California Wheat Commission

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PROJECT TITLE: **Weed Management in California Wheat 2013**

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Abstract/Summary of Results and Conclusions

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 in one tank mixture in order to cut costs and labor. However, when mixing different herbicides, new concerns about crop safety call for more research in tank mixture options. Research was conducted in the San Joaquin Valley in the 2013 production season, generally focusing on the interactions between several different herbicides at varying rates, with and without a surfactant, when applied as a tank mixture. After trials were completed, it was noted that no treatment in any trial caused severe or lasting injury, and what little amount of injury there was did not significantly vary between trials. Simplicity grass and broadleaf herbicide is at DPR waiting for registration, of which results from these studies were part of the registration package.

Introduction and Objectives

Wheat is one of the most important crops throughout California, and for small grain producers, weeds pose a significant problem that nearly always requires treatment. Although broadleaf and grassy weeds can be reduced by crop rotation and tillage, these cultural practices are being replaced by greater dependence on herbicides. In addition, this dependence raised concern about the evolution of herbicide-resistant weeds.

Recently, several new small grain herbicides have been released to the market and have been successfully used in different parts of the country. Growers in California are hesitant to use these herbicides because they are unsure about the crop injury that could result from a chemical that they are unfamiliar with. Research in this area of the country was necessary to evaluate the safety of these new herbicides and to provide confidence for California growers.

Herbicide Tank-mix Weed Control in Small Grains

Trial was conducted in Visalia CA on January 2, 2013 in the morning hours. Temperature at time of planting was 54° F and soil type was 70% Crosscreek (Fine loam). Plot sizes were 7' x 280' with 4 replications. Herbicides used in the trial were Express, MCPA, Axial, 2,4D, and Clarity. Application was applied by hand with a CO_2-pressurized backpack sprayer, with TeeJet 8002 flat fan nozzles, and calibrated to deliver with a spray volume of 30 GPA at 3 mph. Spray height was maintained at 0.5m. Wheat was at the 4-6 leaf stage and 4-7 "tall. Weed present at the time of application: wild oats (*Avena fatua*) (2-4 lf), Shepherd's purse (*Capsella bursa-pastoris*) (1-2" tall), common chickweed (*Stellaria media*) 1-2 diameter), and burning nettle (*Urtica urens*) (1/2-1" tall). Evaluations were made 7 days after treatment (DAT).

Results

All herbicides gave 100% control on all tank mixes by 54 DAT and there was no sign of crop injury or antagonism.

Table 1.

Percent Wheat (*Triticum*) Injury						
		20-Jan	26-Jan	2-Feb	6-Mar	16-Apr
Treatments	Rate/A	7 DAT	13 DAT	21 DAT	54 DAT	95 DAT
1. Express + MCPA Amine + Axial + NIS	0.25 oz + 1 pt + 16.4 floz + 0.25%	0	0	0	0	0
2. Express + MCPA Amine + Axial + NIS	0.5 oz + 1 pt + 16.4 floz + 0.25%	0	0	0	0	0
3. Express + MCPA Amine + Axial	0.25 oz + 1 pt + 16.4 floz	0	0	0	0	0
4. Express + MCPA Amine + Axial	0.5 oz + 1 pt + 16.4 floz	0	0	0	0	0
5. Express + MCPA Amine + Axial + NIS	0.25 oz + 12 floz + 16.4 floz + 0.25%	0	0	0	0	0
6. Express + MCPA Amine + Axial + NIS	0.5 oz + 12 floz + 16.4 floz + 0.25%	0	0	0	0	0
7. Express + MCPA Amine + Axial	0.25 oz + 12 floz + 16.4 floz	0	0	0	0	0
8. Express + MCPA Amine + Axial	0.5 oz + 12 floz + 16.4 floz	0	0	0	0	0
9. Express + 2,4-D + Axial + NIS	0.25 oz + 1 pt + 16.4 floz + 0.25%	0	0	0	0	0
10. Express + 2,4-D + Axial + NIS	0.5 oz + 1 pt + 16.4 floz + 0.25%	0	0	0	0	0
11. Express + 2,4-D + Axial	0.25 oz + 1 pt + 16.4 floz	0	0	0	0	0
12. Express + 2,4-D + Axial	0.5 oz + 1 pt + 16.4 floz	0	0	0	0	0
13. Express + 2,4-D + Axial + NIS	0.25 oz + 12 floz + 16.4 floz + 0.25%	0	0	0	0	0
14. Express + 2,4-D + Axial + NIS	0.5 oz + 12 floz + 16.4 floz + 0.25%	0	0	0	0	0
15. Express + 2,4-D + Axial	0.25 oz + 12 floz + 16.4 floz	0	0	0	0	0
16. Express + 2,4-D + Axial	0.5 oz + 12 floz + 16.4 floz	0	0	0	0	0
17. Express + Clarity + Axial + NIS	0.25 oz + 4 floz + 16.4 floz + 0.25%	0	0	0	0	0
18. Express + Clarity + Axial + NIS	0.5 oz + 4 floz + 16.4 floz + 0.25%	0	0	0	0	0
19. Express + Clarity + Axial	0.25 oz + 4 floz + 16.4 floz	0	0	0	0	0
20. Express + Clarity + Axial	0.5 oz + 4 floz + 16.4 floz	0	0	0	0	0
21. UTC	-----	0	0	0	0	0

