

IRRIGATION REPORT:



FLINT RIVER
SOIL AND WATER
CONSERVATION DISTRICT

► INSIDE

More Crop Per Drop

**Putting Water to
Work for You**

**Hitting the Irrigation
Sweet Spot**

**Conservation Tillage
Can Reduce Water
Usage by 15%**

A large center pivot irrigation system is shown in operation over a vast field of green crops. The sun is low on the horizon, creating a warm, golden glow. The irrigation wheels and structure are visible against the sky.

Water Less, Yield More



More Crop Per Drop

Soil Moisture Sensors and Irrigation Scheduling Help Maximize Yield and Improve your Bottom Line

Too much or too little water can have a negative impact on yield. So how do you hit the sweet spot?

Irrigation scheduling and soil moisture sensors are powerful tools that help farmers decide the optimal amount of water to apply and can help save time and energy. This investment in a farm's irrigation system can maximize yield and provide a significant return on your investment (ROI) for the upgrade. There are several options to consider when looking at the most effective ways to improve how you irrigate. With smartphones and tablets bringing real-time irrigation information to you on-the-go, now is the perfect time to consider all your options.

Soil moisture sensors monitor field data such as soil moisture, soil temperature, crop growth stage and local evapotranspiration (water moving from the soil or plant to the atmosphere). Availability of this data can help you determine how much water is available in the root zone, the area around the roots that plants

draw water from most easily. Using this information, you can schedule irrigation to deliver the right amount of water at the right time to the right field zone. Because you are receiving more precise measurements, you can irrigate more precisely, and since soil moisture sensors are doing more of the work, this means a time savings for you.

Soil moisture sensors are an investment in the health of your soil and your crops, which in turn is an investment that can improve yield. In fact, "Compared to the checkbook method, on average, the yield gains from using sensors will pay for the capital investment multiple times over," says Dr. Adam N. Rabinowitz, assistant professor of Agricultural and Applied Economics at the University of Georgia.

The graphic below describes how irrigation scheduling and soil moisture sensors can help save you time and money. Be sure to check out the last page of this report, which explains how to take the next step to enhance your current irrigation efforts while keeping budget in mind. ●

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– Dr. Adam N. Rabinowitz, assistant professor of Agricultural and Applied Economics at the University of Georgia

More Precise Irrigation Can Increase Crop Yield

GROUND LEVEL Kick the Dirt Method – No Tools Needed

- Lacks precision and control.
- Provides limited feedback on available soil moisture in the root zone.
- Consumes a lot of a farmer's time.

1 Checkbook Method – Commonly Used

- Uses mathematical calculations to keep moisture below holding capacity, without over-watering, to prevent water stress or runoff.
- Doesn't account for many of the environmental factors that can impact irrigation needs.
- Requires your time every day to capture information, calculate and stay up to date.

2 A Variety of Apps – Easy for Immediate Implementation

- Provide more detailed information that can potentially save you money through lower energy costs.
- Range in price from free to requiring some upfront investment.
- Require the user to input the data.
- Apps not connected to a moisture sensor still lack precision and detailed information on what is happening beneath the surface.
- Contact the Southeast Aquatic Resources Partnership (SARP) to learn more about the available apps that will easily work with your irrigation system and method.

3 Soil Moisture Sensors – Reduce Risk with Real-time Data Right from Your Field

- Determine when to irrigate, where to apply and precisely how much water is needed.
- Accessed via any internet-enabled device, so your data is viewable anytime, anywhere.
- Can increase crop yield while saving hours and hours of your time.

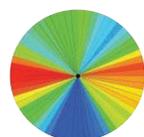
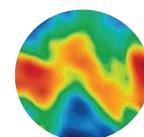
Putting Water to Work for You

You know the water needs in your fields aren't all the same, so why apply the same amount of water everywhere? Variable Rate Irrigation (VRI) allows farmers to apply customized rates of water based on individual zones within a field.

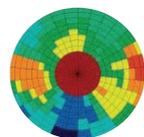
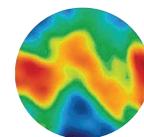
Many fields in southwest Georgia contain non-cropped areas, a field edge, varying soil types, and topography. Rather than applying water at one uniform rate across a non-uniform field, VRI can distribute the right amount of water at the right time to the right field zone.

▶ GET IN THE ZONE WITH VRI

VRI technology essentially converts a center pivot system into a precision water delivery system for all your irrigation management zones. There are two approaches to VRI:



1 Speed control – using pie-shaped sections, the grower can speed up or slow down the system through each "slice of the pie."



2 Zone control – dividing the field into management zones based on soil type, topography, and hydrology, the grower can distribute no water to certain nozzles and, when needed, as much as 200% of the normal application to other nozzles.

