Mobile drip irrigation results in high yields, saves water in watermelon research

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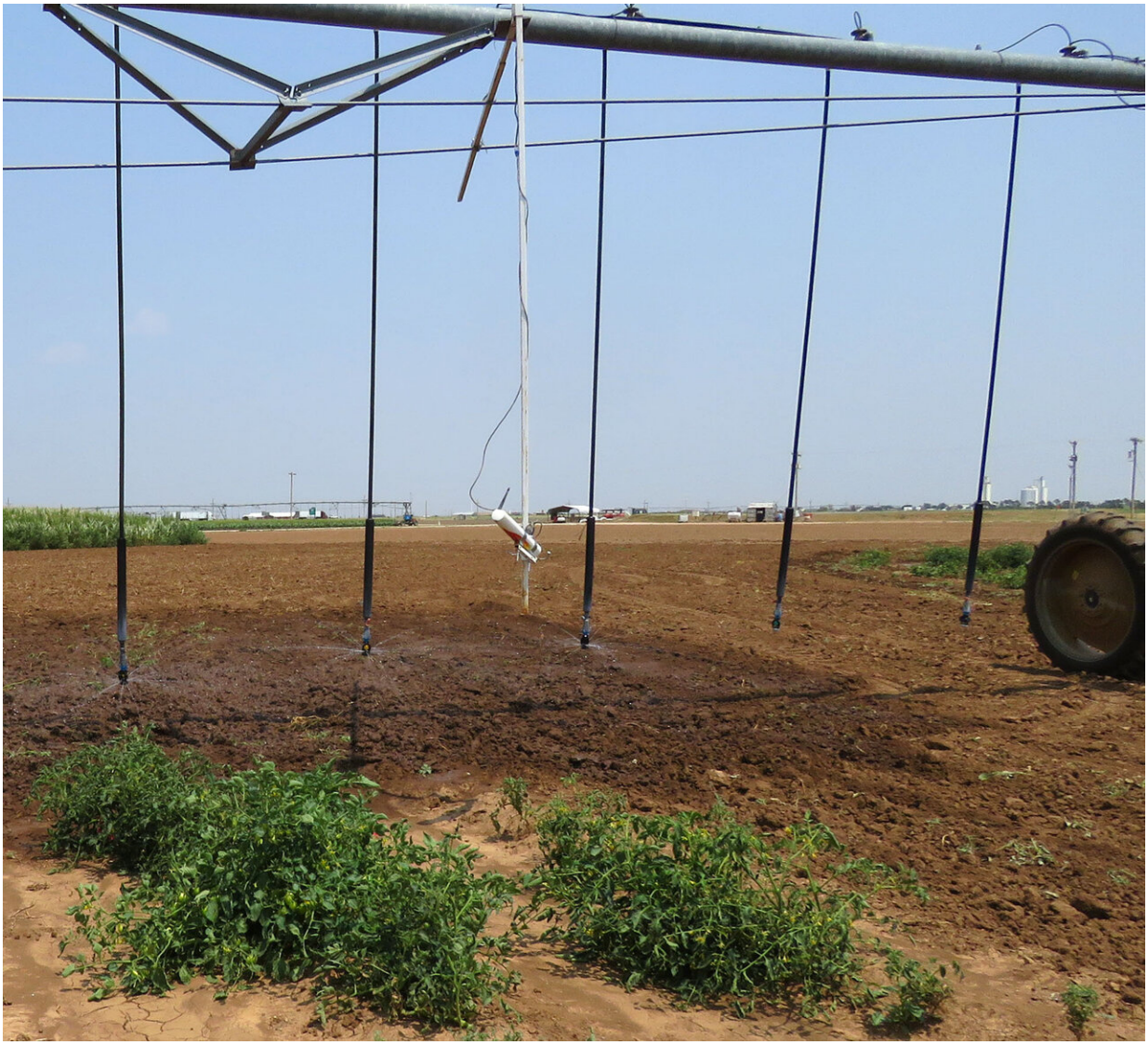

The spray pattern on the typical center pivot system with LESA hoses is much broader. Credit: Texas A&M AgriLife photo by Qingwu Xue

Higher biomass, less water and more fruit are the results of the first year in a Texas A&M AgriLife Research study comparing mobile drip irrigation, MDI, to low-elevation sprinkler application, LESA, irrigation systems.

