California Weed Science Society

Journal

Information on Weeds and Weed Control from the California Weed Science Society

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IN THIS ISSUE

Introduction

Steve Fennimore, Editor

Can you believe that it is summer already! I know that everyone is very busy, but I thank you for taking time to read this issue of the California Weed Science Society (CWSS) Journal. We will be referring to this publication as the CWSS Journal from now on to differentiate it from our society newsletter. The CWSS Journal will have a focus on people, projects, information and issues of interest to California weed management professionals. The CWSS Newsletter will have information on the CWSS annual meeting and membership in the society.

I thank Michelle LeStrange, board member, for reformatting the CWSS Journal. I think that you will find it much improved. We are always looking for ways to improve the quality of information delivery. Please send your suggestions and articles for future issues to me at safennimore@ucdavis.edu, or via fax at 831-755-2814. My office phone is 831-755-2896.

For mailing address changes, please call the CWSS office at 831-442-0883 or by mail at CWSS, P.O. Box 3073, Salinas, CA 93919-3073.

Brad Ramsdale

Asst. Professor, Fresno State University

I joined the faculty in the Plant Science Department at CSU, Fresno (Fresno State) in August, 2003 as the department's Weed Scientist/Agronomist. I'm originally from Kansas where I grew up on a small farm that grew winter wheat, grain sorghum, and various forage crops to supplement our cow/calf operation. My education began at Kansas State University where I earned my B.S. and M.S. in Agronomy. I completed my Ph.D. in Weed Science at North Dakota State University and continued as Research Fellow until moving to my present position.

My research at NDSU was focused on the applied area of improving postemergence herbicide efficacy through more efficient application methods, optimum application timing, and using effective adjuvants. This continues to be my primary focus for research as I look to address major weed control issues in the Central Valley. I currently have one graduate student researching factors that influence postemergence herbicide control of horseweed and hairy fleabane with an emphasis on glyphosate.

Most of my time at Fresno State is focused on undergraduate student education. I teach our weeds and pesticides courses; several agronomic and forage crop production classes; and share responsibilities of teaching a general education course titled "Food, Society, and Environment." Directly next to our campus in the heart of Fresno is a 1000 acre University Farm Laboratory. The farm includes four crop production units each

operating as their own enterprise: (1) a vineyard that includes wine, table, and raisin grapes; (2) agronomic crops including cotton, alfalfa, silage corn, and small grain crops; (3) an orchard that includes almonds, olives, pistachios and many other tree fruit crops; (4) a diverse vegetable crop unit that features sweet corn. The farm also includes a significant quantity of pastures for the animal units. Plant Science students are involved in the farm through direct employment, conducting student crop projects, or undergraduate/graduate research projects. Additionally, we frequently use the farm directly in our courses. For example, students in my weeds course learn to identify over 60 important weed species, 90%+ of which can be found on the farm.

Plant Science students at Fresno State have the opportunity to gain valuable hands-on experience in crop production and pest management. Additionally, our faculty takes pride in educating students with the science behind the management decisions that are made. Many of our students also take advantage of the vast array of employment opportunities in the San Joaquin Valley including part-time and summer jobs with USDA-ARS laboratories, UC Farm Advisors, the UC Kearney Agricultural Center at Parlier, and various agricultural chemical company research stations to name a few. As a weed scientist and teacher, I am very excited about the opportunities available at Fresno State.

Early Season Weed Control in Onions Prior to 2nd True Leaf Emergence

Grant Poole, UC Farm Advisor, Lancaster, CA gjpoole@ucdavis.edu

Recently several post emergent and soil residual pre-emergent herbicides have been developed that could improve early-season weed control for onions. Traditionally weed control in onions has been dependent on the use of oxyfluorfen (Goal 2XL) and bromoxynil (Buctril 4EC) tank mixes at the 2nd true onion leaf. By this stage weeds are often too large to control without higher rates of these herbicides and increased risk of onion injury. Several herbicides were evaluated in the Lancaster area for application to onion prior to the 2nd true leaf. Most of these herbicides have been on the market for several years and now have new applications in onions.

