

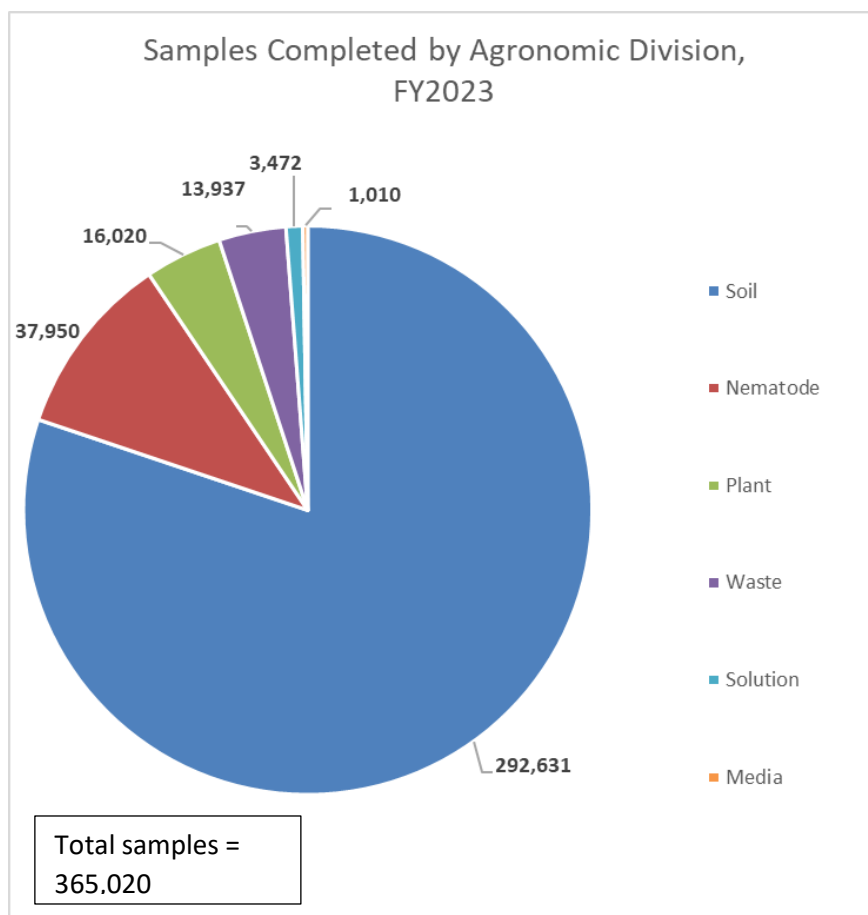
Agronomic Division —2023 Annual Report

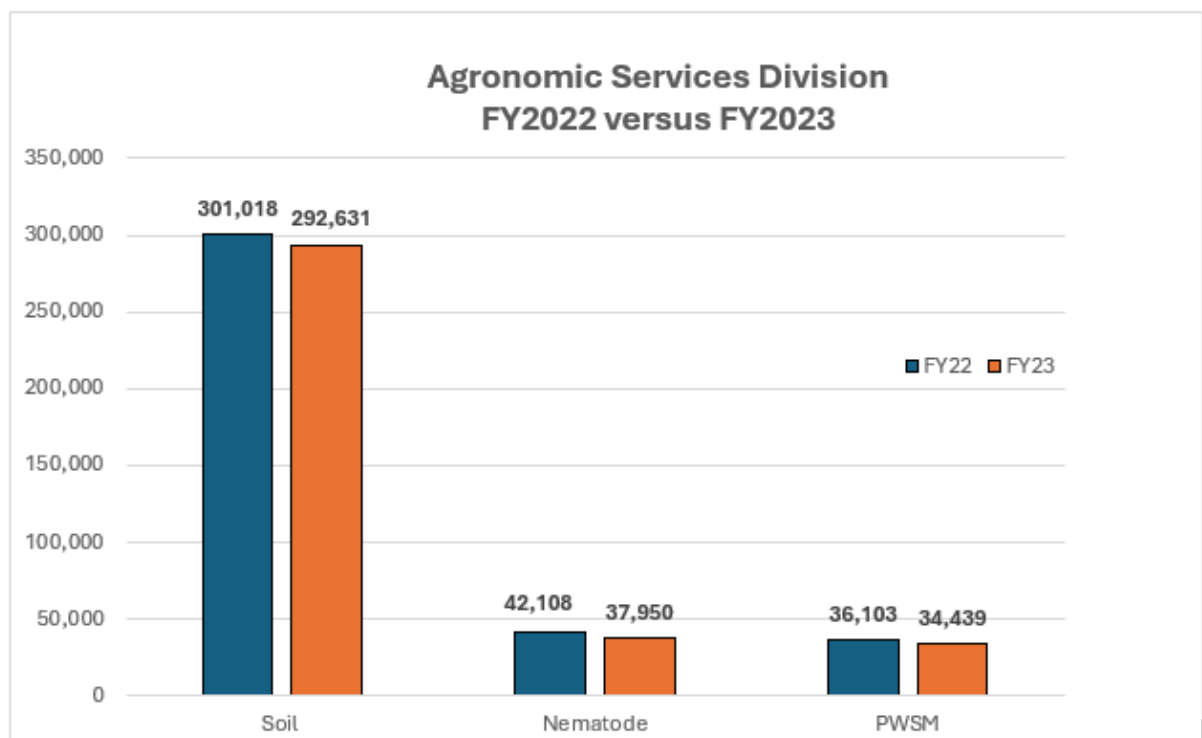
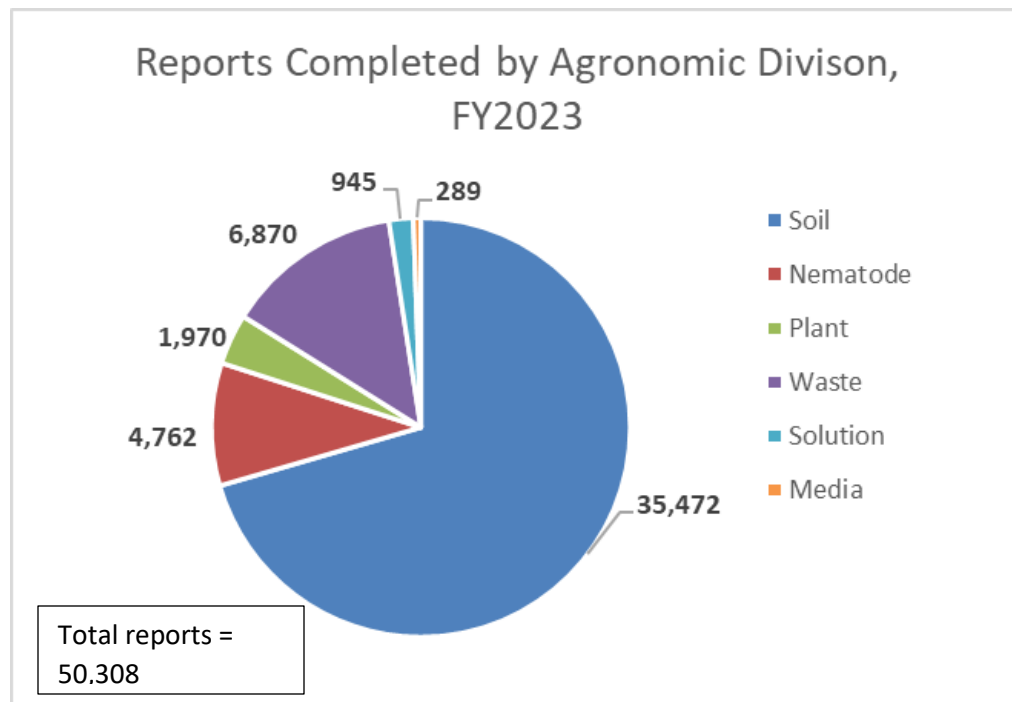
Colleen Hudak-Wise, Ph.D., director, (919) 664-1600

Introduction

The Agronomic Services Division's mandate is to provide all North Carolina residents with diagnostic and advisory services that increase agricultural productivity, promote responsible land management, and safeguard environmental quality. The Agronomic Services Division is the largest publicly operated agronomic laboratory in the country, offering the following laboratory services: soil testing, plant tissue analysis, waste analysis, solution analysis, soilless media analysis, and nematode assay.

The Agronomic Division's laboratories processed 365,020 total samples during FY2023 (July 1, 2022 – June 30, 2023), which is approximately a 3% decrease over the previous year. Over 50,300 reports with test results and recommendations were prepared for clients during FY2023.





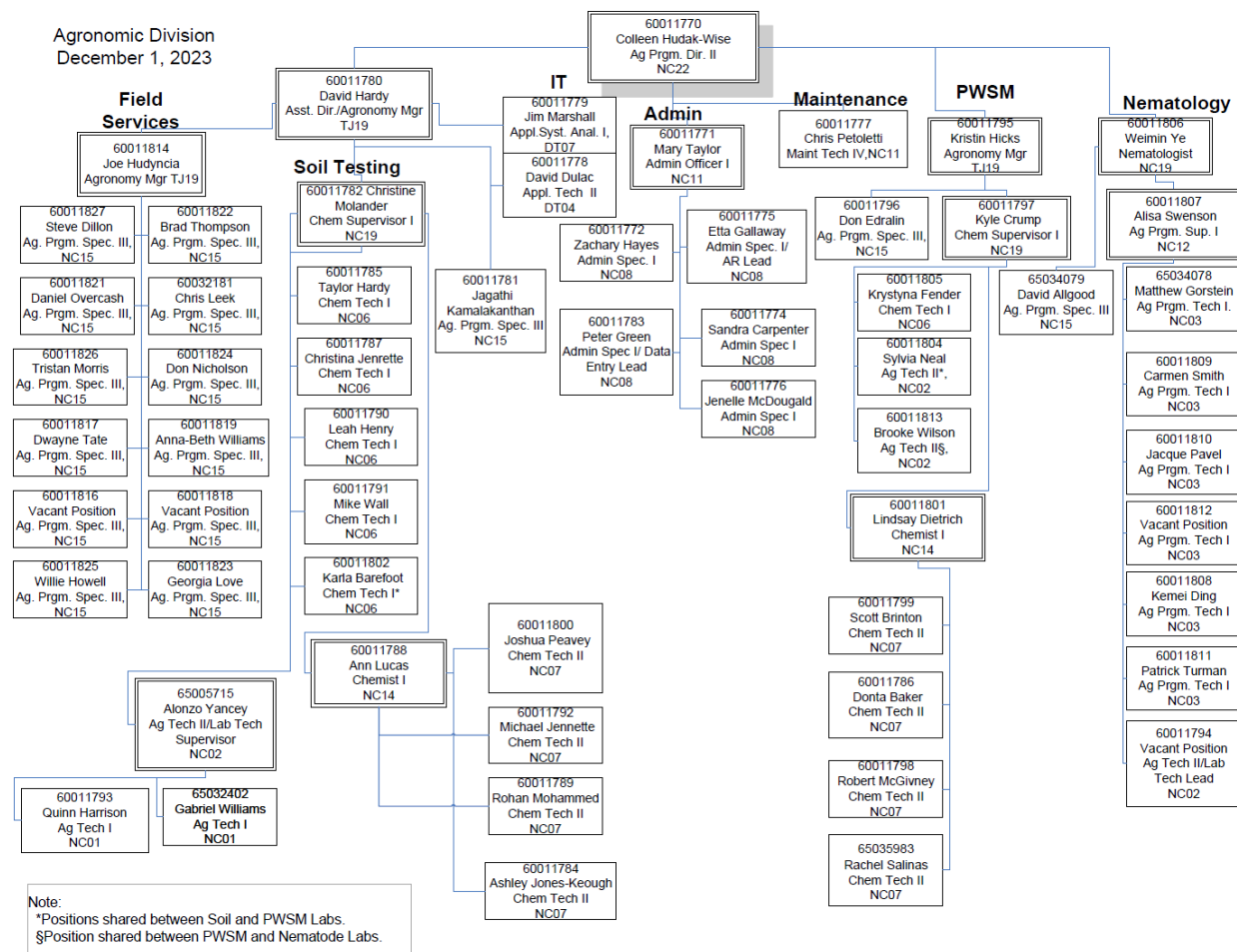
Milestones

Some notable accomplishments for 2023 include the following:

