VOLUME 4, ISSUE 1

SOUTHERN WILLAMETTE VALLEY GROUNDWATER MANAGEMENT AREA

JUNE 2022

INSIDE THIS ISSUE:

TELL THE GOOD DIRT STORY

By Teresa Matteson, Resource Conservationist, Benton SWCD

Benton SWCD received an OWEB Technical Assistance grant to build soil-minded relationships for resilient crop systems. The major area for the work is the Southern Willamette Valley Groundwater Management Area. The primary objective of the project is to raise soil health awareness. By offering soil health tests and follow up meetings to discuss cropping constraints related to the results, BSWCD plans to lay the foundation for a soil-minded community.

Farmers listen when farmers talk. Peer-to-peer is the best conservation education campaign. Eric Horning shares his cover crop experience during a SHOP TALK event.

The real challenge is the transfer of information to on-ground action. What events or information will entice farmers to adopt conservation practices? Benton SWCD will work with partners, such as OSU Extension, to tell the Good Dirt Story. Events will encourage farmers to share peer-to-peer information during tours that showcase conservation practices (reduced tillage demos and cover crops trials) and workshops about in-field tools (compaction testing and the NRCS Soil Health Rapid Assessment Tool).

Soil health is synonymous with the ability of the soil to function in ways that support crop production and reduce farm risk. The soil's capacity to function changes with management and impacts the need for nutrient, water, and labor inputs. Those all add up to dollars. Improving soil health will eventually reduce the farm's out of pocket costs. *Continued on page 2.*

GROUNDWATER WELL MONITORING

By Sarah Sauter, SWV GWMA Coordinator, DEQ

DEQ is committed to tracking the nitrate levels in the SWV GWMA to determine long term trends in nitrate contamination of the regional aquifer. DEQ established a network of domestic and monitoring wells. The wells are sampled up to four times a year. The entire network is sampled once a year in May. In addition to the wells that are sampled, DEQ collects surface water from six locations each May. DEQ monitoring staff collect and analyze the samples. DEQ and the SWV GWMA partners use the monitoring results to help determine if the goals contained in the Action Plan are being accomplished.

For more information:

wellwater.oregonstate.edu/swvgwma

SWV GWMA Coordinator

Sarah Sauter

Sarah.sauter@deq.oregon.gov

This newsletter was produced by:

State of Oregon Department of Environmental Quality

SPRING FERTILIZER TIPS

By Christy Tanner, Ph.D., Assistant Professor (Practice), Oregon State University OSU Extension Service – Linn, Benton and Lane Counties

Christy recommends that growers in the SWV GWMA follow these recommendations when considering your next fertilizer applications.

Choosing the right fertilizer rate

When deciding how much nitrogen fertilizer to apply, farmers have to balance yield, economics and environmental impacts. Too little nitrogen can limit crop yield, while too much fertilizer is a waste of money and can pollute ground and surface water. OSU extension has published fertilizer management guides that include recommended fertilizer rates. While some fields might need more or less fertilizer, the recommendations are based on many years of on-farm research and provide a good starting point for growers.

Recommended Application rates for Spring Nitrogen

*Soil tests will tell you the concentrations of nutrients in your soil. You may not need to apply phosphorous and potassium every year, especially if soil levels are above a threshold value. You might be able to avoid high prices this year by delaying phosphorous and potassium fertilizer applications until next year. This strategy can leave you with a larger fertilizer bill for next year, and there is no guarantee that prices will go down. Do not skip recommended fertilizer applications when establishing a new perennial crop. Nitrogen usually needs to be applied every year, but you should consider the amount of nitrogen in the soil when deciding on your fertilizer rate.

Fertilizer test plots

Fertilizer test plots are a good way to find the best fertilizer rates for your fields and production practices. One approach is to apply 25 lb less fertilizer to one strip of the field, and 25 lb more to another strip. Remember the locations of the strips and watch your combine yield monitor during harvest. Compare yields and fertilizer costs between the strips. If the yield was similar, you can go with the lower fertilizer rate and save money. If the difference in yield was more than enough to pay for the extra fertilizer, then go with the higher rate. Doing test plots every year will help you fine tune fertilizer rates for your farm, and you will be confident that you are applying the right amount.