Field Experiments: Of the results from three trials conducted near Lancaster, the data suggest the importance of the application of 24 oz. of Prowl H_2O at the onion loop stage. In Trial no. 3, 4 oz. of GoalTender tank mixed with 24 oz. of Prowl and applied at the 1st true leaf stage resulted in over 91% filaree control. In Trial no. 2 the tank mix of Prowl (24 oz) and Outlook (14 oz) at the 3rd true leaf was a very safe and effective treatment. These results suggest the optimal treatment is Prowl H_2O applied at the loop stage followed by 4 or 6 oz. of GoalTender applied at the 1st true leaf.

At planting treatments of Prowl H_2O were evaluated at 2, 4, 6, and 8 oz./ac. However, the 6 and 8 ounce treatments resulted in onion stunting that would be marginally tolerable, and the 2 and 4 oz. rates resulted in poor weed control. The issue of crop injury with Prowl H_2O when applied at planting is important because of our sandy soils. Prowl inhibits root growth and has soil residual activity. Light sandy soils do not provide much protection from herbicides with soil activity. Therefore, great care must be taken to ensure that herbicide application methods and timings are safe to onion. If onion plants do not have adequate tolerance to an herbicide treatment they can be stunted and delayed in their growth, resulting in yield loss. Onion yield was not measured from these treatments but needs to be evaluated in further test. However, since emerged onion is more tolerant of post emergence applications of Prowl, the onion loop stage is the most favorable stage for the application of Prowl.

Onion at the 1 leaf stage infested with Russian thistle.

In other treatments from trial no. 3, Prefar caused too much injury. Outlook applied at 10 oz., Eptam and Chateau 51WD caused unacceptable injury to 1st leaf stage onion. However these applications were experimental and results may differ when the material is applied through sprinklers. Buctril applied at 4 and 6 oz./ac. was safe to onion and provided good weed control in Trial no. 2.

GoalTender is a new formulation of Goal 2XL that was registered for use in onions in 2004. GoalTender has twice the amount of active ingredient (4 lbs. Gal.) as the older formulation, Goal 2XL (2 lbs. Gal.). GoalTender is known to cause much less crop injury than traditional applications of Goal 2XL and Buctril. Research has shown that early applications of GoalTender, at low rates of 4 to 6 oz applied when the 1st true leave is ¾ to fully expanded are more effective in controlling weeds with less crop damage than later applications. GoalTender (4 oz) applied at the loop stage is too early and caused 40% stand loss. Weed control is often better with earlier GoalTender applications because the weeds at this time are smaller (less than 2 to 3 inches in size) and easier to kill.

Summary: GoalTender at 6 oz applied at the first true onion leaf stage provided the best weed control with the least onion injury in this trial. The traditional tank mix combinations of Goal 2XL and Buctril 4EC resulted in greater onion injury with weed control similar or less than that of GoalTender applied at the first true leaf. Although GoalTender applied at 8 oz. to 1st leaf onion provided the best weed control, this rate causes significant stand loss and injury. In the past we were forced to wait for onion to reach a growth stage that was more herbicide tolerant. The problem was the weeds also grew larger and more tolerant to the herbicide. These results show that GoalTender can provide good weed control with significantly less onion injury when it is applied at the first true onion leaf stage while weeds are small. This effect is due to improved control of small weeds and the residual weed control effects of GoalTender following the application. Further research needs to be conducted to assess the effectiveness of GoalTender applied through sprinklers on a larger scale and with certain problematic weeds such as lambsquarters.

National Invasive Weed Awareness Week VII

Carl E. Bell, Vice President, CWSS, cebell@ucdavis.edu

The 7th National Invasive Weed Awareness Week (NIWAW VII) took place in Washington, D.C. February 26 through March 3, 2006. I attended for the second time, representing the California Weed Science Society. The purpose of NIWAW is to bring together weed scientists and weed practitioners from across the US to the nation's capitol to inform congress about invasive plants and to hear from the federal agencies about their efforts and activities regarding this problem. About 170 people from over 30 states attended NIWAW VII, an increase from NIWAW VI. The California Invasive Weeds Awareness Coalition (CALIWAC) provide the logistical support for the 10 member California team, which included representatives from Farm Bureau, an Agricultural Commissioner, CDFA Weed Management Area program, California Invasive Plant Council, California Native Plant Society, in addition to CWSS.