- 1) Launch of a new Digital Commons website in December 2023.
- 2) Addition of a third elutriator to the Nematode Assay Lab.
- 3) Replacement of an old humic matter robot in the Soil Testing Lab with a new one custom-built by Automation Techniques of Greensboro, NC.
- 4) Implementation of a new set of ICP standards in the Soil Testing Lab to improve the accuracy of measurements.
- 5) Secured new reliable vendors for soil sample boxes and pre-folded filter papers used in the Soil Testing Lab.
- 6) Completion of a two-year field study to validate soil test phosphorus recommendations in corn.
- 7) Completion of a three-year malting barley nitrogen rate study.

Personnel

The Division had 60 full-time permanent positions during calendar year 2023: 17 office positions, including administrative support, information technology, maintenance, and leadership positions; 31 laboratory staff distributed across three laboratories (Soil Testing, Nematode Assay and Plant/Waste/Solution/Media) and 12 regional agronomists who make up the Field Services Section. Regional agronomists are assigned to territories consisting of 5 to 11 counties; they conduct grower consultations to help diagnose nutrient and/or nematode problems and to offer expert advice regarding plant nutrient management for waste management plans. The Agronomic Services Division's organizational chart and the Field Services territorial map for 2023 follow.



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NCDA&CS Agronomic Division Field Services

August 2023

Vacant, Region 2

Don Nicholson, Region 6
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Section Chief- Joe Hudyncia

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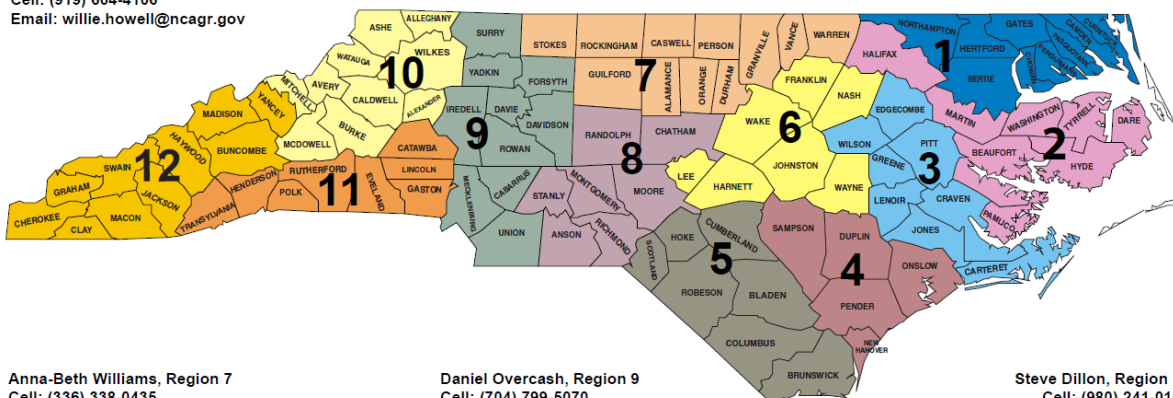
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Staff turnover during 2023 included several positions. The following is a description of the personnel changes that took place during 2023.

Personnel Changes for Calendar Year 2023 (Permanent Staff)

- Agricultural Technician I – 65032402, receipt supported position
December 2023 – Gabriel Williams promoted to Ag Tech II
December 2023 – position vacant.
- Agricultural Program Specialist III (Regional Agronomist) - 60011818
December 2022 – Carla Pugh resigned
December 2023– position vacant.
- Agricultural Program Specialist III (Regional Agronomist) – 60011816
August 2023 – Makala Humphrey resigned.
December 2023 – position vacant.

- Agricultural Program Specialist III (Regional Agronomist) – 60011817
December 2023 – Dwayne Tate retired. Position vacant.
- Agricultural Technician II – 60011813
February 2022 – Rachel Salinas promoted to Chem Tech I
January 2023 – Brooke Wilson hired.
- Agricultural Program Specialist III – 65034079
July 2023 – Rinu Kooliyottil resigned.
December 2023 – David Allgood promoted.
- Agricultural Technician II – 60011794
May 2023 – Gary Hines resigned.
December 2023 – Gabriel Williams promoted.
- Chemistry Technician I – 60011805
December 2022 – Rachel Salinas promoted.
May 2023 – Sylvia Neal hired.
- Agricultural Technician II – 60011804
December 2022 – Michael Wall promoted.
April 2023 – Krystyna Fender hired.
December 2023 - Krystyna Fender resigned. Position vacant.
- Agricultural Program Technician I – 60011810
December 2023 – Jacque Pavel resigned. Position vacant.
- Agricultural Program Technician I – 60011812
December 2023 – David Allgood promoted. Position vacant.

Funding

The Agronomic Services Division's expenditures for FY2023 were more than \$6.2 million. Sources of funding included State Appropriations, expedited soil shippers, peak-season soil fees, fertilizer and lime taxes, and "other" sample fees (nematode, plant, waste, solution, and media samples).

FY2023 Sources of Funding

State Appropriations, 4,280,664 (68%)

Peak-season Soil Fees, \$145,444 (2%)

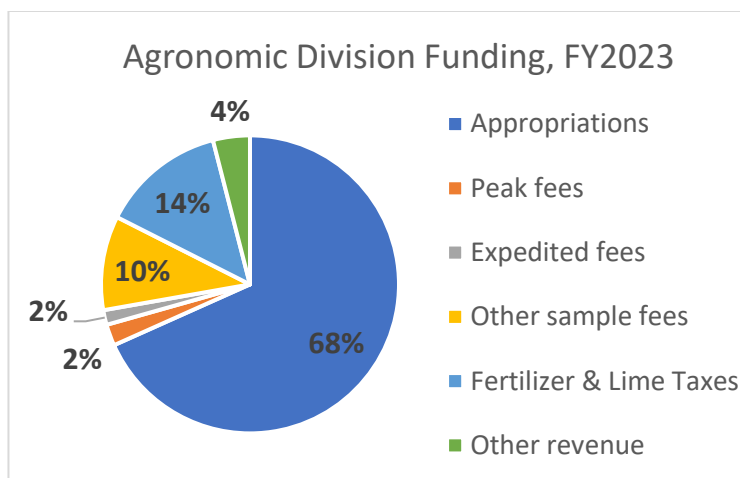
Expedited Soil Fees, \$100,000 (2%)

Other Sample Fees, \$641,077 (10%)

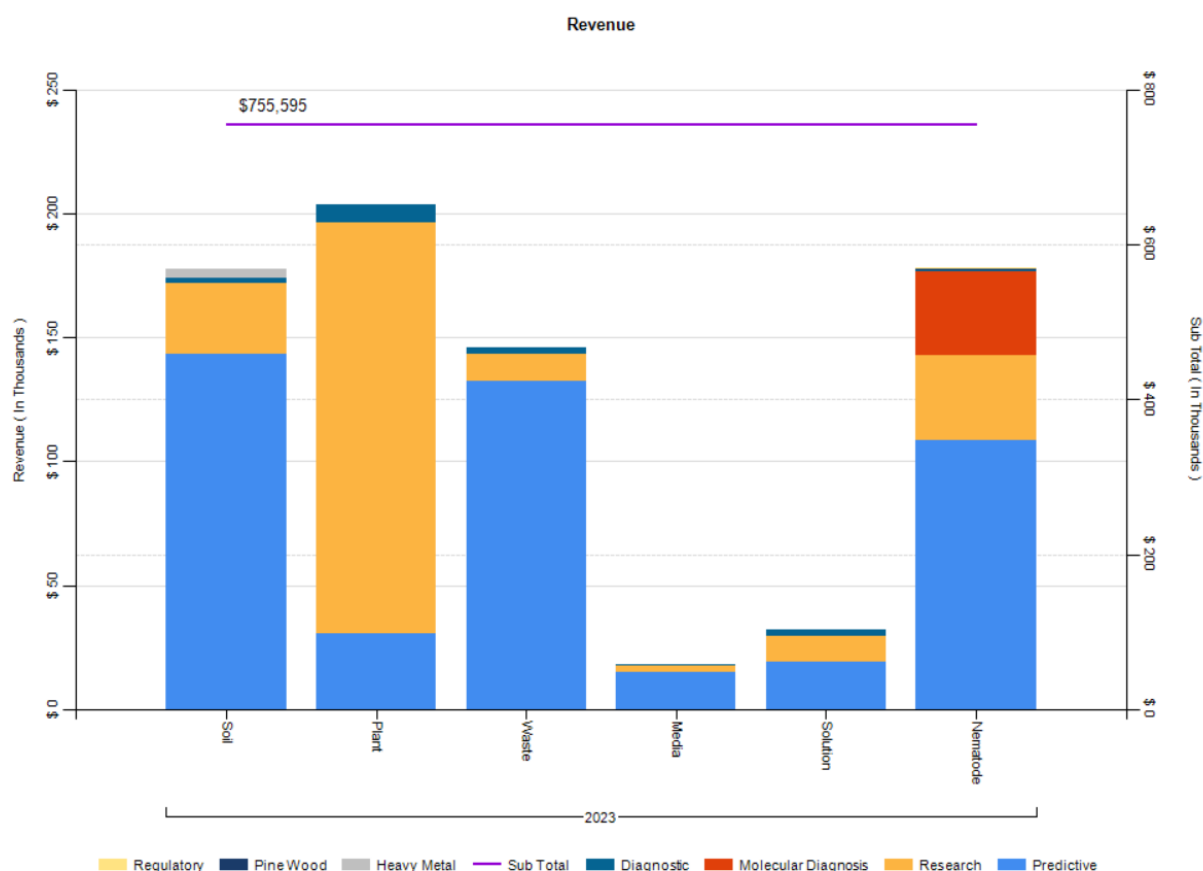
Fertilizer & Lime Taxes, \$848,607 (14%)

Other revenue, \$251,082 (4%)

Total Budget: \$6,266,874



The chart below shows the FY2023 revenue generated by routine samples.