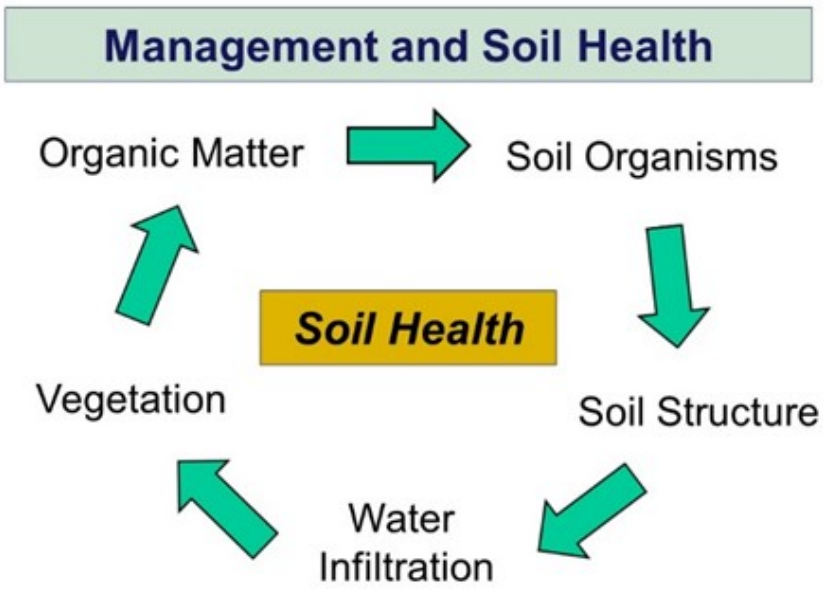
Continued from page 1. Look at the Soil Health Cycle on page 3 and read the bullets below to understand how management is related to soil health. When an arrow in the cycle is removed, soil health degrades.

Farming grows crops = vegetation, so start there in the soil health cycle.

- As plants grow, they mine nutrients from the soil. The harvest of crops removes the nutrients from the soil store. For the next crop to grow, those nutrients need to be replaced.
- Plant materials left in the field become soil organic matter. Those can be residues after harvest, cover crops grown and incorporated, or added compost.
- Soil organic matter is the food supply for soil biology.
- Soil biology builds soil structure.
- Soil structure creates pores so that water, air, and nutrients can move around to be available for plant growth.
- Plant growth brings the process full circle, back to vegetation.

Let's dig deeper into the five **functions of soil**.

Anchor and resource pool for plant growth – As plant roots reach deep into the soil to access nutrients and water, they form a solid base that stabilizes above-ground stems, leaves, and flowers. Growers submit soil samples to fine tune the soil's nutrient pool to match plant needs *(continued on page 3).*



For example, the addition of lime to adjust soil pH has a significant effect on nutrient availability, and helps the grower supply the ideal "diet" for specific crops. Vibrant roots need a balance of air and water and plenty of food to support whole plant growth. That air to water balance comes with good soil structure.

Habitat for soil creatures – From nutrient-cycling bacteria and fungi to larger creatures, like worms, gophers and voles, healthy soil is home to a balanced community of myriad organisms. The soil creatures, large and small, degrade organic compounds, build a nutrient bank account with the very presence of their bodies, and excrete wastes that become food for plants that feed us. Approximately 25% of all living creatures on Earth live in the soil. Each level of soil creatures is vital to soil function. For example, worms and plant roots are soil engineers that mix soil with organic materials and create water and air pores where smaller creatures thrive. Pressure and sticky glues from the creatures build a soil infrastructure called aggregates. Stable aggregates resist wind and water erosion, keeping valuable soil in place.

Nutrient cycling and degradation of wastes – Thriving soil creatures recycle wastes and feeds plants. The soil food pantry gets emptier with each growing season. As the plants mine out the nutrients, food supplies must be replaced by amendments or the breakdown of organic matter by soil biology.

A fascinating fact, roots excrete yummy juices into the surrounding soil that attract and feed soil microbes. The microbes in turn break down nutrients into plant food. Essentially, plants invite their microbe friends to a potluck. Good structure created by the hard-working creatures holds water and nutrients, reducing groundwater contamination and surface water sedimentation.

