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Tame Forage Production with Alfalfa and Fertilizer

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SOIL FERTILITY and AVAILABLE SOIL MOISTURE often limit forage production for grazing and hay in North Dakota. Soil fertility can be improved through the application of commercial fertilizer and/or barnyard manure, and by growing alfalfa or grass-alfalfa mixtures in the rotation. Soil moisture must be conserved by increasing the amount entering the soil and through more efficient water use by the forage crop.

The age of a stand of crested wheatgrass was shown to have a marked influence on forage yield at the Northern Great Plains Research Center, Mandan, N.D. (Figure 1). The greatest forage yield was obtained in the third year following establishment, and then gradually declined until the seventh harvest year when yields stabilized at about 600 to 700 pounds per acre.

The use of alfalfa or grass-alfalfa mixtures for hay and grass-alfalfa mixtures for pasture will increase forage production per acre when compared to an unfertilized or improperly fertilized grass stand. The grass-alfalfa mixture stand should contain more than 50 percent alfalfa if used for hay and about 25-30 percent if used for pasture. In general, a good stand of alfalfa is higher yielding than grasses seeded alone. The grass-alfalfa mixture may yield equal to or more than fertilized grass in areas where growing conditions favor regrowth.

Studies comparing forage yields of unfertilized grass and grass-alfalfa mixtures for hay show that the addition of alfalfa to forage stands may increase yields from about 20 to 40 percent or more for crested-alfalfa (Figure 2) and bromegrass-alfalfa stands (Figure 3) at various locations throughout North Dakota.

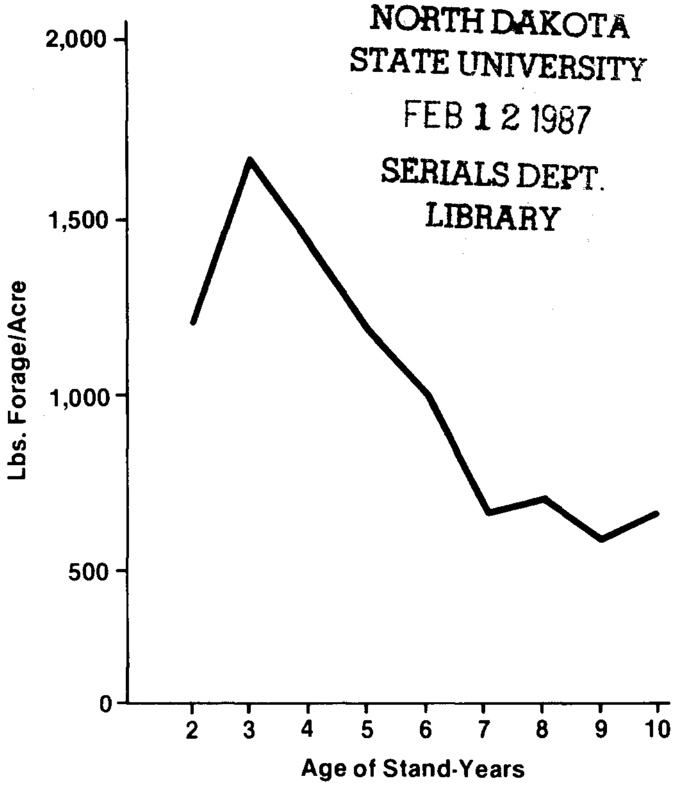

Figure 1. Influence of age of stand on unfertilized crested wheatgrass hay yields. Mandan N.D. (1941-1949)

The decision to fertilize tame grass pasture and hayland will depend on the profit alternatives available. Consider these factors before fertilizing:

- **Is additional forage required**
- **Can additional forage acres be rented**

- **Cost of rented acres vs. fertilization**
- **Productive potential of the soil**
- **Is forage stand adequate for high yields**
- **Profit potential - grass vs. cash crops**
- **Present soil fertility level**
- **Age of grass stand**
- **Alternative forage production systems**

Profitable tame grass and grass-legume forage production with commercial fertilizer requires that yield increases be large enough in relation to the market price of hay or pasture rental rates to pay for the increased costs of production. In addition, the increased forage production must be needed to maintain the livestock enterprise and provide a reasonable amount of harvested forage carryover as insurance against years of low forage production.

Fertilization of seeded pasture and hayland has both advantages and disadvantages. The livestock producer must be prepared to incorporate the advantages into the livestock operation and minimize any disadvantages, otherwise, the value of the fertilizer program will be lost.

ADVANTAGES

- **Increased forage production**
- **Higher quality forage**
- **Increased grazing capacity**
- **Increased water use efficiency**
- **Earlier spring growth**
- **Greater animal production per acre**

DISADVANTAGES

- **Increased yields limited by moisture**
- **Annual applications generally required**
- **Potential for increased weed growth**
- **Possible ground water contamination**
- **Possible livestock disorders (Ex. Grass Tetany)**

The response of tame grass to nitrogen fertilizer depends upon an adequate supply of stored soil moisture and/or timely early spring rains. Forage yield increases due to nitrogen fertilization will vary from year to year due primarily to soil moisture supply and the level of other nutrients, such as phosphorus.