Laboratory Services

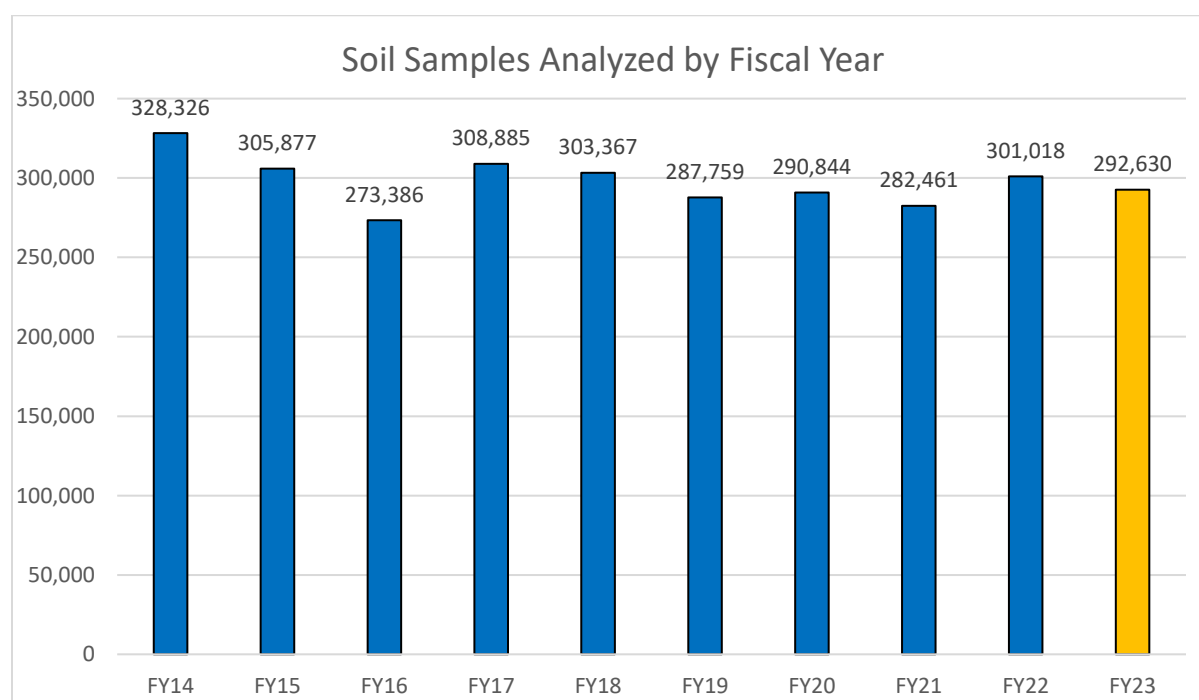
Quality Analysis/Quality Control

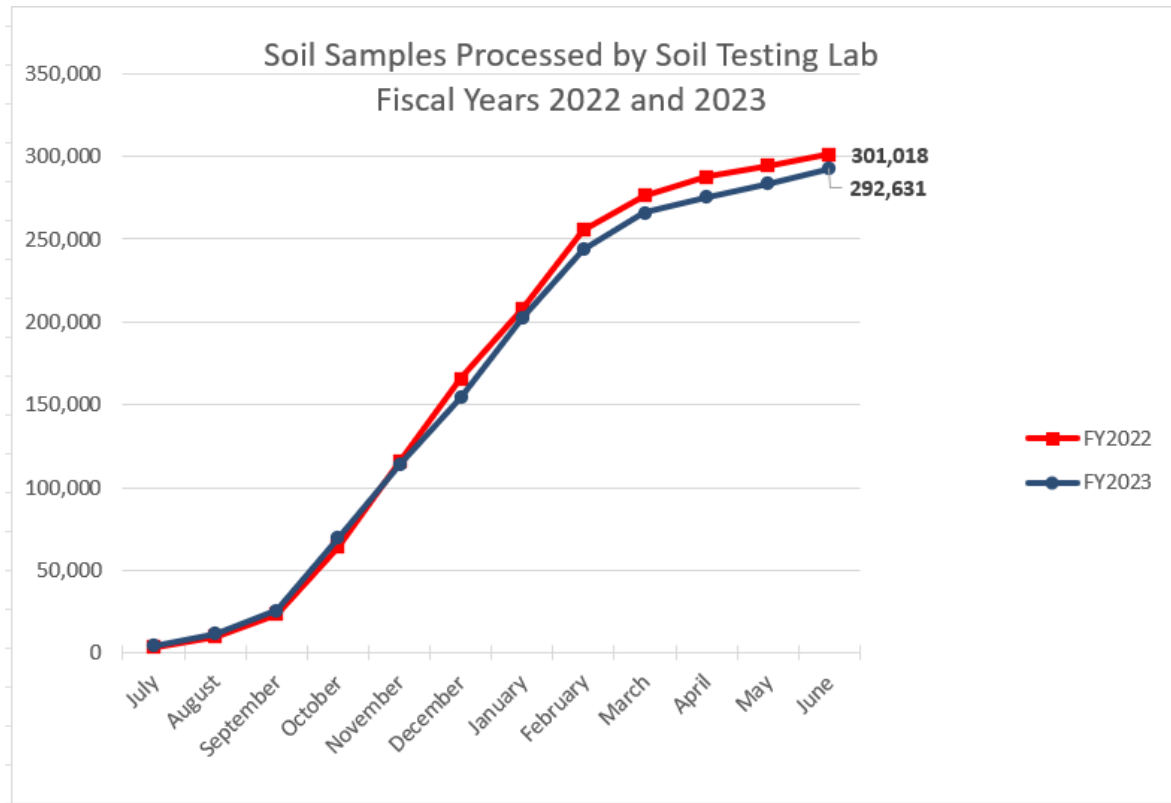
The Soil Testing and Plant/Waste/Solution/Media Advisory Laboratories participate in several external quality control programs. Annual analysis of unknown samples provided by an accredited proficiency testing provider is part of the laboratory recertification process by the Division of Environmental Quality's Division of Water Resources' Laboratory Certification Branch. The Agronomic Division passed its proficiency testing in 2023 and remains certified by DEQ through 2024.

The Agronomic Division also voluntarily participated in the following inter-laboratory proficiency testing and certification programs during 2023:

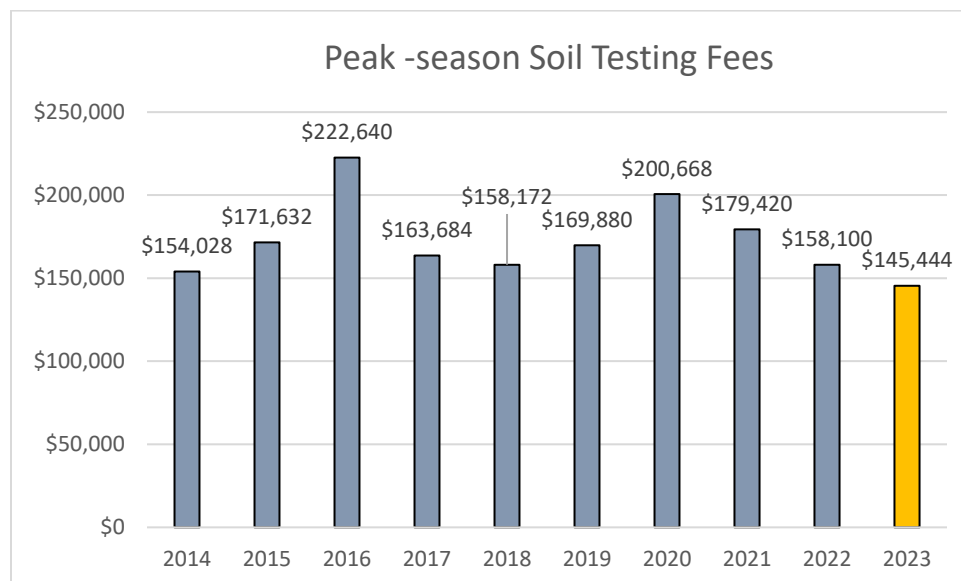
1. North American Proficiency Testing Program (NAPT) – soil analyses
2. Manure Analysis Program (MAP) – manure analyses
3. Agricultural Laboratory Proficiency program (ALP) – soil and plant tissue analyses

The **Soil Testing Section**, under the direction of David H. Hardy, Ph.D., analyzed 292,631 soil samples in FY2023, making this the sixth highest sample volume in the past ten year. Sample distribution was as follows: 265,005 predictive; 18,510 predictive expedited samples; 1,839 diagnostic; 5,677 research; 1,397 internal; 155 heavy metals; and 48 witchweed. The Soil Testing Lab issued a total of 35,472 reports for fertilizer/lime recommendations. Total sample volume for FY2023 was down about 3% compared to the previous fiscal year.

