



# OPTIMIZING NITROGEN FERTILIZER APPLICATION TIMING FOR VIDALIA ONIONS

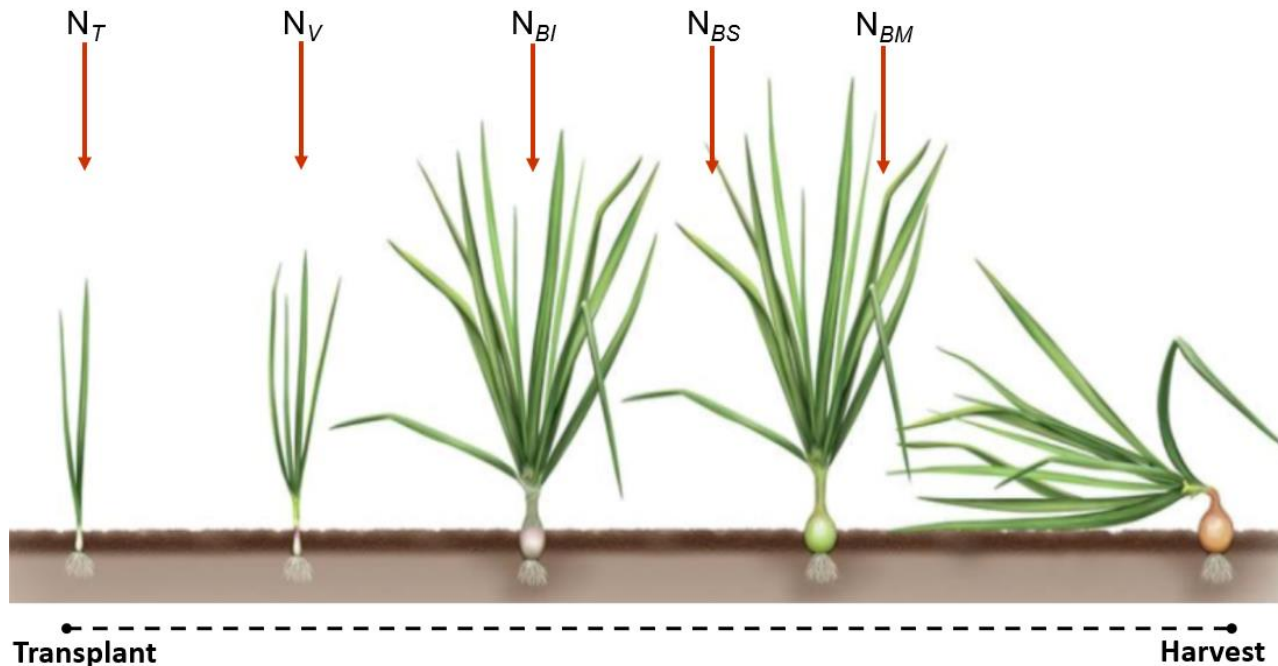
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Coolong<sup>1</sup>