Tame grass fertilization studies have been conducted at research stations throughout North Dakota. The forage yield of unfertilized tame grass stands will generally be highest during the first two to three years following establishment, especially on fields where adequate nitrogen was applied to crops prior to grass establishment.

A study using Lincoln bromegrass at Fargo shows that forage yield was reduced substantially by the fourth harvest year following establishment without the addition of nitrogen fertilizer (Figure 4). Forage yields were 5,400, 4,800 and 5,200 pounds per acre

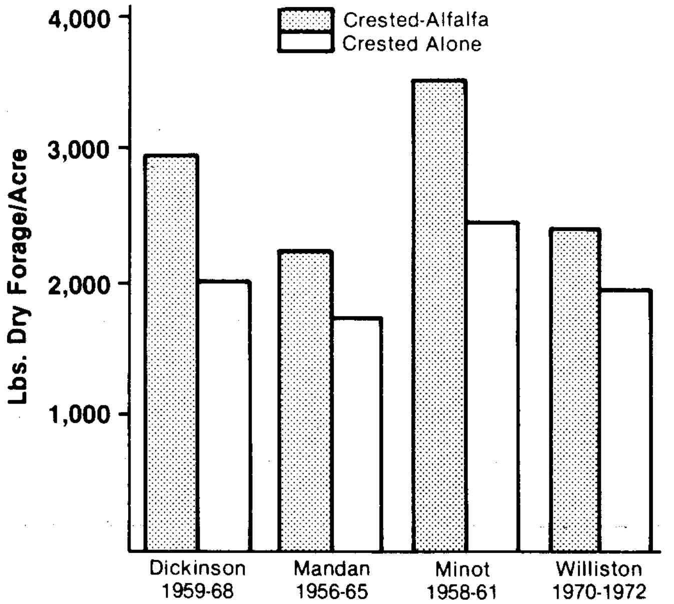

Figure 2. Dry matter forage yield of crested-alfalfa mixtures compared to grass seeded alone and not fertilized.

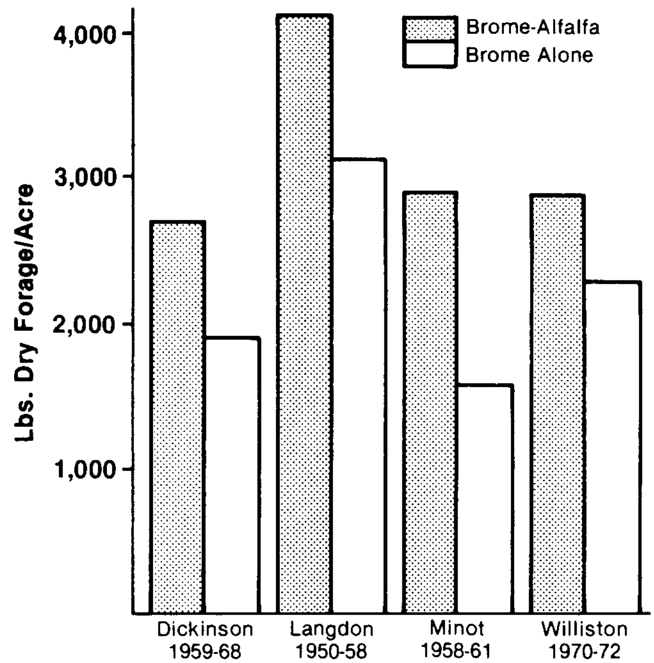

Figure 3. Dry matter forage yields of brome-alfalfa mixtures compared to grass seeded alone and not fertilized.

during the first, second and third harvest years, respectively. Forage yield declined to 2,600 pounds in the fourth harvest year and varied from about 1,200 to 2,250 pounds during the fifth through the ninth harvest year without the addition of fertilizer. During the seventh, eighth and ninth harvest years, 100

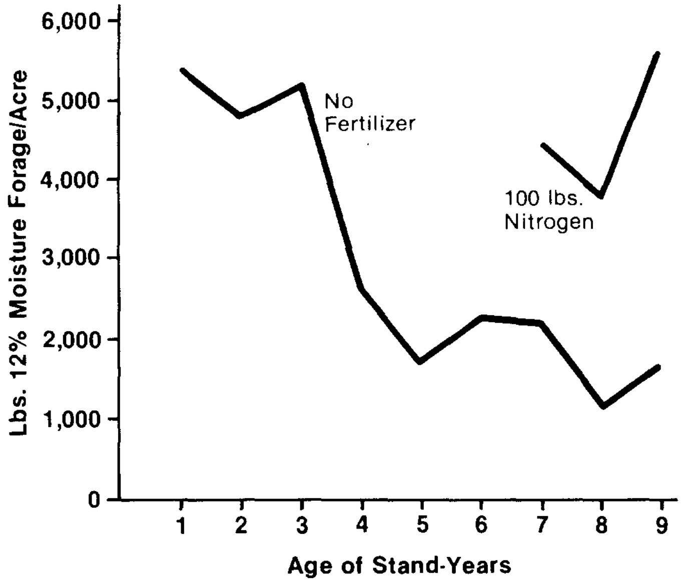

Figure 4. Lincoln bromegrass forage yields following establishment in 1944 and influence of nitrogen fertilizer on forage yield. Fargo, N.D. (1945-53).

