

Leguminous Cover Crop Residues in Orchard Soils: Nitrogen Release and Tree Uptake

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Abstract

Almond production is dependent on nitrogen availability. Cover crops offer a potentially valuable source of nitrogen, especially if the cover crop plants are nitrogen fixers, such as clovers, vetches, and other legumes. Little is known about how much N derived from a cover crop is actually taken up by the almond trees, and over what period of time.

We grew six young 'Non-pareil' almond trees in lysimeters with intact columns of orchard soil for eight weeks. To the soil surface of three lysimeters we applied 180 g (DW) of 'Lana' woollypod vetch hay grown with a ¹⁵N labeled fertilizer (KNO₃). Leaf samples were collected bi-weekly and analyzed for %N and ¹⁵N content. After eight weeks all of the trees were destructively sampled and the soil, roots, stems, and leaves were analyzed for %N and ¹⁵N.

Almond leaf nitrogen derived from a vetch cover crop (%Ndfcc) increased rapidly over four weeks, stabilized at about 30% in existing leaves, and reached 43% in new leaves. Almond leaf nitrogen content increased from 1.6-2.3% over the first four weeks. Leaf biomass doubled in eight weeks compared with control plants grown without vetch hay. Leaf number increased 88% in treated trees and decreased 5% in controls. Soil nitrogen derived from vetch was >4% in the top 4 inches, although absolute soil nitrogen levels decreased in eight weeks. We could account for approximately 75% of nitrogen released from the vetch, about equally divided between soil and plant pools.

These results indicate that substantial nitrogen was released from the vetch residue applied to the soil surface in the treatment lysimeters. Thirty-five percent of the released nitrogen was taken up by the tree in eight weeks following application of the vetch residue. The first four weeks showed the fastest rate of uptake. Vetch nitrogen was partitioned into plant and soil pools approximately equally. On a per biomass basis, and as a total, new leaves represented the greatest uptake of vetch-derived nitrogen. Vetch as a source of nitrogen provided adequate nutrition for young almond trees.