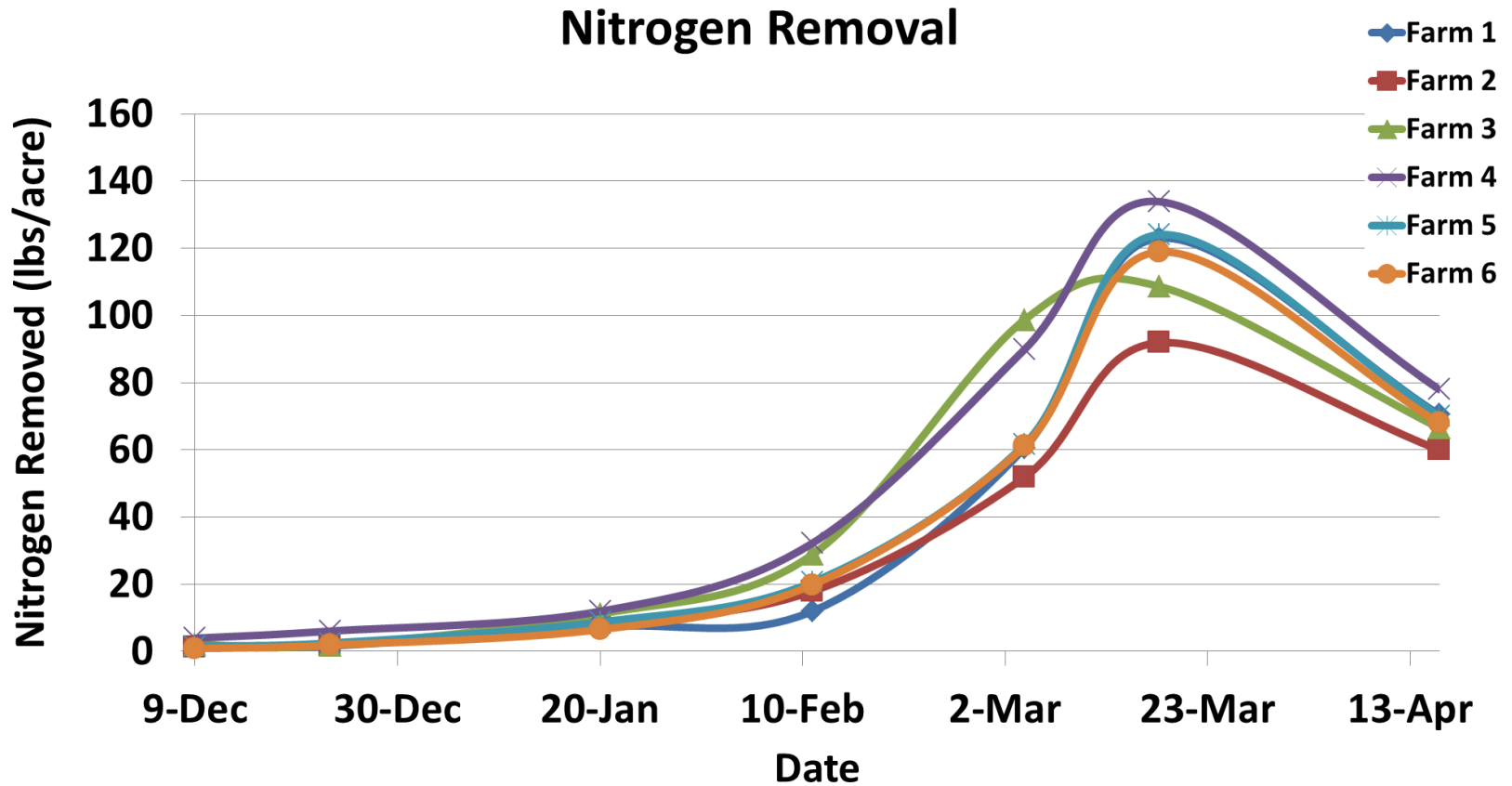
# Introduction

**How the N fertilizer applied at each single application is used by the plant?**

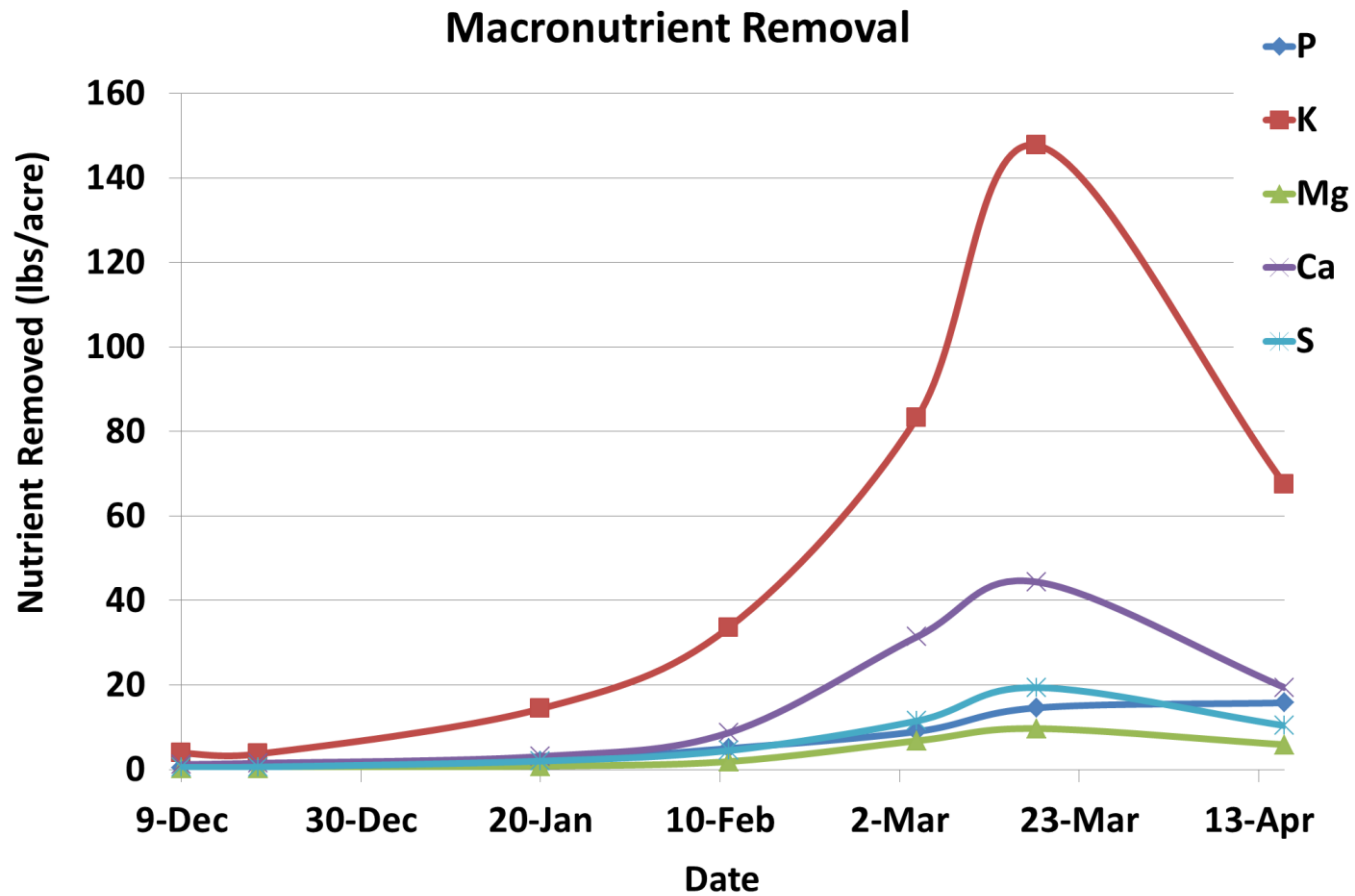
- Onion growth stages have different N fertilizer requirements, so it is important to adjust the N-fertilizer inputs by determining the FNUE of each application timing