I felt that we were very successful in both arenas: the congress and the agencies. On the congressional side, our mission was to seek an appropriation of $15 million per year for the Noxious Weed Control and Eradication Act of 2004 which will fund Weed Management Areas. Visits were made to Congressional offices from all the states represented by NIWAW participants. Our California group made over 20 representative and senator visits, and dropped off informational packets at the rest of the California delegation. Some of these offices had seen our group for multiple years, which is very useful. We did not have to spend much time educating the office staff on invasive weeds, which allowed us to focus our efforts on reminding them that the bill, although passed in 2004, had not yet been funded. I was particularly pleased when I entered the office of my representative, Susan Davis, and her assistant, Patricia Silva, remembered me from last year. Even several of the more conservative members of congress from California indicated that they felt that this was important and monies should be appropriated. At the conclusion of NIWAW, a support letter had been generated by Congressman Hefley of Colorado, the author of the bill, and was being circulated. This support letter was going to Congressman Bonilla of Texas, the chair of the Agriculture subcommittee of the House Appropriations Committee. We do not know at this point if funding is going to be allocated, as this is a very difficult budget year, but we felt that we were closer than last year.

Several federal agencies provided NIWAW with extensive briefing, either at our hotel or at their agency headquarters. Each year NIWAW tends to draw a larger federal list of presenters from higher up in the agency. This is a clear indication that they want us to know that they are working hard on the problem of invasive weeds. Agencies included in briefings in 2006 were; the Army Corps of Engineers, Environmental Protection Agency, USDA (Forest Service; Animal Plant Health Inspection Service (APHIS), Farm Service Agency; Cooperative States Research, Education, and Extension Service; Agricultural Research Service (ARS), Economics Research Service, and Natural Resources Conservation

Service), Department of the Interior (Bureau of Land Management, Fish and Wildlife Service, Geological Survey, National Park Service, and Bureau of Reclamation), and the National Invasive Species Council, which is the federal coordinating group for the agencies. In addition, the California group had taken advantage of an opportunity to have private briefing with selected federal agencies. These included USDA-APHIS, USDA-ARS and the Department of Transportation. A good source of what these agencies are doing can be found through their portal at http://www.fws.gov/ficmnew/. A couple of items of interest to us in California include the revision of APHIS regulations regarding importation of "plants for planting" and ARS support for continued biological control at their lab in Reno, NV that is being proposed for closure in the 2006/07 federal budget. APHIS is revising rules for importation of plants for planting (e.g. nursery stock) to include a new category of NAPRA (not approved for import pending risk assessment). This will add an assessment of plants for their potential invasiveness in addition to the traditional concern for plants that vector insects or diseases. ARS indicated their strong support for the lab in Reno, which is an important site for biological control research for tamarisk, and expected to be able to keep it open.

A New Herbicide: Aminopyralid

Bruce Kidd, Dow AgroSciences

Aminopyralid (DE-750) is a new pyridine carboxylic acid herbicide intended for use in rangeland, permanent grass pastures, industrial vegetation management areas (including rights-of-way for roads, railroads and electric utility lines), natural areas (wildlife management areas, natural recreation areas, campgrounds, trailheads and trails), grazed areas in and around these sites, wheat, barley, sorghum and oil palm and rubber plantations. It is a new Dow AgroSciences compound designed and developed specifically for the control of noxious and invasive weed species in rangeland, pastures and industrial vegetation management sites.

Aminopyralid is a new generation active ingredient that is effective at very low rates as compared to currently registered herbicides with the same mode of action, including 2,4-D, clopyralid, triclopyr, picloram and dicamba. Aminopyralid is a broadleaf weed herbicide that provides systemic, postemergence control of noxious and invasive annual, biennial and perennial weed species, agronomically important weeds and certain semi-woody plants. It provides residual control, thus reducing the need for re-treatment, depending on the rate applied and the target weeds. Once registered and commercialized, aminopyralid will be offered as a stand-alone treatment and in premixes with 2,4-D, fluroxypyr and triclopyr for use in rangeland, pastures, rights-of-way and natural areas. Dow AgroSciences intends to register aminopyralid globally.