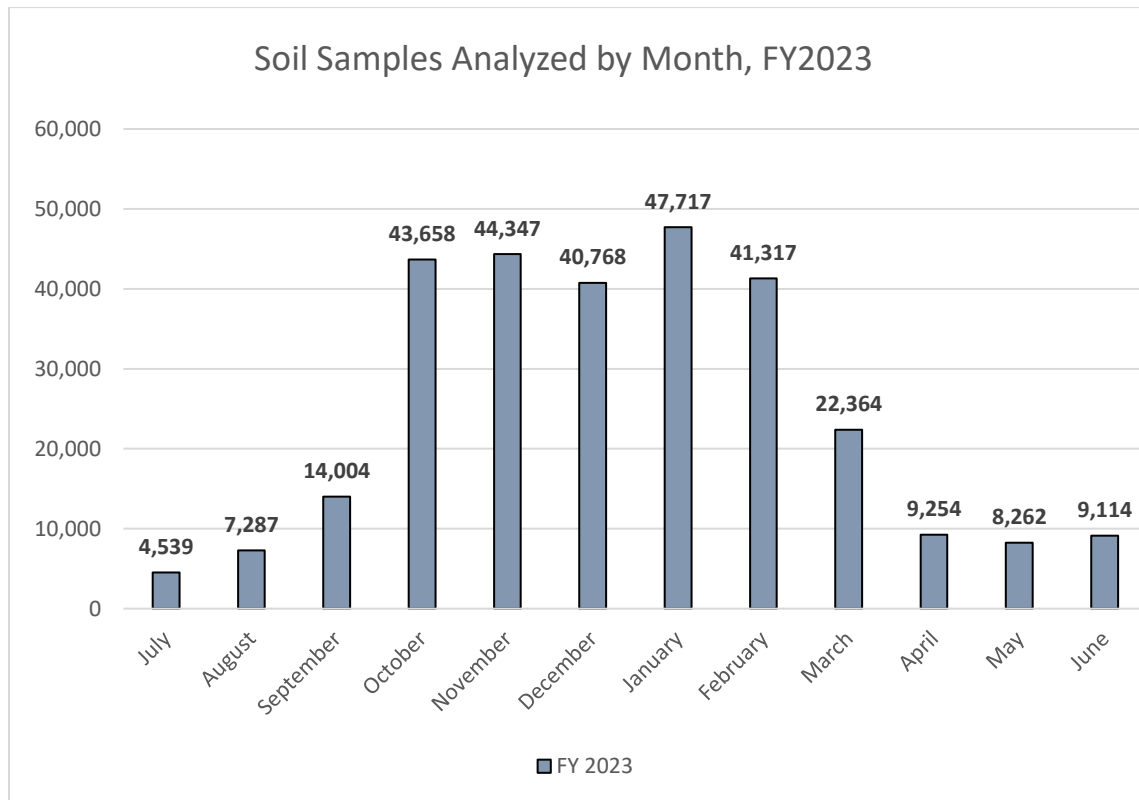




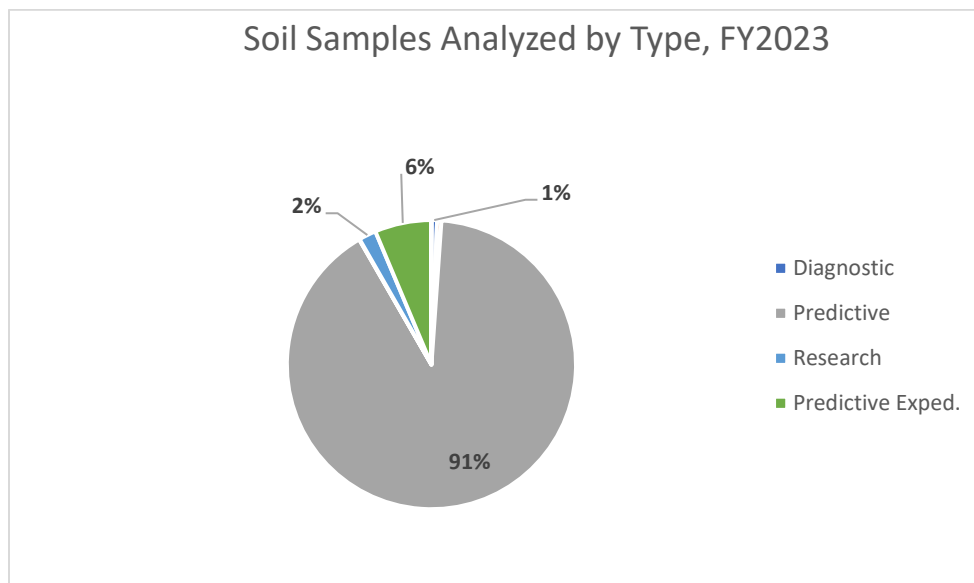
A total of \$145,444 was collected in peak-season soil testing fees (\$4.00/sample) for samples submitted December 1, 2023, through March 31, 2023. Peak-season samples (36,361) represented 13% of the total sample volume analyzed by the Soil Testing Lab.



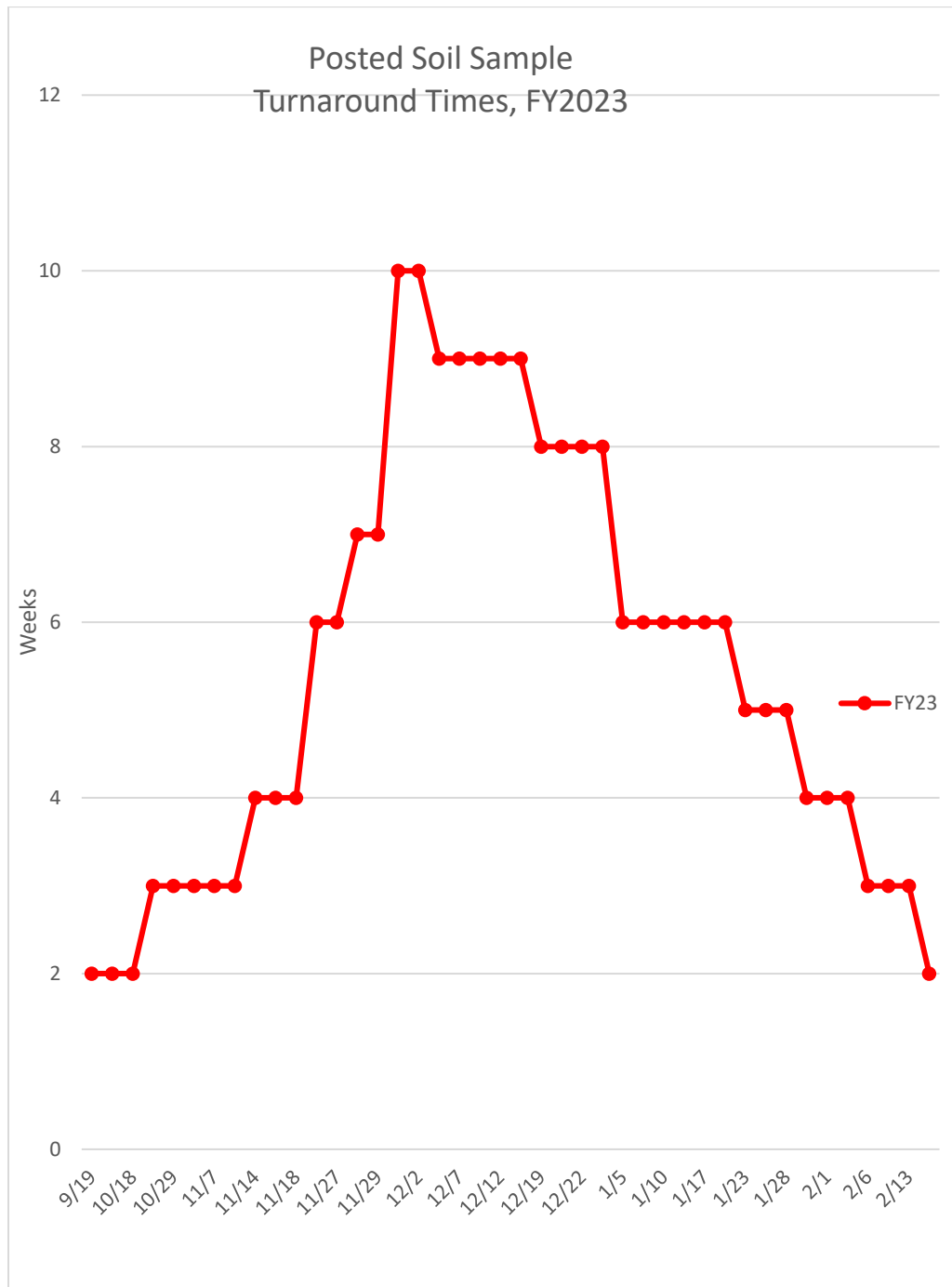
As seen below, the peak-season fee achieved its intended purpose, to distribute the workload for the Soil Testing Lab more evenly across the year. January 2023 was the busiest month of FY2023, with 47,717 soil samples analyzed.



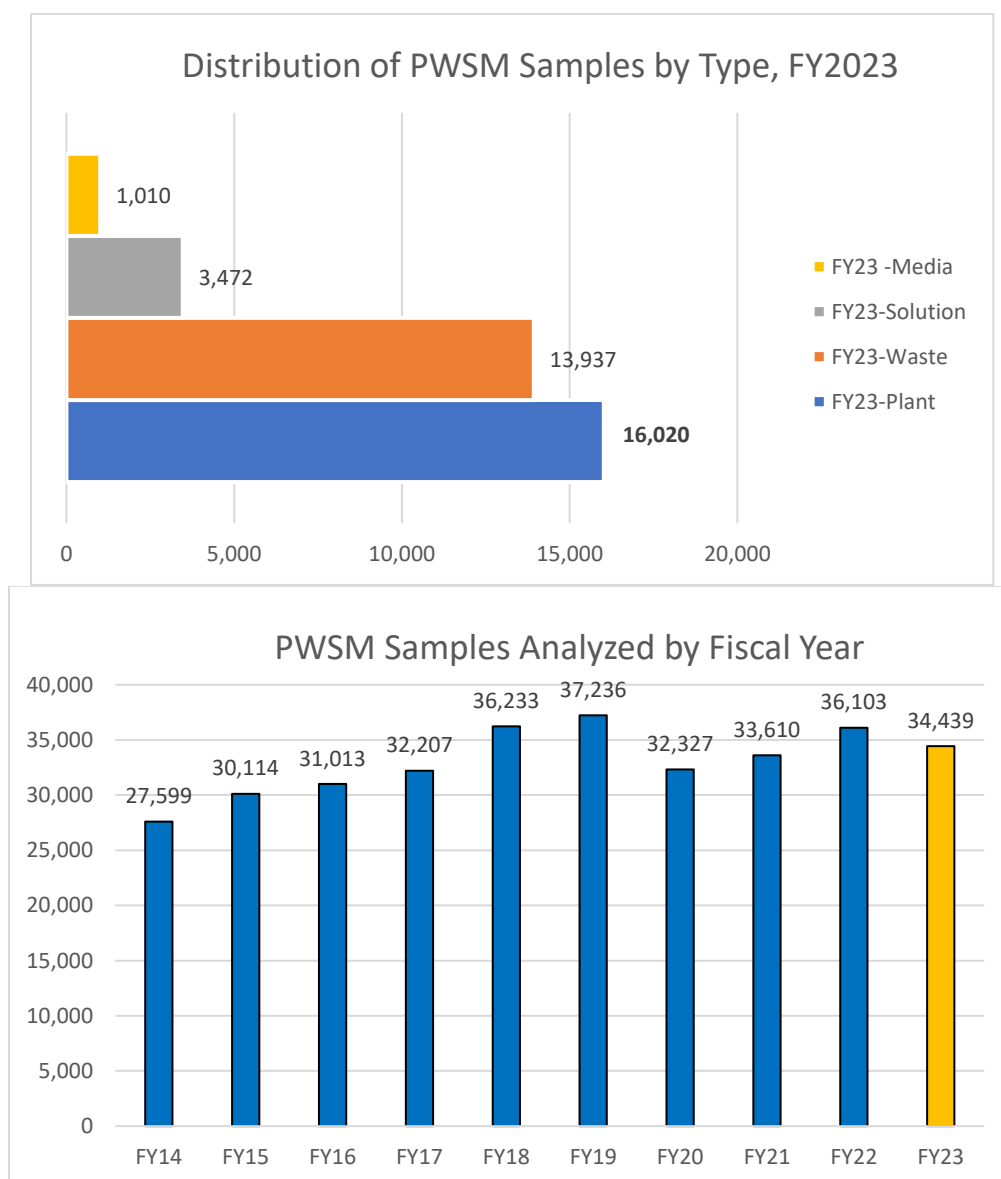
For high-volume customers wanting a guaranteed turnaround time of 7 to 10 business days, a limited number of 36-sample “expedited shippers” were sold at \$200 each. During FY2023, 18,510 samples (~6% of total sample volume) were submitted to the Soil Testing Laboratory in expedited shippers.