Collection and storage of water – Soils have a variety of air and water-filled pores, the sizes of which determine how much and how long water is held or released to plants. Water that is not held by soil will be moved off site as runoff, or pulled down by gravity, potentially carrying contaminants to groundwater. The architecture of the soil, or structure, takes many forms, from tiny pores that are home to bacteria, to larger aggregates that house a wide variety of soil biology. Soil texture (percent of sand, silt, and clay) greatly influences water-soil interactions. Texture determines soil drainage class informing irrigation strategies, plant selection, cultivation timing, and amendment applications.

Engineering medium - Less about soil health, yet important to all agriculture activities, soil texture (sand, silt, clay) determines what is possible on a given site, such as construction of buildings, ponds, dams, and roads.

Fulfilling BSWCD's grant objectives will enable producers to make science-based, informed decisions that improve soil function, protect water resources, and reward farmer pockets.

For more information, contact Teresa Matteson at tmatteson@bentonswcd.org.

RURAL RESIDENT OUTREACH

By Chrissy Lucas, Outreach Program Coordinator, OSU Extension Service

As we move out of the rainy season (pretty please), OSU Extension is wrapping up our 319 grant funded project with the SWV GWMA. It has been a very challenging project when all of our grant deliverables were designed with in-person programming and one on one interactions at the community level. Covid-19 threw that design plan for a loop. Our in-person workshops were transitioned to webinars for 2021 and the first few months of 2022. The response to these webinars were overwhelming and our team was able to offer a monthly Rural Living Basics: Living with your well and septic system. The webinars averaged about 50 participants for each session, and participants joined from all over the state. Without the natural boundaries and limitations of in-person programming, OSU has to look at all of the registration data to calculate how many of those participating live in the SWV GWMA.

All of the OSU Extension offices within the SWV GWMA now have the ability to offer nitrate screenings in office during business hours. This was a direct result of the pandemic but has yielded more accessibility of information to residents. In Summer 2021, OSU Extension welcomed 2 interns to host in-person nitrate screening clinics across the Southern Willamette Valley Region. For all screenings in 2021 willing participants provided survey responses about their experience, information received, and if they decided to change any land-use practices, have a septic system serviced/inspected, had additional well water testing, or installed water treatment.

The most exciting news is that the program is allowed to do in person programming again with no restrictions, allowing for 3 in-person Rural Living Basics workshops to be held. May 18th was the first one at the Junction City Community Center, May 24th was held at the Monroe Library, and the last will be held on June 30th at the Junction City Community Center (last day of this project).

OSU Extension Service at the regional level is committed to continuing outreach and education in the SWV GWMA and has provided a limited amount of funding for Chrissy Lucas to continue work in Linn and Benton counites. County dollars have also been allotted for 3 summer interns for 2022 that will host events in Lane, Linn, Benton, Marion, and Polk counties. For any questions or to refer anyone with questions please reach out to Chrissy.Lucas@oregonstate.edu or 541-713-5009.

WELCOME OSU EXTENSION SUMMER INTERNS

The Groundwater Program is excited to have three interns joining us from June through September.

Briauna Herrick is from Springfield, Oregon but has lived in Corvallis for the past two and a half years. Back home her family has a produce stand, and grows a large variety of crops throughout the year. She is a junior at Oregon State University and majoring in agricultural sciences. She is looking forward to working for Extension this summer and the opportunity to learn more about the program!

Ahad Aziz is from Tigard, Oregon, has some agricultural experience after spending time with relatives' farms and lands in India. He is a senior pursuing a B.S. in Public Health and a B.A. in Psychology. He is finishing his B.A. at the end of the Spring 2022 term and will have one more term (this internship) to complete his B.S. He is looking forward to the summer, working with Chrissy and the rest of the Extension program, and learning more about Corvallis' surrounding communities!

