

Nitrogen Management Plans

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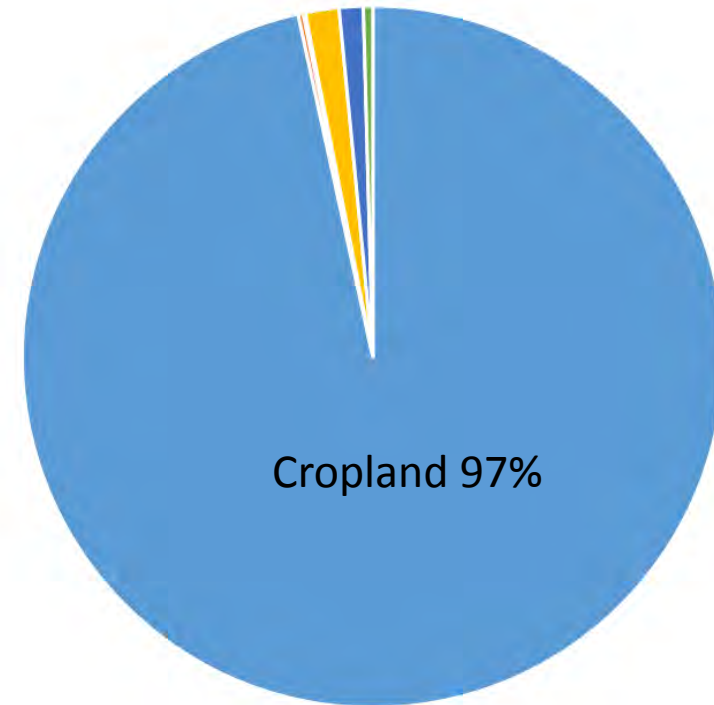
CA Nursery Conference

July 27, 2017

Why Nitrogen Management Plans?

- 'Blue Baby' syndrome
 - Max contaminant level = 45 ppm NO_3^-
- 54% from synthetic fertilizers
- Problem likely to continue for decades
- 34% of applied N ends up in harvested product
- 28% of applied N is taken up by ornamentals
- Harter and Lund recommend a tax on nitrogen fertilizer

Nitrate sources to groundwater



Harter, T. & Lund, J. 2012 Addressing Nitrate in California's Drinking Water: Executive Summary

Nitrogen management plans

- Required for all growers within Central Valley Regional Water Quality Control Board watersheds
- Certification required in high-vulnerability groundwater areas
 - Determined by Groundwater Quality Assessment Reports

CROP NITROGEN MANAGEMENT PLANNING		N APPLICATIONS/CREDITS	15. Recommended/Planned N	16. Actual N
6. Crop		17. NITROGEN FERTILIZERS APPLIED		
7. Production Unit		18. Dry/Liquid N (lbs/ac)		
8. Projected Yield		19. Foliar N (lbs/ac)		
9. N Recommended		20. ORGANIC MATERIAL N		
10. Acres		21. Available N in Manure/Compost (lbs/ac estimate)		
POST PRODUCTION ACTUALS		22. Total N Applied + Available (lbs per ac) (Box 18+19+21)		
11. Actual Yield (Units/ac)		23. NITROGEN CREDITS (EST)		
12. Total N Applied (lbs/ac)		24. * Available N carryover in soil; (annualized lbs/ac)		
13. ** N Removed (lbs N/ac)		25. *N in Irrigation water (annualized, lbs/ac)		
14. *** Notes:		26. Total N Credits (lbs per ac) (Box 24+25)		
		27. Total N Applied + Available + Credits (Box 22+26)	Transfer to Box 9	Transfer to Box 12

Does container production fit in worksheet?

- What's a production unit?
- How to quantify yield?
- How much N is removed with yield?
- How much N lost from production system?
 - Groundwater infiltration?
 - Denitrification (N_2 gas)?



CROP NITROGEN MANAGEMENT PLANNING	
6. Crop	
7. Production Unit	
8. Projected Yield	
9. N Recommended	
10. Acres	
POST PRODUCTION ACTUALS	
11. Actual Yield (Units/ac)	
12. Total N Applied (lbs/ac)	
13. ** N Removed (lbs N/ac)	
14. *** Notes:	

Container plants

Plant type (herb,woody,
annual) & container size

Total production units grown or sold

Based on UCCE, CDFA, etc.

of production units grown or sold

N fertilizer not applied as lbs/ac

How much N removed with yield?