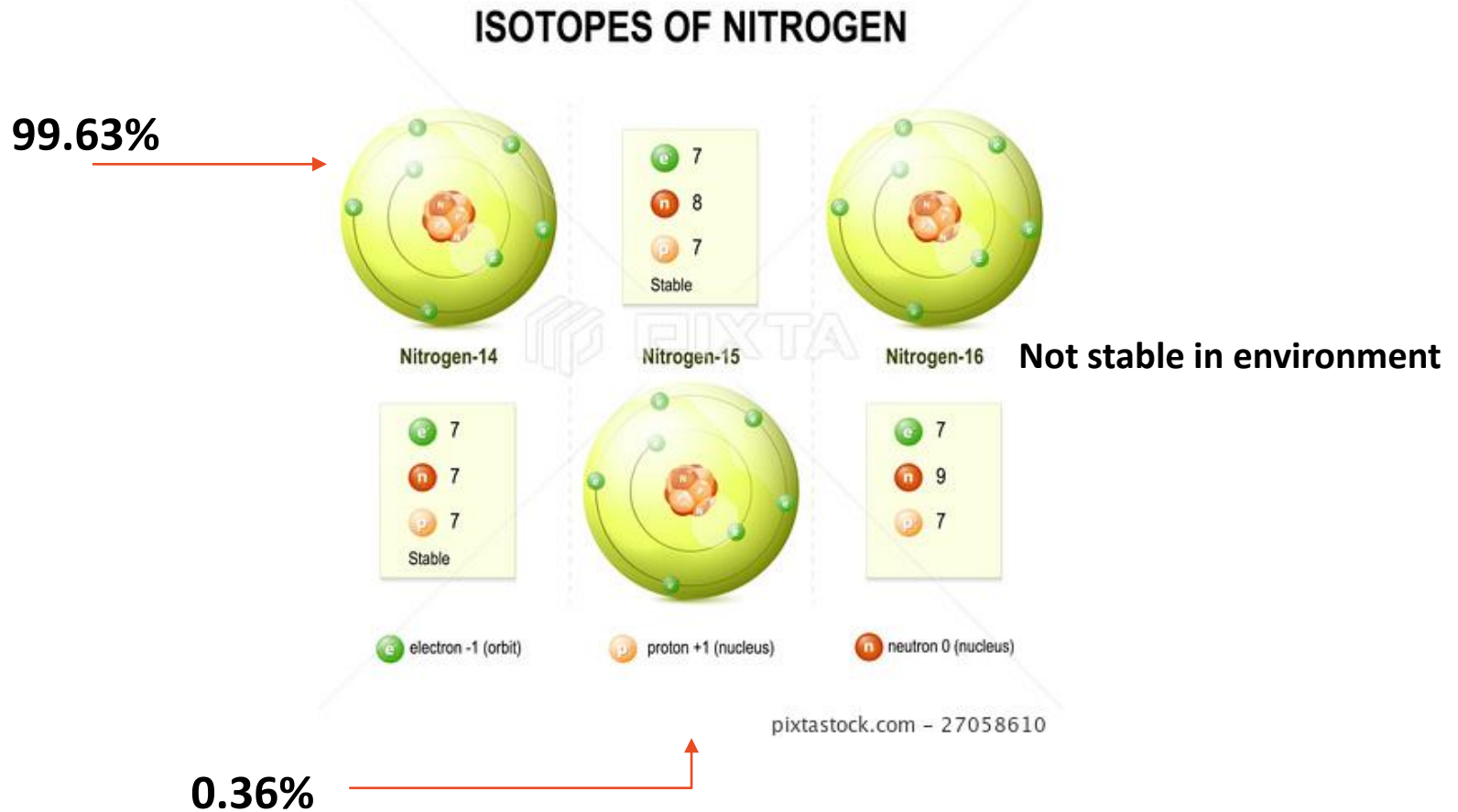
# Nutrient Removal - N



# Macronutrients



# What is N15?



# Materials and Methods

- **Treatments:** Five  $^{15}\text{N}$  isotope fertilizer application timings x 4 replications, in a randomized complete block design
- **Seasons:** 2020-21 and 2021-22

Treatments	N rate (lb./acre)					Total N
	$\text{N}_T$	$\text{N}_V$	$\text{N}_{BI}$	$\text{N}_{BS}$	$\text{N}_{BM}$	
$^{15}\text{N}_T$	21*	21	21	21	21	105
$^{15}\text{N}_V$	21	21*	21	21	21	105
$^{15}\text{N}_{BI}$	21	21	21*	21	21	105
$^{15}\text{N}_{BS}$	21	21	21	21*	21	105
$^{15}\text{N}_{BM}$	21	21	21	21	21*	105

\*The time  $^{15}\text{N}$  enriched fertilizer is being applied;  $\text{N}_T$  = N applied at transplanting;  $\text{N}_V$  = N applied at vegetative stage;  $\text{N}_{BI}$  = N applied at bulb initiation;  $\text{N}_{BS}$  = N applied bulb swelling;  $\text{N}_{BM}$  = N applied at pre-maturation.

# Introduction

Fertilizer Nitrogen use efficiency (FNUE) = Rate of N in the plant tissue derived from the fertilizer applied

