ungrazed smutgrass.

Figure 8. Smutgrass in a vegetative state being grazed

3 || IRRIGATION

Research conducted by Davy and Karle in Glenn County studied the impact of optimizing irrigation intervals on a smutgrass population in a very well drained soil. They found that treatments normally irrigated on a 14-day schedule had higher smutgrass composition compared to pasture treatments more optimally irrigated on a 7-day schedule (Graph 7). Desirable forage grasses showed a corresponding increase in cover. The production response was also very favorable.

Graph 7.



4 || BURNING

Burning can reduce old leaf and stem biomass of smutgrass and clean up the pasture if a rancher plans to graze the smutgrass the following spring. However, researchers at University of Florida found burning alone was not effective in controlling this weed.

5 || MECHANICAL

- Research has shown that while repeated mowing can decrease the diameter of individual plants, the density of plants increased. When mowing was discontinued, smutgrass eventually returned to its previous density. It also has been cited as a cause of further spread of seed in the pasture.
- Mechanical attempts to remove the plant can lead to soil disturbance, which can result in increasing the infestation.
- Some managers have plowed up the pasture and reseeded. However, the smutgrass seedbank in the ground leads to rapid reinfestation. Given that the seeds survive in the ground two or more years, pastures must be left fallow for an extended period or rotated to another crop to eliminate smutgrass.

6 || DRYING OUT

In California, it is possible to stop irrigation for the summer and allow the pasture to dry. In some locations, this has killed adult smutgrass. This practice can be followed by seeding a new pasture in fall with a no-till drill. However, the smutgrass seeds in the ground may reinfest the site.

7 || BIOLOGICAL CONTROL

There have been no biological control efforts for this weed in the United States.

The use of trade names in this article is for convenience and is not meant as an endorsement for any one product over another.

References

Currey, W.L., R. Parrado, and D.W. Jones. 1972. Seed characteristics of smutgrass. Proceeding of Soil Crop Science of Florida. 32:53-54

Davy, J. S. and B. M. Karle. 2010. Unpublished data.

DiTomaso, J.M. and E.A. Healy. 2007. Weeds of California and Other Western States. Univ. Calif. Agr. Nat. Res. Publ. #3488. Oakland, CA.

Ferrell, J.A., M.B. Adjei, J.J. Mullahey and P. Mislevy. 2006. Smutgrass control in perennial grass pastures, University of Florida.

Kyser, G. and G.A. Nader, 2010. Unpublished data

Mislevy, Paul, Donn G. Shilling, Frank G. Martin, and Stephan L. Hatch. 1999 Smutgrass (Sporobolus indicus) Control in Bahiagrass (Paspalum notatum) Pastures. Weed Technology. 1999. Volume 13:571-575.

Wilder, Barton, J. 2009. Seed biology and chemical control of giant and small smutgrass. Thesis. University of Florida. http://etd.fcla.edu/UF/UFE0024543/wilder_b.pdf