N APPLICATIONS/CREDITS		15. Recommended/ Planned N	16. Actual N
17. NITROGEN FERTILIZERS APPLIED			
Fertigation + CRF	18. Dry/Liquid N (lbs/ac)		
Foliar N	19. Foliar N (lbs/ac)		
20. ORGANIC MATERIAL N			
Organic fertilizers	21. Available N in Manure/Compost (lbs/ac estimate)		
Sum of above	22. Total N Applied + Available (lbs per ac) (Box 18+19+21)		
23. NITROGEN CREDITS (EST)			
N in container media	24. * Available N carryover in soil; (annualized lbs/ac)		
Well water, etc.	25. *N in Irrigation water (annualized, lbs/ac)		
Box 24 & 25	26. Total N Credits (lbs per ac) (Box 24+25)		
Sum of all N applied	27. Total N Applied + Available + Credits (Box 22+26)	Transfer to Box 9	Transfer to Box 12

CROP NITROGEN MANAGEMENT PLANNING		N APPLICATIONS/CREDITS	26. Recommended/ Planned N	27. Actual N
6. Crop	Cont. Ornament	15. Nitrogen Fertilizers		
7. Production Units	Each	16. Dry/Liquid (lbs/ac)		122
8. Projected Yield (Units/Acre)	Various	17. Foliar N (lbs/ac)		144
9. N Recommended (lbs/ac)		18. Organic Material N		
10. Acres	12.5	19. Available N in Manure/Compost (lbs/ac estimate)		0
Post Production Actuals		20. Total Available N Applied (lbs per acre)		266
11. Actual Yield (Units/Acre)	Difficult to determine	21. Nitrogen Credits (est)		
12. Total N Applied (lbs/ac)	267.1	22. Available N carryover in soil; (annualized lbs/acre)		0
13. ** N Removed (lbs N/ac)	267.1	23. N in Irrigation water (annualized, lbs/ac)		1.1
14. Notes:		24. Total N Credits (lbs per acre)		1.1
Type of crop is container ornamentals, when container is sold, soil goes with plants. Due to various container sizes, difficult to determine "yield/acre".		25. Total N Applied & Available		267.1

CROP NITROGEN MANAGEMENT PLANNING		N APPLICATIONS/CREDITS	26. Recommended/ Planned N	27. Actual N
6. Crop	Cont. Ornament	15. Nitrogen Fertilizers		
7. Production Units	Each	16. Dry/Liquid (lbs/ac)	500	122
8. Projected Yield (Units/Acre)	Various	17. Foliar N (lbs/ac)		144
9. N Recommended (lbs/ac)	500	18. Organic Material N		
10. Acres	12.5	19. Available N in Manure/Compost (lbs/ac estimate)	0	0
Post Production Actuals				
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13. ** N Removed (lbs N/ac)	267.1	22. Available N carryover in soil; (annualized lbs/acre)	0	0
14. Notes:		23. N in Irrigation water (annualized, lbs/ac)		1.1
Type of crop is container ornamentals, when container is sold, soil goes with plants. Due to various container sizes, difficult to determine "yield/acre".		24. Total N Credits (lbs per acre)	500	1.1
		25. Total N Applied & Available	500	267.1

Previous research

- Evans and Dodge 2004
 - Liquid feed N recommendations for woody and herbaceous
 - 50 ppm N for woodies
 - 120-150 ppm N for herbaceous
- Cabrera 2003
 - Evaluated container N balance of two woody species
- Narvaez 2012 & 2013
 - Evaluated container N balance of woody and herbaceous species, one each

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Cabrera 2003

- N balance of plant and container
 - N applied, leached, in plant, and in soilless media
- Evaluated two woody species from Aug. to May including overwintering in Mid Atlantic

6. Crop	<i>Ilex opaca</i>
7. Production Units	1 Gal cont.
8. Projected Yield (Units/Acre)	69,929
9. N Recommended (lbs/ac)	60 ppm
10. Acres	1
Post Production Actuals	
11. Actual Yield (Units/Acre)	69,929
12. Total N Applied (lbs/ac)	162
13. N Removed (lbs N/ac)	100

6. Crop	<i>Lagerstroemia</i>
7. Production Units	1 Gal cont.
8. Projected Yield (Units/Acre)	69,929
9. N Recommended (lbs/ac)	60 ppm
10. Acres	1
Post Production Actuals	
11. Actual Yield (Units/Acre)	69,929
12. Total N Applied (lbs/ac)	230
13. N Removed (lbs N/ac)	63

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Narvaez et al. 2012 & 2013

- N balance of plant and container
 - N applied, leached, in plant, and in soilless media
- Evaluated one woody (May to Dec) and one herbaceous species (May to July)

