Early Season Nitrogen Sources for Onions

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The majority of Treasure Valley onions are still grown with furrow irrigation. Furrow irrigation complicates effective nitrogen (N) management because nitrate-N is mobile and easily moved away from onion root systems with the wetting front. Fall and early season N applications are frequently less effective than later sidedressings because of N moved beyond onion root systems prior to the bulbing phase, when most N is needed by the plant. Applied ammonic N sources such as ammonium sulfate and urea, without stabilization, rapidly nitrify to nitrate in soil. Conventional practices may include 1 to 3 side-dressed N applications to ensure adequate N availability. The nitrate-N escaping the reach of onion roots can contribute to shallow groundwaters.

More effective early season N applications may preclude the need for one or two subsequent side-dressed N applications. Several delayed release N fertilizers are marketed with potential for improving the effectiveness of early season applied N. Information on the response of onions to alternative, currently available slow release N sources is lacking. Information is needed on the effectiveness of these materials for furrow irrigated onions. The objective of this study was to evaluate early season banded N sources that would provide season long available N and preclude the need for multiple N applications in furrow irrigated onions.

Methods

Furrow irrigated field studies with yellow sweet Spanish onions (Granero) were conducted in 2008 and 2009 at the Parma R & E Center involving early season sidedressings of urea, NutriSphere treated urea, NFusion mix of uran and Nitamin (Methylene urea), SuperU urea, ESN polymer coated urea, and conventional uran applied in delayed (June) split applications. The early season bandings (April 25-28, 2008 and April 29, 2009) were applied after the first irrigation. The N sources were banded after emergence on the furrow side of the onion bed at rates of 60 and 120 lb N/A. Split uran was sidedressed June 5 and 23, 2008 and June 1 and 16, 2009. A control and split applied 180 lb uran N were also evaluated. Onions were grown using conventional cultural practices. Individual plots were six rows wide and 40 ft long. Treatments were arranged in a randomized complete block with six replications. Residual N was measured preplant and twice in bed centers to measure nitrates moved with the wetting front beyond the onion rows. The percentage of tops down was estimated visually by two different persons and the mean of both estimates used for the data analysis. Onion yields were measured from the four middle rows of each plot and graded into mediums, jumbos, colossals, and super colossals.

Results

Onion maturity by late August 2008 or mid September 2009 was delayed in the untreated control compared to the applied N treatments. The percentage of tops down was more affected by available N in 2009 than 2008. Increasing the applied N rate had little effect in 2008 but increased the percentage of tops down in 2009 for some N sources (ESN, SuperU, and Nfusion). SuperU in both years had fewer tops down than urea on some dates suggesting that early season available N may have limited early growth and plant size.

Added N increased bulb size. Consequently the yield of mediums (the smallest onions) was higher for the control than for most all N sources, but jumbo, colossal, and total yields for the control were the lowest of all treatments. The higher banded N rate for N sources did not affect the yield of mediums in 2008, but for all N sources in 2009 the yield of mediums was lower for the 120 than the 60 lb N rate. Among N sources at the 60 lb N rate, the yield of mediums was higher for the 2009 June sidedressed N than for all but SuperU and NSN. Low early season available N with delayed N applications may have limited bulb size in 2009.

Increasing the N rate from 60 to the 120 lb N rate increased the yield of jumbo or colossal sized onions for SuperU in both years, and NSN and NFusion in 2009. Jumbo or colossal yields did not differ significantly for other early banded N sources at the two N rates. Early banded N sources differed in yield in some years. At the rate of 60 lb N/A, both SuperU and NSN yielded less than urea in both years and NSN yielded less than ESN in both years. Total yield in 2009 at the 60 lb rate was higher for early banded ESN, N Fusion and urea than for June split applied uran.

Excessive N (180 lb N/A) as June side-dressings or as early season banded urea (120 lb N/A) reduced jumbo and total yield as compared to the 60 lb rate in 2008, but this did not occur with any of the enhanced N fertilizers suggesting they are safer at higher rates. In contrast, yield increased in 2009 with higher June side-dressed N. The effectiveness of June sidedressed uran in 2009 may have been limited by insufficient N during earlier growth. It is not clear why high N was detrimental in 2008 but contributed to higher yield in 2009. June 2009 was wetter and cooler than 2008.

