Western Region Sustainable Agriculture Research and Education
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Annual Results

SW98-044

Cropping Systems for Intensive Desert Vegetable Production

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Arizona and California

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For a list of more major participants and cooperators, please scroll to the bottom of this report.

OBJECTIVES

This project has three goals:

1. Evaluate the effectiveness of cover crops in reduced-tillage (surface mulch) production and conventional tillage (incorporated) production
2. Develop cost estimates for desert integrated crop management (ICM) and organic production systems compared with costs of conventional systems
3. Disseminate information on cover crop systems to vegetable growers, agriculture-support agencies and other interested parties

ABSTRACT

In the Coachella Valley of California and Yuma, Ariz., both in the major vegetable production area of the Lower Colorado River, interest in sustainable production systems is rising among growers. This three-year SARE project (this report is for the second year) is evaluating the potential for summer cover crops and management systems for intensive desert vegetable production.

Two cover crops, cowpea and sudangrass, are being compared with traditional summer fallow. The sudangrass is incorporated into the soil, and the cowpea is either incorporated or used as mulch in a reduced-tillage system.

SPECIFIC RESULTS

The research team notes benefits in soil temperature, weed suppression and yield from the cover crop systems, whether used as mulch or incorporated.

High soil temperatures in the fall often delay germination and crop growth. The researchers found that the cowpea mulch buffers fluctuations in soil temperature, reducing daily maximum and increasing daily minimum temperatures to 6 inches deep. The effects may allow growers to plant earlier and target markets with better prices.

Weed control, a major component in vegetable production, is often done manually, which can constrain large-scale production. The researchers found that the cowpea cover crop, whether incorporated into the soil or used as mulch, suppressed weeds better than summer fallow or sudangrass cover crop for fall-planted lettuce. At Coachella, the effect was carried over from the lettuce to the cantaloupe planted in winter/spring. The organic crop management system also suppressed weeds better than did the conventional system during the cantaloupe-growing season at Coachella.

Insect populations were similar under all systems, suggesting that the cover crops do not serve as an alternate summer host. However, the crop management system did affect insect populations, with the organic system suffering more leaf-feeding crop injury than the conventional system. This was less likely because of an inherent ability of the organic system to attract insects than the reduced activity of insecticides in the organic plots. The researchers see the need for better insect control in organic systems.

As for yield, the cowpea cover crop boosted lettuce yield significantly, but the sudangrass decreased yield. Parallel to the low yield, the lettuce from sudangrass plots showed low midrib nitrate-nitrogen content, indicating nutrient immobilization during sudangrass decomposition or allelopathy from the cover crop residues. However, these effects seemed to decline during the lettuce-growing season. Cantaloupe planted in the same plots the next spring had the greatest fruit yield in the summer sudangrass plots at Yuma and yields similar to those in the fallow plots at Coachella. In both sites, the sudangrass residues were completely decomposed by the end of the lettuce season.

Cantaloupe yields were sliced 40 to 60% in the cowpea mulch plots. Because of rapid decomposition, the benefits of the mulch were eliminated and the soil was compacted. This suggests that reduced-tillage systems may require conventional plowing after each crop.

The researchers note that for all crops and sites, the organic management system resulted in lower crop growth and nitrate content and smaller yields compared with the conventional and integrated systems, although the yield penalty was acceptable.

The cost studies, currently under way, indicate that hand weeding and insecticide applications are reduced in the integrated crop management and organic systems compared with the conventional system. That would guarantee a greater net benefit under integrated crop management as its yield was comparable to the conventional. And lower inputs and higher prices for organic produce may offset yield penalties.

Potential Benefits

Before the project, few desert vegetable growers used cover crops, thinking such crops needed more water and would not fit production systems. However, with the increased interest in organic produce as a niche crop that can sustain profitability, many conventional growers are adopting cover crops and other methods developed by this project.

Farmer Adoption and Direct Impact

The project has succeeded at introducing the cover crop concept. Estimates show at least 3,000 acres of cowpeas being grown in the low-desert valleys of Yuma, Imperial and Coachella, with interest growing in other areas. Breeding new cover crops with enhanced pest resistance may create a cultural alternative to methyl bromide and other pesticides.

Many growers have inquired about sources of cowpea cover crop seed and have suggested improvements for new cover crop varieties. They also like the idea of developing a local cover crop seed industry.

Future Recommendations or New Hypotheses

The research team has suggested that Western SARE develop generic tools that each funded project could use to build a Web site that could be linked to SARE's main site.

Dissemination of Findings

The results of this SARE-funded project have been disseminated during several local, regional and national meetings and have been featured in newsletter and popular press articles. The findings were also discussed during a field day at the Yuma Ag Center for the Arizona Vegetable Council and a presentation at the Maricopa Ag Center south of Phoenix called "Organic Cropping Systems for Intensive Desert Vegetable Production."

Producer Involvement

Core groups of a dozen interested farmers each at Coachella and Yuma have attended all the project-sponsored events, and producer involvement has spread to other parts of Arizona and California, notably in the Central Valley. In addition, on-farm demonstrations on different aspects of the project's work have been set up for about 10 growers.

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