2018

# Integrating Vegetable and Poultry Production for Sustainable Cropping Systems

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**RFR-A1739**

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## Introduction

In the recent past, the specialty crop segment of U.S. agriculture has seen tremendous growth. Increasing numbers of growers are interested in diversifying their farm operations and growing crops sustainably without chemical inputs. Consumers are interested in how their food is grown and willing to incentivize growers who use sustainable and environment-friendly production practices. Growers are reducing synthetic fertilizers and pesticides and adopting manure, compost, and cover-crop-based cropping systems. They also are interested in learning about integrating crop and livestock production to diversify.

Consumers often associate integrated production systems with a healthier product and increased animal welfare. Integrated systems can include cover cropping, crop production, and/or livestock integration. Benefits of cover cropping include a decrease in soil compaction, improved soil structure, increased soil microbial activity, nutrient recycling, weed suppression, interruption of insect and disease pest cycles, reduced erosion, increased water holding capacity, increased soil organic matter, and nitrogen scavenging.

Integrating vegetable production with livestock (including poultry) production can increase soil nutrition and soil organic matter, offering additional business opportunities for vegetable producers by adding a potentially high-value product such as pasture-raised poultry or forage-raised livestock to a vegetable production system. A system that integrates crops, livestock, and cover crops not only combines the aforementioned benefits, but also potentially reduces input costs (compost application, feed, etc.). Additionally, integrated systems can increase farm resiliency by allowing for the success of one product to compensate for the failure of another.

Organic producers are in need of cost reduction strategies that remain in compliance with organic standards. Organic standards require less reliance on off-farm inputs and emphasize soil management and nutrient recycling. Integrating livestock production with crops could help accomplish this goal. A project that studies the effects of a diversified cropping system can provide research-based findings on benefits of livestock and crop integration, specifically poultry and vegetables (how this impacts soil health, accomplishing organic production goals, reducing off-farm inputs, and increasing farm profitability).

To determine the effects of an integrated cropping system suitable for vegetable growers, this project is investigating changes in soil properties, crop performance, poultry health, and farm profitability over three growing seasons. A total of three rotations were designed (Figure 1) to compare two vegetable-poultry-cover crop systems with a typical vegetable-cover crop system. The hypothesis is the implementation of integrated systems will increase soil health and also increase farm profitability and resiliency.

## Materials and Methods

This project is currently held on transitional organic land at the Iowa State University (ISU) Horticulture Research Station. This is the first year of a three-year project. Organic broccoli transplants were started February 17, 2017 in the Department of Horticulture greenhouses. On April 17, 2017, the organic broccoli transplants were planted into 12-370 $ft^2$ plots.

Each plot had five rows that were 3 ft apart (center-to-center) on bare ground. Switchgrass mulch was used to manage the weeds between the rows. Broccoli was harvested July 10, 2017 and graded for size and quality. Broccoli stems and leaves were left in the field (broccoli residue).

Four of the 12 plots with broccoli residue were randomly selected for broiler chicken integration. The chickens (batch 1) were introduced using a 5 ft x 4 ft floorless movable coop to allow chickens to forage on the broccoli stems and leaves, insects, and weed seeds. Each replication had 10 birds/coop. Upon harvest, an electric fence with fence charger was erected around the perimeter of the field in an effort to protect chickens from predators such as fox, coyote, and raccoons. The remaining eight plots were tilled in and seeded to a cover crop mixture of oats and clover.

The chickens foraged on the plots for eight weeks. During this time they also received a full balanced ration of organic chicken feed. Coops were moved in a uniform manner in each of the plots on a regular basis to obtain access to fresh forage. Although chickens were on the plots, feed data was collected by weighing feed left over and feed added. Chicken weight data was collected three times throughout the season at four (age at which chickens were introduced to the plot), eight, and 12 weeks of age. Chickens were removed after an eight-week period and a fall cover crop of cereal rye was broadcast. Four of the remaining eight plots with oats and clover were randomly assigned for introduction of the second batch of chickens (batch 2). Chickens (batch 2) were introduced using the same method as batch 1. The same feed and weight data also were collected.

In the remaining four plots, cover crop was incorporated and organic lettuce transplants were planted. On November 9, 2017, lettuce was harvested and batch 2 of chickens were removed from the study. Throughout the season, four soil samples were collected from each plot at different integration periods. These samples will be analyzed for chemical and physical properties for determination of soil health. Additional tests on the microbial activity also are being conducted.

This study was approved by the Institutional Animal Care and Use Committee.

## Results and Discussion

At the time of publication, results had not been summarized.

**Acknowledgements**

We would like to thank the staff at the Horticulture Research Station for their help and cooperation with this study. We greatly appreciate the support from Cameron Hall, ISU Poultry Science Farm, and Elizabeth Bobeck, Department of Animal Science, for valuable insight and guidance. Thank you to ISU LAR on-call veterinarians for their invaluable help and farm visits.

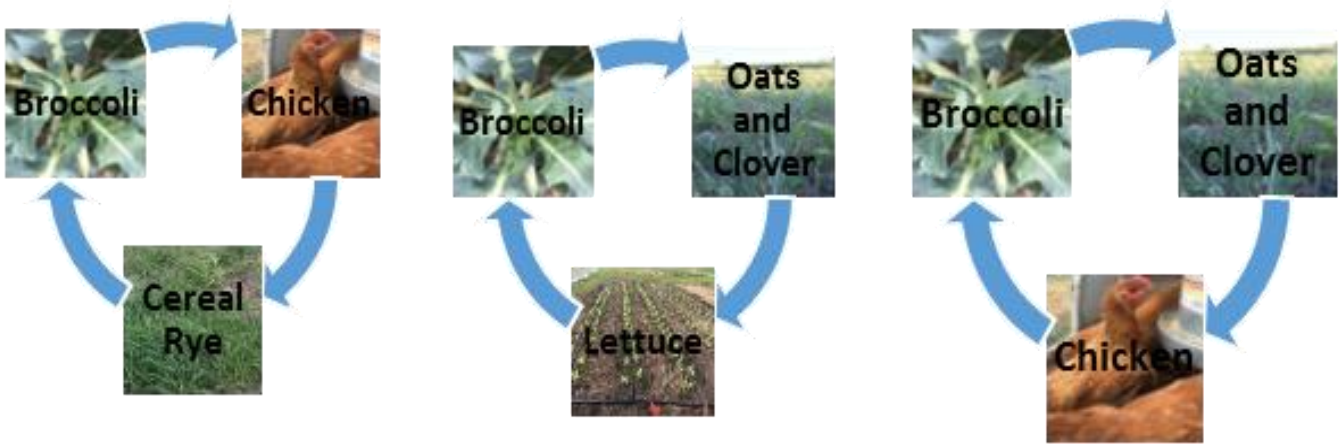


**Figure 1. Year 1 rotations.**