Reflective mulch is a useful orchard floor management tool to suppress weeds and increase photosynthesis

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Abstract

Six orchard floor management systems (OMSs): bare ground as control, reflective mulch, composted manure, reflective mulch placed over composted manure, green manure and bent grass as a companion plant cover were set up as replicated, randomized plots in an establishing 'Honeycrisp' apple orchard. The objective was to suppress weed growth and enhance tree development. Reflective mulch was found to be most useful among all OMSs in suppressing weeds, increasing photosynthesis and producing fruits.

Keywords: Honeycrisp apple, compost, green manure, fruit production

Introduction

Weeds in an establishing orchard can out-compete young trees for space, nutrients and moisture, resulting in a cumulative decrease in tree vigor. Managing the orchard floor using cultivation, growth of companion plants, organic and synthetic surface coverings (or mulches) are all potential methods of weed control (Neilsen et al. 2009). Cultivation (or tillage) can control weeds in the short term, but it degrades soil quality and disturbs ground habitat structure causing a decrease in natural populations of beneficial soil macrofauna (Wilson-Rummenie et al. 1999). Companion plants can prevent soil erosion and provide a stable environment for soil fauna. Reflective mulch is a white synthetic fabric with a potential to control weeds when used as a ground cover. Because it is made with a combination of formulated white and aluminium pigmented thread, it reflects light reaching the tree rows back into tree canopies and increases the amount of available light for trees to carry out photosynthesis. Composted poultry manure placed in the tree rows has been found to be a complex ground habitat, provide suitable dwelling for generalist predators and increase their population density (Matthews et al. 2004). Choosing the appropriate orchard floor management system can be crucial for the establishment of newly planted apple orchards.

Material and Methods

This study was conducted over three seasons (2010 – 2013) in a 2-acre organic research orchard located at the Kentville Research and Development Centre in Nova Scotia, Canada. There were six orchard floor management systems (OMSs): tilled bare ground as control, reflective mulch cover, composted manure, composted manure with reflective mulch cover, green manure of organic hay and bent grass as companion plant cover. A randomized complete block design was used with four blocks each containing all six OMS treatments applied to plots containing four trees with two experimental trees between two guard trees. Other than the imposed treatments, all other management practices followed the organic standards.

The effect of OMS on weed abundance and tree growth was studied. Weed abundance was assessed in each of the OMS plots in 2011 (June and July) and 2012 (June, July and August); weeds in each plot were identified and their percentage coverage was quantified. By the end of each growing season, tree trunk diameter was measured in each treatment tree and the cross-sectional area (TCA) 30 cm above the scion-rootstock union was

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calculated. Gas exchange measurements (using Li-6400 portable photosynthesis system, Lincoln Nebraska, USA) were made on a single leaf from each of the two experimental trees in each plot 15 times over the course of the growing season. In 2012, apples were harvested from each experimental tree and total fruit weight per tree was recorded.

Results and Discussion

Reflective mulch and bent grass were most effective in suppressing weeds. Compost and green manure plots had a high percentage of weed cover, although weed composition between these two OMSs was different. Tree growth as indicated by trunk cross sectional area (TCA) was highest in trees treated with compost, followed by trees growing in the reflected mulch and bare ground; green manure plots and bent grass plots had the smallest trees. The highest photosynthetic rates were found in trees in reflective mulch plots (with and without compost) and the green manure plots. Trees in the green manure plots have shown a faster growth rate in the last two seasons of this study likely due to a higher photosynthetic rate. In 2012, the highest fruit yield was obtained from trees grown in reflective mulch plots treated with compost; trees given compost alone did not yield as much in comparison.

The positive effects of compost on tree growth declined in the third year of this project relative to its effects in the first two years. Since compost was applied only in 2008 and 2009, its nutritional benefits may have worn off over the course of the project. Whereas the effects of the green manure treatment became more positive over time as it was applied each year in the project. Soil temperature was consistently higher in the compost (without reflective mulch) which may explain the rapid degradation of the compost.

From a longer term perspective, it would be advisable to replenish compost on a regular basis to maintain its beneficial effects on tree growth. Using reflective mulch in an orchard can suppress weeds, increase photosynthesis and fruit production. The increase in photosynthesis in the reflective mulch treatment was largely due to its positive effect on the light environment of the leaves.

References

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