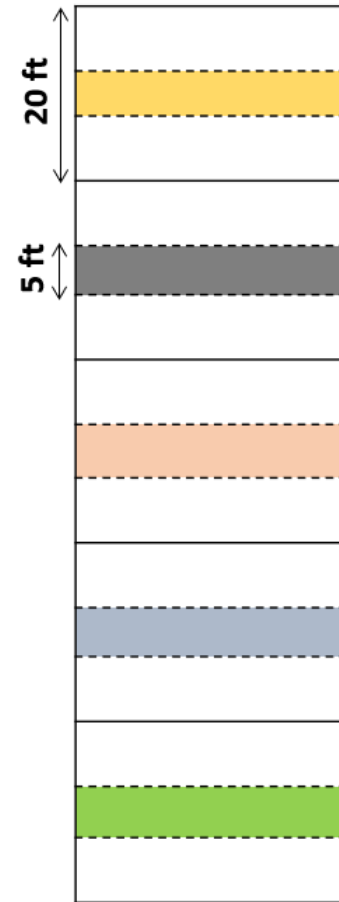
$$Ndff = (^{15}N_p / ^{15}N_F) \times \text{Plant uptake}$$

$$FNUE (\%) = (Ndff / \text{Rate of N applied}) \times 100$$

- Ndff = Total amount of N in the plant derived from the fertilizer (lb/ac)
- $^{15}N_p$  = % of  $^{15}N$  atom excess of the plant sample
- $^{15}N_F$  = % of  $^{15}N$  atom excess of the fertilizer applied

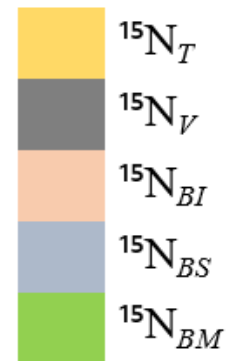
\*A  $^{15}N$  enriched fertilizer is provided to the plant and its amounts are then traced through the plant parts

# Material and methods

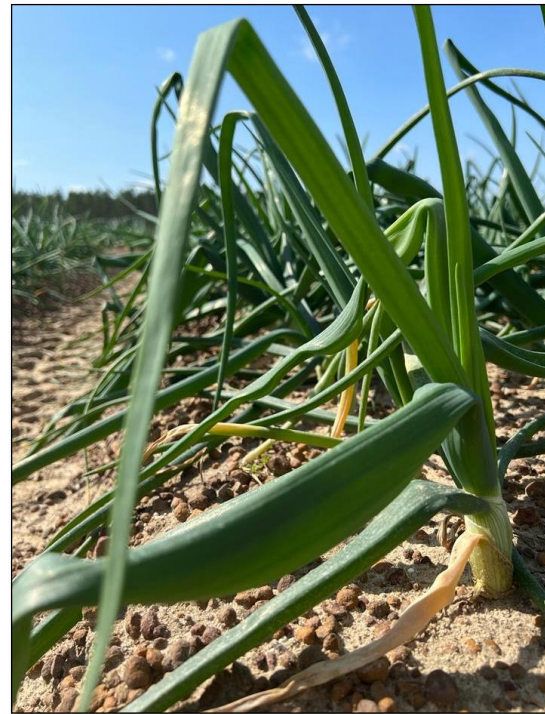


Block A

$^{15}\text{N}$  application  
timing treatments:



Season: 2021-22





# RESULTS

(SEASON 2020 -21)

# Results

Year	Marketable	Colossal	Jumbo	Medium	Culls
	40 lb. bags/ac				
2021	1101	2	932	167	30