Creating field zones is key because VRI is based on the idea that soil conditions vary across most fields and water needs vary by soil type. Because you know your fields best, you may be able to see which zones need extra water and which zones don't. However, some fields can be tricky to interpret so if you are unsure, contact your local irrigation resource expert to help you evaluate your fields.

- Does your field have an area that is constantly saturated or dry?
- Are your crops close to a road where your irrigation is watering the gravel?
- Is your irrigation system watering unproductive, non-cropped land?
- Are you over-watering?
- Does your field contain multiple crops at different growth stages?

If so, VRI may be a cost-effective means of solving these problems by ensuring you are getting the exact amount of water where you need it and preventing excessive runoff. If you need extra control to maintain your yields and crop quality, VRI can increase where, when and how much you are irrigating.

The last page of this report explains how to take the next step to enhance your current irrigation efforts while keeping budget in mind.

▶ DYNAMIC VRI – REAL-TIME TECH DELIVERS EVEN GREATER EFFICIENCY

Dynamic VRI is the next generation of VRI technology and is currently between the research and commercialization stage.

University of Georgia researchers, in partnership with the Flint River Soil and Water Conservation District (FRSWCD), have conducted trials showing the addition of Dynamic VRI can increase water use efficiency by up to 40% and at the same time increase crop yields by 5% to 10% versus traditional irrigation methods.

Dynamic VRI takes VRI and adds in real-time soil moisture field data that updates water application rates by zone on-the-go. This allows growers to apply the precise amount of water at the right time and in the right location to produce a higher-yielding crop.

"Dynamic VRI is a tool that will allow us to improve the sustainability, efficiency, and profitability of our irrigated farming systems," says Dr. George Vellidis, professor of Crop and Soil Sciences at the University of Georgia. ●



"Many farmers are already looking at variable rates for other inputs such as fertilizer and seeds, so using VRI is in line with that same thinking – you can tailor your watering too."

– Calvin Perry, University of Georgia Extension irrigation specialist

▶ Hitting the Irrigation Sweet Spot



“I’m always looking for new tools to address our soil variability. Water in our sandier soils will percolate through much more rapidly, so we must irrigate those areas much differently than with heavier soils. Irrigation scheduling and Variable Rate Irrigation (VRI) can help get the right amount of water to the crop.”

– Casey Cox, southwest Georgia peanut farmer

Irrigation management can be tricky. If rain events aren’t reaching your fields during the right stages of growth, soils will progressively become drier, crops will become stressed and it will impact yield. The more information you have available to guide your irrigation decision-making, the better chance you have to hit the sweet spot — that balance between irrigating the right amount at the right time — to achieve the highest quality and yield.

▶ DROUGHT STRESS REDUCES COTTON YIELD AND QUALITY

Research shows that if a drought occurs from first flower to peak bloom period, it will significantly reduce fiber length. It takes about 20 days for fiber elongation to occur. Once the drought has lifted, if there’s enough carbohydrates available to those fibers, shorter, thick fibers will develop during the thickening phase, allowing the fiber to get really strong. While a strong fiber is important, those fibers are shorter and thicker which reduces overall fiber quality.

When large rain events happen, only a portion is considered effective rainfall because the soil can only hold so much water and the rest will runoff. If the crop goes a week without water, it can have a substantial impact on crop yield.

No matter what kind of weather the season brings, proper irrigation management can ensure your crop will receive the right amount of water during cotton’s critical growth stages. This will make sure the crop reaches its quality and yield potential.

Proper irrigation management saves the farmer time and money through targeted water application. Because of that efficiency, water and nutrients can work together to avoid loss of both through runoff and/or dilution.

Crop Stage	Inches/Week	Inches/Day
Week beginning at 1st bloom	1.0	0.15
2nd week after 1st bloom	1.5	0.22
3rd week after 1st bloom	2.0	0.30
4th week after 1st bloom	2.0	0.30
5th week after 1st bloom	1.5	0.22
6th week after 1st bloom	1.5	0.22
7th week and beyond	1.0	0.15

2019 Georgia Cotton Production Guide. University of Georgia.

Applying the right amount of water at the right time to the right place maximizes the crop’s ability to absorb the nutrients the soil is holding. Too much water spreads out those nutrients to the point where the crop is no longer getting what it needs, and farmers are losing their inputs investment.

Conservation tillage practices can help mitigate drought conditions and reduce overall water use by 15%, saving farmers resources and money. Farmers who use conservation tillage have greater water holding capacity than conventionally tilled soils. Using irrigation scheduling, conservation irrigation maximizes the retention of nutrients, making them more available for plant uptake. It also ensures that the crop receives the proper amount of water to produce a stress-free, quality product.

According to the University of Georgia, a water deficient crop during early flowering can cause a yield loss of up to 60%, relative to a well-watered crop. Drought stress during squaring to flowering, at peak bloom, and from peak bloom to harvest can cause up to a 35% yield loss at each of these growth stages.

