Automated Thinner Spray Material Evaluation

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Summary: Recently, there has been a rapid growth in the use of one-use drip tape, used in conjunction with automated thinners that use nitrogen fertilizers as the thinning agent. This practice has an issue because the nitrogen that is applied with the thinning operation does not get incorporated deep enough into the soil for the roots to utilize it. Growers must now report all nitrogen applications each year to the Regional Water Quality Control Board. The extra nitrogen that is applied for thinning is counted against the nitrogen budget of the lettuce crop, but it does not benefit the crop as it would if sprinkler irrigation was used. The added nitrogen creates an issue in the reporting to the water board. As a result, there is a need to find thinning materials that have less nitrogen. Growers are also concerned about the use of Shark, the only herbicide that is currently registered for use in lettuce thinning, because of collateral damage that occurs if the material wafts onto the keeper plants. In one trial, To address these concerns we examined a variety of materials as potential lettuce thinning materials. Shark, ET and ammonium thiosulfate provided good control of lettuce plants. Raptor and Rely were also effective, but they are slower acting herbicides that took one week to reach full efficacy. When plants were bigger (24 days after the first water – DAW) and moist, none of the materials were effective. ET was effective at 1.0 to 3.0 ounces per acre. Depending on the trial, Shark was most effective at 0.25 to 1.0 ounce per acre. Weed Rot increased the efficacy of 14-0-0-5 and potassium thiosulfate over these materials in combination with MSO and DyneAmic. One promising area to research is the use of a material that contains a lower amount of nitrogen and mixing it with low rates of Shark to heat it up and make it more effective. Weed Rot is an organic herbicide that by itself was not effective, but it heated up materials that it was mixed with. It may be that this material is acting like a surfactant which would be another area to research.

Methods: ***Trial No. 1.*** First water on April 30 and materials applied on May 17 (18 DAW). All materials applied in the equivalent of 39 gallons per acre. The treatments were a demonstration plot and were not replicated. ***Trial No. 2.*** First water on April 30 and materials applied on May 23 (24 DAW). All materials applied with one pass of an 8005 nozzle @ 30 psi applying the equivalent of 21.6 gallons per acre. Materials were applied at 11:00 a.m. to allow the plants to dry following a wet foggy night. ***Trial No. 3.*** First water July 3, 2019 and materials applied on July 23 (20 DAW). All materials applied with one pass of an 8005 nozzle @ 30 psi applying the equivalent of 21.6 gallons per acre. ***Trial No. 4.*** First water July 30 and materials applied on August 16 (17 DAW). All materials applied with one pass of an 8005 nozzle @ 30 psi applying the equivalent of 21.6 gallons per acre. ***Details common to all trials:*** All plots were one 40-inch bed wide by 15 feet long and replicated 4 times in a randomized complete block design (except trial 1). The lettuce plants and weed control was rated according to the following scale: 0 – no control to 10 – lettuce plants dead.

Results: ***Trial No. 1.*** Weather conditions were ideal, and the plants were a small enough (18 DAW) which provided good conditions to evaluate efficacy. Shark, ET and Ammonium Thiosulfate + Weed Rot provided the most complete control on May 20 (Table 1). Ammonium Thiosulfate + MSO/DyneAmic was less effective in this trial than the combination with Weed Rot. Raptor and Rely provide good efficacy one week after application, May 28. ***Trial No. 2.*** This trial was put out in the same field as Trial No. 1, but was applied 24 days after the 1st water. As a result, the plants were bigger than ideal. In addition, the morning of the application was foggy and wet. The application was delayed until 11:00 to allow the plants time to dry, but still