Returning for a second year is Kelci Free. Kelci just graduated from Oregon State University, have joined a graduate program in Agricultural Education. *Continued on page 5.*

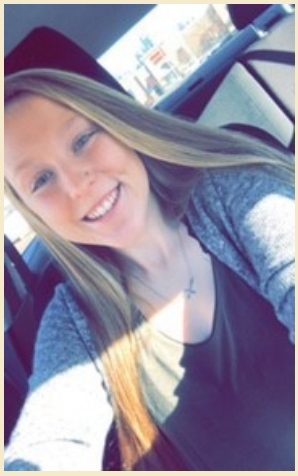
MEET ABIGAIL TOMASEK, OSU SOIL WATER QUALITY EXTENSION SPECIALIST

Abigail Tomasek joined the Department of Crop and Soil Science at Oregon State University in January 2021 as an Assistant Professor and the statewide Soil Water Quality Extension Specialist. Her past research has focused largely on nutrient transport in agricultural systems, and she has worked locally and internationally on the effects of land management practices on soil and water quality. She is broadly interested in developing and implementing practices that promote agricultural productivity while maintaining environmental health. In her extension role, she is interested in working alongside Oregon's agricultural community to co-create adaptive, lasting, and sustainable agricultural practices.

She is currently working with other water specialists at OSU to create mobile education trailers that will be used for field days, workshops, and other Extension events. These trailers will feature modules that demonstrate various water-related topics such as soil-water processes, watershed hydrology, improved irrigation practices, and groundwater-surface water interactions. The current trailer features a large-scale rainfall simulator, which will be used this summer to test the effects of manure application rates on infiltration and runoff water quantity and quality. Please contact Abigail if you are interested in learning more about these trailers or would like to collaborate on this initiative.

You can contact Abigail by email at: abigail.tomasek@oregonstate.edu

Kelci hails from Scio, and is very excited to be working with Chrissy and the rest of the extension team again this summer. Her goal is to work for an Extension Service when she graduates. She is looking forward to the summer, hosting clinics all over the valley and meeting some of you folks that make up this great community!



OSU Extension Summer Interns (let to right): Briauna Herrick, Ahad Aziz, and Kelci Free.

NEW EPA AND OSU PUBLICATION SHOWS THAT STORAGE OF NITROGEN IN THE DEEP SOIL SLOWS NITRATE LEACHING TO GROUNDWATER IN THE WILLAMETTE VALLEY

By Julie Weitzman, Ph.D. ORISE Postdoctoral Research Fellow, USEPA

A team of researchers including ORISE Postdoctoral Fellow Julie Weitzman, scientists from EPA's Groundwater Characterization and Remediation Division in Ada, Oklahoma, scientists Renée Brooks and Jana Compton with EPA's Pacific Ecological Systems Division based in Corvallis, and Oregon State University crop scientist Ed Peachey, recently published the peer-reviewed journal article "Deep soil nitrogen storage slows nitrate leaching through the vadose zone" in Agriculture, Ecosystems & Environment. The main objective of the article was to share findings about the controls on nitrate leaching rates and nitrogen dynamics in the agricultural soils of the Willamette Valley, specifically across soil depths, and in response to seasonal and annual variation in management (e.g., fertilizer input amount and summer irrigation).

Annual nitrogen fertilizer applications are important for agricultural yield, yet not all the applied nitrogen is taken up by crops, leading some to either be stored in soil or leached into groundwater *Continued on page 7.*

