Updates on cranberry plant/soil water relations and on mycorrhizal colonization in Wisconsin cranberry production.

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In this article I will discuss recent findings from our research on root growth responses to soil water availability in cranberry, and from our work on the prevalence and potential role of ericoid mycorrhizal fungi in Wisconsin cranberry marshes.

We can gain insights into management of cranberries in cultivation by considering the adaptations of cranberries to their native, sphagnum bog environment. Cranberries growing in a sphagnum bog are essentially growing in a sponge, with an abundant supply of acidic water. These plants have runners and roots growing down to, but not beyond, the saturated zone.

We know from recent work in our lab that the balance between root and shoot growth in cranberries is sensitive to soil water availability. High water tables lead to shallow rooting depth, as cranberry roots are unable to grow into flooded soil. In these cases, shoot growth dominates root growth, so the root/shoot ratio is relatively small. If the water table is high and constant, this small, shallow root system is capable of supplying sufficient water to maintain growth and reproduction. Lower soil water availability leads to deeper, more vigorous root growth, and an increase in the root/shoot ratio- plants are "rootier".

Sarah Stackpoole has collected data in 2004 that indicates that this same response is seen in the field. Samples were collected at the high- and low-water table ends of a gradient along approximately ½ mile, where bed elevation was constant, but the water table was approximately 4 inches deeper at the dry end relative to the wet end, leading to consistently lower soil moisture. (Fig. 1). This seemingly small difference in water table height has caused a significant difference in cranberry root/shoot development. The root system in the dry end of the series of beds was generally deeper, and constituted proportionately more of the total plant biomass. These plants were "rootier", consistent with observations in the greenhouse (Fig. 2).

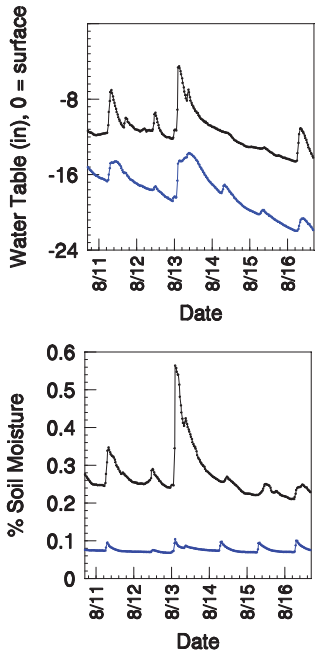


Figure 1. Top Panel: Water table depth from surface (inches). Bottom panel: % soil moisture (g water per gram soil). Dark line is data from wet end of the gradient, light line is data from dry end of the gradient. Data collected in 2004.

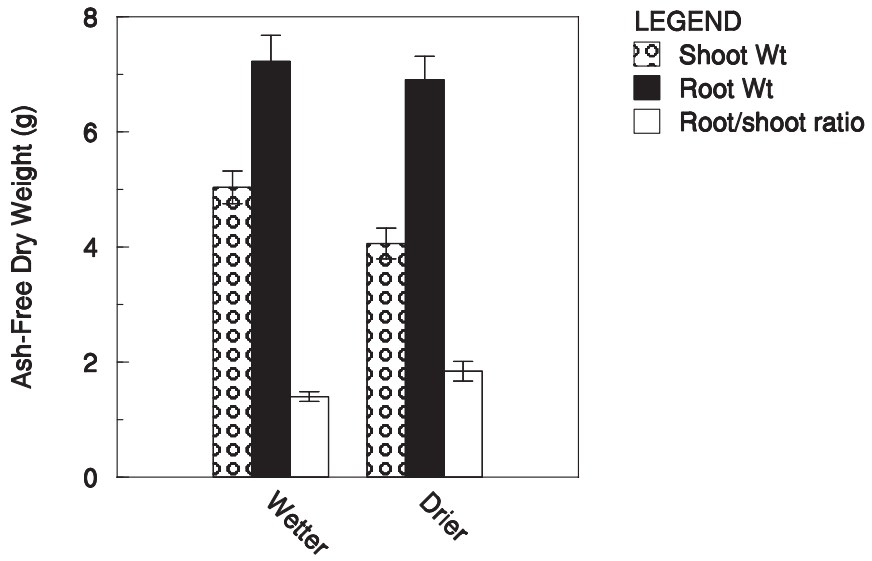
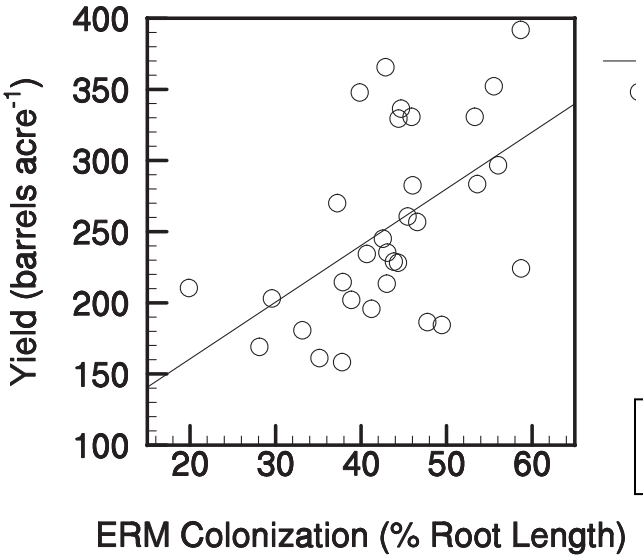


Figure 2. Shoot weight, root weight, and Root Wt/Shoot Wt ratio (root/shoot ratio) for "Stevens" vines growing at the wet and dry end of a water table gradient over approximately ½ mile.

Mycorrhizal colonization is common in Wisconsin cranberry production. In our initial survey of mycorrhizal colonization in 100 different cranberry beds distributed among 7 marshes, we found the average rate of colonization was 42% (% root length with mycorrhizal fungi). Marshes where Bravo is applied yearly to control cottonball had colonization levels similar to those found on the other marshes where fungicides are not typically applied.



We found a positive relationship between colonization and yield on one of the 3 marshes where we have sufficient data for this analysis (Fig. 3). We sampled 35 beds in this marsh, including both old and renovated beds with a peat substrate and old and new beds with a sand substrate. Colonization was generally quite high on this marsh, even on very new plantings.

Figure 3. Mycorrhizal colonization (% root length) vs. yield (bbl/acre).

Does this positive relationship imply that we should be trying to obtain high colonization rates in order to improve yields? Probably not, given that we only found this relationship in one marsh. A possible cause for the positive relationship between mycorrhizal colonization and yield is the common response of both traits to nitrogen availability. At very low nitrogen levels, both yield and mycorrhizal colonization show a common response to increased applications of N, but only up to a

point. Above optimal N levels, both colonization and yield are likely to decline with increasing N fertilization.

Do mycorrhizal fungi serve a beneficial role in cranberry production? In their native sphagnum bog habitat, mycorrhizal fungi act to break down organic nitrogen, giving mycorrhizal cranberry plants access to this otherwise unavailable source of soil nitrogen. We are currently investigating the role of dissolved organic nitrogen in the nitrogen budgets of cranberry beds.