Integrated
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for Wisconsin

Cranberry

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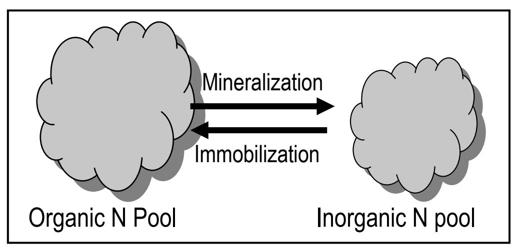
SOIL TEMPERATURE AND NITROGEN UPTAKE

Nitrogen is the most common nutrient applied to cranberry beds by growers. Cranberry vines can take up and utilize nitrogen only in the ammonium form (NH_4). Most nitrogen in soil is in the organic fraction that is not readily plant available. The process through which organic N is converted to plant available inorganic N is called mineralization. The process occurs as microorganisms decompose organic material for their energy supply. As the organic matter is decomposed, the organisms use some of the energy released plus part of the nutrients in the organic matter. When the microbes have used all the nutrients they need, excess amounts are released into the soil for plant growth.

Nitrogen can also be converted from inorganic to organic forms. This process is called immobilization. It is the reverse of mineralization. Immobilization occurs as organic materials high in carbon and low in nitrogen are incorporated into the soil.

Mineralization and immobilization occur simultaneously in soils. Whether the balance shifts one direction or the other is determined by the C:N ratio of the organic fraction. Organic matter with high C:N ratios pushes towards immobilization as microbes extract inorganic N from the soil to decompose this material. The balance shifts towards mineralization when C:N ratios are less than 20:1. The C:N ratio of cranberry tissue is about 45:1. Thus, decomposition of this materials would lead to immobilization of N from cranberry soils.



Because mineralization is microbe mediated it is also temperature dependent. The ability of roots to take up ammonium is energy dependent and is also related to temperature.

Recently Davenport and DeMoranville reported on their research on mineralization in four cranberry soils. They examined the interaction of soil type and temperature on nitrogen release. The soils they used were sand, a sanded organic soil, a highly decomposed muck, and less decomposed peat. The soils were put in PVC columns and incubated at temperatures ranging from 50 to 75°F. Every three to four days water was poured through the columns to leach any available nutrients and the leachate was analyzed for ammonium and nitrate.

The sand and striped organic soils released very little nitrogen and the release of N was not highly temperature dependent. The peat soil didn't release much N until the soil reached 70°F. The muck soil released N even at 50°F, but released N at a higher rate at 75°F.

Interestingly, most of the N being found in the leachate was nitrate. Nitrifying bacteria were converting the ammonium released from the organic fraction of the soil into nitrate in the 3-4 days between leachings.

The researchers then adjusted the pH of additional soil columns to low (pH 3.0), medium (4.5) and high (6.5). At the high pH more nitrogen was released, but 89% of the N was nitrate. At the medium and low pH less N was released, but only 62% of the N had been converted to nitrate (Table 1).

Table 1. Average soluble N released from sandy soil with pH adjusted to 3.0. 4.5, or 6.5.

Soil pH	Total N	NH4	NO3
	ppm		
High	56.6a	6.4a	50.2a
Medium	10.3b	3.9a	6.5b
Low	14.1b	5.5a	8.6b

Numbers within columns followed by the same letter are not significantly different.

Several years ago we did a study looking at how quickly nitrogen (ammonium) fertilizer would be taken up by cranberry vines. At locations in four states ^{15}N labeled fertilizer was applied to small plots and samples taken daily for 14 days and again at ~60 days.

We found that in all locations N fertilizer was found in vines within 24 hours after application. However, the rate of uptake over the first week or so was different in different states. MA and OR were both cool that year and they had lower rates of uptake than WI or NJ.

This prompted us to take a look at N uptake as a function of temperature in the laboratory. We exposed the roots of cranberry vines growing in a mist system to temperatures ranging from 40 to 85°F and measured how much 15N was taken up at these different temperatures. We found the optimum temperature for N uptakes was between 65 and 75°F.

Table 2. Uptake of N fertilizer by cranberry vines at different temperatures in aeroponics.

Root Temperature (°F)	%N from fertilizer
40	1.658 a [z]
45	2.505 b
55	3.643c
65	4.737 d
75	4.672 d
85	1.383 a

Our data also suggest that growers wait until soil temperatures are at least 55°F before applying N fertilizers. Data from Davenport and DeMoranville also support waiting until soils warm before applying N fertilizer.

Their research (and we have similar data) also shows the importance of managing soil pH to prevent nitrification. We found that if soil pH was 5.5 or less we found negligible amounts of nitrification. However, at a soil pH of 6.5 there were substantial populations of nitrifying bacteria and nitrification.