Table 2.

Wild Oats (*Avena fatua*) Percent Control						
		20-Jan	26-Jan	2-Feb	6-Mar	16-Apr
Treatments	Rate/A	7 DAT	13 DAT	21 DAT	54 DAT	95 DAT
1. Express + MCPA Amine + Axial + NIS	0.25 oz + 1 pt + 16.4 floz + 0.25%	10	15	79	100	100
2. Express + MCPA Amine + Axial + NIS	0.5 oz + 1 pt + 16.4 floz + 0.25%	10	16	79	100	100
3. Express + MCPA Amine + Axial	0.25 oz + 1 pt + 16.4 floz	10	15	71	100	100
4. Express + MCPA Amine + Axial	0.5 oz + 1 pt + 16.4 floz	10	15	76	100	100
5. Express + MCPA Amine + Axial + NIS	0.25 oz + 12 floz + 16.4 floz + 0.25%	10	15	79	100	100
6. Express + MCPA Amine + Axial + NIS	0.5 oz + 12 floz + 16.4 floz + 0.25%	10	16	79	100	100
7. Express + MCPA Amine + Axial	0.25 oz + 12 floz + 16.4 floz	9	15	80	100	100
8. Express + MCPA Amine + Axial	0.5 oz + 12 floz + 16.4 floz	10	15	79	100	100
9. Express + 2,4-D + Axial + NIS	0.25 oz + 1 pt + 16.4 floz + 0.25%	10	15	80	100	100
10. Express + 2,4-D + Axial + NIS	0.5 oz + 1 pt + 16.4 floz + 0.25%	10	15	79	100	100
11. Express + 2,4-D + Axial	0.25 oz + 1 pt + 16.4 floz	10	15	80	100	100
12. Express + 2,4-D + Axial	0.5 oz + 1 pt + 16.4 floz	10	15	78	100	100
13. Express + 2,4-D + Axial + NIS	0.25 oz + 12 floz + 16.4 floz + 0.25%	10	15	79	100	100
14. Express + 2,4-D + Axial + NIS	0.5 oz + 12 floz + 16.4 floz + 0.25%	10	15	78	100	100
15. Express + 2,4-D + Axial	0.25 oz + 12 floz + 16.4 floz	10	15	79	100	100
16. Express + 2,4-D + Axial	0.5 oz + 12 floz + 16.4 floz	10	15	78	100	100
17. Express + Clarity + Axial + NIS	0.25 oz + 4 floz + 16.4 floz + 0.25%	10	15	80	100	100
18. Express + Clarity + Axial + NIS	0.5 oz + 4 floz + 16.4 floz + 0.25%	10	15	80	100	100
19. Express + Clarity + Axial	0.25 oz + 4 floz + 16.4 floz	10	15	79	100	100
20. Express + Clarity + Axial	0.5 oz + 4 floz + 16.4 floz	10	15	76	100	100
21. UTC	-----	0	0	0	0	0

Table 3.