In general, the sample turnaround times were very acceptable for growers during FY2023. Soil sample turnaround for predictive samples plateaued at ten weeks on December 1, 2022, but then dropped back down to two weeks by February 17, 2023.

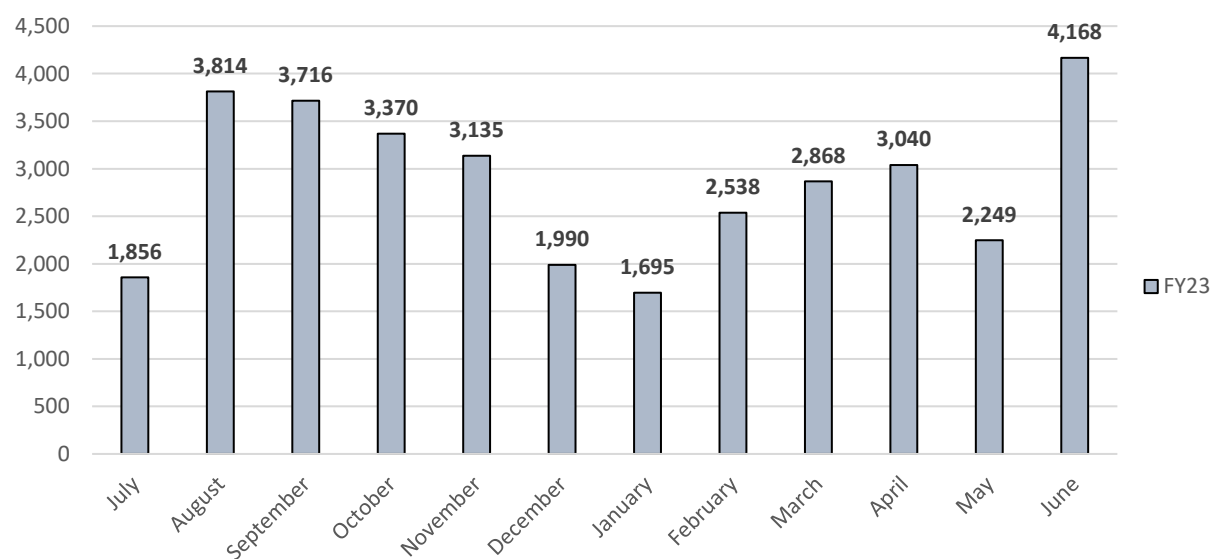


The **Plant/Waste/Solution/Media (PWSM) Section**, under the direction of Kristin Hicks, Ph.D., issued a total of 10,074 reports during FY2023. These reports gave recommendations for 16,020 (47%) plant tissue samples; 13,937 (40%) waste samples; 3,472 (10%) solution samples; and 1,010 (3%) soilless media samples in FY2023. Overall, the annual sample volume was down about 5% compared to the previous fiscal year, but still FY2023 was the fourth highest in the past ten years. With few exceptions, the following turnaround times were able to be maintained throughout the year: plant, 2 days; media and solution, 3 to 4 days; and waste, 7 to 10 days.

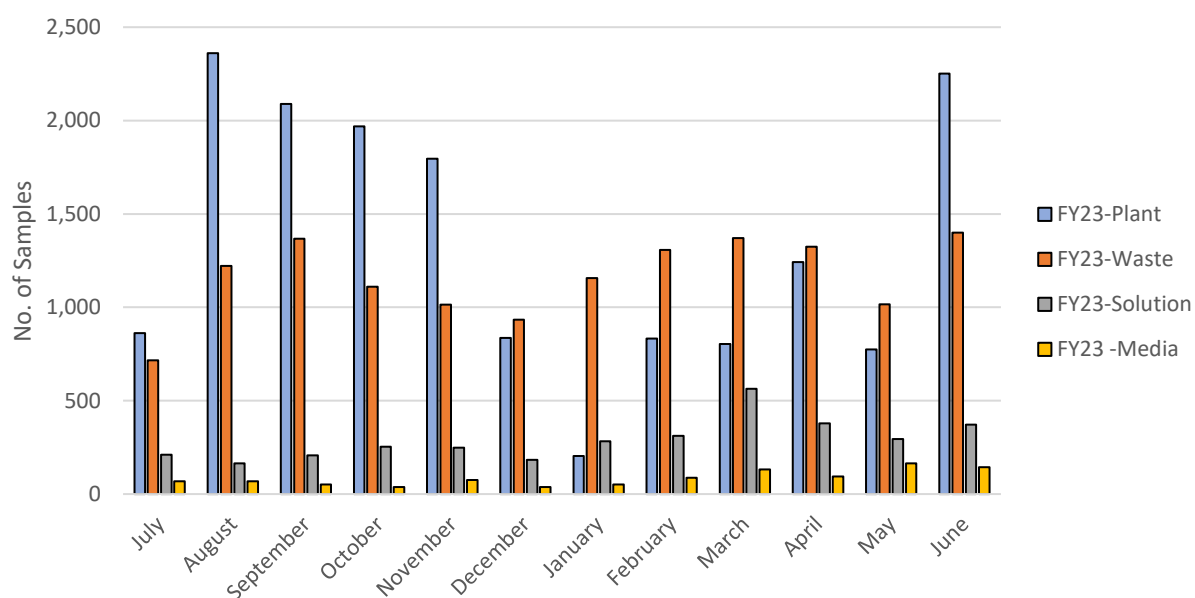


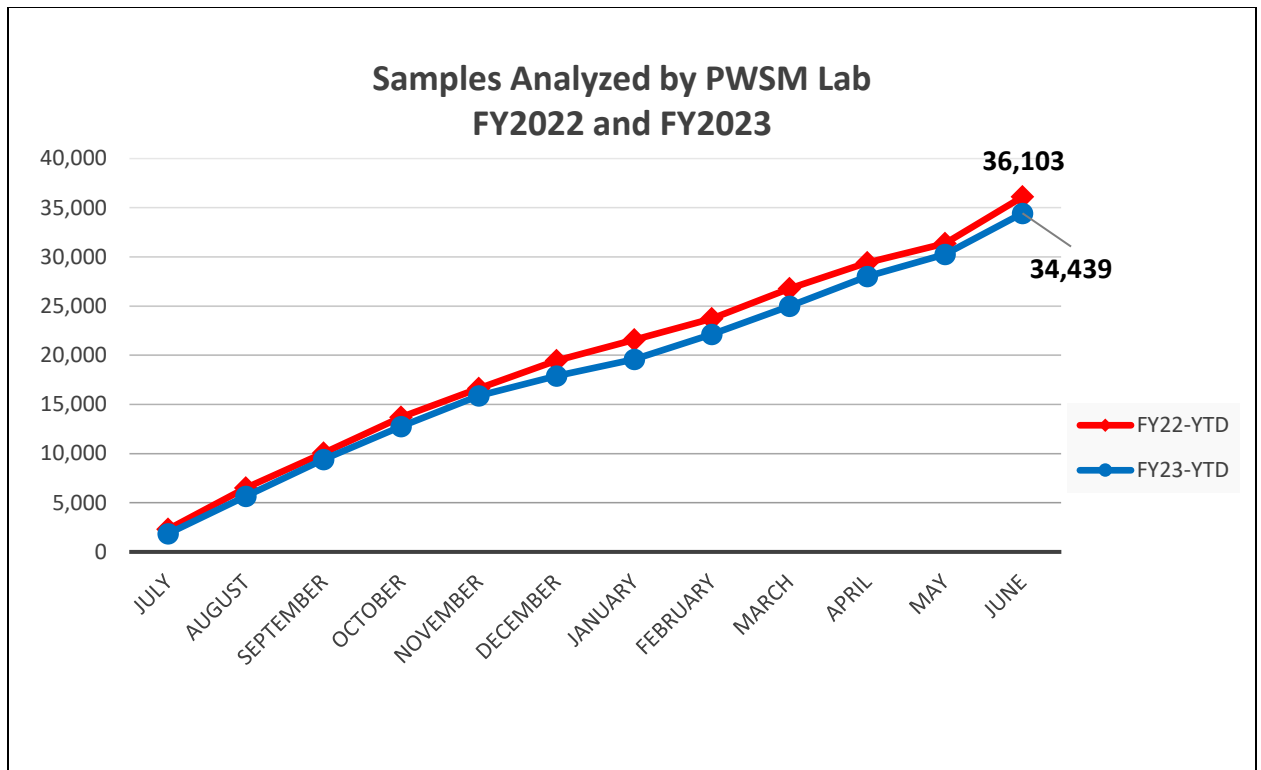
The busiest month for the PWSM Section was the last month of the fiscal year (June 2023), with 4,168 samples analyzed, followed by August 2022, with 3,814 samples. In total, 34,439 samples were processed during FY2023.

