2024-2025 SRSFC Research Report

Title: Long-Term Study of the Impacts of Crop Rotation on Southeastern Plasticulture Strawberry Production

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Public Abstract

Preliminary results from our trials indicate an occasional benefit of crop rotation and summer cover crop use in non-fumigated plasticulture strawberry production in the Southeast in some years. In 2024, which was the 2nd year of our trial, and the first harvest season of back-to-back strawberry production we observed lower yields (20% reduction) when crop rotation was not used in unfumigated plasticulture strawberry production. In 2025, yields between the continuous strawberry plots (three years of back-to-back crops) yielded similarly to plots where crop rotation was implemented. However, yields between the two years differed, and were overall higher in 2025 likely in part due to differences in plant quality, weather and fall fungicide use. Additional years of data are needed to verify these results. Impacts of crop rotation, summer cover crop use and their interaction will continue to be investigated through the 2027 harvest season.

Objectives

1. Evaluate the effect of **crop rotation** in non-fumigated plasticulture strawberry production on plant health, soil characteristics, fruit yield and fruit quality over a five-year period.
2. Investigate the impact of **a summer cover crop mix** and its interaction with crop rotation on strawberry plant health, soil characteristics, fruit yield and fruit quality over a five-year period in non-fumigated plasticulture strawberry production.

Introduction

Small scale strawberry producers in the Mid-south do not rely on soil fumigation to the same extent that is common in larger scale production in the Southeast. Many of these growers prioritize short (one-three year) crop rotation strategies for mitigating soil borne disease. However, little research exists to quantify the utility and impact of crop rotation on strawberry crop health and plant productivity over extended periods for southeastern plasticulture strawberry production. Anecdotally growers using a system of yearly crop rotation experience low incidence of soil borne disease and plant loss, however the true

economic value of crop rotation is not clear within non-fumigated plasticulture strawberry production systems.
Following the phase out of methyl bromide for use as a soil fumigant much research has been done to establish the value of alternative practices for strawberry production in the Southeast. Cover crops have been shown to provide nutrient inputs and be used effectively in strawberry crop rotation (Beck et al., 2016; Garland et al., 2011; McWhirt 2016), mustard cover crops can be used for biofumigation (Brennan and Smith, 2018), compost and the use of biological inoculants can improve strawberry plant production (Ferguson, 2006; Louws et al., 2000; McWhirt, 2016). Biodegradable mulches can be substitutes for plastic mulches (Devetter et al., 2017), efficient water-use can reduce negative environmental impacts and costs (Hartz et al., 2018), and recommendations on the effectiveness of organic and targeted integrated pest management programs can be used to manage disease in plasticulture strawberry production (Chase, 2015; Melanson, 2021). Additionally, cost comparisons have shown sustainable strawberry production to be economically feasible in the Southeast (Rysin et al. 2015).

Side-by-side comparisons of sustainable practices and conventional practices in North Carolina found that compost and summer cover-crops can be substitutes for conventional fumigation practices (McWhirt, 2016) however the investigation of long-term crop rotation combined with other soil building practices has not been investigated for non-fumigated plasticulture strawberry.

Methods

To this end, a 5-year trial was initiated at the University of Arkansas Vegetable Research Station in Kibler, Arkansas in the summer of 2022. The trial is currently in its 3rd year.

The trial is a strip-split-plot RCBD with **crop rotation** (*crop rotation* (3-year) *or no-crop rotation* (continuous)) as the strip, and the split is sub plots of **summer soil management** treatments (*cover crop* (cowpea (100lb/ac) and pearl millet (10lbs)) or *summer fallow*). Summer cover crop were established in June and terminated in August of the same year. Cover crop and summer weed biomass was assessed on a per $0.5m^2$ basis prior to termination in the summer soil management treatments sub plots. Standard pre-plant fertility applications and plasticulture beds were laid in August, followed by strawberry crop establishment in September. Each crop rotation x summer soil management treatment had three replicate plots consisting of 30 strawberry plants each. The strawberry variety for the 2025 season was “Camino Real”. Strawberry plant biomass, fruit number, fruit weight, fruit quality (brix, pH) and assessments of plant mortality were assessed across all treatments. In the spring, strawberry yield was measured on a bi-weekly basis and fruit flavor parameters (Brix and pH) be measured at three points throughout the season.

Plant tissue nutrient sampling was conducted at five points early in the growing season and performed by University of Arkansas Agricultural Diagnostic Laboratory (Altheimer Lab) Fayetteville AR. Destructive strawberry plant biomass was assessed at dormancy (December) and small green fruit (March- April) to assess the number of crowns and plant size. Soil nutrient content and nematode populations are monitored yearly prior to

bed laying activity in September. Pest populations was assessed throughout the season including, monitoring disease incidence, and percent number of cull fruits due to botrytis or anthracnose fruit rots. Data was analyzed in SAS v. 9.4 (SAS Institute Inc., Cary NC) using mean square separation tests. At the end of the 5-year project an economic analysis is planned of the impact of crop rotation and summer cover crop use in non-fumigated plasticulture strawberry production.

The Horticulture staff at the University of Arkansas Vegetable Research Station, and the PI's program technicians oversaw much of the duties related to daily care, fertilizer application and will assist the PIs in data collection.

Preliminary Results

Preliminary yield results for the 2024 harvest season indicate a yield benefit from crop rotation in non-fumigated plasticulture strawberry production but not from summer cover crops (Table 1). Marketable yield of 1.04 lbs. per plant with crop rotation and 0.842 lbs. per plant without crop rotation. This yield difference may in part be explained by larger fruit size with crop rotation. There was no statistical effect of summer cover crops on impacting crop yields but numerically with crop rotation (+) summer cover crop yielded 0.10 lbs./ plant higher than crop rotation (-) summer cover crop. This equates to an additional 1,550 lb/ac of yield when using summer cover crops.

In 2025, yields between the continuous strawberry plots (three years of back to back crops) yielded similarly to plots where crop rotation was implemented. However yields between the two years differed, and were overall higher in 2025. Plant mortality in the late season was higher in 2024 due to Neopestalotiopsis once fungicide applications were stopped and heavy rain occurred. Additional years of data are needed to verify these results.

Table 1. Impacts of summer cover crops and annual crop rotation on marketable yields of Southeastern strawberry (Camino Real) in annual plasticulture production systems during the 2024 and 2025 seasons.

	2024		*2025*	
Treatment	**Sum of Squares**	**Prob > F**	**Sum of Squares**	**Prob > F**
Cover Crop	1,699.79	0.4107	4,028.240	0.7335
Rotation	24,612.39	0.0108*	18,702.45	0.4646
Cover Crop*Rotation	1,390.19	0.4551	3,839.217	0.7396

Results of impacts on plant size, and fruit quality components are still being investigated. Final results from the five-year project are expected in 2027.

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