WEED MANAGEMENT IN WHEAT

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ABSTRACT

Broadleaf and grassy weeds are problematic in cereal production, posing challenges to growers in the selection of effective herbicides. Many growers are interested in combining different treatments into a single tank mixture to cut costs and reduce labor. However, when mixing different herbicides, concerns about crop safety call for more research in tank mixture options. Research was conducted in the San Joaquin Valley and Intermountain region in the 2010- 2012 production seasons, generally focusing on the interactions between several different herbicides applied as a tank mix combination at varying rates, with and without a surfactant. It was observed that no treatment in any trial caused severe or lasting injury. Tank mixtures that included both Axial and Express with varying amounts of MCPA Amine, Clarity provided excellent control of both grasses and broadleaf weeds. Express does not control grasses and Axial does not control broadleaves. The herbicide Simplicity gave good control of wild oat (*Avena fatua*) and Italian ryegrass (*Lolium perenne*). The tank mix of Osprey + (AMS) + Induce controlled ripgut brome (*Bromus diandrus*) and volunteer barley (*Hordeum vulgare*). All of the treatments with Express, ET, Shark, or Osprey gave excellent control of common chickweed (*Stellaria media*) except ET+NIS, Shark+AMS+NIS, and Axial alone.

Key Words: broadleaves, grasses, herbicides, tank mixtures, crop injury, Wheat, San Joaquin Valley

INTRODUCTION

Wheat is one of the most important crops throughout California. Weeds pose a significant problem for wheat producers nearly always requiring treatment. Although broadleaf and grassy weeds can be reduced by crop rotation and tillage, these cultural practices are being replaced by a greater dependence on herbicides—a dependence that also raises concern about the potential evolution of herbicide-resistant weeds or weed shifts.

Broadleaf Weeds

The most common broadleaf weeds that infest cereals include mustards (black mustard, wild radish, London rocket), fiddleneck, malva, burning nettle, common chickweed, field bindweed, smartweed, lambsquarters, and yellow starthistle. Broadleaf weeds vary in their competitive ability. One wild radish plant/square foot, when established at the same time the crop emerges, can reduce wheat yield by as much as 66%. It does this by completely overtopping the wheat canopy and competing for light. Common chickweed is low growing and is generally less

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competitive; it reduces yield by removing needed soil nutrients and moisture, however under high fertility conditions can grow over the top of small grains.

Grasses

Many grasses germinate at the same time as small grains, and their seed matures slightly before or at the same time as their crop competitor (thus assuring an ample supply of seed for next year's weed crop). Wild oat and canarygrass have been shown to reduce yield by as much as 75%. California's small grain grassy weeds are winter annuals including: wild oat, Italian ryegrass, ripgut brome, annual wild barley, rabbitfoot grass, both hood and littleseed canarygrass, and annual bluegrass. Wild oat has been the major weed throughout California; however, other grassy weeds are replacing it, since it is controlled with most of the grass herbicides used in small grains. Wild oat emerges throughout the cool season from autumn through spring. It causes lodging, slows harvest, clogs harvester screens, and lowers yields. As few as seven wild oat plants/square foot can reduce wheat yields by 3,000 pounds/acre in comparison to a 6,000 pounds/acre yield potential where no wild oat exists.

Ripgut Brome and wild barley are an increasing problem, particularly in dryland culture. In addition to reducing yield, their seed can reduce the marketability of grain. Delayed planting, mulch planting, rotation, or alternate year production in the fallow year helps control. Often these weeds show up when grain prices are high and former pastures or vacant fields are brought under production. Proper identification of seedling grasses is essential because grass herbicides do not control all grassy weeds.

Chemical Control

Postemergence Broadleaf Weed Control

Typically, only postemergence herbicides applied after the crop has emerged are used for weed control in small grains. Fall-planted small grains are usually treated between December and mid-March, depending on the planting date and growing conditions. Spring-seeded cereals in the intermountain area are treated in April to June.