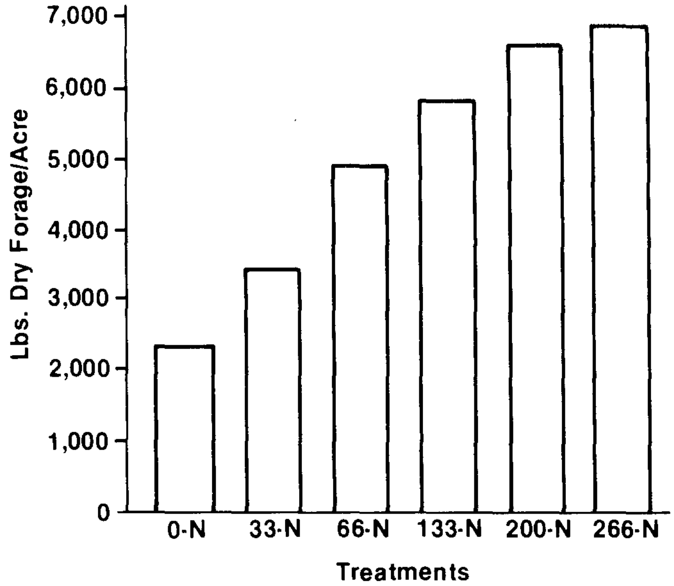

Figure 5. 22-year average forage dry matter yields of an old bromegrass stand with various nitrogen fertilization rates. Fargo, N.D. (1955-76).

pounds of nitrogen per acre was applied. Forage yields with fertilizer were 4,420, 3,800 and 5,600 pounds in harvest years seven, eight, and nine compared to 2,200, 1,180 and 1,540 pounds per acre without nitrogen fertilizer. The "sod bound" condition or lack of adequate nitrogen fertility developed by the fourth harvest year. New stands must be established or nitrogen fertilizer applied if forage yields are to be maintained at high levels.

Twenty-two years of nitrogen fertilization on an old bromegrass stand at Fargo, N.D. has shown rather dramatic forage yield increases for each increment of nitrogen applied through 66 pounds per acre annually (Figure 5). The average pounds of forage dry matter produced per pound of "N" applied was increased through the 66-pound "N" application rate, then decreased as the rate of nitrogen was increased to 266 pounds per acre. The increased forage produced per pound of nitrogen applied was 32, 37, 25, 20 and 16 pounds for the 33, 66, 133, 200 and 266 pound nitrogen treatments, respectively. Based on forage yields in this study and with hay valued at $40.00 per ton and nitrogen at $.25 cents per pound plus an application cost of $2.00 per acre, the break even fertilizer rate was approximately 133 N per acre. The highest return for $1.00 invested was obtained at the 66 pound nitrogen rate.

SEE TABLE 3 FOR THE FORAGE YIELD INCREASE REQUIRED TO BREAK-EVEN WITH VARIOUS HAY AND FERTILIZER PRICES, PLUS A $2.00 CHARGE FOR APPLICATION.

Fertilization studies with crested wheatgrass at Dickinson, N.D. (Figure 6) have shown average hay yield increases of 615 pounds with annual application of 33 pounds of nitrogen, 1,005 pounds with 67 pounds and 1,230 pounds with 100 pounds of nitrogen per acre. If hay were valued at $40 per ton and nitrogen at $.25 cents per pounds, plus a $2.00 charge for application costs, the break-even forage yield increase would be about 513 pounds for the 33-pound N treatment, about 938 pounds for the

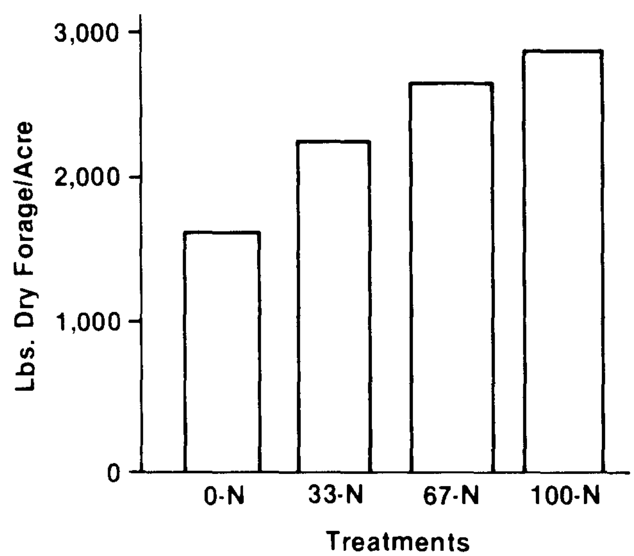

Figure 6. Average dry matter yields of fertilized crested wheatgrass. Dickinson, N.D. (1958-69).