6. Crop	Viburnum tinus
7. Production Units	1.25 Gal. cont.
8. Projected Yield (Units/Acre)	69,930
9. N Recommended (lbs/ac)	57.4 ppm
10. Acres	1
Post Production Actuals	
11. Actual Yield (Units/Acre)	69,930
12. Total N Applied (lbs/ac)	493
13. N Removed (lbs N/ac)	330

6. Crop	Osteospermum
7. Production Units	1 Gal. cont
8. Projected Yield (Units/Acre)	87,412
9. N Recommended (lbs/ac)	120 ppm
10. Acres	1
Post Production Actuals	
11. Actual Yield (Units/Acre)	87,412
12. Total N Applied (lbs/ac)	1,426
13. N Removed (lbs N/ac)	1,127

Narvaez et al. 2012 & 2013

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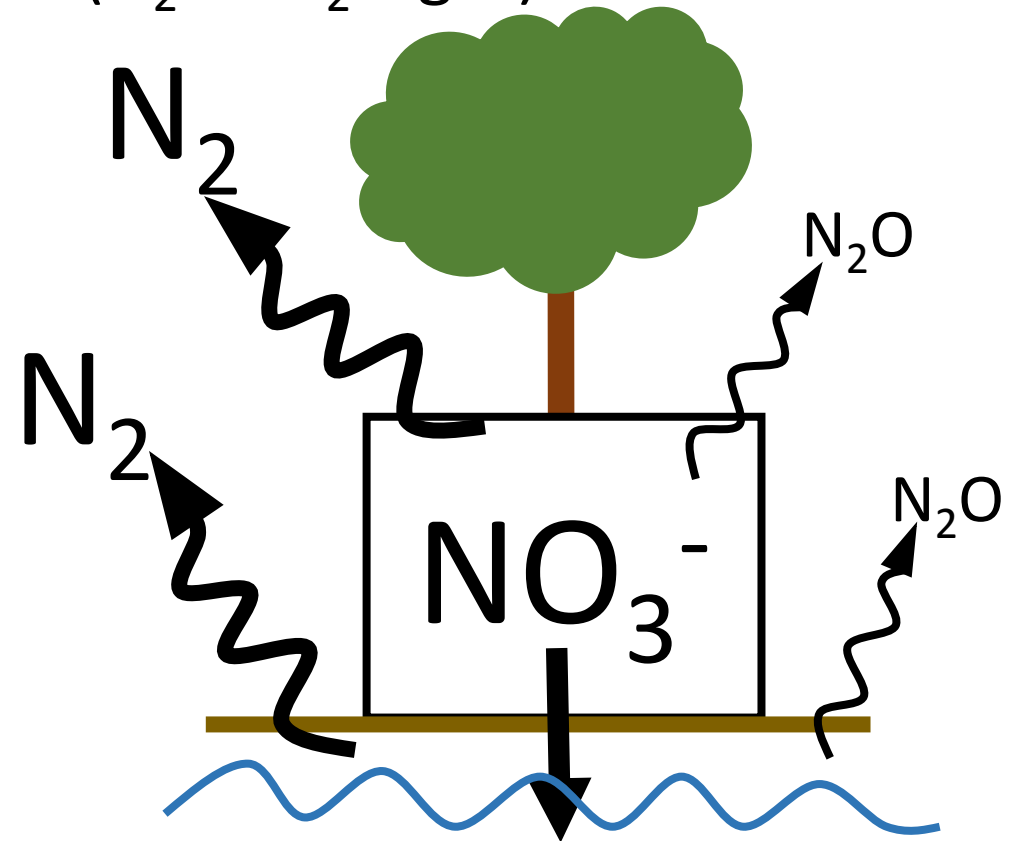
33% unutilized

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21% unutilized

Where does unutilized N go?

- Some N loss through leaching
- How much N is lost through denitrification (N_2 or N_2O gas)?
 - Container substrate
 - Soil below growing bed



Proposed research and outreach

- Develop system nitrogen balance for container plant production
- Document N applied, leached, utilized by plant and soilless substrate, and emitted as N₂ or N₂O gas
- Identify environmentally harmful discharges and develop mitigation strategies
- Inform growers about BMPs to improve NUE
- Inform State Water Boards in development of next generation nursery specific NMP

Future of NMPs

- Met with Central Valley Regional Water Quality Control Board
- CVWB are learning about nursery production
 - Organizing nursery tours
- Create nursery working group for developing NMP template