Hormonal herbicides are commonly used in cereals, alone or in combinations. These herbicides include 2,4-D, MCPA and dicamba (Clarity, Banvel), and are most effective when applied to small and succulent weeds. These herbicides are especially effective against weeds in the mustard family. The preferred time for applying 2,4-D is after the cereals are well established and tillered, but before they reach the boot stage. Yield reductions can occur if application is made before tillering or at boot stage. Best control is obtained when weeds are small, and before the crop has reached the jointing stage. Late applications are sometimes ineffective because the crop canopy shields the weeds, preventing the herbicide from making contact. Dense weed populations require a more thorough application with a greater spray volume to ensure that weeds are contacted by the herbicide. The use of aircraft often facilitates timely herbicide application, but care must be taken to make applications at the appropriate time to avoid injury to adjacent crops from drift or volatilization.

MCPA does not control large weeds as well as 2,4-D, but it offers greater crop safety, especially when it is applied to cereals in early-growth stages. It is also safer to oats than 2,4-D.

Dicamba is effective for broadleaves such as mustards, and partial control of malva, chickweed, burning nettle and filarees. Small grains are generally more sensitive to it than to 2,4-D or MCPA and it causes a flattening effect. Dicamba is safer when applied at an early growth stage of cereals (two-to-three-leaf stage). Dicamba is often combined with carfentrazone (Shark), Pyraflufen-ethyl (ET) or MCPA. When applied early, these combinations are very effective and increase the weed spectrum controlled over either one of these herbicides used alone.

Tribenuron (Express) effectively controls common chickweed, malva, burning nettle, black mustard, coast fiddleneck, common groundsel, common lambsquarters, common purslane, London rocket, pineappleweed, and shepherd's purse. Weeds listed as "partially controlled" can be better controlled by tank-mixing Express with 2,4-D, MCPA, Buctril, or Shark.

Bromoxynil (Buctril), a contact herbicide, is effective on young seedling weeds with no more than two to four leaves, but is less effective than the hormonal herbicides on older weeds. Buctril is not translocated, or moved, from the site of absorption throughout the plant; therefore, thorough coverage is more important than with translocated hormonal herbicides. An advantage is that it controls the toxic weed fiddleneck when applied at the early-growth stages. Buctril is also recommended in areas with hormonal-sensitive crops (grapes, cotton, tree crops) because it is less likely to damage nearby crops.

Carfentrazone (Shark) is a herbicide that controls plants by disrupting cell membranes. It is effective at very low-use rates for controlling fiddleneck, malva spp., burning nettle, and other weeds that have been difficult to control with previous herbicides. Pyraflufen-ethyl (ET) is in the same PPO family of herbicides and is very effective on common chickweed and burning nettle but does not control fiddleneck. Both herbicides usually cause some wheat necrotic burn injury to wheat. Combining these herbicides with Express, 2,4-D, MCPA or dicamba broadens the weed spectrum, lowers herbicide-application rates, and can reduce the risk of weeds building up herbicide resistance.

Chlorsulfuron (Glean) is registered for use on wheat in a wheat/fallow rotation. It is a sulfonyl urea herbicide that controls most broadleaves. It is not widely used in California because it has a long soil life that prevents its use in areas where many different crops are grown.

Grass Weed Control with Preemergence Herbicides

Preemergence herbicides are not commonly used in small grains in California, but can be effective in certain situations. Trifluralin is a preemergence herbicide used for wild oat or canary grass control . It is applied before seeding and must be incorporated at less than two inches. Seeding is below two inches. Results can be erratic if the zone of treatment does not have adequate moisture or seed is placed in the treated zone. Pendemethalin may be applied after wheat emerges but before weeds emerge. Moisture is required to activate the herbicide.

Grass Weed Control with Postemergence Herbicides

Imazethabenz-methyl (Osprey) is available for the control of wild oat, Italian ryegrass, annual bluegrass and certain broadleaved weeds such as chickweed, burning nettle, and malva in wheat

and barley. Crop injury is common. Certain rotation crops are be restricted because this herbicide has soil residual.

