Maryland Soybean Board

Soybean Sampler

Research Report 2018

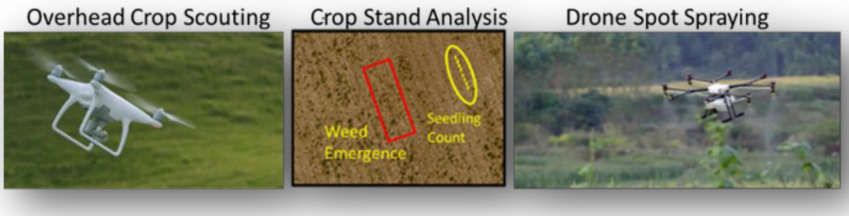
Drone Technology to Improve Crop Productivity

"Drones are a new tool for crop farming and are expected to have a significant impact on the industry over the next several years," says Carl Wise, who, with additional support from the USDA Agricultural Research Center, has been researching drones and their farm use.

Drone crop scouting is now available with high resolution video or pictures. Potential problem areas can be located quickly for effective field management. Drone sensors and algorithms improve these techniques are expected to provide quick, inexpensive analysis of crop health throughout the growing season.

With a small, low cost quadcopter, it is very straight forward to survey several hundred acres in an hour. For areas of interest, the drone can be navigated to an area for close in pictures or video. This can be helpful for crop insurance, seedling emergence, pest identification, and other contract issues.

Besides crop scouting, seedling and weed analysis is being done today with good results. Widely used in Asia, larger spray drones use location information along with spraying settings to setup the application. Holding about two gallons of liquid, when empty the drone returns to the starting point for refilling and then continues where it left off.



Topological profiling is being used in the construction industry. These measurements are critical to road construction and other ground projects. Among its capabilities is the ability to calculate cubic yards of material that needs to be moved. This new drone application could be used to analyze and design field drainage.

Compared to drones, satellites and manned aircraft are cost effective over large areas (over 100k acres) but they have scheduling and weather problems. Spatial resolution is worse than drone sensors, which can provide ten times higher resolution with 2.5 cm.

"For small size farm areas, drones are better for quick, responsive crop scouting," concluded Wise.

Environmental Solution for Controlling Stink Bugs on the Horizon

Naturally occurring entomopathogens are important regulatory factors in insect populations, and they are key components of integrated pest management (IPM) programs. Entomopathogens have been shown to be efficient and cost-effective.

Environmental benefits including safety for humans and other non-target organisms, reduction of pesticide residues in food, increased activity of most other natural enemies, and increased biodiversity in managed ecosystems are taken into account; their advantages are numerous.

The brown marmorated stink bug (BMSB), green stinkbugs, and kudzu bug have become abundant pests of mid-Atlantic soybeans since its introduction in the mid-1990s. BMSB damage in soybeans includes shriveled, deformed, and stained seeds, flattened pods, and reduced seed quality/yield.

As integrated pest management strategies are lacking for this invasive pest, Simon Zebelo and Jocelyn Simmons at the University of Maryland entomology department took on the task of developing an alternative organic bio-pesticide using the virulent entomopathogenic fungi to control BMSB nymphs and adults.

Field-collected entomopathogenic fungal strains were isolated from cadavers of kudzu bug. Based on their colony color they were identified as pink and white strains. The strains were assessed against adult and nymph stink bugs in the laboratory.

The field collected fungi are pathogenic to both adult and nymph stinkbugs, Pink fungal strains were more aggressive than the white strains. Both adult and nymph stinkbugs were not active after treated with pink fungal strains. The tested fungal strains might have real potential as a biological control agent of hemipteran pests and useful in IPM strategies.

Nitrates Slow-Moving through Groundwater

To develop a better understanding of the transport of nitrate to groundwater under irrigated and dryland farming in the Upper Chester Watershed, Judy Denver of the U.S. Geological Survey studied two adjacent fields, one with irrigation beginning in 2014 and one in continuous dryland farming.

Nitrate transport through the soil zone to groundwater was observed in soil water beneath both fields, but was greatest beneath the irrigated field. Recharge to the water table is greatest in winter, but also occurs with heavy rainfall in the summer. This can promote deeper nitrate movement through unsaturated zone into groundwater and leaching of soil nitrogen. Leaching of nitrate beyond zone of plant uptake occurred during the growing season with corn crops. Higher nitrate concentrations were seen with irrigation because of greater amount available from recent nitrogen application to corn crops and greater soil saturation. Leaching of nitrate was not as evident after soybean senescence.

Most nitrogen travels through the ground-water system for years to decades before being discharged to streams, so the effects of conservation practices on water quality are difficult to measure today. Legacy P was found throughout the landscape and will likely take decades to exit the system.

Early Wheat Harvest = Better Soybeans

An objective of the Mid-Atlantic soybean agronomists research team was to look at harvesting wheat at higher than normal moisture and drying the grain using an on-farm drying system to improve the double-crop system of wheat-soybean production. This early wheat harvest emphasis fits with an initiative by Perdue Agribusiness to offer price incentives with no penalty for wheat delivered at 15% moisture content in response to wheat industry demand for better wheat quality. Both research years, double crop soybeans were planted at all sites usually within a day after each wheat harvest date.