Burning Nettle (*Urtica urens*) Percent Control						
		20-Jan	26-Jan	2-Feb	6-Mar	16-Apr
Treatments	Rate/A	7 DAT	13 DAT	21 DAT	54 DAT	95 DAT
1. Express + MCPA Amine + Axial + NIS	0.25 oz + 1 pt + 16.4 floz + 0.25%	10	41	86	100	100
2. Express + MCPA Amine + Axial + NIS	0.5 oz + 1 pt + 16.4 floz + 0.25%	10	48	86	100	100
3. Express + MCPA Amine + Axial	0.25 oz + 1 pt + 16.4 floz	10	41	85	100	100
4. Express + MCPA Amine + Axial	0.5 oz + 1 pt + 16.4 floz	10	48	88	100	100
5. Express + MCPA Amine + Axial + NIS	0.25 oz + 12 floz + 16.4 floz + 0.25%	10	46	85	100	100
6. Express + MCPA Amine + Axial + NIS	0.5 oz + 12 floz + 16.4 floz + 0.25%	10	44	89	100	100
7. Express + MCPA Amine + Axial	0.25 oz + 12 floz + 16.4 floz	9	44	84	100	100
8. Express + MCPA Amine + Axial	0.5 oz + 12 floz + 16.4 floz	10	49	86	100	100
9. Express + 2,4-D + Axial + NIS	0.25 oz + 1 pt + 16.4 floz + 0.25%	10	44	86	100	100
10. Express + 2,4-D + Axial + NIS	0.5 oz + 1 pt + 16.4 floz + 0.25%	10	46	86	100	100
11. Express + 2,4-D + Axial	0.25 oz + 1 pt + 16.4 floz	10	43	87	100	100
12. Express + 2,4-D + Axial	0.5 oz + 1 pt + 16.4 floz	10	46	86	100	100
13. Express + 2,4-D + Axial + NIS	0.25 oz + 12 floz + 16.4 floz + 0.25%	10	40	84	100	100
14. Express + 2,4-D + Axial + NIS	0.5 oz + 12 floz + 16.4 floz + 0.25%	10	48	84	100	100
15. Express + 2,4-D + Axial	0.25 oz + 12 floz + 16.4 floz	10	39	85	100	100
16. Express + 2,4-D + Axial	0.5 oz + 12 floz + 16.4 floz	10	44	88	100	100
17. Express + Clarity + Axial + NIS	0.25 oz + 4 floz + 16.4 floz + 0.25%	10	44	85	100	100
18. Express + Clarity + Axial + NIS	0.5 oz + 4 floz + 16.4 floz + 0.25%	10	41	85	100	100
19. Express + Clarity + Axial	0.25 oz + 4 floz + 16.4 floz	10	43	83	100	100
20. Express + Clarity + Axial	0.5 oz + 4 floz + 16.4 floz	10	48	85	100	100
21. UTC	-----	0	0	0	0	0

Table 4.