A dominant contributing factor to higher yields is high boll density (the number of bolls per unit land area). University studies show that when drought stress occurs, either a smaller plant is produced with fewer fruiting sites, or there’s plenty of fruiting sites but drought stress causes the plant to shed them. In both scenarios, the result is fewer bolls per unit land area, which is the key factor in cotton yield loss.

▶ TOO MUCH OR TOO LITTLE WATER CAN IMPACT PEANUT QUALITY AND YIELD

Historically, about 23 inches of water was considered the required amount of moisture for peanuts from planting to harvest, however new research conducted at the University of Georgia suggests that 18 inches of water is optimal. About 14 to 16 inches of water is needed — either from rainfall or irrigation — from weeks 10 to 17 of the 20-week peanut growing season.

TABLE 2
Peanut Irrigation Schedule

Week of Growing Season	1.5 inches/week maximum	2.0 inches/week maximum
0-4	0.1-0.2	0.1-0.2
5-6	0.5	0.75
7-9	0.75	1.0
10-12	1.5	1.5
13-17	1.5	2.0
18-20	0.5	0.75

The 1½ inches per week irrigation schedule is recommended when available water is limited or there is above average rainfall. Otherwise, the 2 inches per week schedule is recommended.

For the peanut crop, too much water, whether it’s from too much rainfall or over-irrigation, can cause heightened disease and pest pressure. Moist, humid conditions can be a breeding ground for molds and fungi and leave the peanut crop vulnerable to crop stress.

Too little water has a similar impact, resulting in the development of aflatoxin which can impact yield and quality. A water deficient crop can also impact plant vigor and health, which can damage the grade and quality of the peanut and yield. Proper water application during the 7- to 15-week growth period is critical for a successful peanut

“In southern Georgia, more and more growers are realizing that rainfall patterns are changing. For our growers to remain financially viable and stay in this business, they just about have to manage their irrigation and use the scheduling tools that are now available to be as efficient with their water use as possible.”

– Calvin Perry, University of Georgia Extension irrigation specialist

The image shows two scenarios of peanut yield. On the left, the 'Checkbook Method' shows 15 inches of irrigation resulting in a yield of 5,000 lbs./acre. On the right, the 'Soil Moisture Sensor Method' shows 9 inches of irrigation resulting in a yield of 6,600 lbs./acre. Each scenario includes an image of a soil moisture sensor and a pile of peanuts.

crop. If the crop receives too little water, many of the pegs never become peanuts, and yield is reduced. In addition, immature pods are typical when the crop is under-watered.

Conservation irrigation and conservation tillage practices improve a farmer’s opportunity to grow a healthy crop. Irrigation scheduling helps balance water applications and can lessen concerns of poor peg formation.

Due to their precision, soil moisture sensors and VRI take the guesswork out of water application and ensure your crop is getting the moisture it needs during specific growth stages. They also save countless hours driving to check the soil moisture of the fields. With connected apps and dash-boards, a farmer can check everything on their smartphone or office computer. Additionally, conservation tillage and cover crops can build organic matter and soil tilth and trap soil moisture to improve water availability.

University of Georgia research observations indicate that too much water reduces peanut yield. Research from 2014 showed that over-irrigating the crop reduced yields by approximately 1,500 lbs./acre. When following the checkbook method, about 15 inches of irrigation was applied to the field during a dry year, which produced a yield close to 5,000 lbs./acre. When following a soil moisture sensor-based method, the field was irrigated with about 9 inches of irrigation and yielded close to 6,600 lbs./acre. ●

Conservation Tillage Can Reduce Water Usage by 15%

Cover crops and conservation tillage, when properly managed, can improve water availability for critical summer cash crops. Conservation tillage and cover crops are natural partners, working above and below the ground by loosening compacted soil, increasing pore space to add water-holding capacity and building organic matter over time. It's been shown that having soil cover significantly reduces erosion and helps keep your inputs right where you want them.



COVER CROPS PERFORM TILLAGE FUNCTIONS, JUST WITH MORE BENEFITS

You've probably heard a lot about cover crops and conservation tillage, but you might not have heard all the benefits they can bring to your operation:

- 1 Reduces labor, saves time** – once you plant your cover crop (prior to Oct. 31), you won't enter the field until four weeks before planting. Conventional till farmers might till a few times during winter to break up the soil, spray for weeds or set up erosion trenches.
- 2 Reduces machinery wear and saves fuel** – there's no need to run the tractor in the winter months, so expect to save hours of machinery use and fuel costs.
- 3 Increases organic matter** – residue break-down captures carbon and builds organic matter over time.
- 4 Reduces soil erosion and improves water quality** – erosion is dramatically reduced or stopped.
- 5 Improves soil tilth** – promotes a healthy soil biome, including fungus, microbacteria, earthworms; their excretions help hold the soil together better, which builds soil tilth.
- 6 Traps soil moisture to improve water availability** – as the winter cover crop decays, it creates channels that allow more water to flow deeper into the soil profile.
- 7 Weed suppression** – leaving residue on top of your field and in between plants will limit sunlight exposure and weed growth.

