RUTGERS
New Jersey Agricultural Experiment Station

# THE SOIL PROFILE

**A newsletter providing information on issues relating to soils and plant nutrition in New Jersey**

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## Need Nitrogen? Grow Sunn Hemp Cover Crop

Sunn Hemp is a fast growing, soil building summer cover crop. Among the many different cover crop choices, sunn hemp is especially good for converting N from the atmosphere into soil fertility. It also builds soil organic matter content and helps control soil erosion. From a seeding in late spring, it can produce a large amount of biomass over the summer growing season. The tall dense growth habit of sunn hemp is very competitive against weeds. It is also reported to suppress parasitic nematodes in soil.

After serval years of growing sunn hemp in rotation with various grain and vegetable crops I will share some observations and experiences in this issue of The Soil Profile newsletter. The field research was conducted at the Rutgers Snyder Research and Extension Farm near Pittstown, NJ and the Rutgers Vegetable Research Farm in East Brunswick, NJ. In addition to the information provided here, a web search for sunn hemp can to find several useful publications about growing this cover crop. A web search for "cover crop decision tool" is another useful resource.

### Agronomics of Sunn Hemp

- Soil pH range 5.0 to 7.0
- Plant in late spring when soil temperature is about 65F
- Inoculate the seed with the correct strain of Bradyrhizobium for nodulation and N fixation
- Drill seed 0.5 to 1.0 inch deep at rate of 30 to 50 pounds per acre
- Organic growers can purchase certified organic seed of sunn hemp


- Sunn hemp should reach 4 feet in 8 weeks and about 7 feet in 12 weeks
- Yellow-orange flowers appear in late summer
- In New Jersey, killing frost prevents seed set; there is no risk of sunn hemp becoming a weed

- Potential to produce 2.5 tons of biomass and 100 to 140 pounds of nitrogen per acre
- Mowing and tilling the large amount of biomass into the soil can be a challenge

**End of Season Sunn Hemp Management**

The huge amount of biomass accumulated by a sunn hemp cover crop by the end of summer can at first appear to be a formidable challenge for mowing or tillage. What has been found to work well at the Rutgers Snyder Research and Extension Farm is to mow the sunn hemp off at about a foot above the ground using a sickle bar mover. The tall green plants falling upon the stubble eventually dry over winter. Once this biomass is dry (or even frozen in winter) it shatters fairly easily by mowing it with a brush hog type of mower. The remaining shredded sunn hemp cover crop residue is easily incorporated with spring tillage.

**Soil Fertility Research with Sunn Hemp**

Soil fertility research conducted at Rutgers NJAES over the last two decades was instrumental in adapting the presidedress soil nitrate test (PSNT) to a wide range of crops, especially annual vegetable crops. The procedures for using this soil test and the recommendations for various crops are given in the Rutgers Cooperative Extension fact sheet entitled: Soil Nitrate Testing as a Guide to Nitrogen Management for Vegetable Crops https://njaes.rutgers.edu/pubs/publication.asp?pid=E285

Current research with the PSNT soil test is focused on how to adapt its use to additional vegetable crops, and in particular when those crops follow legume cover crops such as sunn hemp.

The main focus of my research with sunn hemp is on its capacity to supply and deliver available N to annual crops in the following growing season. Although sunn hemp fixes a substantial amount of N, it is not easy to predict how much and when this N will become available to subsequent crops. How much N accumulates in the cover crop biomass from biological N fixation depends on many factors. Also, cover crop and soil management practices could influence the rate that this N eventually becomes available for plant uptake.

Causes of this uncertainty may include how many weeks the sunn hemp was allowed to grow to accumulate N, and suitability of weather for the cover crop development. Potentially as much as 140 pounds of N may be fixed by sunn hemp.

Additional uncertainty relates to how rapidly the accumulated N will be converted in the soil to forms easily available to subsequent crops. This may depend on how the cover crop was killed at seasons end and if the cover crop residue was allowed to remain on the soil surface or was it tilled into the soil. Also it may depend on residue particle size and if the residue was shredded.

Although sunn hemp has many leaves which should easily decompose and release available

N, the stems are very thick and woody. At the Rutgers Snyder Research Farm, many months after sunn hemp has been killed by frost, mowed, shredded, and tilled into the soil, much of the stem residue remains visible in the soil. This stem tissue is probably an important factor slowing the release of the N contained in the biomass into the soil pool available N.

