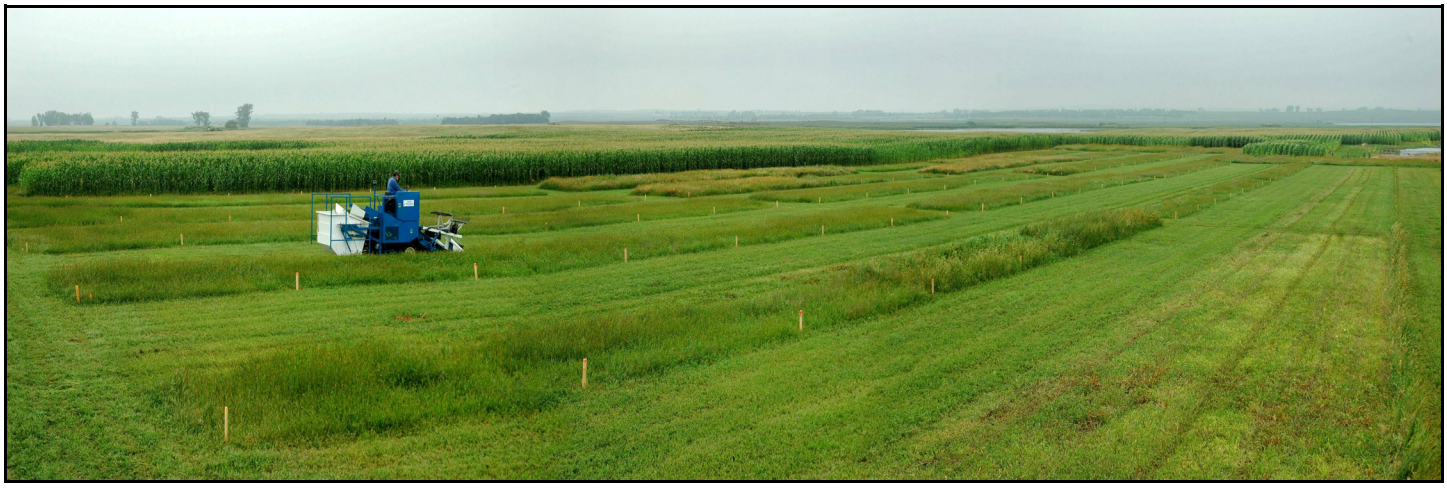
Screening and Evaluation of Legume Species and Their Varieties for Grazing, Forage Production, Cover Crops, and Soil Health

Guojie Wang, Forage Agronomist, *NDSU Central Grasslands REC*



Introduction

Animal production depends on forage production and quality, so how to manage our lands to produce more and higher quality forage in a sustainable way becomes the primary question that needs to be answered before researchers can create guidelines for producers. Land resources are limited for individual producers, and they have different demands and goals for their lands, such as grazing, haying, cropping, and fallowing. However, the information that supports the producer's decision is scarce or limited. What is the best forage species for grazing by cattle? What is the best forage species for haying? What is the best forage species that could be used as cover crops? Also what is the best forage species that could be used to improve soil structure, fertility, and function? Finally, how to manage the forage species in the field, such as seeding rates, weed control, and harvest methods? All these questions cannot be answered with one project. Since the selection of a legume forage species is important to producers, the screening and evaluation of legumes is a good starting point. In general, legumes have high protein content and because of their role in nitrogen fixation, legumes were used historically as hay species worldwide. In North Dakota, more than half of hayland is occupied by alfalfa alone and in combination with other species. Despite its characteristics as a super forage legume species, alfalfa is not the best for every purpose. Recently, I received several phone calls from producers asking information about Canada milkvetch, northern sweetvetch, and hairy vetch. These phone calls demonstrate the need to study other species as well as alfalfa for forages in our region.