The project comparing types of irrigation and irrigation scheduling is led by Charlie Rush, Ph.D., Texas A&M AgriLife Research plant pathologist and a faculty member in the Department of Plant Pathology and Microbiology within Texas A&M University's College of Agriculture and Life Sciences, Amarillo.

Rush is working with the U.S. Department of Agriculture-Agricultural Research Service faculty at Bushland and industry partners to investigate the potential of producing high-quality vegetables under irrigation for fresh market sales.

Irrigation systems in the study

Most vegetable farmers use stationary drip irrigation, either subsurface or surface. In contrast, most crop growers in the High Plains grow traditional crops and use center pivots for sprinkler irrigation.

"We want to look for options for Texas High Plains producers to use specialty crops to diversify their operation and have the potential to get higher returns for their water," he said. "We know high-value crops do best under drip irrigation. However, most producers have already invested in center pivot systems, so we feel this study will let them see if it will be worth their time to retrofit those with draglines."

The two-year study compares MDI and LESA irrigation systems against the traditional subsurface drip irrigation. Additionally, the study uses

neutron probes to measure soil moisture and help determine irrigation timing.

The MDI system attaches to existing center pivot irrigation systems and applies water directly to the soil surface as the driplines are dragged across the field to provide uniform wetness.

The LESA irrigation system is representative of traditional irrigation in most fields. It includes spray nozzles that hang from the center pivot and place the water application about 2 feet from the soil surface.

First-year study shows differences

Watermelon plant growth under mobile drip irrigation. Credit: Texas A&M AgriLife photo

Ranjeeta Adhikari, Ph.D., a post-doctoral researcher in Rush's program, ran the trials using two spans of a traditional LESA center pivot system, retrofitted with MDI on the AgriLife Research facilities at Bushland.

The study included four replications of each MDI and LESA, with 10-foot row spacings and 26 inches between plants. Production was compared to that using traditional stationary drip as a control. While the plan was to use both tomatoes and watermelons, herbicide drift damaged the tomatoes. So, the same variety of watermelon was planted across the entire test.

The team transplanted the watermelon plants from the greenhouse on May 27. Harvests were Sept. 1, Sept. 15, Oct. 1 and Oct. 15. During the second and third harvests, they selected an equal amount of fruit for quality analysis. The LESA tests did not make it to the fourth harvest, as the plants had died back by then.

Adhikari said there was no difference in the sugar content and fruit size of the watermelons between the treatments. But there were significant differences in other areas, including:

- Much higher biomass—35% more—and ground coverage appeared under MDI compared to LESA.
- Vegetation difference started to show 40–45 days after transplanting.
- MDI led to a longer vegetative and fruit-growth period. The

plants under LESA started to die earlier than those under MDI.
- The number of fruit and total fruit yield was much higher with MDI—almost 30% higher—compared to LESA.
- LESA used more water for the same amount of production. So, MDI had higher water-use efficiency.

Water-use efficiency results promising

During the first phase of the experiment, from planting to mid-July, the same amount of water was applied with LESA and MDI—1 inch per week for a total of 9 inches, Adhikari said. During the remainder of the growing season, neutron probe readings of each plot dictated how much water the plot would receive.

The LESA plot received 13 inches during this second phase, reaching a total of 22 inches. The MDI section required only 10.5 inches in the second phase, for a total of 19.5 inches.

The yields recorded include:

- Single fruit weight averaged 13.9 pounds under LESA and 14.7 pounds under MDI.
- The number of fruits per plant was 1.5 under LESA and 1.9 under MDI.
- The fruit yield averaged 20.1 pounds per plant on LESA and 27.5 pounds per plant for MDI.

"Since the water applied was less with MDI, and the yield was higher, the overall water-use efficiency was higher under MDI," Adhikari said. "MDI allows the water to be applied directly to the root zone, while the LESA application doesn't all fall on the root zone, affecting everything from forage to fruit. More of the water evaporates and is inaccessible under LESA."

Rush said this initial year of study offers promise. The study will be repeated in 2022 to see if similar results are recorded.

Provided by Texas A&M University