Fenoxaprop ethyl (Puma) is applied as a postemergence spray; it controls canary grass, wild oat and several *Setaria* spp. It is most effective when treatment timing is made between the one-leaf-to-one-tiller grass stages. A tank mixture with bromoxynil, will allow for a wide range of weed control at an early timing.

Pinoxaden (Axial) controls wild oat, canarygrass and Italian ryegrass in wheat and barley, without variety restrictions. It can be tank-mixed with Buctril, MCPA, Express, and Glean for broadleaf control. Crop tolerance exists from two-leaf stage to boot stage.

CONCLUSION

Recently, new small grain herbicides have been released to the marketplace and have been used successfully in several of the country's wheat production areas. Research in California's wheat producing regions was necessary to evaluate the safety of these new herbicides so that they could be confidently used by California growers without concern over crop injury. Field experiments were conducted in the San Joaquin Valley and Tulelake. Trials were conducted with grower cooperators in the respective locations and at the West Side Research and Extension Center (WSREC) to evaluate the efficacy of the herbicides along with crop injury. When comparing treatments, it was noted that tank mixtures that included both Axial and Express with varying rates of MCPA Amine, Clarity, and Induce provided excellent control of both grasses and broadleaf weeds, but Express alone does not control grasses and Axial alone does not control broadleaves (Tables 1, 2, 3, 4, 5). No treatment in any trial resulted in any lasting injury to wheat (*Triticum*) (Tables 1, 2, 3, 4, 5). Injury was minimal between herbicides used in these tank mixtures. Research should continue to further verify the safety of new wheat herbicides and when possible work with chemical companies and the Department of Pesticide Regulation (DPR) to change labels when appropriate to allow more flexibility with herbicide tank mixes.

REFRENCES

Wright S.D, S.B. Orloff. June 2012. Weed Control in California Wheat. International Weed Sci. Soc. Beijing, China.

Wright S.D, S.B. Orloff, M. Canaveri. 2012. Weed control in small grains chapter. In Revision. University of California. Small Grains IPM Pest Management Guidelines ANR Pub. 3466.

Wright, S.D., S.B. Orloff. Weed control in small grains Chapter. In Revision. California Weed science Society (2012) Principles of Weed Control. (Thomson Publications, Fresno, CA).

Wright, S., G. Banuelos, Small Grains update-SJV. Calif. Weed Sci. Soc. Jan. 2010. 39pp.

Wright S.D., G. Banuelos. Grassy weeds in small grains. Calif. Weed Sci. Soc. Jan. 2008.

Table 1. Percent Control - Broadleaf and Wild Oat Control Interactions in Small Grains, Visalia

		Wild Oats	Common Chickweed	Burning Nettle	Coast Fiddleneck	Shepherds purse	Wheat Injury
Treatments	**Rate/A**	**54 DAT**	**54 DAT**	**54 DAT**	**54 DAT**	**54 DAT**	**54 DAT**
1. Express	0.5 oz*	0	100	95	100	100	0
2. Osprey	4.75 oz*	6	100	90	100	100	0
3. Axial	16.4 floz	6	0	0	0	0	0
4. Express + Osprey	0.25 oz + 4.75 oz*	5	100	95	100	100	0
5. Express + Osprey	0.375 oz + 4.75 oz*	8	100	95	100	100	0
6. Express + Osprey	0.5 oz + 4.75 oz *	8	100	95	100	100	0
7. Express + Axial	0.25 oz + 16.4 floz*	8	100	95	100	100	0
8. Express + Axial	0.375 oz + 16.4 floz*	9	100	95	100	100	0
9. Express + Axial	0.5 oz + 16.4 floz*	9	100	95	100	100	0
10. Express + MCPA Amine + Axial	0.25 oz + 1 pt + 16.4 floz*	9	100	95	100	100	0
11. Express + MCPA Amine + Axial	0.5 oz + 1 pt + 16.4 floz*	14	100	98	100	100	0
12. UTC	-----	0	0	0	0	0	0

