

PERFORMANCE OF NITROGEN LIQUID FERTILIZER SOLUTIONS
IN BROCCOLI USED TO ENHANCE WEED CONTROL

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Grower interest in nitrogen fertilizer sprays for weed control has raised questions about the relative effectiveness of various materials and the contribution these materials make toward the nitrogen nutrition of the crop. A research program established in 1988 evaluated weed control and crop response with four plantings of broccoli.

METHODS

The broccoli variety gem was planted on three separate occasions at the OSU vegetable research farm. The first set of plantings were made on 4/13/88, 4/26/88, and 5/12/88. The entire plot area received a band treatment of 105 lbs. N/A preplant incorporated and no herbicides were used. The 4/13/88 planting was treated at the 20 leaf stage and will be referred to as the late application (Table 1). The 4/26/88 and 5/12/88 plantings were treated at the 12 and 6 leaf stage respectively and will be referred to as the middle and early application, respectively (Tables 1 and 2). Three days after the foliar applications were made, all treatments were brought up to 295 lbs. N/A by side dressing Ammonium Nitrate. A later, second set of plantings, was made on 6/21/88 and also treated at the 6 leaf stage (Table 3). Information about the materials used is as follows:

AN-20 - A manufactured 20-0-0 formulation containing 2.11 lbs N/gallon of product. This formulation is different from a solution prepared by dissolving ammonium nitrate in water and has different herbicidal properties. As used in this study it results in the addition of 127 or 190 lbs of N per acre.

AM-THIO - Ammonium thiosulfate 12-0-0-24 solution containing 1.12 lbs N/gallon was used at the same application rates (gallage) as AN-20 and provided 67 or 100 lbs of N per acre.

MON-UREA - Monourea sulfuric acid 15-0-0-16 is a reaction product of urea and sulfuric acid containing 1.9 lbs N/gallon. For the first three plantings dates it was used at rates of 20 or 30 gallons per acre, contributing 38 or 57 lbs of N per acre, respectively. At the later, second set of plantings monourea sulfuric acid was applied at 10.5 and 15.8 gallons per acre. These rates supplied 20 or 30 lbs of N per acre.

DISCUSSION

Generally the most satisfactory weed control and the least injury to the crop resulted from applications to young broccoli plantings (early application (33 days after planting with broccoli at the 6 leaf stage), and middle application (28 days after planting with broccoli at the 12 leaf stage)). Research plans for the first three plantings were to apply the sprays at an earlier date but rains during the planned spray period resulted in delays. In addition to the development of the crop and weeds beyond that considered optimum, wet weather conditioning of the broccoli plants probably resulted in more crop injury than would be expected for spray applications following dry weather. Crop yield loss (from the spray injury or weed competition) was significant for all spray treatments for the middle (12 leaf stage) and late (20 leaf stage) applications.

Considering results from only younger plantings, the best spray treatments were combinations of AN-20 and ammonium thiosulfate. Not only was there less yield loss (although significant in the second set of plantings), the control of most weed species present, particularly in

later evaluations, was superior to the other spray treatments. However, in all cases the hand weeded checks provided the best weed control.

Later evaluations (2 or 3 weeks after spray applications) showed less crop injury and better weed control than the same plots evaluated soon after (1 or 2 days) the sprays were applied. Apparently many of the weeds continued to respond to the herbicidal effects of the sprays while there was a significant recovery of the broccoli as a result of new growth replacing injured, older leaves.

To more precisely evaluate the contribution of the nitrogenous sprays to the nitrogen nutrition of the broccoli crop, the confounding effects of direct crop injury by the sprays must be separated from the nitrogen nutrition efficacy of these materials. This can be accomplished with additional research by using directed sprays to avoid crop contact in plots kept free of weeds by tillage/hand weeding.

SUMMARY

Yields of broccoli from plots treated with various nitrogenous fertilizer foliar sprays were not equal to yields from plots receiving all applied N in a combination of "at seeding" plus "side-dressing". This result could have happened because (1) the soil applied fertilizer was a more efficient source of N, (2) crop injury from foliar N sprays reduced yields, or (3) the incomplete weed control obtained with foliar applied nitrogen solution sprays resulted in the remaining weeds interfering or competing with the broccoli crop, or a combination of these factors.

Of the spray treatments in this trial the most satisfactory for selective weed control in broccoli was a combination of AN-20 and ammonium thiosulfate. Although not statistically significant, the higher application rate of 90 GPA (45 gallons of each product) appeared to give

results superior to the lower rate of 60 GPA (30 gallons of each product). Applications to younger plantings, approximate one month after seeding, were better than applications to more mature weeds and crop.