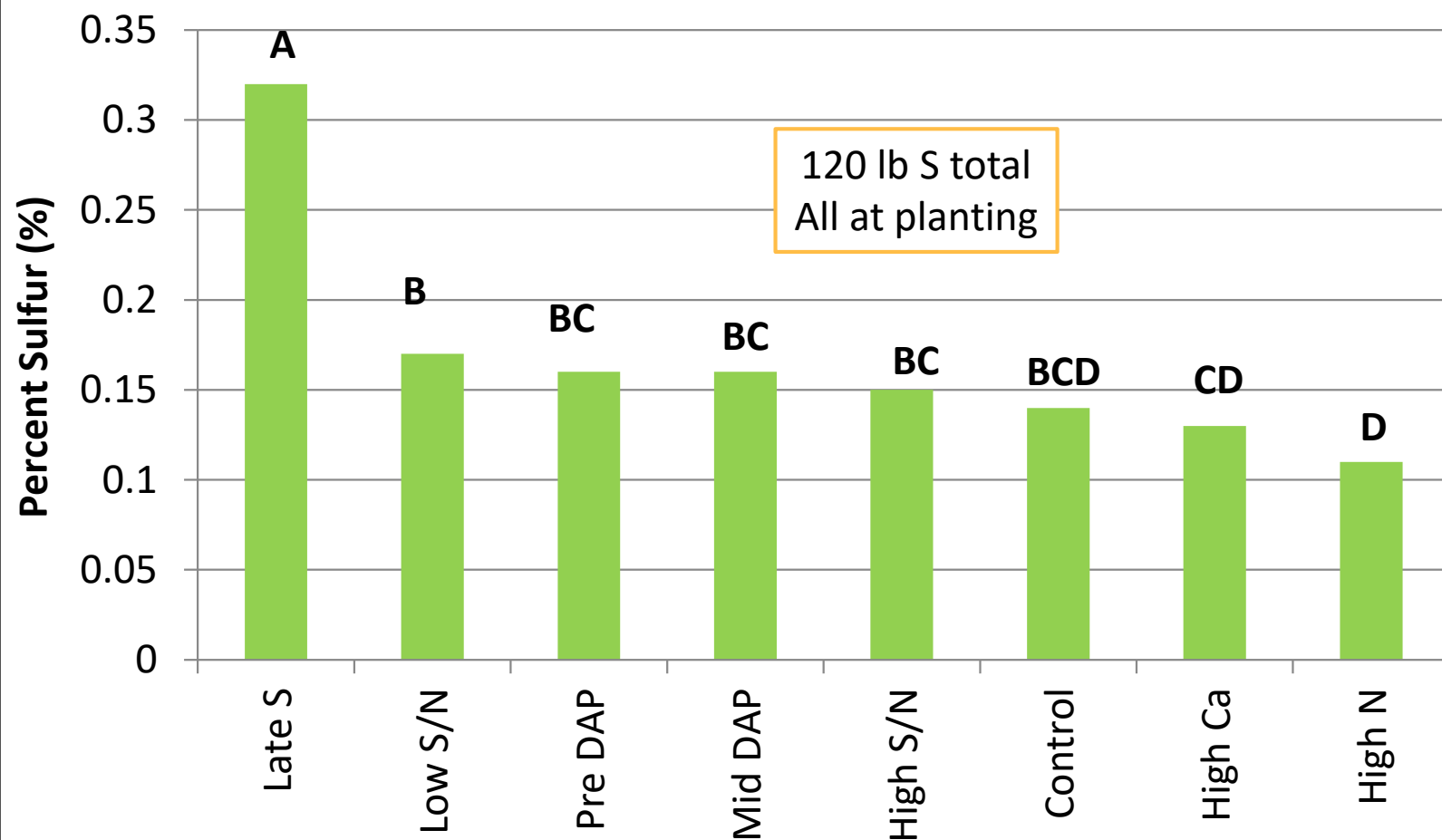
15N fertilizer timing	N in plant provided by the fertilizer (lb N/ac)				N fertilizer leached (lb/ac)	FNUE
	Bulbs	Leaves	Roots	Total plant		
<sup>15</sup> NT	1.03 c	0.81 d	0.01 c	1.86 c	18.76 a	8.87 c
<sup>15</sup> NV	3.00 bc	2.49 c	0.03 bc	5.53 b	15.09 b	26.37 b
<sup>15</sup> NBI	4.16 b	3.20 c	0.04 b	7.40 b	13.26 b	35.27 b
<sup>15</sup> NBS	10.57 a	11.59 a	0.06 a	22.23 a	0.00 c	105.90 a
<sup>15</sup> NBM	11.37 a	8.91 b	0.04 b	20.34 a	0.29 c	96.87 a
Total	30.98	27.05	0.22	58.26	47.40	55.50

\*Values followed by the same letters indicate no significant difference by the Tukey test ( $p < 0.05$ ) among N fertilizer timing treatments

# Sulfur (2015/2016)

60 lb S total  
30 lb early Feb

## Sulfur



# Conclusion

- Only a small fraction of the N applied at the transplanting was recovered in the plant (less than 10% FNUE).
- Minimal N inputs are necessary early in the season to maintain onion yield;
- Low residence time of N fertilizer in soil will reduce the risk of N being lost.
- N applications closer to the bulb swelling and bulb maturation were efficiently used by the actively growing bulbs.



**THANK YOU!**