Total Plant, Waste, Solution and Media Samples Analyzed by Month, FY2023

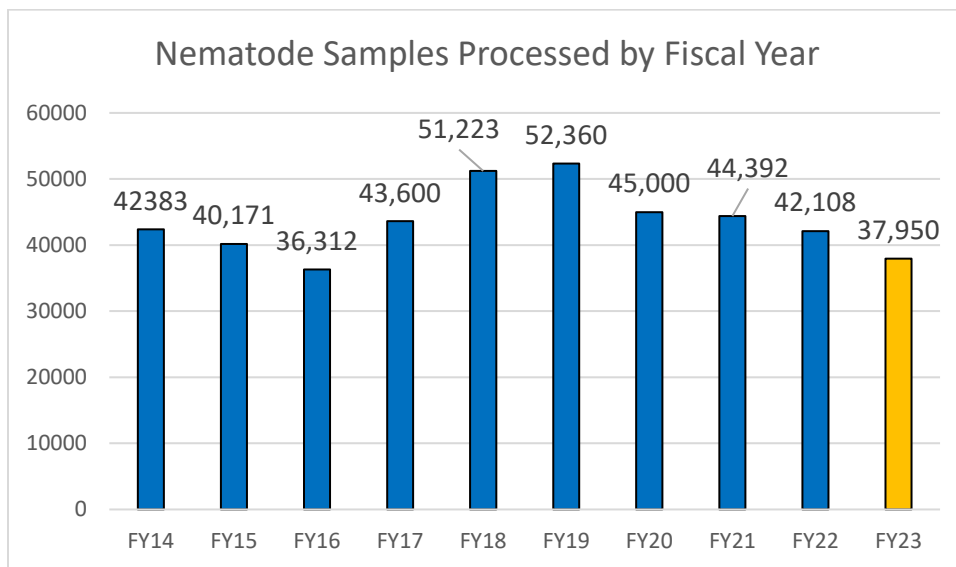


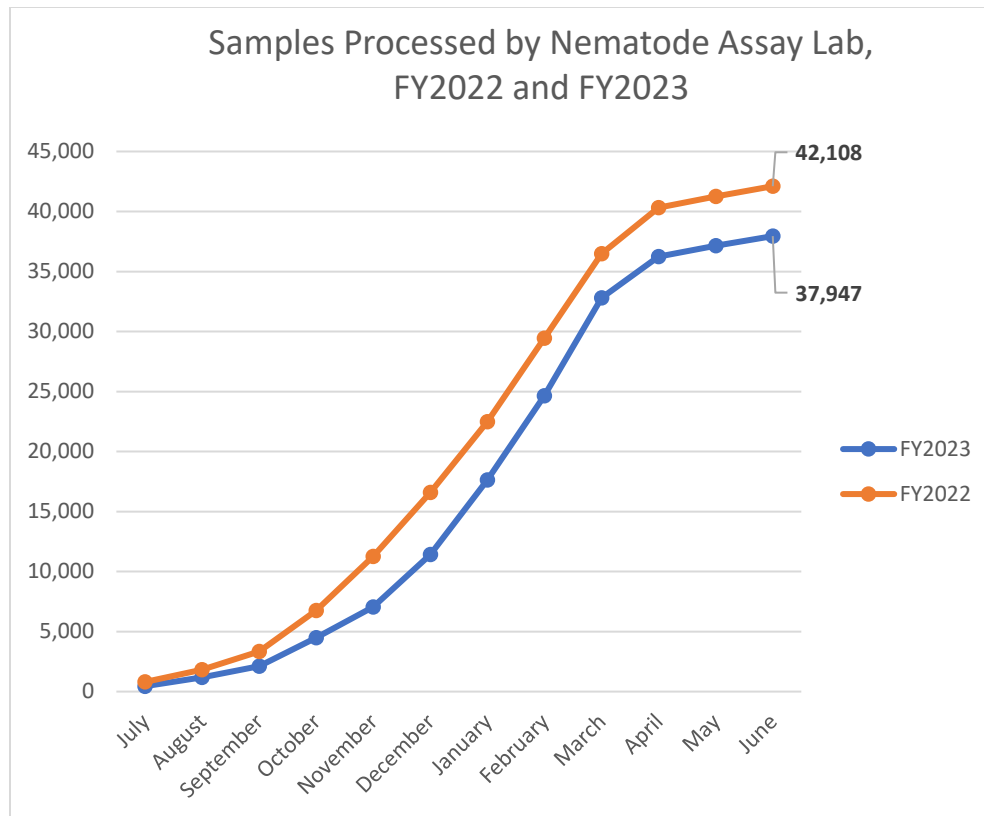
Distribution of PWSM Samples for FY2023



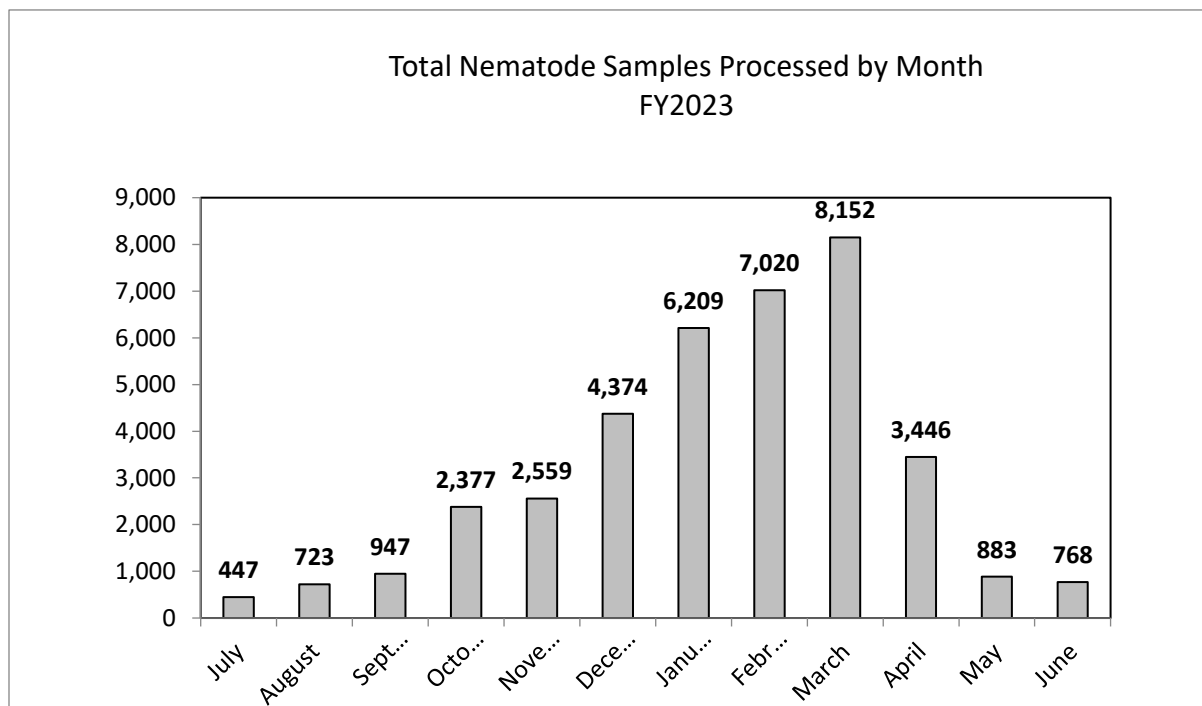


The Nematode Assay Section, under the direction of Weimin Ye, Ph.D., processed 37,950 samples and issued 4,762 reports in FY2023. Total sample volume was down about 10% compared to FY2022 and the second lowest in the past ten years. The drop in sample volume was mainly attributable to the drastic reduction in pinewood samples. The productivity of the Nematode Assay Lab was still very impressive in FY2023, with the 10th highest sample volume in the NCDA&CS Nematode Lab' 43-year history.



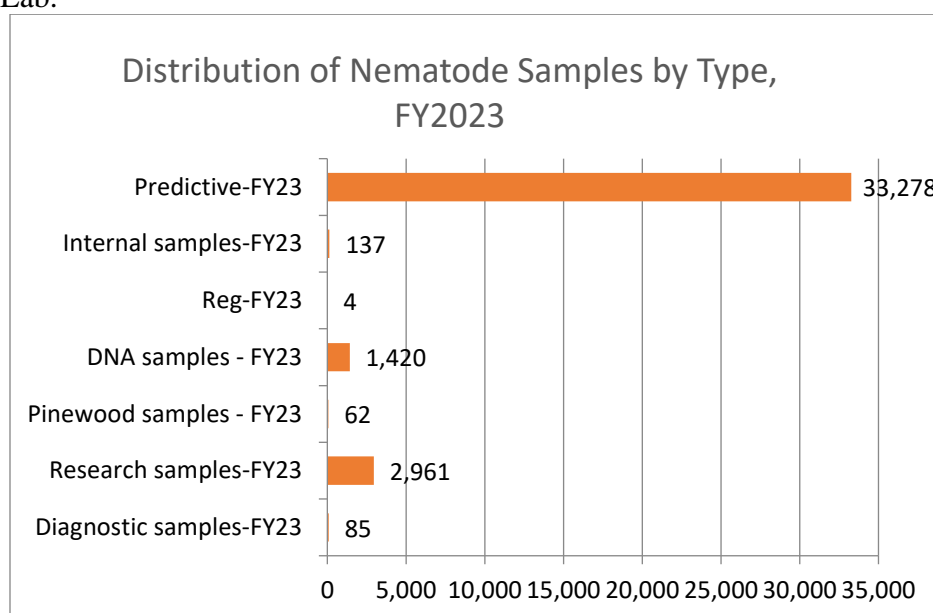


March was the busiest month in FY2023 for the Nematode Assay Lab, with 8,152 samples processed.

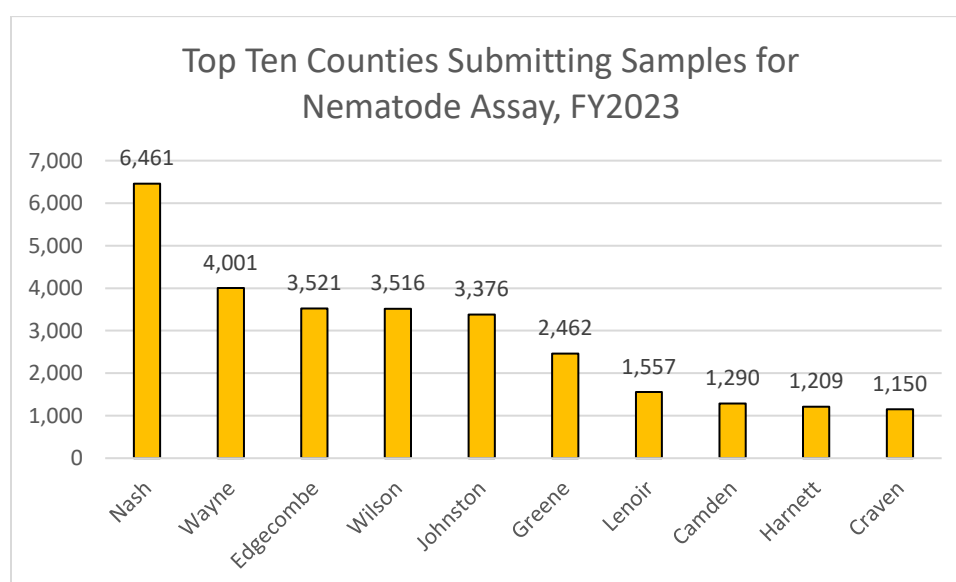
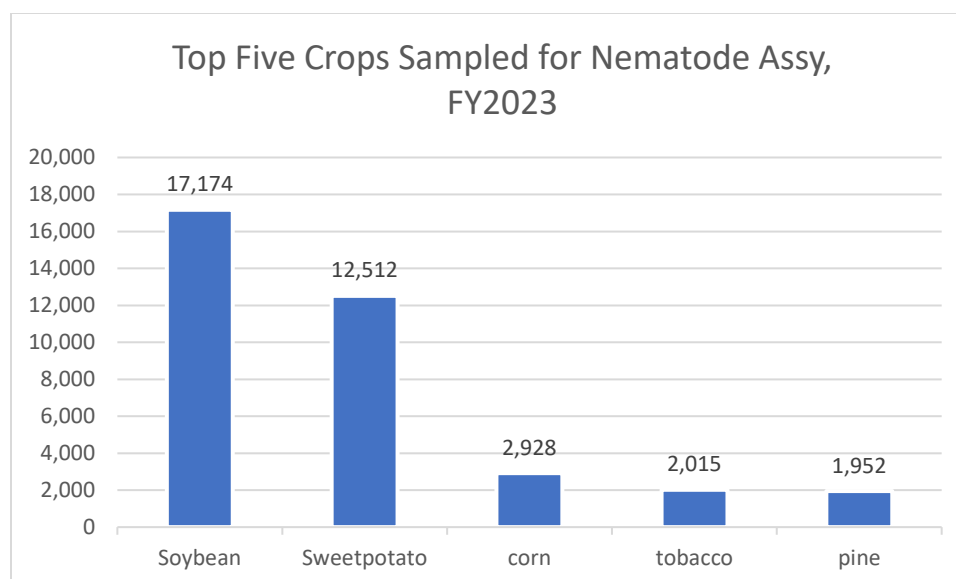


Most samples (33,278) were predictive in nature; other types included 2,961 research samples, 85 diagnostic samples, 137 internal samples, 1,420 molecular diagnostic samples, and 4 regulatory samples from the NCDA&CS Plant Industry Division.