"Recommendations from this research are quite simple," stated Dr. Robert Kratochvil. "First, to attain maximum yield and test weight for wheat, harvest as soon as possible at approximately 20% grain moisture. Second, to maximize double crop soybean production following wheat, plant a mid-late MG 4 soybean variety or varieties following early harvest of wheat."

New and Improved .... Made from Soy

The next generation of capsules could be made of soy as developed by Qin Wang at the University of Maryland's of Nutrition and Food Science Department. Wang has successfully fabricated the soy glycinin microcapsules based on a nanotechnology process of NaCl induced microphase separation with subsequent heating. The loading amounts are no longer limited by the concentration of compounds in bulk solution, and hydrophilic compounds can be successfully encapsulated in large quantity by simple alteration of the pH value. Such spontaneous deposition technique greatly improves the loading efficiency and can be considered for the encapsulation of a variety of materials. This has not been found with any other protein microcapsules.

Healthier heart? Lower cancer risk?

Dr. Liangli (Lucy) Yu at UMD's Department of Nutrition and Food Science evaluated the nutritional values of soy foods for fresh frozen edamame, soybeans, tofu, soybean oil, soy yoghurt and milk to see where soy can contribute to a healthy diet and found positive results.

Isoflavones have health benefits to promote heart health and bone health. Intake of antioxidants is closely linked with the reduced incidence of several chronic diseases, including cancer. Total phenolic content (TPC) are believed to decrease risk of developing cancer.

Across the spectrum, soybean and tofu samples ranked highest, closely followed by soy yoghurt and soy milk.

10% Loss for Stem Borers in your field?

Dectes stem borer (DSB) is a native species of long-horned beetle that can be a sporadic pest of soybeans. Damage to soybean plants is caused by the larvae, which feed internally on soybean stems. As the plant matures, the larvae girdle the stem at the base of the plant, which can cause lodging before soybean harvest. Management options for this pest are limited, as the larvae are protected from insecticides by tunneling inside of the soybean plant.

Studies of DSB in other states have found several parasitic wasp and fly species that will attack and kill DSB larvae. However, Alan Leslie and Kelly Hamby, entomologists with the University of Maryland, found no evidence of any mortality inflicted by parasitoids in the larvae reared.

Analysis showed that, within a field, larger diameter soybean plants are more likely to be infested with DSB than smaller diameter plants. Feeding by DSB larvae causes a 10% reduction in yield of individual soybean plants, even in the absence of lodging.

Sweeping for adult beetles is a much more effective way to detect adult beetles than visual counts. Adults appear to emerge from overwintering larvae and pupae over an extended period of time, which contributes to their prolonged presence in soybean fields.

"Based on what we've learned, our next step is to concentrate on developing a plan to manage the DSB," concluded Leslie.

MD Crops is Where It's At

The University of Maryland provides the latest research news and resources for farmers on its Maryland Crops website, including results of checkoff funded projects. This includes the statewide soybean variety trial results, seed supplier list and disease and nematode management information.

MD CROPS

psla.umd.edu//extension/md-crops

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Small but Mighty take on Pests and Pathogens

Nanotechnology is an emerging branch of science with enormous potential to manage plant pests and pathogens. The current work of Naveen Kumar at the University of Maryland Easter Shore on soybean looper, armyworm, beetles, and Fusarium Head Blight using nanoparticles (nano-clay, nano-zinc oxide (NZO) and their combinations) is showing promising results.

Results showed 80 to 100% mortality of soybean looper and beet armyworm within 5 to 24 hours, with less damage on soybean leaves using first instar stage of soybean looper. Five spray applications at V1 (first trifoliate leaf) to V5 (five trifoliate leaf) stage of soybean development showed decline in leaf damage and blemishes in comparison to control untreated plants. Yield per plant increased in NZO treated plants. Adverse effect was observed on the growth of Fusarium Head Blight in vitro conditions.

"This is the outcome of a singular one season study and needs to be replicated in successive years," Kumar said. "These studies were conducted using a narrow range of nanoparticle and there is a possibility of more success in vivo conditions by manipulating the size of nanoparticles."

What's good for the goose … or is it?

"Research in other areas of the U.S. shows that fungicide seed treatments may have a positive effect on protecting soybeans from soilborne diseases, improve stands, increase yields, and increase profitability compared to untreated controls in highly susceptible areas," said Andrew Kness of the University of Maryland Extension. "We wanted to see if these seed treatments are effective and economical under local, lower prone production scenarios."

Data from first-year trials by Kness and Nathan Kleczewski from the University of Delaware indicate that fungicide seed treatments may increase soybean emergence over untreated seed in low-pressure soil-borne disease situations; however, this increase did not translate into a statistically significant increase in yield. In addition, fungicide seed treatments did not increase profitability; the added expense for treated seed coupled with no increase in yield resulted in an average loss of $136.50 per acre compared to untreated seed.

