# Improving tomato, pepper, and eggplant rotation with cover crops: Experience from Michigan

Mathieu Ngouajio
Department of Horticulture
Michigan State University

## Introduction

Intensive vegetable production is generally achieved through high fertilizer and pesticide inputs. However, it is increasingly difficult for growers to maintain high yields along with quality. This can be attributed to factors such as increased incidence of soil borne diseases, weed pressure, low soil fertility, limited availability of good land, and economic constraints. Vegetable growers are interested in adopting sustainable production practices, which can serve a three-fold purpose: cost reduction, quality improvement, and profitability. Most growers understand benefits of long-term crop rotations. However, lack of good land and the need for crop specialization has forced them to adopt short-term rotations (two to three years). Cover crops have been used as a tool to improve vegetable production under short-term crop rotation. With the phase-out of methyl bromide and the increased cost of synthetic and organic fertilizers, the role of cover crops is even more critical for the long-term sustainability of vegetable cropping systems.

### Benefits of cover crops and cover crop windows for intensive vegetable production

Cover crops multifaceted benefits include: improved soil quality (tilth, fertility and structure) and health, improved weed and disease management, and reduced soil erosion. The short growing season imposed by the climate (temperate) in the Great Lakes and Northeastern regions of the U.S. is a major constraint to the full exploitation of most cover crops in vegetable systems. Therefore, finding appropriate windows to integrate specific cover crops into the crop rotation is critical. In Michigan for example, a rotation of cucurbits and solanaceous crops is common with a typical example being cucumber – tomato rotation. Because of the short growing cycle of cucumber, harvest is usually completed by mid-July, allowing a short window for growth of summer cover crops like sorghum sudangrass and cowpea or cool season species like mustards. Additionally, most vegetables could allow planting of winter hardy cover crops like cereal rye and hairy vetch in the fall. Cover cropping has been reported to improve soil quality parameters and crop yield over time.

### Example of cover crop use in solanaceous crops in Michigan

#### *1. Tomato production*

Cover crops tested were sorghum sudangrass, cowpea, cereale rye, and hairy vetch. When sudangrass was allowed to grow throughout summer, it produced a significant amount of biomass. However, its residue reduced tomato growth the following year. This was probably due to nutrient immobilization resulting from the high C:N ratio of its residue. When sudangrass was planted in late summer, it was frost killed a young stage and its residue did not affect crop growth the following season. Tomato growth was enhanced in plots where cowpea was previously planted in late July. These finding suggest that cover crop management is critical for improved performance in tomato cropping systems. In order to avoid nutrient immobilization by

cover crop residue most grass species should be mowed at young stage to speed up residue decomposition.

***2. Eggplant production***

With the phase-out of methyl bromide, Verticillium wilt has become a major thread to eggplant production in Michigan and many other states in the region. Studies were conducted in Benton Harbor, MI to examine the impact of oilseed radish, Oriental mustard, and yellow mustard on eggplant growth and yield on a site with high infestation of Verticillium wilt. The cover crops were seeded in early April; soil incorporated at flowering stage in mid May and eggplant was transplanted about 10 days after cover crop incorporation. Yellow mustard reduced eggplant growth and plant vigor suggesting that the plant-back-period after cover crop incorporation should be longer than 10 days. The cover crops did not affect Verticillium wilt incidence on eggplant suggesting that they should not be recommended if the main objective is control of this disease. However, benefits of the cover crops were observed on nutrient cycling, and crop growth.

**Conclusion**

Cover crops are useful tools available to growers interested in improving short-term crop rotations. However, appropriate selection of the cover crops should take into account 1) cover crop intended benefits, 2) cash crop rotation system, and 3) appropriate timing of cover crop planting. These factors are important and may help optimize performance of the cover crops in intensive vegetable cropping systems.

Table 1. Tomato yield following various cover crops planted after cucumber harvest. Yield benefits of cover crops may not be evident in the short-term especially if adequate amount of fertilizer is applied to the crop.

| **Treatment** | **Tomatoes yield (Lb/plot)** |
|---|---|
| Cowpea | 121.4 |
| Sorghum sudangrass | 119.2 |
| Cereal rye | 113.6 |
| Hairy vetch | 107.4 |
| Bare ground | 103.2 |

Table 2. Eggplant height, Verticillium wilt incidence and yield following mustard cover crops in Michigan.

| **Treatment** | **Plant height 2009 (cm)** | **Plants with Verticillium Wilt 2009 (%)** | **Yield 2007 (bushels/A)** | **Fruit 2007 (1000 fruit/plot)** |
|---|---|---|---|---|
| Oilseed radish | 49.5 a | 97.6 | 611 a | 35.5 a |
| Oriental mustard | 46.5 ab | 98.8 | 570 b | 31.9 ab |
| Yellow mustard | 42.7 b | 98.8 | 572 b | 33.2 ab |
| Control | 47.1 ab | 100.0 | 449 c | 27.0 b |
| $LSD_{0.05}$ | - | NS | - | - |

Funding for these studies was provided by Michigan State University, Project GREEEN, NCR-SARE (Sustainable Agriculture Research and Education Program) and USDA and SWMREC (Southwest Michigan Research and Extension Center).