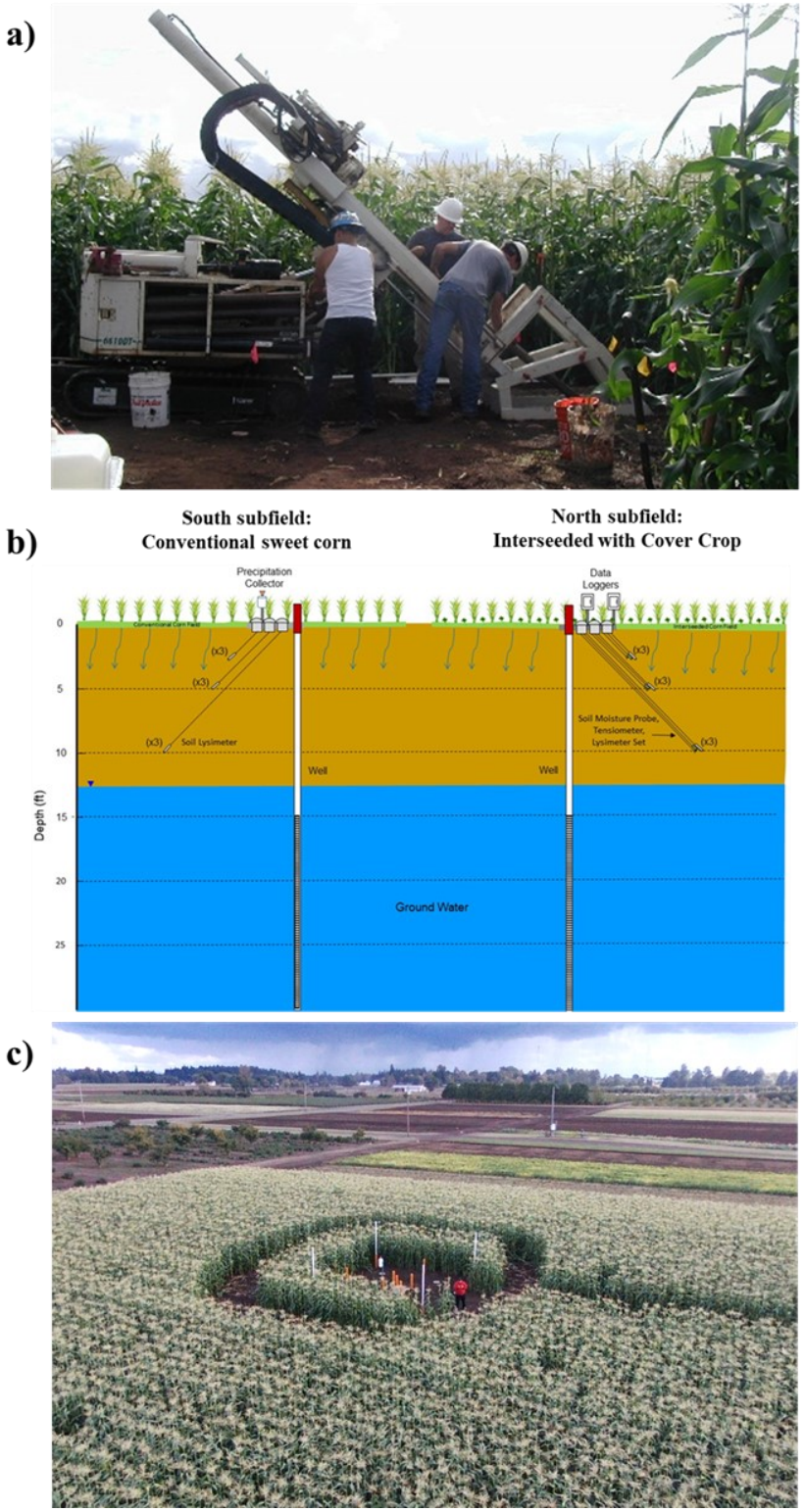


Figure 1. a) Installation of groundwater wells and soil instrumentation at OSU's Vegetable Research Farm field site. b) Schematic of groundwater and soil monitoring network for the two subfields. Vadose zone instrumentation was installed at an angle to minimize soil disturbance and the creation of preferential flowpaths along the instrument shafts. c) Aerial view of monitoring network in one of the subfields.

Leaching loss of nitrogen from fertilizer as nitrate, an inorganic form of nitrogen that is highly mobile, represents a cost for farmers and has consequences for human health and the environment, especially in the southern Willamette Valley, an area recognized by the state of Oregon for groundwater nitrate contamination issues. While improved nutrient management and conservation practices have been implemented to minimize leaching, nitrate levels in groundwater continue to increase in many long-term monitoring wells. However, a similar increase in nitrate exported to the Willamette River has not yet been observed. This disconnect between nutrient sources on the land and what is observed in the river over time suggests that a large part of the nitrogen used on land is being retained in the soil or groundwater. Thus, accounting for nitrate leaching across multiple soil depths down to the groundwater table is essential for accurately representing the true behavior of the system and identifying effective approaches for management of groundwater nitrate contamination.