Shepherds'purse (*Capsella bursa-pastoris*) Percent Control						
		20-Jan	26-Jan	2-Feb	6-Mar	16-Apr
Treatments	Rate/A	7 DAT	13 DAT	21 DAT	54 DAT	95 DAT
1. Express + MCPA Amine + Axial + NIS	0.25 oz + 1 pt + 16.4 floz + 0.25%	10	38	84	100	100
2. Express + MCPA Amine + Axial + NIS	0.5 oz + 1 pt + 16.4 floz + 0.25%	10	48	81	100	100
3. Express + MCPA Amine + Axial	0.25 oz + 1 pt + 16.4 floz	10	41	76	100	100
4. Express + MCPA Amine + Axial	0.5 oz + 1 pt + 16.4 floz	10	45	84	100	100
5. Express + MCPA Amine + Axial + NIS	0.25 oz + 12 floz + 16.4 floz + 0.25%	10	41	84	100	100
6. Express + MCPA Amine + Axial + NIS	0.5 oz + 12 floz + 16.4 floz + 0.25%	10	40	81	100	100
7. Express + MCPA Amine + Axial	0.25 oz + 12 floz + 16.4 floz	9	40	81	100	100
8. Express + MCPA Amine + Axial	0.5 oz + 12 floz + 16.4 floz	10	48	85	100	100
9. Express + 2,4-D + Axial + NIS	0.25 oz + 1 pt + 16.4 floz + 0.25%	10	40	79	100	100
10. Express + 2,4-D + Axial + NIS	0.5 oz + 1 pt + 16.4 floz + 0.25%	10	43	84	100	100
11. Express + 2,4-D + Axial	0.25 oz + 1 pt + 16.4 floz	10	40	82	100	100
12. Express + 2,4-D + Axial	0.5 oz + 1 pt + 16.4 floz	10	44	83	100	100
13. Express + 2,4-D + Axial + NIS	0.25 oz + 12 floz + 16.4 floz + 0.25%	10	40	83	100	100
14. Express + 2,4-D + Axial + NIS	0.5 oz + 12 floz + 16.4 floz + 0.25%	10	48	81	100	100
15. Express + 2,4-D + Axial	0.25 oz + 12 floz + 16.4 floz	10	41	81	100	100
16. Express + 2,4-D + Axial	0.5 oz + 12 floz + 16.4 floz	10	40	83	100	100
17. Express + Clarity + Axial + NIS	0.25 oz + 4 floz + 16.4 floz + 0.25%	10	43	80	100	100
18. Express + Clarity + Axial + NIS	0.5 oz + 4 floz + 16.4 floz + 0.25%	10	45	83	100	100
19. Express + Clarity + Axial	0.25 oz + 4 floz + 16.4 floz	10	43	83	100	100
20. Express + Clarity + Axial	0.5 oz + 4 floz + 16.4 floz	10	46	83	100	100
21. UTC	-----	0	0	0	0	0

Broadleaf Control Study in Wheat

Trial was conducted in Visalia CA on February 13, 2013 in the morning hours. Temperature at time of application was 54° F and soil type was 70% Crosscreek (Fine loam). Plot sizes were 7' x 280' with 4 replications. Herbicides used in the trial were Express, MCPA, Axial, 2,4D, and ClarityApplication was applied by hand with a CO_2-pressurized backpack sprayer, with TeeJet 8002 flat fan nozzles, and calibrated to deliver with a spray volume of 30 GPA at 3 mph. Spray height was maintained at 0.5m. A small grain was at the 4-6 leaf stage and 4-7 "tall. Weed present at the time of application: wild oats (*Avena fatua*) (2-4 lf), Sheppard's purse (*Capsella bursa-pastoris*) (1-2" tall), common chickweed (*Stellaria media*) 1-2 diameter), and burning nettle (*Urtica urens*) (1/2-1" tall). Evaluations were made 7 days after treatment (DAT).

Table 1.

