

## North Coast Diversified Agricultural Systems Notes

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***Weed Science Research: Current Management of Italian Ryegrass in Perennial Cropping Systems***

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In California, Italian ryegrass [*Lolium perenne* L. spp. *multiflorum* (Lam.) Husnot] has been around for a long time and is a major weed in orchards, vineyards, field crops, fallow fields, and so on. Italian ryegrass is an annual or biennial, cool-season weed that establishes from seed in the fall, overwinter in a vegetative state, and grows vigorously when temperatures warm up in spring. It is a short weed that grows from 11 to 35 inches tall, often with erect stems exhibiting purple coloration at the base, and the root system is highly branched and dense, with many fibrous, adventitious roots. That species can be identified by its dark green, glossy, and hairless leaves that are rolled in the bud. Auricles are well-developed and the shape can vary from clasping to blunt, and the ligules are long and membranous. Once flowering occurs, Italian ryegrass is easily distinguishable by alternating spikelets that run along the length of the main seed head stem. The seed heads range from 3 to 12 inches and consist of solitary small stalkless spikelets (Fig. 1). Additional details regarding identification can be found on the UC IPM website.



**Fig. 1. ITALIAN RYEGRASS CHARACTERISTICS:** **Stem;** Often purplish coloration at the base (a). **Seed Heads;** The spikes are often as long as 12 inches (b). **Leaf and Stem;** The blade is flat, from 1/8 to 1/4 inches wide, dark green with prominent veins, ligule is membranous, can grow to 1/10 inch in length the auricle is small and narrow, about 1/12 inch long (c). **Spikelets;** These are placed edgewise and alternate along the flowering stem, anthers are yellow or purple. (d). **Photo by Clebson Gonçalves.**

Also called annual ryegrass, Italian ryegrass herbicide resistance and management strategies have been the topic of discussion among growers, PCAs, UCCE farm advisors, and UC weed science specialists (*Fig. 2*). Historically, Italian ryegrass has been controlled in crop production systems with herbicides (*Grey et al. 2012*). Since 1998, populations of Italian ryegrass have been documented to be resistant to glyphosate. In California, the first report of Italian ryegrass glyphosate-resistant was in 2008 in almond orchards and vineyards, and the evolution and spread of these populations in the state made alternative postemergence herbicides an important management strategy against this troublesome species (*Jasieniuk et al. 2008*).



**Fig. 2.** Italian ryegrass infestation in an organic walnut orchard (a) and Italian ryegrass escaping from a herbicide application program in a conventional pear orchard (b). **Photo by Clebson Gonçalves.**

Repeated herbicide use has selected Italian ryegrass populations resistant to multiple of herbicide modes of action. Recently, poor control of Italian ryegrass was reported in a prune orchard in Northern California, and greenhouse dose–response experiments confirmed multiple resistance to the herbicides paraquat (Gramoxone<sup>®</sup> 2.0 SL), clethodim (Envoy Plus<sup>®</sup>), and glyphosate (Roundup PowerMax<sup>®</sup>) (*Brunharo, and Hanson, 2018*). A second study conducted in Dr. Hanson's Lab. also confirmed that another Italian ryegrass biotype population collected in Hamilton City is resistant to paraquat (Gramoxone<sup>®</sup> 2.0 SL), clethodim (Envoy Plus<sup>®</sup>), glyphosate (Roundup PowerMax<sup>®</sup>), and Mesosulfuron-Methyl (Osprey<sup>®</sup>). It should be noted that ryegrass populations resistant to fluzifop-butyl (Fusilade<sup>®</sup> DX), glufosinate-ammonium (Rely<sup>®</sup>

280), and sethoxydim (Poast<sup>®</sup>) also have been reported in other cropping systems elsewhere in California.

Worldwide Italian ryegrass has been identified as resistant to 29 herbicides, from 8 different groups of classification with multiple resistance to 1, 2, 3, or 4 sites of action; herbicides include: glyphosate, glufosinate-ammonium, paraquat, fluazifop-butyl, clethodim, sethoxydim, pinoxaden, pyroxsulam, sulfometuron-methyl, mesosulfuron-methyl, haloxyfop-methyl, diclofop-methyl, fenoxaprop-ethyl, quizalofop-ethyl, imazamox, nicosulfuron, clodinafop-propargyl, flucarbazone-Na, tepraloxydim, iodosulfuron-methyl-Na, propoxycarbazone-Na, flufenacet, cycloxydim, propaquizafop, tralkoxydim, amitrole, chlorotoluron, isoproturon, and flufenacet (*WeedScience.org*, 2022). The most recent Italian ryegrass biotype was identified in a soybean and winter wheat field in North Carolina with multiple resistance to 4 sites of action (clethodim, glyphosate, nicosulfuron, and paraquat).