In addition, 62 pine wood samples were specifically tested for the presence of pinewood nematode, so shipments of lumber and wood products could be cleared for export from the United States. Pine wood nematode was detected in only 1 sample, which was 0.16% of the total pine wood samples assayed. Trade issues with China and new USDA sampling protocols have both had a negative impact on the number of pinewood samples submitted to the Nematode Assay Lab.



In FY2023, the crop with the largest number of submitted samples was soybean, with 17,174 samples (41% of total sample volume), followed by sweetpotato (12,512 samples and 30% of total). The top five counties submitting nematode samples for assay were Nash, Wayne, Edgecombe, Wilson, and Johnston Counties, with samples totaling, 6,461; 4,001; 3,521; 3,516, and 3,376, respectively.



The Nematode Assay Lab processed 69 samples for the NC State University's Plant Disease and Insect Clinic as part of a long-standing cooperative agreement.

Field Services

Field Services Section personnel, under the direction of Joe Hudyncia, Field Services Section Chief, made about 7,787 grower consults in FY2023, primarily to help diagnose nutrient and/or nematode problems. Regional agronomists assist landowners, growers, business and agency personnel, and homeowners with the use of Agronomic Division laboratory services for sound nutrient use and nematode management. Regional agronomists handled more than 165 inquiries regarding environmental issues in FY2023, primarily nutrient management plan guidance, regulatory changes or updates, and river basin oversight reviews.

Field Services personnel served on at least 24 agricultural commodity and agricultural organization boards, committees, and advisory groups during FY2023.

1. Carbon Task Force (EP) – Joe Hudyncia
2. Corn Growers Association of North Carolina Board – Don Nicholson
3. Lee County Farm Bureau Board – Don Nicholson
4. Lee County Ag Advisory Board – Don Nicholson (Chair)
5. Lee, Moore, Montgomery Counties FSA Board – Don Nicholson
6. Local Advisory Committee - Jordan Lake Nutrient Strategy – Anna-Beth Williams
7. Local Advisory Committee - Falls Lake Nutrient Strategy – Anna-Beth Williams
8. Haywood County Local Workgroup – Chris Leek
9. Jackson County Local Workgroup – Chris Leek
10. Madison County Local Workgroup – Chris Leek
11. Mountain Research Station Planning Committee – Chris Leek
12. NC Agricultural Foundation Board – Georgia Love
13. NC Farm Bureau Cotton Advisory Committee – Willie Howell
14. NC Peach Growers Society – Brad Thompson (President)
15. NC Tomato Growers Association Board – Chris Leek
16. Robeson County Extension Field Crops Advisory Committee – Georgia Love (Chair)
17. Robeson County Extension Advisory Council – Georgia Love
18. Rowan County Extension Advisory Board – Daniel Overcash
19. Technical Review Committee – Joe Hudyncia
20. Upper Mountain Fraser Fir Research Committee– Dwayne Tate
21. Wayne County Farm Bureau Board of Directors – Willie Howell
22. Wayne County Voluntary Agricultural District Committee – Willie Howell
23. Wilkes County/Roaring River Watershed Advisory Board – Dwayne Tate
24. SB1217 Interagency Guidance Committee – Willie Howell, Joe Hudyncia

Outreach Activities and Publications (Fiscal Year 2023)

Agronomic Division staff reached thousands of growers and agricultural professionals through a wide range of outreach activities during FY2023.

AdvanSix

The N.C. Department of Agriculture and Consumer Services (NCDA&CS) Agronomic Division is very grateful to AdvanSix for their sponsorship of a voucher program for analysis of plant samples for North Carolina growers. Growers can use plant analysis as a tool to improve their fertility management program, thereby maximizing yields and plant quality while safeguarding the environment from unnecessary fertilizer applications. Each year AdvanSix provides funding for the distribution of a limited number of vouchers to cover the cost of plant tissue analysis to introduce growers to this service.

Regional agronomists play a key role in spreading the word about tissue testing and offering these free vouchers to interested growers. During fiscal year 2023, the AdvanSix and NCDA&CS Voucher Program funded the nutritional analysis of 105 plant samples, benefiting 45 growers. Of the 105 samples, 68 vouchers were used for 8 field crops and 37 vouchers for 12 horticultural crops. By geographic region, 30 plant samples were collected from the Piedmont, 64 from the Coastal Plain and 11 from the Mountains. Plant samples from 22 of North Carolina's 100 counties were supported by the voucher program. Robeson [17], Columbus [15], Cumberland [11], and Bladen [10] counties used the greatest number of vouchers.

Laboratory Tours

In-house staff conducted at least 16 laboratory tours for farmers, master gardeners, agribusiness groups, scientists, and students, with at least 202 participants (Appendix A.). Information on agronomic services was disseminated through more than 23 educational exhibits displayed at farm shows, field days, training events and professional meetings (Appendix B).

Other Outreach

Outreach also included six news releases and four Facebook posts (Appendix C). Many presentations on agronomic services were made to master gardeners, growers, commodity associations, conservation groups, and county and state organizations as well as to regional, national, and international meetings (Appendix D). At least six external professional publications were published by staff in FY2023 (Appendix E).

Research (Fiscal Year 2023)

Division staff routinely engage in cooperative studies with university personnel, farmers, and industry specialists. Research conducted in FY2023 includes the following:

- 1) **Validation of Phosphorus Recommendations in Corn for Grain** in cooperation with the Crop and Soil Sciences Department at N.C. State University (NCSU) – **Dr. David Hardy** (NCDA&CS); Dr. Luciano Gatiboni (NCSU) and Dr. Deanna Osmond (NCSU) Project funding: Corn Growers Association of North Carolina.
- 2) **Starter fertilizers for corn: what, when, it is needed** in cooperation with the Crop and Soil Sciences Department at N.C. State University (NCSU) – Dr. Luciano Gatiboni (NCSU) and Dr. Deanna Osmond (NCSU) and **Dr. David Hardy** (NCDA&CS); Project funding: Corn Growers Association of North Carolina.
- 3) **Characterization of *Meloidogyne enterolobii* on sweet potato in North Carolina, USA** – **Dr. Weimin Ye** (NCDA&CS).
- 4) **Efficacy of Fumigants to Pinewood Nematode Found in Debarked Southern Yellow Pine Woodchips in Savannah, Georgia** – **Dr. Weimin Ye** (NCDA&CS).

- 5) **Nitrogen Rate Management for Malting Quality Barley in North Carolina** in cooperation with the Crop and Soil Sciences Department at N.C. State University (NCSU) – **Dr. Kristin Hicks** (NCDA&CS); Regional Agronomist Brandon Poole (NCDA&CS); Dr. Luciano Gatiboni (NCSU); Dr. Deanna Osmond (NCSU) and Graduate Student Josh Whelan (NCSU). Project funding: N.C. Tobacco Trust Fund Commission

Safety Program (Calendar Year 2023)

The Agronomic Services Division maintains a very active, employee-led safety program. The Division has been recognized as a Public-Sector Star site by the North Carolina Department of Labor (NCDOL) for the past fourteen years. All employees serve on one of eight Star safety teams: Safety Inspection & Compliance; Safety Program & Policy; Safety Information & Communication; Job Safety Analysis; Housekeeping and Wellness; Ergonomics; Environmental Management, and Field Services.

The Agronomic Services Division prepared a detailed annual report on its 2023 safety program and submitted it to the N.C. Department of Labor (NCDOL) on February 15, 2024. (Reports are prepared according to the calendar year per NCDOL guidelines.)

APPENDIX A – Laboratory Tours Conducted During FY2023

	Tour Date	Tour Group	Attendees
1	1/24/2023	Teleos AG Solutions Group	4
2	2/2/2023	Harnett Soil & Water Conservation District	4
3	2/15/2023	NC Cooperative Extension- EOD	4
4	3/15/2023	New Hanover Extension Master Gardener Class	12
5	3/16/2023	Durham County Master Gardener Class	27
6	3/22/2023	Surry/Stokes Co Master Gardener Volunteers	20
7	3/30/2023	Hoke, Scotland, Robeson EMG Class	10
8	5/2/2023	Davidson County Master Gardener Volunteers	22
9	5/10/2023	New Hanover EMG Class - Masters	19
10	5/16/2023	Waters Agricultural Lab - Group 1	9
11	5/17/2023	Waters Agricultural Lab - Group 2	5
12	5/18/2023	Johnston County Master Gardener Volunteers	25
13	5/24/2023	Wayne County Master Gardeners	10
14	5/24/2023	Bertie County Cooperative Extension	4
15	6/7/2023	NC State Extension	11
16	6/9/2023	CEFS Summer Interns	16
		Total Tour Attendees	202

APPENDIX B – Educational Exhibits during FY2023

<u>MEETING OR EVENT</u>	<u>DATE</u>
Mountain Research Station Field Day (Waynesville)	July 21, 2022
NE Ag Expo Field Day (Camden Co)	July 28, 2022
Blackland Farm Managers Tour (Beaufort Co)	Aug 3, 2022
NC Christmas Tree Summer Meetings (Jackson Co)	Aug 12, 2022
Caldwell County Nurseryman's Association Field Day (Collettsville)	Sept 16, 2022
NC Greenhouse Vegetable Growers Association (Smithfield)	Nov 2-3, 2022
SE Strawberry Expo (Winston-Salem)	Nov 9-11, 2022
SE Vegetable & Fruit Expo (Durham)	Nov 28-30, 2022
SE Regional Fruit & Vegetable Conference (Savannah)	Jan 5-8, 2023
NC Blueberry Council 57 th Open House & Trade Show (Fayetteville)	Jan 10-11, 2023
NC Commodities Conference (Durham)	Jan 11-13, 2023
SE Apple Growers Meeting (Asheville)	Jan 18-19, 2023
NC Sweetpotato Commission Annual Meeting (Goldsboro)	Jan 19, 2023