Percent Wheat (*Triticum aestivum*) Injury					
		21-Feb	**28-Feb**	**7-Mar**	**14-Mar**
Treatments	**Rate/A**	**8 DAT**	**15 DAT**	**22 DAT**	**29 DAT**
1. Shark + AMS + NIS	2 floz + 10 lbs/100 gal. + 0.25% v/v	11	9	6	1
2. Shark + Express + AMS + NIS	2 floz + 0.25 oz + 10 lbs/100 gal. + 0.25% v/v	7	7	5	1
3. Shark + Express + AMS + NIS	2 floz + 0.5 oz + 10 lbs/100 gal. + 0.25% v/v	8	8	5	1
4. Shark + Express + AMS + NIS	1 floz + 0.25 oz + 10 lbs/100 gal. + 0.25% v/v	8	7	4	1
5. Shark + Express + AMS + NIS	1 floz + 0.5 oz + 10 lbs/100 gal. + 0.25% v/v	6	6	3	1
6. Shark + Express + MCPA + AMS + NIS	1 floz + 0.25 oz + 1 pt + 10 lbs/100 gal. + 0.25% v/v	5	5	3	0
7. Shark + Express + Clarity + AMS + NIS	1 floz + 0.25 oz + 3 floz + 10 lbs/100 gal. + 0.25% v/v	5	5	3	0
8. Shark + Axial + NIS	2 floz + 16.4 floz + 0.25% v/v	10	10	7	1
9. Shark + Axial + NIS	2 floz + 8.2 floz + 0.25% v/v	8	8	6	0
10. Shark + BST + AMS + NIS	2 floz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	8	8	7	1
11. Shark + Express + BST + AMS + NIS	2 floz + 0.25 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	7	5	3	0
12. Shark + Express + BST + AMS + NIS	2 floz + 0.5 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	11	4	2	0
13. Shark + Express + BST + AMS + NIS	1 floz + 0.25 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	4	4	2	0
14. Shark + Express + BST + AMS + NIS	1 floz + 0.5 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	4	4	2	0
15. Shark + Express + MCPA + BST + AMS + NIS	1 floz + 0.25 oz + 1 pt + 2 qt + 10 lbs/100 gal. + 0.25% v/v	4	3	1	0
16. Shark + Express + Clarity + BST + AMS + NIS	1 floz + 0.25 oz + 3 floz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	4	3	2	0
17. Shark + Axial + BST + NIS	2 floz + 16.4 floz + 2 qt + 0.25% v/v	13	9	5	1
18. Shark + Axial + BST + NIS	2 floz + 8.2 floz + 2 qt + 0.25% v/v	11	10	3	0
19. Express + AMS + NIS	0.5 oz + 10 lbs/100 gal. + 0.25% v/v	0	0	0	0
20. Untreated	-----	0	0	0	0

Table 2.

London Rocket (*Sisymbrium irio*) Percent Injury					
		21-Feb	28-Feb	7-Mar	14-Mar
Treatments	**Rate/A**	**8 DAT**	**15 DAT**	**22 DAT**	**29 DAT**
1. Shark + AMS + NIS	2 floz + 10 lbs/100 gal. + 0.25% v/v	30	66	74	74
2. Shark + Express + AMS + NIS	2 floz + 0.25 oz + 10 lbs/100 gal. + 0.25% v/v	28	61	85	85
3. Shark + Express + AMS + NIS	2 floz + 0.5 oz + 10 lbs/100 gal. + 0.25% v/v	28	71	93	93
4. Shark + Express + AMS + NIS	1 floz + 0.25 oz + 10 lbs/100 gal. + 0.25% v/v	24	78	89	89
5. Shark + Express + AMS + NIS	1 floz + 0.5 oz + 10 lbs/100 gal. + 0.25% v/v	29	79	86	86
6. Shark + Express + MCPA + AMS + NIS	1 floz + 0.25 oz + 1 pt + 10 lbs/100 gal. + 0.25% v/v	43	81	93	93
7. Shark + Express + Clarity + AMS + NIS	1 floz + 0.25 oz + 3 floz + 10 lbs/100 gal. + 0.25% v/v	34	81	83	83
8. Shark + Axial + NIS	2 floz + 16.4 floz + 0.25% v/v	41	70	71	71
9. Shark + Axial + NIS	2 floz + 8.2 floz + 0.25% v/v	34	76	69	69
10. Shark + BST + AMS + NIS	2 floz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	29	69	74	74
11. Shark + Express + BST + AMS + NIS	2 floz + 0.25 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	34	85	80	80
12. Shark + Express + BST + AMS + NIS	2 floz + 0.5 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	43	89	93	93
13. Shark + Express + BST + AMS + NIS	1 floz + 0.25 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	23	65	79	79
14. Shark + Express + BST + AMS + NIS	1 floz + 0.5 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	36	73	78	78
15. Shark + Express + MCPA + BST + AMS + NIS	1 floz + 0.25 oz + 1 pt + 2 qt + 10 lbs/100 gal. + 0.25% v/v	43	86	91	91
16. Shark + Express + Clarity + BST + AMS + NIS	1 floz + 0.25 oz + 3 floz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	37	78	85	82
17. Shark + Axial + BST + NIS	2 floz + 16.4 floz + 2 qt + 0.25% v/v	40	80	86	86
18. Shark + Axial + BST + NIS	2 floz + 8.2 floz + 2 qt + 0.25% v/v	39	80	80	77
19. Express + AMS + NIS	0.5 oz + 10 lbs/100 gal. + 0.25% v/v	14	54	59	59
20. Untreated	-----	0	0	0	0

Table 3.