EPA scientists and OSU staff worked together to study nitrogen leaching loss by intensively monitoring the transport of water and nitrate through the soil at three depths (0.8, 1.5, and 3.0 m) over four years (2016-2020) in a 0.8-ha sweet corn field located at Oregon State University's Vegetable Research Farm in Corvallis, OR (Figure 1).

Annual nitrate leaching rates declined with depth, with rates decreasing by an average of 54% across the study years between the 0.8 m and 3.0 m depths (Figure 2) *Continued on page 8.*

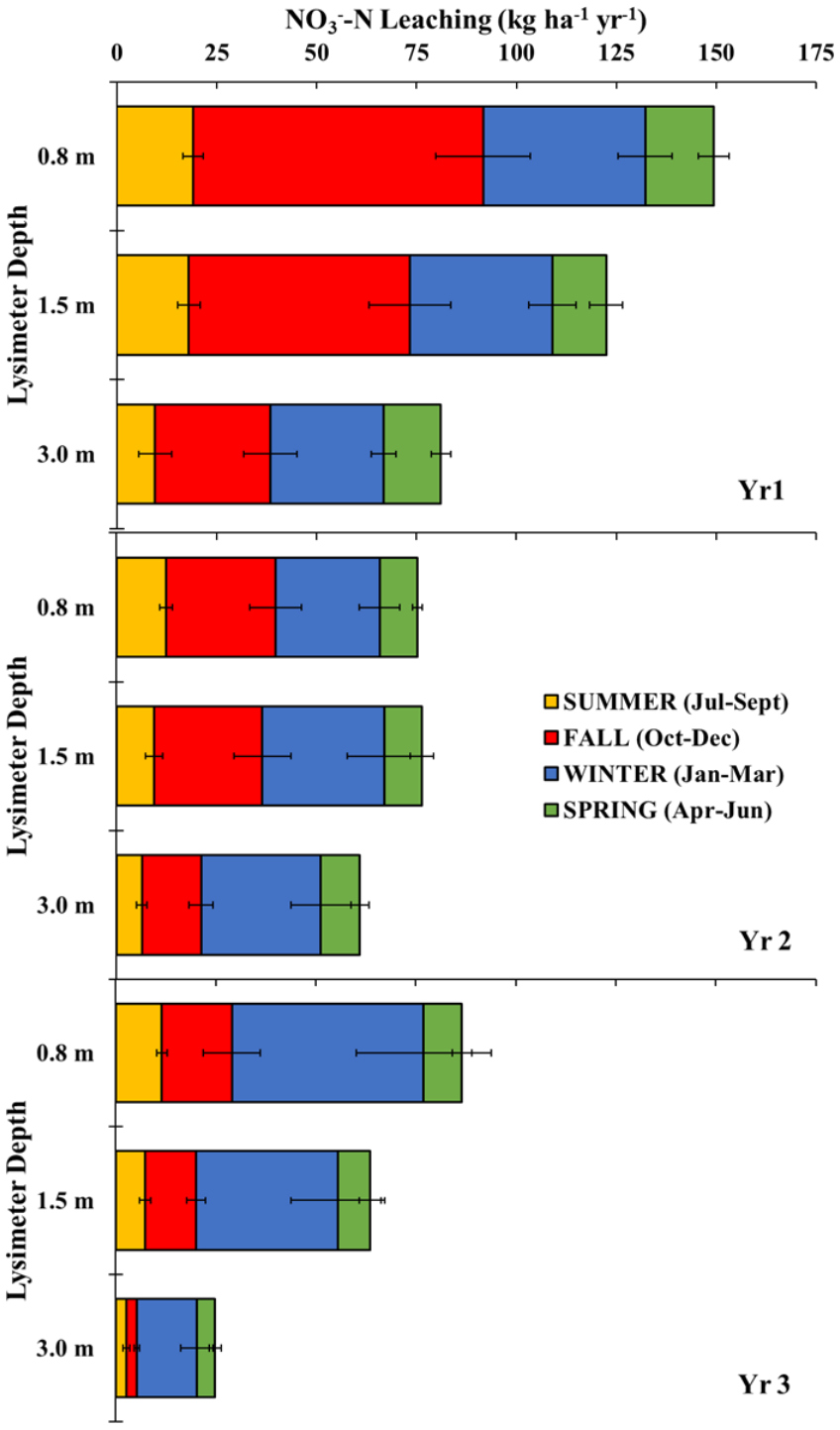


Figure 2. Seasonal nitrate (NO3--N) leaching averages (with standard error bars) summarized by depth (0.8, 1.5, and 3.0 m) and Fertilizer Year (Yr1, Yr2, and Yr3) across the field site. Seasons span three months each – summer (yellow; left-most bar): July-September, fall (red; second bar from left): October-December, winter (blue; second bar from right): January-March, and spring (green; right-most bar): April-June.