Considerable research has been done since the1980s or even earlier for different legume forage species. Alfalfa, red clover, alsike clover, sweetclover, white clover, birdsfoot trefoil, crimson clover, arrowleaf clover, and other legumes were evaluated separately regarding their distribution, cultivars, management, and seed production. This information is very useful, however, all of these studies were scattered in various study sites with different climatic and soil conditions. This makes the comparison between different legumes difficult. Furthermore, the previous work did not mention soil health concerns. Ashley et al. (2007) evaluated forage crop variety performance in three years with six sites all over North Dakota. The time duration and the numerous site selections made this information valuable for producers in North Dakota. However, while these studies evaluated several dozen varieties of alfalfa no other legume species were included. The performance of the alfalfa was monitored for characteristics such as salt-tolerance,

grazing-tolerance, traffic-tolerance, and winter kill survival without information about the soil properties.

Methods

Forty-two legume species/varieties are being evaluated in the current legume study conducted at the Central Grasslands Research Extension Center, Streeter, based on a wide screening of possible legume species in this region through consultation with several researchers from USDA and producers from this region. The 42 legume species/varieties are: alfalfa (5 varieties), cicer milkvetch (2 varieties), birdsfoot trefoil (5 varieties), sainfoin (3 varieties), Canada milkvetch, silver mountain lupine, black medic, white clover, alsike clover, strawberry clover, kura clover, thermopsis Montana, white prairie clover, purple prairie clover, northern sweetvetch, crown vetch, yellow sweetclover, white sweetclover, red clover, hairy vetch, crimson clover, berseem clover, chuckling vetch, field pea, forage pea (2 varieties), cow pea, red cow pea, mung bean, lentil, and sunn hemp. Among these 30 species, 16 species are perennials, four are biennials, and the remaining ten species are annuals. A completely randomized block design was employed to design the field plots layout. Each of the 42 treatments serves as a block and is replicated three times in the field for a total of 126 plots. Each plot is 20 feet x 20 feet with a 20 foot border between them. The study will last three to five years based on the outcomes.

Specific objectives are: (1) Build a database of forage legume species/varieties including morphology, phenology, nutrition, and productivity in our region. (2) Determine the soil health under different legume species/varieties, including but not limited to, soil organic matter, soil nitrogen, soil infiltration, and soil aggregate stability.

Legume Establishment
Seeding of legumes was done in late May, 2010 without fertilizer application. The buffer zones between the plots were seeded with crested wheatgrass. The big concern about the legume establishment is weed control. The plots were placed on a site originally seeded to oats in 2009 and corn in 2008. In the first year of this study, we wanted to test the ability of legume species to compete with common weeds in our region so no herbicide was applied. The field observation showed that only one species, field pea, could suppress the weeds, the rest of the tested species/varieties had severe problems with weeds. Generic select herbicide will be applied to the plots to control undesirable grasses and forbs in the next year, 2011.

Objective (1). To build a database of forage legumes in this region, field plots were monitored every two weeks after the seeding date. Seedling stages and their development were recorded, and photos were taken at different developmental stages. Production was measured visually and by cutting. Based on these data each legume species/varieties' growth curve will be evaluated in the future and the morphological development noted. After the first pod is set, forage samples will be collected, ground in a Wiley mill and then sent to the laboratory to be analyzed for ash, crude protein, neutral detergent fiber, and acid detergent fiber.

Objective (2). Soil samples were collected before the seeding date in 2010 and will be collected every year at the same time at 0-6 inches and 6-12 inches. Soil samples are air-dried, passed through a 2 mm soil sieve and sent to the laboratory for analysis of soil organic matter, total nitrogen, sulfur, and phosphorus. In the first pod development period, soil infiltration will be measured in each plot to test the soil hydrology.

This is the first year of this study and currently we do not have data to present. However, we have some observations that may be very crucial to mention here. First, weed control is critical to legume establishment and we should employ multiple measures to control weeds. Second, this screening and evaluation process is dynamic and we will keep screening the new species/varieties and replace the ones that cannot fit our region's soil and climate until we are able to make some recommendations on the best species for our area.