Integrating Cover Crops into Organic Orchard Systems

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Abstract

Cover crops other than grass can provide various functions in an organic orchard, including nitrogen fixation, biomass for mulch, soil improvement, and flowers for beneficial insects. The current study evaluated various legume species as well as cultivars within species for their potential as a renewable nitrogen source for organic growers, when planted in the drive alley to replace grass. Lucerne (alfalfa) produced the most biomass N over the three-year study, exceeding 100 kg N/ha in most years, which would nearly meet the orchard N needs.

Keywords: alfalfa, clover, biomass, nitrogen

Introduction

Half or more of the ground surface of most fruit orchards is commonly planted to an inert perennial vegetation such as grass to suppress dust, provide a surface for machinery traffic, stop soil erosion, and maintain soil structure. Alterantive species can be planted to perform additional functions, such as legumes for nitrogen fixation. In organic orchards in Washington State, nitrogen is a nutrient needed annually in substantial quantities relative to other nutrients, and is often the most expensive macro-nutrient to supply. Legume cover crops have been examined in various settings: in or between the tree row; in newly planted and mature orchards; in sole planting versus species mixtures (Granatstein & Mullinix, 2008; TerAvest *et al*., 2010; Mullinix & Granatstein, 2011; Granatstein *et al*., 2013).

Material and Methods

The most recent study involved three organic orchard sites in the Yakima Valley of Washington State, USA. Site A: mature 'Golden Delicious' apple (*Malus* x*domestica* Borkh.). Site B: 2-year old almond (*Prunus dulcis* Mill.). Site T: 2-year old 'Gala' apple. The drive alleys were all tilled in early September 2012, and legume cover crops were planted between Sept 11-13. Each site had 20-25 plots 2.3m wide by 30m long, and each plot had one cover crop treatment. Cover crops included multiple species [e.g., lucerne (*Medicago sativa* L.), white clover (*Trifolium repens* L.), hairy vetch (*Vicia villosa* Roth)] as well as several cultivars within a specie, and both annuals and perennials were tested. Plots with perennials were harvested 2-4 times per year in 2013-2015 based on the grower schedule. Annuals were harvested only once in 2013. Measurements included percent cover of legumes, grass, broadleaf weeds, or bare ground; legume height; cover crop biomass, and total N in the biomass. Site B was discontinued after 2013.

Results and Discussion

Data analysis is still on-going and results presented are preliminary. The lucerne entries provided more biomass N over the three years than the other species, often containing 100-120 kg N/ha in the cut aboveground biomass (Fig. 1) which would nearly meet the orchard N requirement assuming a 40 % mineralization (Mullinix & Granatstein, 2011).

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Several white clovers performed well in 2013 but declined yearly after that. Vetch provided the most biomass N of the annual species at about 40-50 kg N/ha. Red clover (*Trifolium pratense* L.) biomass N ranged from 45-120 kg N/ha.

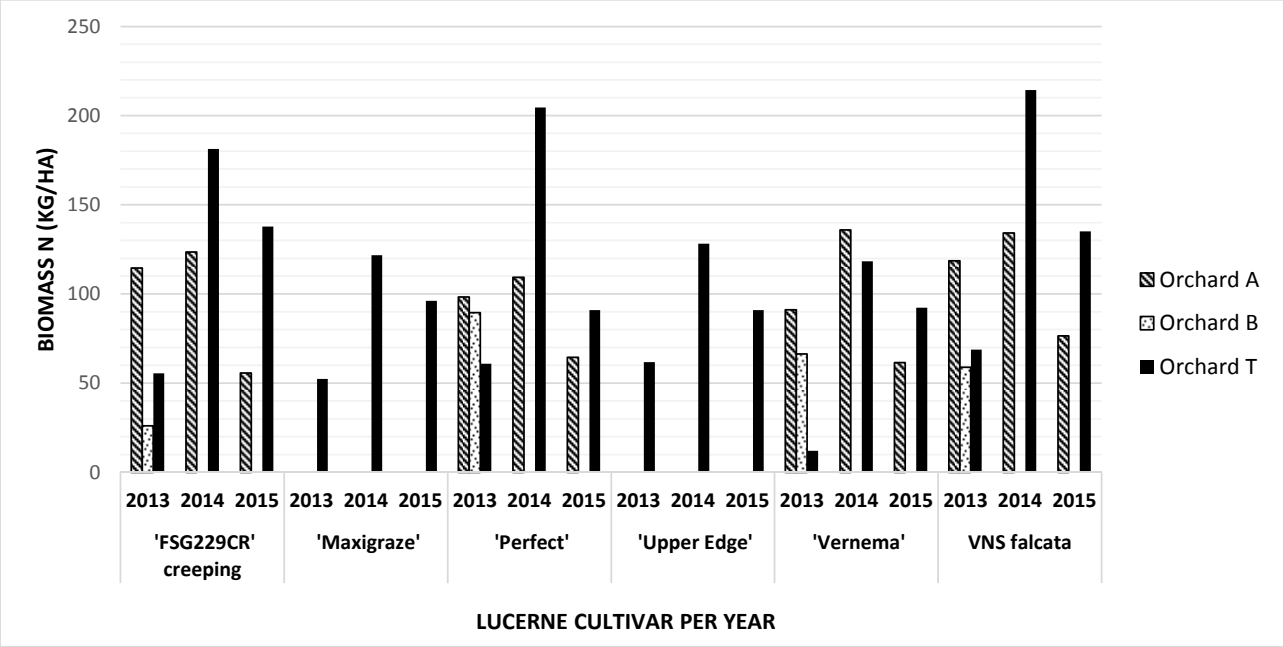

Figure 1: Lucerne (*M. sativa*) biomass N content (kg N/ha) by year, cultivar, and orchard site, Yakima Valley, USA.

To understand potential grower adoption, costs of planting the cover crop (soil preparation, seed, seeding) were estimated for the different species and cultivars and ranged from $200-350 / ha. Total biomass N was then multiplied by the cost per kg of N as chicken manure compost ($4.40) to determine the three year value of the legume. Lucerne was the most economically attractive averaging $617 / ha of value of N based on the compost price (range $440-825 / ha). Clovers (except 'White Dutch' and kura) also covered the planting cost, while none of the annual species did. Thus, it appears that lucerne and red clover can provide a large share of organic orchard N at a lower cost (~$1.40 / kg N) than with compost and would be a sound economic choice for growers.

References

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Citation of the full publication

Pavek, P. & Granatstein, D. (2016). Legume Conservation Cover in Orchards - Final Study Report. United States Department of Agriculture – Natural Resources Conservation Service, Pullman, WA. (In press).