*0.25% of NIS was used

Table 2. Control – Broadleaf Control in Wheat, WSREC 2012

		Common Groundsel	Shepherds purse	London Rocket	Coast Fiddleneck	Wheat Injury
Treatments	**Rates/A**	**23 DAT**	**23 DAT**	**23 DAT**	**23 DAT**	**23 DAT**
1. ET	1 floz *	75	43	44	1	0
2. NAI 1295-2	1 floz*	95	55	50	0	0
3. Venue	1.2 floz*	98	23	20	0	0
4. ET + Shark	1 floz + 1 floz*	98	30	33	43	0
5. ET + Shark + MCPA Amine	1 floz + 1 floz + 12 floz*	99	99	99	70	0
6. Shark + AMS	2 floz + 2 lb *	78	98	98	100	0
7. Shark + Express + AMS	2 floz + 0.5 oz + 2 lb*	100	100	100	100	0
8. Shark + Express + AMS	2 floz + 0.25 oz + 2 lb*	100	100	100	100	0
9. Shark + Express + AMS	1 floz + 0.5 oz + 2 lb*	100	100	100	85	0
10. Shark + Express + AMS	1 floz + 0.25 oz + 2 lb*	100	100	98	100	0
11. Shark + Express + MCPA Amine + AMS	1 floz + 0.25 oz + 16 floz + 2 lb*	100	99	98	98	0
12. Shark + Express + Clarity + AMS	1 floz + 0.25 oz + 3 floz + 2 lb*	100	98	98	100	0
13. Express	0.5 oz*	100	63	65	73	0
14. ET + Express	1 floz + 0.25 oz*	95	87	88	65	0
15. ET + Express	1 floz + 0.5 oz*	91	97	97	83	0
16. ET + Express + MCPA Amine	1 floz + 0.5 oz + 16 floz*	88	85	88	63	0
17. Untreated	-----	0	0	0	0	0

*0.25% of NIS was used

Table 3. Percent Control – Grass Control in Wheat, Visalia 2012

		Italian Ryegrass	Ripgut Brome	Common Chickweed	Volunteer Barley	Wheat Injury
Treatments	**Rates/A**	**39 DAT**	**39 DAT**	**39 DAT**	**39 DAT**	**39 DAT**
1. Simplicity (4SC)	6.75 floz*	93	0	100	0	0
2. Simplicity + AMS	6.75 floz + 1.5 lb ai*	90	0	100	0	0
3. Simplicity + COC	6.75 floz + 1.25%	80	0	100	0	0
4. Osprey (4.5WG) + AMS	4.75 oz + 1.5 lb ai*	95	100	100	100	0
5. Axial (0.42EC)	16.4 floz	95	0	100	0	0
6. Simplicity + Express (50SG)	6.75 floz + 0.25 oz*	95	0	100	0	0
7. Simplicity + Express	6.75 floz + 0.5 oz*	95	0	100	0	0
8. Express + MCPA Amine (3.7EC) + Axial	0.25 oz + 1 pt + 16.4 floz	91	0	100	0	0
9. Express + MCPA Amine + Axial	0.5 oz + 1 pt + 16.4 floz	93	0	100	0	0
10. UTC		0	0	0	0	0

*0.5% of NIS was used

Table 4. Percent Control – Tank-Mixture Study for Broadleaf /Wild Oat Control, Visalia 2012