Weed Control: Aminopyralid products will provide selective, broad-spectrum control of annual, biennial and perennial broadleaf and semi-woody plants. Applied as a stand-alone treatment, aminopyralid will control important invasive pasture weeds, including *Acroptilon repens*, *Carduus nutans*, *Centaurea maculosa*, *Centaurea solstitialis*, *Cirsium arvense*, *Solanum viarum* and *Senecio jacobaea*. Aminopyralid premixes, with other herbicides, will provide control of a broad spectrum of broadleaf weeds, including species in the genera *Vernonia*, *Rumex*, *Urtica*, *Sida*, *Solidago*, *Vervain*, *Acacia* and *Mimosa*.

Range, Pasture, Rights-of-way and Natural Areas: Aminopyralid controls a number of invasive plants and noxious weeds, woody and semi-woody plants including most of the species from the genera *Acacia* and *Mimosa*. Some woody and semi-woody species are treated on an individual plant basis. Aminopyralid will be recommended alone and or in pre-mixes with other herbicides. Long-term weed control is most effective where grass and other desirable vegetation form competitive stands after the aminopyralid application.

The benefits of weed control achieved with aminopyralid may be optimized and extended when integrated with other vegetation management practices (i.e., prescribed fire, grazing management, fertilization, planting improved temperate and tropical grass and legume forages, mechanical controls, biological controls, etc.) that promote recovery of desirable vegetation and increase forage production.

The following sections provide lists of key economic weed species that are susceptible to aminopyralid and its mixtures with 2,4-D, fluroxypyr or triclopyr, when applied as a broadcast or directed spray in rangeland, pastures, rights-of-way, other non-cropland and certain crops. Examples of these weeds include *Daucus carota*, *Solidago* sp., *Rumex* sp., *Vernonia* sp., *Vervain* sp., *Lespedeza* sp., *Ranunculus* sp., *Urtica* sp., *Taraxacum officinale*, *Symphoriocarpus occidentalis*, *Capsella bursa-pastoris* and *Lantana camara*.

Mode of Action: Plant growth is a complex process that is controlled, in part, by a variety of plant growth regulators, including auxin compounds. To ensure proper growth, plants produce very controlled amounts of these materials. Auxins bind to specific cell surface receptor proteins, turning on and off vital plant processes. Aminopyralid is a herbicide possessing auxin-like qualities. Aminopyralid moves systemically throughout the plant and deregulates plant growth metabolic pathways affecting the growth process of the plant. This disruption of plant growth processes, by binding of aminopyralid at receptor sites normally used by the plant's natural growth hormones, results in control and death of susceptible plant species.

Absorption/Translocation: Aminopyralid is a systemic, phloem and xylem mobile herbicide that is rapidly absorbed by leaves and roots. It translocates throughout the plant and accumulates in meristematic tissue, resulting in uneven cell division and growth.

Herbicidal Activity: Symptoms are typical of those for the auxinic mode of action. Within hours or days of application depending on the weed species, aminopyralid causes symptoms such as thickened, curved and twisted stems and leaves, cupping and crinkling of leaves, stem cracking, narrow leaves with callus tissue, hardened growth on stems, enlarged roots and proliferated growth. Most annual susceptible weeds are controlled within 4 to 8 weeks after application. Complete kill of main stems and the root systems of woody and semi-woody plants may require 2 or more months after application. Plant growth will stop within 24-48 hours after treatment.