If weather conditions during the 3-5 week period after seeding are unfavorable for spraying nitrogen liquid fertilizers for selective weed control, delayed applications, and broccoli plants without sufficient cuticular or epicuticular wax development, can result in poor weed control and excessive crop injury. Growers must weigh these undesirable effects against potential crop loss from weed interference or the expense of removing the weeds by other means.

TABLE 1. Injury and Yield with Nitrogen Liquid Fertilizers Used for Weed Control
Applied on Broccoli at 6 leaf, 12 leaf, and 20 leaf stage

<u>TREATMENT</u>	<u>EARLY APPLICATION</u>				<u>MIDDLE APPLICATION</u>			<u>LATE APPLICATION*</u>	
	Rate (gal/A)	%Broccoli Injury		Yield	% Broccoli Injury		Yield	% Broccoli Injury	Yield
		1st Eval.	2nd Eval.	T/A	1st Eval.	2nd Eval.	T/A	1st Eval.	T/A
CHECK		0	0	4.0	0	0	4.0	0	1.6
AN-20	60	14	5	3.1	29	8	3.7	21	1.9
AN-20	90	15	11	3.3	39	16	2.9	38	1.2
AM-THIO	60	24	11	3.0	38	19	2.7	23	0.2
AM-THIO	90	19	26	2.8	36	18	2.9	28	0.1
AN-20	30	18	8	3.3	40	20	3.2	33	1.2
AM-THIO	30								
AN-20	45	20	10	3.6	44	19	3.0	36	1.0
AM-THIO	45								
MON-UREA	20	76	56	1.5	79	43	2.7	65	0.1
MON-UREA	30	90	73	0.8	78	50	1.9	75	0.0

* Only one injury evaluation made before harvest

LSD (0.05) - Injury 1 = 12
Injury 2 = 11
Yield = 0.625

TABLE 2. Weed Control Using Nitrogen Liquid Fertilizers in Broccoli

TREATMENT	Rate (gal/A)	EARLY APPLICATION ¹				MIDDLE APPLICATION ²				LATE APPLICATION ^{3,4}	
		Pigweed		Groundsel		Pigweed		Groundsel		Pigweed	Groundsel
		Control (%)		Control (%)		Control (%)		Control (%)		Control (%)	Control (%)
		1st Eval.	2nd Eval.	1st Eval.	2nd Eval.	1st Eval.	2nd Eval.	1st Eval.	2nd Eval.	1st Eval.	1st Eval.
Hand-Weeded CHECK	--	100	98	100	98	100	99	100	100	100	100
AN-20	60	45	74	21	73	35	78	10	70	11	5
AN-20	90	50	81	26	73	48	93	28	73	15	9
AM-THIO	60	49	85	40	80	34	80	13	73	13	9
AM-THIO	90	35	81	11	75	31	80	6	68	9	8
AN-20	30	58	84	43	84	46	85	25	75	18	10
AM-THIO	30										
AN-20	45	50	75	42	88	53	80	26	75	14	16
AM-THIO	45										
MON-UREA	20	78	63	84	76	70	65	49	68	48	31
MON-UREA	30	98	79	100	89	78	70	56	73	63	46

LSD (0.05) Pigweed - 1st eval. = 21, 2nd eval. = 13; Groundsel - 1st eval. = 19, 2nd eval. = 9

¹ Six leaf stage² Twelve leaf stage³ Twenty leaf stage⁴ Only one control evaluation was made before harvest.

TABLE 3. Second Set of Treatments - Broccoli Injury, Yield and
Weed Control Using Nitrogen Liquid Fertilizer Applied at 6 Leaf Stage

Treatment	Gal Rate lbs/A	% Broccoli Injury		Yield T/A	WEED CONTROL					
		1st Eval	2nd Eval		Hairy				Wild	
					Pigweed	Nightshade	Radish			
					1	2	1	2	1	2
CHECK		0	0	3.2	90	100	91	99	95	100
AN-20	60	16	21	1.2	74	59	81	58	83	80
AN-20	90	11	11	1.6	73	66	80	85	85	94
AM-THIO	60	18	21	1.9	85	71	93	75	98	90
AM-THIO	90	25	35	1.2	95	80	98	73	98	86
AN-20	30	18	16	1.6	85	98	93	78	96	85
AM-THIO	30									
AN-20	45	24	13	2.1	90	81	95	90	98	96
AM-THIO	45									
MON-UREA	10.5	29	31	1.2	84	64	90	71	88	94
MON-UREA	15.8	30	40	1.0	84	68	90	71	88	94
LSD		7	14	0.7	8	20	8	21	8	13