

Closing the alfalfa yield gap

Hay & Forage Grower is featuring results of research projects funded through the Alfalfa Checkoff, officially named the U.S. Alfalfa Farmer Research Initiative, administered by National Alfalfa & Forage Alliance (NAFA). The checkoff program facilitates farmer-funded research.

WHILE alfalfa may be a key element of sustainable agricultural systems due to its well-known environmental and ecosystem benefits, the reported average yield of alfalfa for U.S. farms is well below the potential of what growers could produce. To help answer the question of “How do we close that alfalfa yield gap?” Nicole Tautges, agroecologist at the Michael Fields Agricultural Institute, along with the University of Wisconsin’s Valentin Picasso, was awarded funding from NAFA’s Alfalfa Checkoff to identify critical relationships between alfalfa yields, management practices, and soil fertility and health indicators.

“It all stemmed from this realization that alfalfa yields in controlled research trials — at a university research station or at a company research farm — are significantly higher than average yields on farms,” said Tautges. “While that’s not atypical for crops, the yield gap for alfalfa is a lot higher than for other crops. The question is, ‘Why is that going on, and how are people managing their alfalfa?’ That was what spurred this study.”

The project was intended to build upon a Midwest Forage Association-funded management survey that identified farms with high alfalfa yields and the production practices they used by adding a soil fertility and health assessment to on-farm data collection activities; compiling a database that combines alfalfa production, management practices, and soil parameters; and identifying critical relationships between alfalfa yields, management practices, and soil fertility and health.

Specific goals for the project were to identify alfalfa management practices associated with high yields, generate data that makes the case for alfalfa as

a soil health crop, and demonstrate the importance of managing alfalfa for soil health and economic gains.

Start stands right

“The biggest message we gleaned from the survey data was that management in the establishment year really matters and has an effect on stand health throughout the life of the alfalfa stand,” Tautges said. The management practices that maximized alfalfa yields most were the number of cuts, tillage

type, and manure application, as well as the use of potassium (K) and sulfur (S) in the first year, suggesting that nutrient application in the establishment year is positively associated with greater alfalfa yields throughout the life of the stand (see Table 1).

Additionally, strong positive relationships emerged between soil carbon pools (SOM and POX-C) and critical soil components for alfalfa growth, including pH, K, S, calcium (Ca), and cation exchange capacity (CEC). Overall, these



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Frequency (%) of fields in each management practice associated with yield group				
		Low yield (N=21; <3.5 ton/ac)	Medium yield (n=23; 3.5 to 4.4 ton/ac)	High yield (n=22; >4.4 ton/ac)
Cuts	1	25	13	0
	2	25	13	2
	3	25	31	13
	4	25	38	80
	5	0	6	4
Tillage	No	0	6	13
	Vertical	75	56	47
	Conventional	25	38	40
Manure first year	No	100	63	69
	Yes	0	38	31
K first year	No	75	63	64
	Yes	25	38	36
S first year	No	75	69	71
	Yes	25	31	29

PROJECT RESULTS

- The fields with higher yield presented positive association with number of cuts, tillage, and added fertility in the first year.
- There was a strong positive yield association for soil organic matter (SOM) and active carbon (POX-C), several macronutrients important for alfalfa growth (N, Mg, K, Ca, and S), clay content, CEC, and pH.
- Nutrient application, particularly K and S, in the establishment year is positively associated with greater alfalfa yields throughout the life of the stand.
- Soil results suggest a fertile and healthy soil condition characterized by balanced nutrient availability, active microbial communities, and positive interactions among soil components, indicating a favorable soil environment for alfalfa productivity.

findings highlight the significance of maintaining a good nutrient supply to ensure higher alfalfa yields throughout the stand's life and suggest that a fertile and healthy soil characterized by balanced nutrient availability, active microbial communities, and positive interactions among soil components can provide a favorable soil environment for alfalfa productivity.

Tautges added, "I think we feel rel-

atively confident in the management practice findings that we have for fertilizing in the first year, but that cutting intensity signal is pretty high from what we can parse from the data. That is a major outcome. All farmers who are growing alfalfa should plan on that unless it's a drought year. Otherwise, you are not getting the most economic benefit that you can from your alfalfa.

"I think the next step in this research

is to do purposeful experimental manipulations of these different factors, including fertilization and/or manure application in the establishment year, to evaluate the effects it has on soil biology-alfalfa plant relationships, and how these relationships enhance plant health, vigor, yield, and forage quality," she concluded.

A full copy of the final report can be found at alfalfa.org. ●



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