may not have been ideal. None of the treatments provided excellent weed control on May 24 (one day after treatment); however, Suppress and Axxe provided the best overall control on this evaluation date (Table 2). Lettuce and weed control improved in the Raptor, ET and Shark treatments on May 28 (5 days after treatment). Weed Rot improved the efficacy of potassium thiosulfate over MSO/DyneAmic. The high salt solution of KCl was not effective. ***Trial No. 3.*** This trial was applied 20 days after the first water, and this was probably a bit too late as indicated by the fact that Shark (the standard material) did not perform well at either rate (Table 3). ET at 1.0 and 2.0 ounces/A gave good control of the lettuce and weeds. Suppress in combination with Oroboost had improved efficacy over combinations with mineral or paraffinic oils. ***Trial No. 4.*** The trial was applied 17 days after the first water. ET at 3.0 fl oz/A gave complete control of lettuce and weeds (Table 4). The rate of Shark affected the level of control: at 1.0 fl oz/A gave near complete control, but at 0.25 and 0.125 fl oz/A the level of control was significantly reduced. Weed Rot improved the efficacy of 14-0-0-5 over MSO/DyneAmic. Small quantities of Shark improved the efficacy of a low efficacy Material like 2-6-2.

Table 1. Trial No. 1

Treatment	Rate/A	Lettuce Ratings[1]		
		May 20	May 23	May 28
Raptor MSO Ammonium sulfate	4.0 fl oz 1% v/v 15% wt/v	1.0	5.0	8.0
ET MSO	1.0 fl oz 1% v/v	9.0	9.0	9.8
Rely	29 oz/A	2.0	7.0	9.0
Shark DyneAmic	0.17 fl oz 0.25% v/v	9.0	9.9	9.8
Suppress Oroboost Natural Oil	6% v/v 0.5% v/v oil 1% v/v	8.0	8.0	8.0
Axxe Oroboost Natural Oil	10% v/v 0.5% v/v 1% v/v	7.0	7.5	8.5
Weed Away Oroboost Natural Oil	12% v/v 0.5% v/v 1% v/v	0.0	0.0	0.0
Weed Rot Oroboost Natural Oil	9% v/v 0.5% v/v 1% v/v	0.0	0.0	0.0
Potassium thiosulfate MSO DyneAmic	39 GPA MSO 1% v/v NIS 0.25% wt/v	2.0	2.0	6.0
Ammonium thiosulfate MSO DyneAmic	39 GPA MSO 1% v/v NIS 0.25% wt/v	7.0	8.5	9.0
Potassium thiosulfate Weed Rot	39 GPA 9% v/v	3.0	4.0	5.0
Ammonium thiosulfate Weed Rot	39 GPA 9%v/v	9.0	9.0	9.5

Table 2. Trial No. 2

Treatment	Rate/A	Lettuce Ratings[1]	
		May 24	May 28
Raptor MSO Ammonium sulfate	4.0 fl oz 1% v/v 15% wt/v	0.8	3.0
ET MSO DyneAmic	2.0 fl oz 1% v/v 0.25% v/v	5.8	8.3
Shark DyneAmic	0.17 fl oz 0.25% v/v	5.8	7.0
Suppress Oroboost Mineral oil	6% v/v 0.5% v/v 1% v/v	6.5	5.0
Axxe Oroboost Mineral Oil	10% v/v 0.5% v/v 1% v/v	6.3	5.8
Weed Rot Oroboost Natural Oil	9% v/v 0.5% v/v 1% v/v	0.6	0.4
Potassium thiosulfate MSO DyneAmic	21 GPA 1% v/v 0.25% v/v	3.0	3.0
Potassium thiosulfate Weed Rot	21 GPA 9% v/v	4.3	4.5
Calcium thiosulfate MSO DyneAmic	21 GPA 1% v/v 0.25% wt/v	1.5	1.0
Calcium thiosulfate Shark DyneAmic	21 GPA 0.17 fl oz 0.25% v/v	4.5	4.0
14-0-0-5 MSO DyneAmic	21 GPA 1% v/v 0.25% wt/v	4.3	4.3
Untreated	---	0.0	0.0
Pr>F treat		0.0000	0.0000
$LSD_{0.05}$		1.1	1.2
Observational treatments			
KCl MSO DyneAmic	21 GPA 1% v/v 0.25% v/v	3.0	0.0
Weed Away Oroboost Mineral Oil	12% v/v 0.5% v/v 1% v/v	1.0	0.0