RECYCLE YOUR NUTRIENTS

The use of cover crops helps increase available nitrogen in a few ways. First, cover crops help with the "mining of nutrients." If any nutrients leach below the commercial crop's root zone, they can potentially be "harvested" by the cover crop. When the cover crop dies and converts into organic matter, the nutrients — nitrogen, phosphorus, potassium and micronutrients — are returned to a higher location in the soil profile where they are more available to the crop.

Second, a grower can plant a cover crop that specifically targets nitrogen fixing to the plant. A common nitrogen fixing cover is clover, but other legume crops could be grown, like lupin or sunn hemp. Since peanuts are a legume, this cash crop can help with nitrogen fixation, but if growers turn the soil over, the denitrification process removes some of the built-up nitrogen. ➡

“Conservation tillage provides several long-term impacts that can reduce your inputs annually and save money, all while building up your soil structure, soil moisture, and your organic material over time as well.”

– Perri Campis, executive director of Flint River Soil and Water Conservation District

Every **1%** increase in organic matter results in as much as **25,000** gallons of available soil water per acre

“Raising a cover crop and using conservation tillage are like insurance for the investment that you're making in your soil. Growers apply nutrients, fertilizer and irrigation, but when a rain event hits bare soil, it could erode a lot of your input investment.”

– Perri Campis, executive director of Flint River Soil and Water Conservation District

GEORGIA FARMER'S VIEW OF COVER CROPS

Clayton Anderson, a grower from Bulloch County, Georgia, farms cotton, corn and peanuts in a five-year rotation. Once his commodity crop is harvested, he plants a cover crop mix, including cereal rye, Cousaque black oats and FIXatioN balansa clover, from “fence post to fence post.”

“I plant clover and cereal rye until November 1, then I plant straight rye because it takes the clover a little longer to mature,” explained Anderson. “I spray Roundup and 2,4-D before drilling my cover crops right into the standing cotton stalk stubble. I use a 20-foot Great Plains double-disk drill. I get rid of winter weeds first because if you plant into them, the winter weeds will compete with your cover crop and overall stand.”

Why plant a cover crop?

“I plant cover crops because it's the right thing to do. It cleans the air and water, reduces erosion, mines the nutrients in the soil, and builds up organic matter,” he said.

It also allows Anderson to grow his commodity crops without irrigation. “When it rains, the soil really holds the water,” he noted. “This year, I was in the driest spot in the state, but I still made a crop because my soil held on to every ounce of water. My bottom line probably looks better than some of the people who made a higher yield with irrigation.”

Anderson recommends creating a cover crop plan, getting organized and staying dedicated to the process. “The environmental and soil health benefits of cover crops are worth the time and effort,” he said.



Southeast Aquatic Resources Partnership (SARP) is a regional collaboration of natural resource and science agencies, conservation organizations and corporations working together to strengthen the management and conservation of aquatic resources in the southeastern United States.

The Flint River Soil and Water Conservation District is a state agency based in southwest Georgia dedicated to the stewardship of natural resources for future generations and the exploration of conservation-driven technologies and strategic partnerships that enhance agricultural sustainability.

This project is made possible through funding provided by the National Fish and Wildlife Foundation's Southeast Aquatics Fund. This conservation content is brought to you in partnership with Trust In Food, a Farm Journal Initiative. This material is based upon work supported by the Natural Resources Conservation Service, U.S. Department of Agriculture (USDA), under number 1906.18.062128. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the USDA. USDA is an equal opportunity provider and employer.



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Water Management Resources to Boost Your Yield

Homegrown experts from Georgia organizations, Southeast Aquatic Resources Partnership and the Flint River Soil and Water Conservation District, have come together to provide FREE ACCESS to resources that can help you increase your irrigation efficiency.

Call: (913) 438-0771

Email: SARP@trustinfood.com

Online: www.trustinfood/irrigationstation



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Irrigation Station online:

- Resource guides with information on the impact of variations in soil and topography, major crops grown, and percent water savings for each irrigation management system, informed by original, University of Georgia research.
- Video spotlights showcasing how your peers are managing their water resources.
- Webinars to guide you through the latest in water management techniques.

“ Many farmers are already looking at variable rates for other inputs such as fertilizer and seeds, so using VRI is in line with that same thinking – you can tailor your watering too.”

– Calvin Perry, researcher at the C.M. Stripling Irrigation Research Park, University of Georgia



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