"Perennials: a Fresh look at an old idea"

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Perennials are nothing new to adding value to a cropping system or to the impact on a farm's fertility system. Building organic matter is a specific result of the broad qualities perennials bring to a cropping system. And so my discussion could be very broad today. But working in an area with heavy feed needs and increasing animal numbers, the days of being able to take a corn crop every three years without a lot of fertilizer inputs like my grandfather have long since past. In the sixties, we depended on crop rotation and manure as our primary nutrient sources. Our yields today are much higher, but the requirement of farmers to consider the crop yields impact on organic matter is no less important. Here in the Shenandoah Valley, farms also feel the pressures of designing cropping systems for growing crops under stricter environmental guidelines as well as economic considerations. Perennials, when used in shorter rotations, can be high yielding, profitable and good for water quality. **As scientists and the world community talk about the need to double crop yields by 2030, our ability to capitalize on that increased genetic potential on the farm will depend on how well we integrate basic agronomic principles into the new technologies to realize new plateaus of yield response.**

This is not going to be a presentation about how to grow Alfalfa or perennials. That is for another session or even a series of sessions. But I do want to highlight a presentation Dr. Dan Undersander from the University of Wisconsin made at a conference sponsored by the VFGC about two years ago focused on Alfalfa production economics. It is important to note that at the University of Wisconsin more than twenty scientists work on improving alfalfa's yield and economic value. I have enclosed a copy of the summary of his presentation sponsored by the VFGC about alfalfa research on "Alfalfa in shorter rotations" for your reference. What caught my attention was his research that alfalfa in short rotations with corn was the most profitable cropping system. **Shorter rotations mean greater profit per acre for the entire farm because of higher alfalfa yield, higher forage quality, reduced pesticide use, greater nitrogen credits, and increased corn yields.** The actual profitable alfalfa yield was realized in the first four years when compared to costs. Wheel traffic, compaction, disease, pests, etc. lead the list of reasons for alfalfa stand decline, which ultimately reduces overall crop yield. Dr. Undersander noted that if yield could be increased in the establishment year, the profit from the system was even greater. The significant contribution to profit came when the alfalfa was rotated to corn, and nitrogen purchases in the first year were reduced to a starter rate of 40 pounds. In fact,

research is indicating that the nitrogen contribution to a corn crop in the second year is more than that provided from a previous soybean crop.

So what about alfalfa in Virginia where we have traditionally used longer rotations to spread out the high costs of crop establishment? Here are 5 key reasons alfalfa should be added to our crop rotations:

1. Great production: 6-8 ton per acre at Orange Experiment Station. Alfalfa sold for $225 per ton at the January 18 Rushville Hay Auction.
2. Late 80's and 90's, perennials in rotation with row crops were required to meet the soil erosion control measures and standards for Farm Bill goals.
3. Living roots and decayed matter: alfalfa's growing season runs from late March to well into November. In fact, I remember Dr. Harlan White commenting in response to a herbicide question related to "crop dormancy" by asking a question himself, "does alfalfa ever go dormant in Virginia?" The growing season may be 7 months or 210 days, but alfalfa can continue to grow, pushing down roots and foraging through the soil profile excepting the coldest winters of December and January. Alfalfa, especially mixed with a grass, can be the crop that exhibits the longest growing season of all but the most aggressive summer annual cover crop system. If the soil microbiologists are correct about the value of living roots and decaying material being available for the soil biota of mycorrhizae, fungi, bacteria, and viruses to digest organic matter for nutrient availability, that is where alfalfa in Virginia shines. If 8 ton above ground yields are common and 65% of the crop is below ground, then 10,400 pounds of the crop is below ground. It would take a very aggressive cropping system with annuals to achieve this same level of carbon addition.
4. A balance of carbon, both living and decaying, moves alfalfa ahead of any other crop in its ability to produce total pounds of residue and carbon. The farmer can take a harvest of alfalfa hay in multiple cuttings and the roots and below ground impacts are still positive. Most annual cover crops' value to the soil exists if the top growth is not removed as feed and returned to the soil. The exception to this from our plots is hairy vetch and radishes.
5. Many of you have heard agronomists ask the question about, "What are the key nutrients needed for crop growth? N-P-K immediately come to mind, followed by secondary and micro-nutrients. We quickly jump past C,H,O. Active organic matter and water are the two necessary nutrients before we come to the identifiable "fertilizer" plant foods. The scoring of a cropping system's ability to build organic matter and retain water is the best definition of NRCS Soil Quality Institute's Slogan: "Go beyond T, Manage for C". Controlling soil loss is not enough. Improving soil organic matter is the key to nutrient cycling and allowing a crop to extract available

nutrients for crop growth. This is particularly true when the soil test levels exceed the level needed for agronomic yield response.

Dr. Undersander's research about shorter rotations of corn and alfalfa or perennials prompted me to go back to some work Chris Lawrence and I did more than seven years ago when he was an agent for VCE. H.B. 1207 required phosphorus based nutrient management planning with application limits. Farmers and nutrient management planners were asked to consider the use of a Phosphorus Index when making nutrient applications to crops when the STP or soil test level is above what is considered required for agronomic yield response. And so, I want to spend some time on this busy slide illustrating the P-Index used here in Virginia. Here again is a reference to a value for perennials in shorter rotations. I apologize for it being hard to read, but what I want you to pay attention to are the trends and the extremes. A copy of this table is printed in your proceedings and I encourage you to reference it as I go along. This example indicates how environmental protections are gained by considering crop systems that reduce soil erosion, improve soil quality and increase yield. We are trying to balance all three and achieve a score or rating of Medium to Low risk. Crop yield is still important to "mine" high levels of nutrients, but the crop sequence or system must have a positive (+) soil quality score.

This summary page compares three cropping system extremes: continuous corn silage/rye silage; permanent hay; and three years of alfalfa and corn silage with a cover crop. This example assumes a soil test level of 200 ppm, which is the level where research points to the loss of soluble phosphorus increasing exponentially. This is primarily influenced by slope and is characterized as a C slope in this comparison. No buffer exists on the crop field. This is a typical crop field condition on Shenandoah Valley farms.

P-Indexes are much maligned in the Mid-Atlantic as allowing higher manure application rates to continue and/or providing a Medium range result or score. This allows too much flexibility. I support the use of the P-Index because it reminds us as agricultural professionals and farmers that crop rotations are important tools to increase nutrient cycling and crop response, achieve a better nutrient balance on the farm and reduce the risk of nutrient loss to the environment.

My message is that perennials, particularly alfalfa in shorter rotations, are profitable, they increase soil organic matter, which is at the heart of improving soil quality, they play a role in protecting sensitive environmental sites, and they will be the building blocks of cropping systems that will take nutrient management into the 21st century.

If we were to use total alfalfa crop acres in Virginia as a yardstick of our success of addressing these issues, how would we be doing? Particularly in Rockingham and Augusta counties we have lost 21% and 34% respectively. In fact, alfalfa acres have decreased almost twenty percent over a decade across all of Virginia.