Green & Growin' (Greensboro)	Jan 19-20, 2023
NC Peach Growers' Society Annual Meeting (Carthage)	Jan 24, 2023
Henderson County Winter Apple School (Flat Rock)	Feb 1, 2023
Southern Farm Show (Raleigh)	Feb 1-3, 2023
Northeast Ag Expo Small Grain Field Day (Elizabeth City)	Feb 15, 2023
NC Blackberry Growers' Annual Meeting (Rose Hill)	Feb 17, 2023
Winter Vegetable Conference (Asheville)	Feb 22-23, 2023
NC Christmas Tree Association Annual Meeting (Boone)	Feb 24, 2023
Organic Commodities & Livestock Conference (Raleigh)	Mar 6, 2023
Strawberry Field Day at Cottle Farms (Faison)	Apr 25, 2023

APPENDIX C – News Releases, Facebook Posts, and Interviews during FY2023

	News Release/Facebook Post/Interview	Date
1.	<i>Happy retirement to one of our Regional Agronomists, Mike Wilder (Facebook).</i>	Sept. 17, 2022
2.	<i>The Agronomic Division would like to welcome Dr. Rinu Kooliyottil as the new Nematode Diagnostic Specialist (Facebook)</i>	Oct. 18, 2022
3.	<i>Submit soil samples now to avoid busy lab time and peak-season fee, J. Kamalakanthan.</i>	Nov. 10, 2022
4.	<i>North Carolina Agriculture Commissioner Steve Troxler reminds you to submit soil samples now to our Agronomic Services Division and avoid peak-season fees (Facebook).</i>	Nov. 15, 2022
5.	<i>Turnaround times for routine nematode testing expected to be long; molecular diagnosis of guava root-knot nematode will be given priority, C. Hudak-Wise.</i>	Dec. 1, 2022
6.	<i>Waste Lab receives Manure Analysis Proficiency (MAP) Program and Certified Manure Testing Laboratory (CMTL) Program certifications for 2023 (Facebook).</i>	Jan. 12, 2023
7.	<i>Agronomic Division Labs Open Doors to Tours, D. Hardy.</i>	Jan. 23, 2023
8.	<i>Soil calcium, magnesium, and potassium – straight talk about nutrient ratios, D. Hardy.</i>	Jan. 24, 2023
9.	<i>New Section of Field Services named for NCDA&CS Agronomic Division, D. Hardy.</i>	Jan. 26, 2023
10.	<i>Optimized strawberry fertility with plant tissue testing, K. Hicks.</i>	Mar. 7, 2023.

APPENDIX D – Presentations Made by Agronomic Division Staff during FY2023

Nematode Assay Section

- The 61st Annual Meeting of the Society of Nematologists. (Anchorage, AK, Sept. 26-29, 2022)
 - Presentation: *Update of the Guava Root-Knot Nematode Meloidogyne enterolobii from Sweet Potato in North Carolina, USA*, W. Ye.
- Pine Wilt Disease Conference 2022. (Lisbon, Portugal, Sept. 6-9, 2022)
 - Presentation: *Pinewood Nematode Diagnostic Services in North Carolina Department of Agriculture & Consumer Services*, W. Ye.

Soil Testing Section

- 66th Annual Meeting of the Soil Science Society of North Carolina (Raleigh; April 17, 2023)
 - Presentation: *Recent Changes in Phosphorus Soil Test Recommendations for Grains- Preliminary Field Results*, D. Hardy, L. Gatiboni, and D. Osmond.

Plant/Waste/Solution/Media Section

- 21st Annual Vermiculture Conference (Raleigh, October 22, 2022, Tobacco Workers' Conference (Myrtle Beach; Jan 15, 2018)
 - Presentation: *Chemical Characteristics of Vermicompost & Its Application to Soil Fertility*, K. Hicks.
- Mid-Atlantic Soil and Plant Analysis Working Group (Raleigh; Feb 22, 2023)
 - Presentation: *Recommended Methods of Manure Analysis*, K. Hicks.
- 17th International Symposium on Soil and Plant Analysis (Concepcion, Chile; March 21, 2023)
 - Presentation: *Recommended Methods of Manure Analysis*, K. Hicks.
- 17th International Symposium on Soil and Plant Analysis (Concepcion, Chile; March 23, 2023)
 - Presentation: *Simplified Approach to Developing Tissue Nutrient Reference Ranges with Cannabis sativa as a Model*, K. Hicks.
- Southern Extension and Research Activity Annual Meeting Region Analysis (Auburn, AL; June 6, 2023)
 - Presentation: *Alternative Approach to Developing Tissue Nutrient Reference Ranges with Cannabis sativa as a Model*, K. Hicks.

Field Services Section

- Mountain Research Station Field Day (Haywood Co; Jul 21, 2022)
 - Presentation: *Soil Testing in Forages*, S. Dillon
- Watauga Summer Fraser Fir Tree Meeting (Boone; Aug 4, 2022)
 - Presentation: *Benefits of Tissue Sampling and How to Properly Take a Sample*, D. Tate
- Uwharrie Charter High School (Randolph Co; Sep 26, 2022)
 - Presentation: *Introduction to Soils – How to Collect Soil and Tissue Samples*, B. Thompson
- Uwharrie Charter High School (Randolph Co; Sep 26, 2022)
 - Presentation: *Soils 101 – Importance of Soil and Nutrients for Plant Growth*, B. Thompson
- West Rowan High School (Rowan Co; Oct 5, 2022)
 - Presentation: *A Day in the Life of an Agronomist*, D. Overcash

- Animal Waste Applicator Continuing Education Meeting (Duplin Co; Dec 9, 2022)
 - Presentation: *Maximize Yield and Nutrient Uptake on Your Sprayfields*, W. Howell
- Animal Waste Applicator Continuing Education Meeting (Sampson Co; Dec 13, 2022)
 - Presentation: *Maximize Yield and Nutrient Uptake on Your Sprayfields*, W. Howell
- Cumberland County Soldiers to Agriculture Class (Cumberland Co; Aug 8, 2022)
 - Presentation: *Soils and Soil Fertility*, G. Love
- UNC Pembroke Pest Management Class (Robeson Co; Sep 20, 2022)
 - Presentation: *Plant Disease and Agriculture in North Carolina*, G. Love
- Robeson County Livestock Association Meeting (Robeson Co; Oct 20, 2022)
 - Presentation: *Fertility Management in Bermudagrass Hay*, G. Love
- Uwharrie Charter High School (Randolph Co; Nov 22, 2022)
 - Presentation: *Introduction to Soils – How to Read and Interpret a Soil and Tissue Analysis Report*, B. Thompson
- Uwharrie Charter High School (Randolph Co; Nov 22, 2022)
 - Presentation: *Soils 102 – Nutrient Basics: Macro and Micro Nutrients and Their Effect on Plant Growth*, B. Thompson
- Statewide Waste Management Webinar (Virtual; Nov 28, 2022)
 - Presentation: *Nutrient Management for Forage Crops in N.C.*, G. Love
- Hoke County Livestock Association Meeting (Hoke Co; Jan 10, 2023)
 - Presentation: *Nutrient Management with Manure and Other Fertilizer Sources*, G. Love
- Surry County Extension Master Gardener Volunteers (Surry Co; Jan 18, 2023)
 - Presentation: *Soil Testing and Interpretation*, D. Overcash
- Soldier to Agriculture Training Class (Cumberland Co; Jan 25, 2023)
 - Presentation: *NCDA&CS Overview/Soils and Soil Fertility*, G. Love
- Certification Training for Animal Waste Management Systems (Bladen Co; Jan 26, 2023)
 - Presentation: *Tools for the Plan: Waste, Soil, and Plant Analysis*, G. Love
- Alamance County Cattlemen's Association (Alamance Co; Feb 14, 2023)
 - Presentation: *Maximizing Forage Nutrition Through Soil Fertility*, A. Williams
- Robeson/Scotland Counties Master Gardener Soils Class (Robeson Co; Feb 16, 2023)
 - Presentation: *Soils and Soil Fertility*, G. Love

- Surface Irrigation System Operators Training (NCSU) (Wake Co; Mar 22, 2023)
 - Presentation: *Collecting and Submitting Soil Samples Correctly*, B. Thompson
- Bladen County Livestock Association Meeting (Bladen Co; Apr 13, 2023)
 - Presentation: *Fertility and Weed Management in Bermudagrass Hay*, G. Love
- Soldier to Agriculture Training Class (Cumberland Co; Apr 20, 2023)
 - Presentation: *Soils and Soil Fertility*, G. Love
- Union County Extension Master Gardener Volunteers (Union Co; May 18, 2023)
 - Presentation: *Soil Testing and Interpretation*, D. Overcash

APPENDIX E – External Publications of the Agronomic Division during FY2023

Soil Testing Section

1. Havlin, J., R. Austin, **D. Hardy**, A. Howard, J. Heitman. Nutrient management effects on wine grape tissue nutrient content. 2022. *Plants*. 11(2). 158.
2. Morales, N., L. Gatiboni, D. Osmond, R. Vann, S. Kulesza, C. Crozier, **D. Hardy**. Critical soil test values of phosphorus and potassium for soybean and corn in three long-term trials in North Carolina. *Soil Science Society of America Journal*. 2023. 87(2):278.
3. Tiecher, T, C. Pace, L. Gatiboni, M. Vann, **D. Hardy**, L. Fisher. Flue-cured tobacco and CI rates: Implication on yield, quality, and nutrient concentration. *Agronomy Journal*. 2023. 115 (2):896.

Nematode Assay Section

1. Gu, J., **W. Ye**, M. Munawar. Description of *Xiphinema pupureum* n. sp. (Nematoda: *Longidoridae*), a new *Xiphinema americanum* group species detected from the rhizosphere of *Ilex purpurea* from Japan. *Nematology*. 2023. 25(1): 91-105. doi: <https://doi.org/10.1163/15685411-bja10208>.
2. Stevens, M.C., **W. Ye**, S. Thalavaisundaram. Efficacy of ethane dinitrile against pinewood nematode in woodchips under field conditions. *Forest Products Journal*. 2022. 72 (3): 170–174. <https://doi.org/10.13073/FPJ-D-22-00033>.

Plant/Waste/Solution/Media Section

1. Veazie, P., P. Pandey, S. Young, M.S. Ballance, **K. Hicks**, and B. Whipker. November 2022. Impact of Macronutrient Fertility on Mineral Uptake and Growth of *Lactuca sativa* ‘Salanova Green’ in a Hydroponic System. *Horticulturae*, 8(11), 1075.