Studies have pointed out that a continuous increase in Italian ryegrass biotypes resistance is associated with the obligate-outcrossing, self-incompatible breeding system of Italian ryegrass that facilitates the dispersal of herbicide-resistance genes within and among populations. Also, the overreliance on herbicides has been selected Italian ryegrass populations resistant worldwide (*Preston et al. 2009; Loureiro et al. 2016*).

Even with the increase in herbicide-resistant weeds, herbicide control options continue to be the most effective and used option for producers because of time and money. However, diversified management practices should be encouraged as they are crucial for crop productivity, efficiency, saving cost, and sustainability of the systems.

## **Management Strategies**

For efficient management of Italian ryegrass, integrated weed management (IWM) practices must be adopted that allow the combination of various control strategies, including preventive, cultural, mechanical, physical, biological, and chemical control.

**Prevention Control:** Avoiding dispersion and introduction of Italian ryegrass into the property and ensuring that seeds and equipment are free of Italian ryegrass contaminants is one of the main strategies in the IWM programs.

**Biological Control:** Italian ryegrass infestation can be reduced by some natural enemies, including mites, crown rust, gray leaf spot, stem rust, and ryegrass blast. The Italian ryegrass

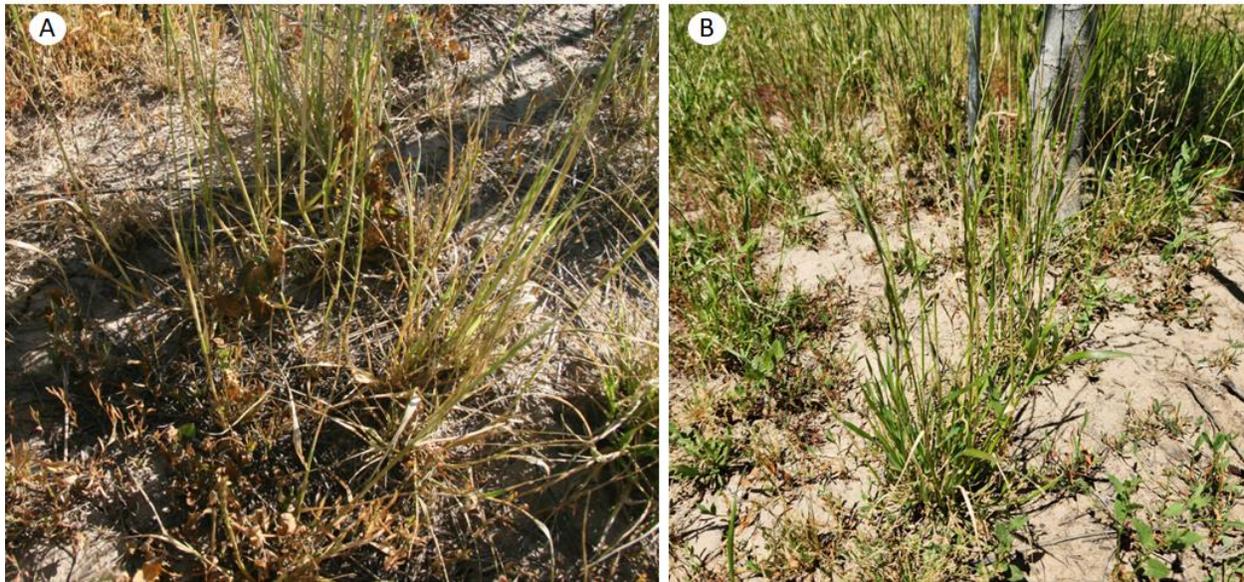
generally tolerates trampling, mowing, and grazing, but can be very sensitive to prolonged/intense grazing after a dry season fire (*Ditomaso and Healy, 2007*).