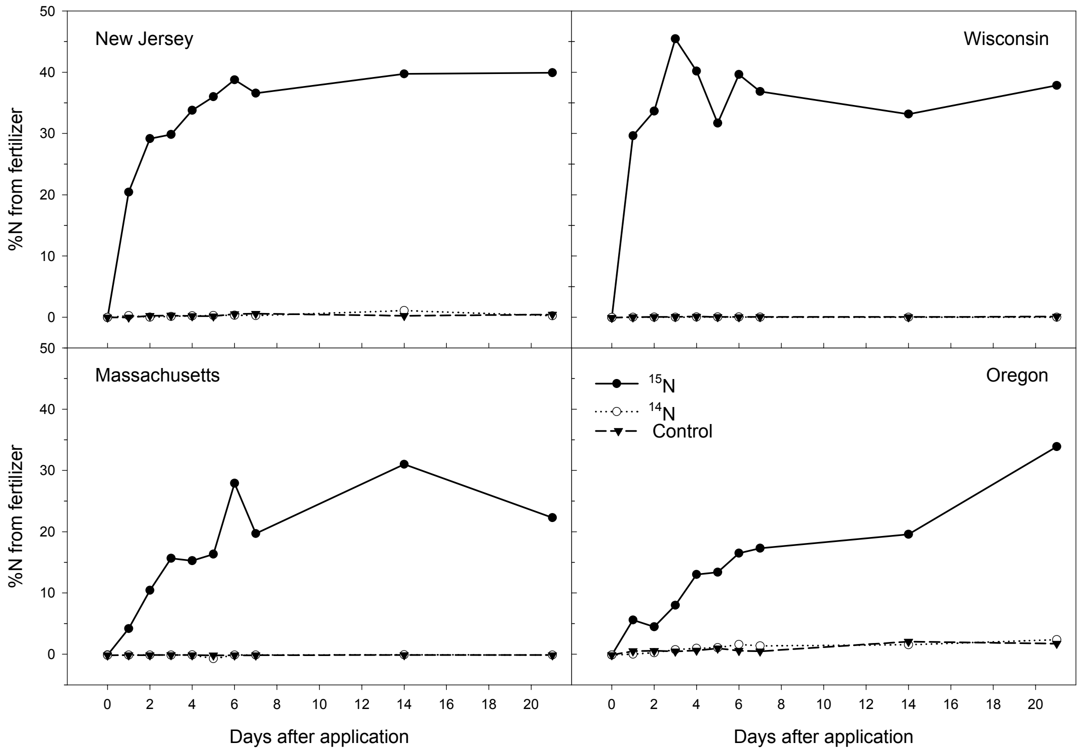


Figure 1. Nitrogen uptake over time by cranberries in four locations in North America.

HILL FIREWORM

Most of the Hill Fireworm that our team has found is in newer upland marshes and sandy soils yet a few have been found in traditional wetland marshes. What are they and what do they do?

The young Hill Fireworm larvae can be found feeding on the stems and moving upwards to the tips – the plants wilt over or actually drop over. As the Blackheaded Fireworm some of these Hill Fireworm web the tips yet we see much more frass. I believe that they get their names because when they are older we see hills of new plantings defoliated. Typically we see more than one Hill Fireworm working one single area.

Anne Averill and Martha Sylvia writes that they believe that is a single generation each year and that the eggs over winter. The larvae feed in June and July but can hang around until mid August. They envelope themselves in a cocoon of silk and sand, generally on the bed floor. The moths emerge from mid August to early September and lay eggs. Henry Franklin (1948) also reported that some of the pupae live through the winter.

The larvae have blackish heads and reddish bodies when newly hatched. As they grow larger, the head is black; the prothoracic shield with a much-broke pale-yellow strip along it front margin; the body dark brown, marked lengthwise on the back and sides, except toward the hind end, with about eight narrow and brown pale-yellow stripes; these being more conspicuous toward the head end; the center without stripes, the back and sides with noticeable scattered pale hairs. The full grown larvae is from 16 – 21 mm (10/16 – 13/16" long)

Is this a new pest? Apparently not, as Henry Franklin has documented the Hill Fireworm as early as 1928 and Anne and Martha have revisited it in 1998 in their publication "Cranberry Insects of the Northeast". Is this a pest that is widespread in Wisconsin? No not really – we find it occasionally.

Control measures of this pest: Henry Franklin noted in 1928 that flooding did not prove effective against this fireworm. I believe that by June and July our plants are far too advanced for a flood any way. Most insecticides we use today have been effective.

Sharing some field experience,

Jayne Sojka – Lady Bug IPM

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