Using fungicide seed treatments may not provide any significant economic benefit in fields that are not conducive for soil-borne disease development and/or that do not have a history of soil-borne diseases.

Palmer Amaranth Battle Continues

Herbicide resistance continues to be a major concern for soybean growers, particularly with ALS and Glyphosate herbicide resistant Palmer amaranth, common ragweed and marestail.

On-farm replicated research trials conducted during the 2015, 2016, and 2017 seasons evaluated the efficacy of fifteen pre-emergent herbicide treatments for control of Palmer amaranth.

"Results indicate significantly better control of Palmer amaranth with the use of any residual product when compared to a non-treated control," reported Ben Beale, researcher from the University of Maryland.

Residual products varied in the length of control provided from two to six weeks. Products with the active ingredient flumioxazin, including premixes of Fierce or Fierce XLT, or ingredient sulfentrazone, including premixes such as Broadaxe or Authority XL, provided the most consistent control. Residual herbicides also resulted in significant differences in weed height over the length of the season. This is especially advantageous in that it provides a longer time-frame for the timely and thus effective application of post-emergent herbicides.

Hold the Neonicotinoids if Low Pest Pressure

Insecticide seed treatments are a convenient and economical way to protect a wide variety of crops from insect pests. Cruiser® 5F (thiamethoxam, Syngenta Crop Protection) and Gaucho 600 Flowable (imidacloprid, Bayer Crop Science) are neonicotinoid insecticides that are registered for use as seed treatments on wheat, corn, and soybeans, with application rates varying by the crop and pest targeted.

"This study is unique in its approach because it evaluated the effects of repeated use of neonicotinoid seed treatments within a common mid-Atlantic grain crop rotation of soybeans, followed by fall-planted wheat, double-cropped soybeans and corn," commented Kelly Hamby, Department of Entomology, University of Maryland.

Hamby and fellow researchers Aditi Dubey, Galen Dively and Margaret Lewis teamed up to consider impacts on both arthropods and soil microbes to determine if the seed treatments result in a significant increase in yield in the mid-Atlantic region and whether use of these treatments impacts beneficial invertebrates and soil health.

The use of NSTs reduced early season pest abundance in full season soybean and wheat, but not in double cropped soybean or corn. NSTs also reduced beneficial insects in full season soybeans. In this case, neonicotinoid residues from NSTs were not taken up by winter annual flowers and did not pose a threat to pollinators.

Stand count and plant height indicate that the use of NSTs did not improve plant growth through pest protection or direct stimulation in most cases.

Pest abundance was low throughout the study; in the absence of pest pressure, the neonicotinoid seed treatments did not improve yield in any of the crops, suggesting that there is no economic benefit associated with using neonicotinoid treated seeds when pest pressure is low.

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Investing in Profitability and Sustainability

Improving management techniques and applying new technology is the focus for research projects funded by the Maryland Soybean Board in 2018. Twelve projects were approved for funding, totaling $180,894 in checkoff dollars invested.

New soybean research projects for 2018:

✓ An Integrated Pilot Project to Tackle Herbicide Resistance in Soybean, *Naveen Kumar, UM Eastern Shore*, $17,000

✓ Evaluate the Effect of Early and Late Maturing Wheat Cultivars and Early High Moisture Wheat Harvest on Wheat and Double Crop Soybean Yield and Quality, *Bob Kratochvil, UMD Plant Science,* $7,002.50

✓ Evaluate the Effect of Two Agronomic Management Factors on Double Crop Small Grain and Soybean Yield and Quality, *Bob Kratochvil, UMD Plant Science*, $6,302.50

✓ Identification of New Sources of Resistance/ Tolerance to Sclerotinia sclerotiorum among Soybean Germplasm Showing Resistance to Phytophthora root rot, *Kathryne Everts, UMD/UMES*, $22,952

✓ Row Spacing & Fungicide Timing on Disease Control & Profitability in Double Crop Soybeans, *Andrew Kness, UMD Extension*, $5,605

Ongoing projects funded in 2018 include:

✓ Developing a Management Program for the Dectes Stem Borer by Targeting Its Weak Links, *Alan Leslie, UMD Entomology*, $27,445

✓ Evaluation of Fungicide Seed Treatments, *Andrew Kness, UMD Extension*, $5,417

✓ Integrated Strategies to Manage Herbicide Resistant Weeds in MD Soybean Systems, *Ben Beale, UMD*, $7,380

✓ Maximizing Yield and Quality of Soybean Production with Soil Sulfur Management, *Ray Weil, UMD Environmental Science and Technology*, $26,031

✓ Nanotechnology for Sustainable Soybean Production Under Biotic and Abiotic Stresses, *Naveen Kumar, UMD Eastern Shore*, $26,500

✓ Plant Early Kill Late – Extend the Green to Get More from Cover Crops, *Ray Weil, UMD Environmental Science and Technology*, $23,459

✓ Precision Drone Technology for Improved Crop Yield, Input and Environmental Impact, *Carl Wise, Precision Ag UAS Technology*, $5,800