Table 3. Trial No. 3

Treatment	Rate/A	Lettuce	Groundsel	Pig weed	Shepherd's purse	Malva
ET MSO DyneAmic	3.0 fl oz 1% v/v 0.25% v/v	9.8	9.8	10.0	10.0	10.0
ET MSO DyneAmic	2.0 fl oz 1% v/v 0.25% v/v	9.1	10.0	10.0	9.8	9.9
Shark DyneAmic	0.13 fl oz 0.25% v/v	7.0	6.8	6.5	6.5	7.6
Shark DyneAmic	0.26 fl oz 0.25% v/v	7.5	8.0	7.0	8.0	9.1
Suppress Mineral oil	6% v/v 1% v/v	4.8	3.8	3.8	4.3	4.0
Suppress Paraffinic oil	6% v/v 1% v/v	4.5	4.0	4.0	5.0	4.0
Suppress Oroboost	6% v/v 0.5% v/v	6.0	5.0	5.0	6.0	5.3
Suppress Oroboost Mineral oil	6% v/v 0.5% v/v 1% v/v	5.5	5.0	5.5	5.8	5.0
Axxe Oroboost Mineral Oil	10% v/v 0.5% v/v 1% v/v	5.0	4.8	4.8	5.3	4.8
14-0-0-5 MSO DyneAmic	21 GPA 1.0% v/v 0.5% v/v	2.6	4.5	3.8	5.0	4.8
14-0-0-5 Weed Rot	21 GPA 9.0% v/v	4.0	4.5	4.0	4.8	3.8
14-0-0-5 Water MSO DyneAmic	10.5 GPA 10.5 GPA 1.0% v/v 0.5% v/v	1.3	1.3	1.0	1.5	1.3
2-6-2 MSO DyneAmic	21 GPA 1.0% v/v 0.5% v/v	1.5	1.5	1.5	1.5	1.5
Untreated		0.0	0.0	0.0	0.0	0.0
	Pr>F treat	0.0000	0.0000	0.0000	0.0000	0.0000
	$LSD_{0.05}$	1.3	2.2	2.0	2.2	2.3

Table 4. Trial No. 4

Treatment	Rate/A	Lettuce	Shepherd's purse	Sow thistle	Night-shade
Raptor MSO Ammonium sulfate	4.0 fl oz 1% v/v 15% wt/v	2.5	2.5	2.8	1.8
ET MSO DyneAmic	3.0 fl oz 1% v/v 0.25% v/v	10.0	10.0	10.0	10.0
Shark DyneAmic	0.13 fl oz 0.25% v/v	6.5	7.5	7.5	7.5
Shark DyneAmic	0.25 fl oz 0.25% v/v	7.0	7.3	7.5	7.5
Shark DyneAmic	1.0 fl oz 0.25% v/v	9.5	10.0	10.0	10.0
Suppress Oroboost Mineral oil	6% v/v 0.5% v/v 1% v/v	7.0	8.3	8.3	8.3
Axxe Oroboost Mineral Oil	10% v/v 0.5% v/v 1% v/v	5.0	6.0	6.0	6.0
Weed Rot	9.0% v/v	0.8	0.8	0.8	0.8
14-0-0-5 Weed Rot	21 GPA 9.0% v/v	7.5	6.3	6.3	6.0
14-0-0-5 MSO DyneAmic	21 GPA 1.0% v/v 0.25% v/v	4.0	4.0	4.0	4.0
2-6-2 MSO NIS	21 GPA 1.0% v/v 0.25% v/v	1.8	1.8	1.8	1.8
2-6-2 Shark MSO DyneAmic	21 GPA 0.13 fl oz 1.0% v/v 0.25% v/v	6.8	6.8	6.8	6.8
Potassium chloride MSO DyneAmic	254 gm/liter 1.0% v/v 0.25% v/v	0.0	0.0	0.0	0.0
Untreated	---	0.0	0.0	0.0	0.0
	Pr>F treat	0.0000	0.0000	0.0000	0.0000
	$LSD_{0.05}$	1.6	1.8	1.9	1.9