As a practical way to manage around these uncertainties, I am using the pre-sidedress soil N test (PSNT). This soil test is being used to measure the nitrate-N concentration in the top 12 inches of soil where sunn hemp cover crops were grown in the previous year. The soil sampling is performed at the specific time when annual crops such as corn or many types of vegetables are already established in the field and are about go into the rapid N uptake growth phase.

One of the most challenging problems when dealing with on-farm sources of N, from cover crops, crop rotations, compost, or manures, is figuring out when and how much of that N will be available to meet the needs of the next crop. Sure there are estimates given in various look up tables, but they are not reliable. The estimates are subject to all the uncertainties and vulnerabilities of the processes that take place within the nitrogen cycle. While it helps to know and understand the N cycle, one of its most unpredictable features is the influence of weather conditions on the potential for N losses from the soil.

The great value of the PSNT soil test is its effectiveness at making accurate predictions. Its accuracy is related to taking a measure the nitrate-N concentration in the soil right before the most critical demand stage for crop N uptake. In general, and for most crops, when the PSNT finds 25 ppm nitrate-N in the soil, the field soil is considered to have enough available N to meets the needs of the crop. In such cases no supplemental or sidedress N is recommended. However, when the PSNT finds less than 25 ppm in the soil, some sidedress N fertilizer is usually recommended to ensure an adequate supply of N to the crop. When the PSNT levels are between 20 and 25 ppm, low rates of sidedress N may be recommended and when PSNT levels are very low (<10 ppm) higher application rates of N are recommended.

One of the great benefits of using the PSNT on fields where legume cover crops have been grown is that when this soil test finds more than 25 ppm nitrate-N in the soil, growers can with confidence avoid applying unneeded N fertilizer. On fields without legume cover crops or without recent applications of manures or compost, the PSNT levels are almost always rather low; often they are less than 10 ppm.

In fact, when there is no significant contribution from on-farm sources of N to the soil supply, it is almost always a waste of time and effort to use the PSNT. These low N testing fields can be predicted by the absence of manure application or legumes in the crop rotation. Farmers should instead focus their PSNT soil sampling efforts only on those fields where there is reason to believe that the soil may have a good capacity to supply available N to crops without adding supplemental N fertilizer. Thus, the PSNT is especially useful for classifying fields as adequate or deficient when on-farm sources of N such as cover crops are involved.

At the Rutgers Snyder Farm, on fields where sunn hemp was grown in the previous year, PSNT soil samples collected in early summer have found values of 14, 20, and 24 ppm. Fields not following sunn hemp typically have PSNT values of 10 ppm or less. While sunn hemp appears to be increasing N availability in the soil, the levels are still below the 25 ppm standard, in which case a low application rate of sidedress N may be recommended. But in this particular field where sweet potato is being grown, PSNT levels between 20 to 24 ppm are

probably adequate. (This is because the generally recommended total application of N for sweet potato is 50 to 75 lbs N/acre. And a PSNT of 20 ppm is approximately equivalent to 80 lbs N/acre of available N in the surface 12 inches of soil.)

In bare soil during the summer months, nitrate-N tends to accumulate in soil where no crop is growing to uptake and remove N from the soil. An apparent difference in nitrate-N accumulation was shown for late summer 2016 for a field that had been cover cropped to sunn hemp in 2015. The section of the field planted to sweet potato had a PSNT soil test level of 20 ppm when sampled in mid-June, and only 4 ppm when sampled at the same location in mid-August after the vines had completely covered the soil. However, in an unplanted area of this field the PSNT level 26 ppm.

This soil testing for N shows that the growing sweet potato plants were withdrawing N from the soil but in the unplanted area the nitrate-N levels increased because N was allowed to accumulate. Most interestingly, the results suggest that sunn hemp continues to release available N into the soil during summer months when growing crops have their greatest need for N fertility. Thus, sunn hemp is an effective biological source of sustainably grown N fertilizer.

References:


Heckman, J.R. 2003. Soil Nitrate Testing as a Guide to Nitrogen Management for Vegetable

Crops. E285, 6 pp. Web Site: http://www.rcre.rutgers.edu/pubs/publication.asp?pid=E285

Sunn Hemp: A Cover Crop for Southern and Tropical Farming Systems http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053283.pdf

Sunn hemp gains popularity as a stress-tolerant cover crop https://mosesorganic.org/sunn-hemp/



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