Crop Tolerance: Aminopyralid offers a high level of tolerance on a wide range of temperate and tropical forage grasses and on small grain cereals. More than 20 different forage grasses evaluated in field trials from 1999-2004, with aminopyralid applied at rates up to 2 times the maximum use rate, demonstrated tolerance to aminopyralid. Grasses evaluated included *Agropyron* sp., *Andropogon gerardii*, *Andropogon saccharoides*, *Andropogon scoparius*, *Bouteloua curtipendula*, *Bouteloua gracilis*, *Brachiaria bryzantha*, *Brachiaria decumbens*, *Bromus inermis*, *Buchloe dactyloides*, *Cynodon dactylon*, *Cynodon nlemfuensis*, *Cynodon plectostachyus*, *Dactylis glomerata*, *Digitaria decumbens*, *Eragrostis ciliaris*, *Festuca* sp., *Lolium* sp., *Panicum maximum*, *Panicum virgatum*, *Paspalum notatum*, *Phleum pratense*, *Poa* sp. and *Sorghastrum nutans*.

Yellow Starthistle – The other California state flower.

Steve Schoenig, Sr. Environmental Research Scientist
Terrestrial Weed Eradication Program, Calif. Dept. of Agriculture, sschoenig@cdfa.ca.gov

Yellow starthistle (YST) has become ubiquitous in much of the rolling grasslands, roadsides and disturbed sites of central and northern California. It is rapidly moving southward and eastward. Recent estimates (Pitcairn et al. 2006) put its distribution at 14 million acres in California. Its thick, impenetrable late-season growth and large sharp spines have made it a weed that most people love to hate.

History of invasion: Dr. John Gerlach is one of the Sherlock Holmes of Western invasive weed origins. His investigative research of 19th century seed inspection records have led to the documentation of YST seed contamination in cheap alfalfa seed as a primary route into the western United States via Argentina. (Gerlach 1997). YST has been in California for over 100 years, but has gone through a series of expansions as irrigation and development has helped the plants move from the areas of initial establishment to the millions of acres that are susceptible.

Biology: Yellow starthistle is a winter annual geminating primarily in the fall. It forms a rosette and a deep taproot. In mid spring it begins to bolt, eventually branch and form numerous spiny flowers. (DiTomaso and Gerlach 2000). Depending on plant density and water availability, plants can vary in size from only one to many hundred seed heads. Each flower head can contain up to 60 seeds. In a wet year large plants can grow to over 6 feet tall. YST defers its main reproductive and grow efforts until late in the spring when drought conditions generally have set in. Most exotic and native annuals have reproduced and senescing at this point. The deep root of YST (up to 20 feet) allows the plant to tap deeper soil moisture than most native plants.

Yellow starthistle produces two types of seeds. One type leaves the flower heads early and germinates immediately after the first rains of late summer or early fall. The other non-plumed seeds remain in the flower heads on the plants and become dormant. Presumably seed dormancy is a bet hedging strategy against mass early-season germination events, which could be followed by lethal multi-month droughts in the late summer and fall.

Impacts

Yellow starthistle (YST) is classified by the CDFA as a C-rated Noxious weed. All CDFA rated noxious weeds are considered to be highly damaging to agriculture and/or important native species. A "C" rating, as opposed to an "A" or "B" is given based on the widespread distribution (not impact) of YST and the impossibility of statewide or even large-region eradication. The California Invasive Plant Council (Cal IPC) rates YST as HIGH in ecological impact. Refer to (http://portal.cal-ipc.org/files/PAFs/Centaurea%20solstitialis.pdf)

Yellow starthistle flower

No intensive studies have been done on the impacts of YST to native species diversity or genetic diversity. Anecdotal observations by many in the field seem to suggest that YST invasions can almost completely suppress native grasses and forbs. Heavy YST infestations in one year often leave almost 100% thatch cover in subsequent years. There are many rare and endangered plant species in areas, which have increasing YST populations. These rare plant species seem to be declining in large part due to YST.

Recent research shows that total losses of livestock forage value due to YST on private land for the state of California are estimated at $7.96 million/year, with ranchers' out-of-pocket expenditures on YST control amounting to $9.45 million/year. (Eiswerth et al. submitted for publication)

There has been a growing inquiry into the differential water usage of YST versus other types of grassland vegetation. (Benefield et al. 1998; Enloe 2002). Enloe has estimated the loss to California water supply at 16.6-30.4 billion gallons annually. (Enloe 2003 CalEPPC Symposium).