Overall, a net equivalent of ~29% of surface nitrogen inputs leached below 3.0 m into the deeper soil and groundwater, while ~44% of the nitrogen inputs were removed in crop harvest. These results indicate that considerable nitrogen retention occurred in the soil (~27% of inputs) (Figure 3).

External factors impacting total nitrogen input levels, like fertilizer amount and precipitation (and irrigation) amount, were not found to be predictors of nitrate leaching below 3.0 m. Rather, nitrate leaching was well predicted by post-harvest soil nitrate concentrations, which explained 69% of the variability in the annual rates. This relationship is especially strong during the fall, suggesting that nitrogen inputs not used by crops during the growing season have the potential to be lost quickly via leaching. On-field management that minimizes leftover soil nitrogen and allows for greater uptake by the crops is expected to reduce the amount of nitrate leaching into groundwater.

The variation in leaching across depths and years appears to be influenced by a legacy of nitrogen accumulation at depth, controlled by internal nitrogen cycling processes within the soil. While less than a third (i.e., ~29%) of the surface nitrogen inputs ultimately leached below the 3.0 m soil depth, the release of such stored legacy nitrogen has the potential to sustain groundwater contamination at timescales that lag behind field-level management improvements.

Management practices such as planting deep-rooted crops that could use mineralized nitrogen from the existing soil nitrogen pool (accounted for by applying soil/ tissue testing results to nitrogen fertilizer recommendations), or planting cover crops, which may assist in taking up more stored soil nitrogen during the fallow seasons, could help address the issue of groundwater nitrate contamination. More research is necessary to properly understand the long-term fate of this deep soil nitrogen storage and to assess the effects of management intended to reduce groundwater nitrogen contamination.