**Physical Control:** Soil tillage may be used as one strategy to be added to the IWM toolbox. Italian ryegrass seeds buried in the soil die quickly and must be close to the surface to emerge. So, this practice can help suppress the population and provide long-term control.

**Chemical Control:** Italian ryegrass control using PRE and POST herbicide management programs continues to be the most effective. A well-designed herbicide application program with a combination of PRE- and POST-emergent herbicides (e.g., fluazifop-butyl (Fusilade<sup>®</sup> DX), glufosinate-ammonium (Rely<sup>®</sup> 280), pyroxsulam (Simplicity<sup>MT</sup>), rimsulfuron (Matrix<sup>®</sup>SG), sethoxydim (Poast<sup>®</sup>), flumioxazin (Chateau<sup>®</sup>), oxyfluorfen (GoalTender<sup>®</sup>), pendimethalin (Prowl H<sub>2</sub>O), and so on) are possible options that have still been quite effective in controlling Italian ryegrass. Growers should always consult a PCA and a local UCCE farm advisor to help design herbicide application programs and application rates appropriate for their unique growing system. Growers should also keep in mind that they need to avoid repeated herbicide use to prevent resistance in Italian ryegrass populations. Herbicides with different modes of action on a rotational basis should be encouraged to suppress the Italian ryegrass population and provide long-term control.

If you are looking for alternatives such as non-synthetic herbicide products (organic herbicides) for Italian ryegrass control. Among those available commercial products, the active ingredients, including acetic acid (Weed Pharm<sup>®</sup>), citric acid + Clove oil (BurnOut<sup>®</sup>), caprylic acid + capric acid (Suppress<sup>®</sup>), pelargonic acid + related fatty acids (Scythe<sup>®</sup>), D-limonene (AvengerAG<sup>®</sup>), ammonium nonanoate (Axxe<sup>®</sup>) and others, have been ranked as potential alternatives for the non-selective control of that weed (consult your UCCE Farm Advisor or your PCA for a correct recommendation and always read the pesticide label; the label is the law).

Usually, organic herbicides are recommended for grass and broadleaf weeds in the early stages of growth (these herbicides are more effective on small and medium-sized annual weeds). For Italian ryegrass already established, organic herbicides have shown poor effectiveness, and recovery approximately two weeks after treatment application (*Fig. 3*). Studies have shown that organic herbicides applied to control Italian ryegrass may require late sequential application due to the non-systemic characteristics of these products (ongoing trials by *Clebson Gonçalves, 2023*).



**Fig. 3.** Italian ryegrass infestation in an organic walnut orchard: 4 days after application of organic herbicides (a) and 14 days after application of organic herbicides (b). **Photo by Clebson Gonçalves.**

### Where do we go from here?

UC Cooperative Extension, in collaboration with UC IPM, and UC Davis experts, has designed IWM programs and conducted field trials to access long-lasting control of Italian ryegrass in orchard systems using different management strategies. Several other ongoing studies using non-chemical approaches methods such as propane flaming, steam, and electric weed control may be a viable alternative for managing Italian ryegrass and other resistant weeds in perennial cropping systems.

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## UPDATE ON LOCAL UCCE PROGRAMS

UCCE continues to be grateful for the strong continuing support from the Counties of Lake and Mendocino, including for 4-H, Master Gardener, and agricultural program assistance. All of us at UCCE are here to serve you with assistance from other County and campus-based colleagues. Our current advisors and program staff serving Lake and Mendocino Counties include:

### Advisors

- John Harper, County Director and Livestock and Natural Resources Advisor, Emeritus (Mendocino)
- Dr. Chris Chen, Integrated Vineyard Systems Advisor (Hopland Research Extension Center)
- Rachel Elkins, Pomology Farm Advisor, Emeritus (Lake)
- Dr. Clebson Gonyalves, Diversified Agriculture Advisor (Lake)
- Dr. Mike Jones, Forestry Advisor (Mendocino)
- Dr. Cindy Kron, North Coast Area IPM Advisor (Sonoma)
- Breanna Martinico, Human-Wildlife Interactions Advisor (Napa)

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### Administrative Staff

- Nicole Gentry, 4-H Secretary (Lake)
- Shauna La Brash, Office Manager (Lake)
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**THANK YOU ALL FOR YOUR SUPPORT!**

Sincerely,



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