Bed center accumulated nitrate-N was higher at bulb initiation for the early banded N applications relative to the untreated control, but did not differ among N sources. Likewise, bed center nitrates in September were higher for all applied N treatments as compared to the control. Most N sources did not differ in bed center nitrates in either June or September. Net mineralized N by September in buried bags measured over 60 ppm in 2008 and 40 ppm in 2009 in the first foot. This mineralization may account for the relatively good yields obtained without applied N.

In summary, some single early season banded N sources were comparable to or better in yield than split uran applications in June, but did not prove more effective than urea banded early after the first irrigation. Some slow release N sources at moderate N rates such as NSN and SuperU may not release N rapidly enough to meet early season onion N requirements. Delayed side-dressings in June did not prove more effective than N banded early in the season after the first irrigation.

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Table 1. Onion maturity, yield, and bed center nitrate concentrations as affected by early season banded N sources. Parma, 2008.

N Source	N Rate	N Timing	Tops Down 8/29/08	Tops Down 9/4/08	Tops Down 9/9/08	Yield Mediums	Jumbos	Colossals	Super Colossals	Total	Bed Center NO_3-N 6/17/08	Bed Center NO_3-N 9/9/08
	lb/A		-------------%------------			cwt/A	c wt/A	c wt/A	c wt/A	c wt/A	ppm	ppm
Control	0	--	37	61	77	287.4	374.0	20.1	0	682	23.7	16.5
Urea	60	early	66	79	86	199.6	590.6	48.3	1.7	840	--	--
	120		67	83	92	228.8	507.2	31.9	0.8	767	32.2	52.3
ESN	60	early	69	83	90	209.0	589.2	38.8	0.4	838	--	--
	120		73	89	95	234.5	553.6	30.6	0	819	28.2	46.0
SuperU	60	early	41	68	84	252.2	474.4	25.5	0.4	752	--	--
	120		66	81	93	216.8	562.0	68.9	0.4	848	30.8	38.5
NSN	60	early	58	71	88	206.9	503.7	36.9	1.6	749	--	--
	120		63	77	90	215.0	537.9	36.4	0.4	790	29.5	37.7
N Fusion	60	early	69	79	90	202.5	543.3	36.6	0.8	783	--	--
	120		57	74	88	205.9	545.4	48.4	1.2	801	28.3	39.5
Uran	60	split	68	82	94	219.7	548.5	40.9	0.8	810	--	--
	120		56	70	88	239.4	522.8	13.3	0.4	776	--	32.7
	180		67	82	95	248.0	447.1	22.2	0.8	718	--	--
$LSD_{0.1}$			23	17	10	39.8	84.8	21.9	1.6	66.6	4.6	14.4
Average			61	77	89	226.1	521.4	35.6	0.7	784	28.8	37.6

Table 2. Onion maturity, yield, and bed center nitrate concentrations as affected by early season banded N sources. Parma, 2009.

N Source	N Rate	N Timing	Tops Down 9/11/09	Tops Down 9/16/09	Yield Mediums	Yield Jumbos	Yield Colossals	Yield Super Colossals	Yield Total	Bed Center NO_3-N 6/12/09	Bed Center NO_3-N 10/6/09
	lb/A		----------%--------		cwt/A	cwt/A	cwt/A	cwt/A	cwt/A	ppm	ppm
Control	0	--	1	5	249	355	52	4	660	22	8.9
Urea	60	early	33	62	133	582	184	24	923	--	--
	120		30	53	110	610	210	26	956	37	23.3
ESN	60	early	12	39	140	603	158	13	915	--	--
	120		55	72	112	622	206	19	961	38	25.2
SuperU	60	early	14	36	156	572	139	11	877	--	--
	120		59	80	103	653	222	28	1005	41	16.4
NSN	60	early	17	52	154	556	148	8	865	--	--
	120		25	48	128	599	168	16	911	35	15.4
N Fusion	60	early	29	54	137	576	173	15	901	--	--
	120		53	72	94	628	260	42	1024	43	24.5
Uran	60	split	8	28	171	548	112	10	842	--	--
	120		32	55	105	640	223	26	995	--	--
	180		51	82	86	646	251	35	1018	--	--
$LSD_{0.1}$			22	18	21	40	49	11	50	9	9.5
Average			30	58	134	585	179	20	918	36	18.9