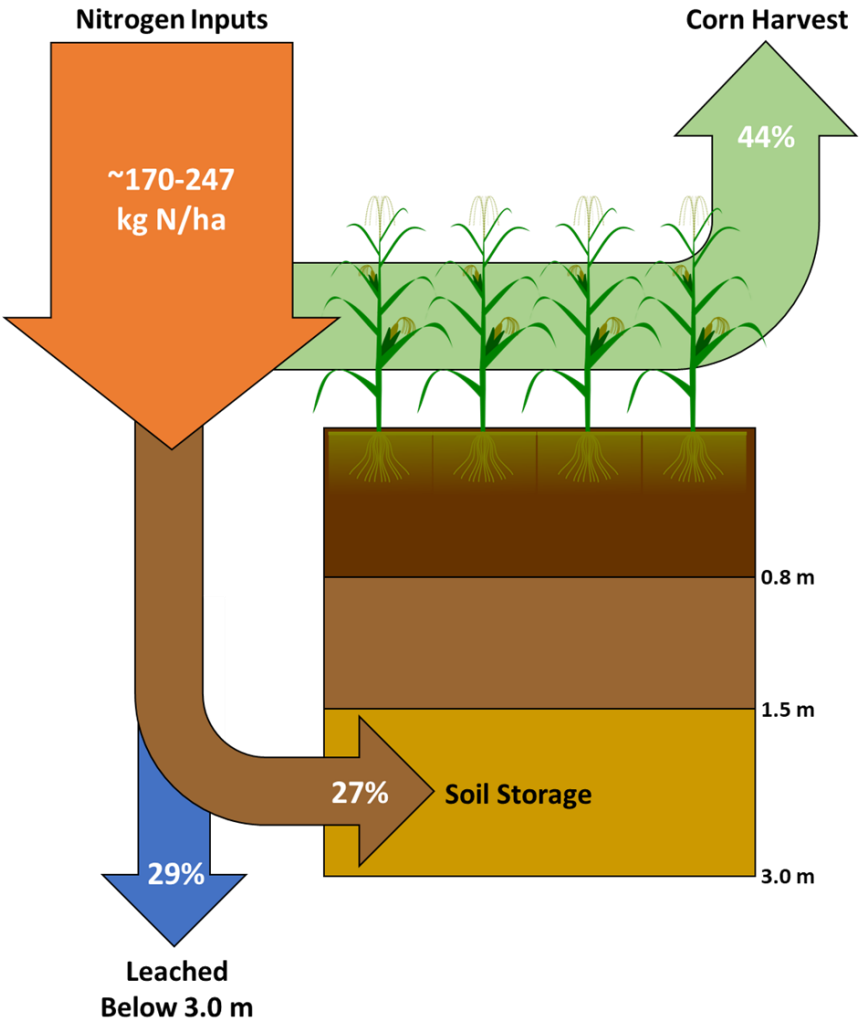


Figure 3. Fate of nitrogen inputs (i.e., fertilizer N + irrigation water N + atmospheric N deposition) at the field site. Fertilizer N was the largest input component, contributing ~121-224 kg N ha-1 yr-1 (~71-90% of total N inputs) over the study period. Corn harvest represents the nitrogen removed in corn ears during crop harvest.

ODA AGRICULTURAL DRAINAGE CHANNEL MAINTENANCE PROGRAM

By Brittany Mills, Agricultural Drainage Channel Specialist , ODA

The Oregon Department of Agriculture (ODA) is managing a new program to help farmers and ranchers maintain drainage channels.

The Agricultural Drainage Channel Maintenance or ADCM Program was born out of a request to have a quicker, more user-friendly option to maintain field drainage channels for agriculture. Maintaining drainage on agricultural lands is critical for agricultural production in much of Oregon. ODA was directed by the Legislature to create and manage the new program in 2019.

Prior to the creation of the ADCM Program, landowners and water districts were unhappy with the permitting process, or they were unaware they needed a permit to do work on drainage channels. Now, landowners and water districts can utilize the free ADCM Program to get a permit, called a Notice. The entire process takes 45 days or less. A Notice is good for five years once it has been approved by ODA. This means a landowner could have a Notice validated in 2022 and do maintenance work on their channels outlined in the application until 2027.

To be eligible for the ADCM Program, a channel must be routinely maintained; could have provided drainage in the past five years; be dry at the time of work; and not designated as Essential Salmonid Habitat (ESH). A landowner can check online with the Department of State Lands (DSL) or contact ODA to determine if their channel is ESH designated. If a channel doesn't qualify for the ADCM Program, landowners can still go through a DSL permit process.

Maintenance of channels must protect, maintain, or improve ecological functions of the channel, uphold state objectives for fish recovery, and protect wetlands, waterways, and fish and wildlife habitat. There are standard, mandatory conditions for work. The conditions include timing of work, equipment use, and treatment of vegetation to protect the ecological functions of the channel and adjacent, undisturbed wetlands.

For more information, go to oda.direct/AgChannelMaintenance or contact Brittany Mills, program specialist, at Brittany.Mills@oda.oregon.gov or 971 -218-1409.

EQIP HAZELNUT CONSERVATION PROGRAM

By Amy Kaiser, District Conservationist - Benton and Linn Counties

NRCS is currently offering an EQIP Hazelnut Conservation program that overlaps with the GWMA focus area in Benton and Linn counties. Since 2018 we have offered seven conservation practices to address organic matter depletion and irrigation efficiency in hazelnut orchards. Extra ranking points are given to applicants who are directly located within the GWMA focus area. The overall goal of this Conservation Implementation Strategy is to provide technical and financial assistance to participants willing to install conservation cover or cover crops in between hazelnut rows; and decrease nutrient leaching over the entire life of the orchard with conversions of big gun irrigation to micro drip irrigation. The irrigation water management conservation practice is also a requirement for the EQIP program. This practice provides the participant with an IWM record keeping packet to learn more about their soils while monitoring ground and surface water using soil moisture sensors. Specific program details can be found here: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/programs/financial/?cid=nrcseprd1351823