Malva (*Malva neglecta*) Percent Control					
		21-Feb	28-Feb	7-Mar	14-Mar
Treatments	Rate/A	8 DAT	15 DAT	22 DAT	29 DAT
1. Shark + AMS + NIS	2 floz + 10 lbs/100 gal. + 0.25% v/v	18	25	32	45
2. Shark + Express + AMS + NIS	2 floz + 0.25 oz + 10 lbs/100 gal. + 0.25% v/v	15	50	50	65
3. Shark + Express + AMS + NIS	2 floz + 0.5 oz + 10 lbs/100 gal. + 0.25% v/v	0	10	40	75
4. Shark + Express + AMS + NIS	1 floz + 0.25 oz + 10 lbs/100 gal. + 0.25% v/v	8	18	50	68
5. Shark + Express + AMS + NIS	1 floz + 0.5 oz + 10 lbs/100 gal. + 0.25% v/v	30	50	62	73
6. Shark + Express + MCPA + AMS + NIS	1 floz + 0.25 oz + 1 pt + 10 lbs/100 gal. + 0.25% v/v	25	63	76	68
7. Shark + Express + Clarity + AMS + NIS	1 floz + 0.25 oz + 3 floz + 10 lbs/100 gal. + 0.25% v/v	20	48	50	63
8. Shark + Axial + NIS	2 floz + 16.4 floz + 0.25% v/v	25	40	40	56
9. Shark + Axial + NIS	2 floz + 8.2 floz + 0.25% v/v	10	45	27	48
10. Shark + BST + AMS + NIS	2 floz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	5	60	40	54
11. Shark + Express + BST + AMS + NIS	2 floz + 0.25 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	25	30	37	64
12. Shark + Express + BST + AMS + NIS	2 floz + 0.5 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	20	58	35	66
13. Shark + Express + BST + AMS + NIS	1 floz + 0.25 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	10	30	37	61
14. Shark + Express + BST + AMS + NIS	1 floz + 0.5 oz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	30	22	40	69
15. Shark + Express + MCPA + BST + AMS + NIS	1 floz + 0.25 oz + 1 pt + 2 qt + 10 lbs/100 gal. + 0.25% v/v	30	45	47	66
16. Shark + Express + Clarity + BST + AMS + NIS	1 floz + 0.25 oz + 3 floz + 2 qt + 10 lbs/100 gal. + 0.25% v/v	10	60	50	46
17. Shark + Axial + BST + NIS	2 floz + 16.4 floz + 2 qt + 0.25% v/v	30	70	60	56
18. Shark + Axial + BST + NIS	2 floz + 8.2 floz + 2 qt + 0.25% v/v	30	63	60	59
19. Express + AMS + NIS	0.5 oz + 10 lbs/100 gal. + 0.25% v/v	5	25	28	61
20. Untreated	-----	0	0	0	0

Italian Ryegrass Control in Wheat

Due to defective herbicide formulation of Axial the trial was terminated towards the middle of evaluation

Discussion, Conclusions and Recommendations

The low incidence of injury suggests that there is minimal if any antagonism between herbicides used in the many tank mixtures. There appears to be adequate safety in all treatments. Research should continue to further verify the safety of new wheat herbicides and when possible to work with chemical companies and DPR to change some labels to allow more flexibility with herbicide application using tank mixes. Simplicity grass and broadleaf herbicide is at DPR waiting for registration, of which results from previous year studies were part of the registration package. Syngenta added MCPA as a tank mix to Axial as a result of these studies, and is considering expanding this to more herbicides.

Budget: Funding was used almost entirely for employee labor/benefits with a small amount used for supplies.