		Wild Oat	Common Chickweed	Burning Nettle	Shepherds Purse	Wheat Injury
Treatments	**Rate/A**	**54 DAT**	**54 DAT**	**54 DAT**	**54 DAT**	**54 DAT**
1. Express + MCPA Amine + Axial	0.25 oz + 1 pt + 16.4 floz*	100	100	100	100	0
2. Express + MCPA Amine + Axial	0.5 oz + 1 pt + 16.4 floz *	100	100	100	100	0
3. Express + MCPA Amine + Axial	0.25 oz + 1 pt + 16.4 floz	100	100	100	100	0
4. Express + MCPA Amine + Axial	0.5 oz + 1 pt + 16.4 floz	100	100	100	100	0
5. Express + MCPA Amine + Axial	0.25 oz + 12 floz + 16.4 floz*	100	100	100	100	0
6. Express + MCPA Amine + Axial	0.5 oz + 12 floz + 16.4 floz*	100	100	100	100	0
7. Express + MCPA Amine + Axial	0.25 oz + 12 floz + 16.4 floz	100	100	100	100	0
8. Express + MCPA Amine + Axial	0.5 oz + 12 floz + 16.4 floz	100	100	100	100	0
9. Express + 2,4-D + Axial	0.25 oz + 1 pt + 16.4 floz*	100	100	100	100	0
10. Express + 2,4-D + Axial	0.5 oz + 1 pt + 16.4 floz*	100	100	100	100	0
11. Express + 2,4-D + Axial	0.25 oz + 1 pt + 16.4 floz	100	100	100	100	0
12. Express + 2,4-D + Axial	0.5 oz + 1 pt + 16.4 floz	100	100	100	100	0
13. Express + 2,4-D + Axial	0.25 oz + 12 floz + 16.4 floz*	100	100	100	100	0
14. Express + 2,4-D + Axial	0.5 oz + 12 floz + 16.4 floz*	100	100	100	100	0
15. Express + 2,4-D + Axial	0.25 oz + 12 floz + 16.4 floz	100	100	100	100	0
16. Express + 2,4-D + Axial	0.5 oz + 12 floz + 16.4 floz	100	100	100	100	0
17. Express + Clarity + Axial	0.25 oz + 4 floz + 16.4 floz*	100	100	100	100	0
18. Express + Clarity + Axial	0.5 oz + 4 floz + 16.4 floz*	100	100	100	100	0
19. Express + Clarity + Axial	0.25 oz + 4 floz + 16.4 floz	100	100	100	100	0
20. Express + Clarity + Axial	0.5 oz + 4 floz + 16.4 floz	100	100	100	100	0
21. UTC	-----	0	0	0	0	0

*0.25% of NIS was used

Table 5. Broadleaf and Grass Herbicide Tank-Mix Study, Tulelake, 2012

		Wheat Injury	Wild Oats
Treatments	**Rate/A**	**54 DAT**	**54 DAT**
1. Express	0.5 oz*	5.5	12.5
2. Axial	16.4 floz	4.8	98.8
3. Simplicity	6.75floz*	1.3	47.5
4. Simplicity + AMS	6.75 floz + 1.5 lbs*	5.0	71.3
5. Simplicity + COC	6.75 floz + 1.25%	2.5	54.5
6. Puma	10.5 floz	9.3	85.0
7. Osprey + AMS	4.75 oz + 1.5 lbs*	31.3	76.3
8. Express + Axial	0.5 oz + 16.4 floz	5.8	85.9
9. MCPA Amine + Axial	16 floz + 16.4 floz	7.3	95.5
10. Weedar + Axial	16 floz + 16.4 floz	11.3	96.3
11. Weedone + Axial	16 floz + 16.4 floz	7.5	98.9
12. Banvel + Axial	4 floz + 16.4 floz	10.0	93.1
13. Express + MCPA Amine + Axial	0.25 oz + 12 floz + 16.4 floz	5.5	94.3
14. Express + MCPA Amine + Axial	0.5 oz + 12 floz + 16.4 floz	4.3	94.5
15. Express + Weedar + Axial	0.25 oz + 12 floz + 16.4 floz	3.0	93.0
16. Express + Weedar + Axial	0.5 oz + 12 floz + 16.4 floz	5.0	96.0
17. Express + Weedone + Axial	0.25 oz + 12 floz + 16.4 floz	6.0	97.0
18. Express + Weedone + Axial	0.5 oz + 12 floz + 16.4 floz	7.5	88.0
19. Express + Banvel + Axial	0.25 oz + 4 floz + 16.4 floz	5.3	95.9
20. Express + Banvel + Axial	0.5 oz + 4 floz + 16.4 floz	8.5	89.5
21. Express + MCPA Amine + Banvel + Axial	0.5 oz + 12 floz + 2 floz + 16.4 floz	5.0	96.0
22. UTC	-----	1.3	0.0

*0.5% of NIS was used

Due to frost all treatments gave some injury.