Sweet side

Just like Rosey Grier the massive ex-NFL defensive lineman who took up knitting as a hobby, YST has a sweet side. YST flowers produce copious nectar, which is turned into a light flavorful honey by bees and their keepers. It is said that beekeepers in the 20th Century actually blocked statewide eradication and containment programs for YST and possible moved the seeds either intentionally or inadvertently. An interesting side note to illustrate that impacts are not always one-sided; a benefit of YST to native bees on Santa Cruz island has been documented by Barthell et al. (2000).

Control techniques

Yellow starthistle responds well to many control techniques and excellent control strategies have been worked out by Joe DiTomaso and many others. An upcoming YST book (see below) will summarize and synthesize this large body of work.

Chemical – The appearance of Transline® in 2000 provided an excellent early-season herbicide for semi-selective control of YST in most problem areas such as pasturelands, roadsides, and open space preserves. The soon to be registered Milestone® will offer this same control at even lower active ingredient and may add some residual kill. Many other chemicals offer mid and late season control options also.

Biocontrol - The CDFA Biolological Control Program, in partnership with the USDA and County Ag Departments, has been pursuing a biological control solution to YST. Five insect herbivores and a pathogenic fungus have been imported from the native range of YST and become established in California. While short of a dramatic statewide reduction in YST biomass, these agents are having a large impact on seed production and ongoing research will help measure the impact of the bioagents. Further research is continuing to find new natural enemies for YST control.

Others – Mowing, intensive grazing and appropriately-cycled burning have all been shown to greatly reduce YST densities when applied at the first flowering (2-5%) phenology.

Weed Management Areas and Regional Control

As important as individual management tools are for individual land owners in achieving site-specific goals, coordinated strategies, outreach campaigns and human infrastructure are of supreme importance to achieving regional suppression, prevention and containment goals. Local county-based Weed Management Areas (WMAs) augment the traditional expertise and leadership of the Agricultural Commissioners to run effective "stop the spread" campaigns in many California counties. In these fiscally stringent times many counties rely more on outside grant monies to combat YST on a regional basis. Coordination groups such as WMAs are the most effective mechanism to get outside money

Upcoming book!

Look for an upcoming comprehensive YST management guide being written by Joe DiTomaso, Guy Kyser and Mike Pitcairn pulling together all the current information about biology and control. It is being published by the California Invasive Plant Council this summer, and when available, it can be ordered from: http://www.cal-ipc.org/resources/index.php

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Student Papers: Call for Abstracts

All weed science graduate and undergraduate students are invited to submit one paper for the 59th Annual Conference of the California Weed Science Society, January 8-10, 2007, in La Jolla. Student papers can cover any aspect of weed science, should be scientific in nature, and should not be sales or marketing tools.

The Undergraduate/Graduate Student Paper Contest will be conducted in the same manner as last year. Four time slots are available for student papers, which will be presented during one of the current sessions of the conference. A panel of CWSS members will evaluate all abstracts submitted and select the top four in terms of the required components listed below. The four papers selected will each be awarded a $200 stipend. Students not selected for the Paper Contest will be encouraged to present their research as part of the Student Poster Contest. More information on the Student Poster Contest is forthcoming.

Papers will still be judged and prizes awarded as done in previous conferences. Abstracts will also be published in the CWSS Proceedings. Prizes for the three best student papers and three best student posters will be awarded as follows: 1st place - $500; 2nd place - $300; 3rd place - $200.

Abstract Details:

Include the paper title, author(s), and author affiliations. The body of the abstract should include the following: justification for the research; clear statement of research objectives; brief description of experimental design and research methods; discussion of significant results; and the overall conclusions including the significance of the findings to weed science in California. A maximum of 300 words is allowed for the abstract.

Abstract Deadline: September 30, 2006

Please email your abstract as a MS Word Document to:

Brad Ramsdale, Student Session Chair
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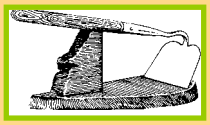

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