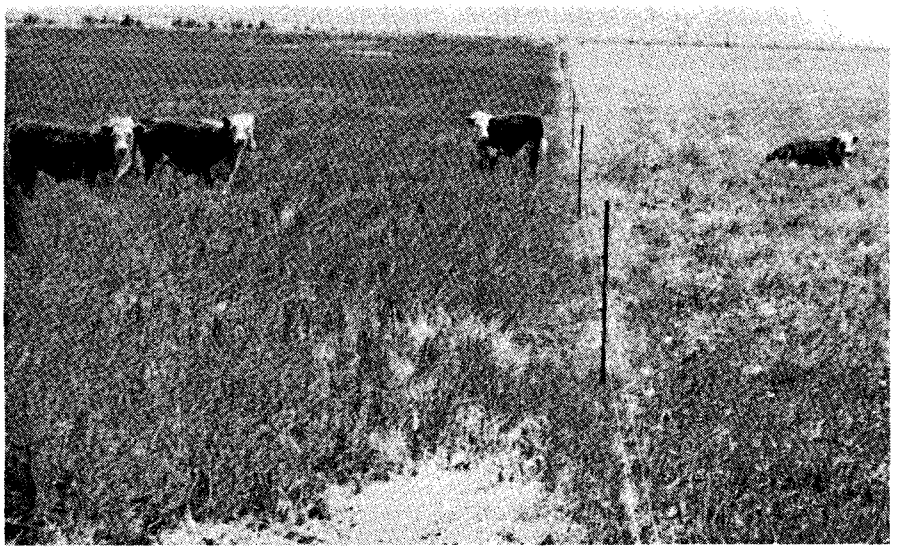
R-544 (Revised)



Renovated native pasture (left); overgrazed weedy pasture (right).

Renovation of Rangeland and Grassland Pastures

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Low production of herbage from forage grasses is a problem for livestock producers in North Dakota, particularily following a drought and with improper grazing management. The contributing factors causing this problem are different for native rangeland and domesticated (tame species that have gone through a plant breeding program) grassland pastures.

Rangeland

Renovation of rangelands is needed because of reduced vigor in desirable grass plants and an increase in less desirable species. This situation results following stress on the grass plants from drought conditions or improper management of grazing. The most common grazing management problems are seasonlong grazing of one pasture from mid May to mid November, early grazing in April or May, annual repeated seasonal grazing in pastures (such as consistantly using the same pastures for spring grazing, summer grazing, and fall grazing), and continually stocking a pasture higher than its carrying capacity.

When desirable grass plants are stressed, their vigor is reduced and stem densities decrease. This increases open spaces and the less desirable grasses and weedy species that are normally present at low levels increase and take over the openings. The less desirable grasses and weeds do not cause the desirable grasses to decrease, they simply take advantage of the available space and nutrients left when stress situations occur. Once established undesirable species compete for nutrients, moisture, and space. Renovation efforts with fertilization and herbicide application directed solely at the less desirable plants without a change in grazing management will not solve the basic problem that created the initial need for renovation. A change in grazing management is needed.

RANGELAND IMPROVEMENT PRACTICES WILL NOT BE EFFECTIVE IF PROPER GRAZING MANAGEMENT IS NOT PRACTICED.

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The grazing management program should be designed to benefit the desirable grass species. These native grass plants are dependent on a mutually beneficial relationship with a group of soil organisms. These organisms convert nitrogen and other needed nutrients from unavailable forms to available forms that can be used by the grass plants. In return, the soil organisms receive usable carbon from the grass plant. This relationship gives the desirable grass species a competitive advantage in rangeland soils over less desirable plant species. The activity of this symbiotic relationship between desirable grasses and soil organisms can be manipulated by proper timing of grazing pressure. Preliminary data from studies at Dickinson indicate that grazing for short periods of eight to 15 days between early June and mid July in each pasture can increase soil organism activity and herbage production.

Grazing pressure should be rotated between a set of pastures. Grass plants need a period of time during the growing season to be free of defoliation from livestock. A simple three or four pasture rotation system can accomplish this required period of rejuvenation. Several three or four pasture rotation systems may be needed on large acreage ranches with several breeding herds.

Grazing during early greenup from April to May causes a measurable loss of total potential herbage production. A 45 percent to 76 percent reduction in total herbage production can occur from grazing in May (Table 1). This lost herbage is never available to livestock decreasing carrying capacity potential of the pasture. This accounts for a direct economic loss to the livestock producer. Management to maximize herbage and livestock production on native rangeland should be to delay grazing until about June 1 on pastures in the western two-thirds and northern regions of North Dakota and after May 20 in the southcentral to southeastern regions of North Dakota on rotational grazing systems. Early to mid June is the earliest grazing should occur on seasonlong grazing treatments. Grazing on domesticated grassland pastures should be used for grazing livestock prior to these dates.

Table 1. Percent of potential herbage compared by start of grazing date on seasonlong treatments.

Starting date of grazing	May 1	May 15	June 1	June 15	July 1	July 15	Aug 1
Mandan, N.D.							
% of max. total	24	43	57	67	92	100	87
% lost	76	57	43	33	8	0	-13
Canada							
% of max. total			55	88	93	100	82
% lost			45	12	7	0	-18

Source: Rogler, G.A., R.J. Lorenz, and H.M. Schaaf. 1962. **N.D. Agri. Exp. Sta., Bull.** 439. 15p.
Campbell, J.B. 1952. **J. Range Manage.** 5:252-258.

The total grazing management plan must be analyzed before pasture improvement can occur. Stocking rate or number of livestock grazing must be in balance with the amount of available forage produced on the rangeland to support livestock production and still maintain proper herbage production. Herbage production varies greatly with range sites. Determine the range site composition of your rangelands and manage accordingly.

Xeric (dry) sites such as shallow-to-gravel and thin upland range sites will need to receive more moisture than mesic (wet) sites before adequate forage production is available for grazing. If your pastures contain a high percentage of xeric sites, delaying the grazing season until the first weeks in June is essential. Mesic sites, comprised of wet meadow, subirrigated and overflow range sites, will obtain adequate forage production by late May or early June, allowing for earlier grazing.

Grazing in May, grazing for long periods of time during the early summer, grazing one pasture seasonlong, and continually using high stocking rates have been shown to be detrimental to the desirable grass species and soil organisms. These types of management practices cause problems on rangelands and should be avoided.

Improving forage production on native rangelands which have suffered improper grazing management for many years usually will require a minimum of two years on a rotational grazing system with a conservative stocking rate as recommended by the U.S. Soil Conservation Service (1975). Time required will depend on available moisture, whether commercial fertilizer is applied on productive soils and whether weedy plants are abundant. Native grassland renovation programs should first begin with proper grazing management. The use of fertilizers and herbicides for weed control is the second step in range renovation.

Nitrogen fertilizer is often used to speed up the range renovation process. Grasses respond to moderate amounts of fertilizer, especially nitrogen. Nitrogen fertilizer has been shown to improve the condition of overgrazed pastures, increase crude protein and total digestible nutrients, and improve palatability and utilization of low use areas.

Native grass production increased when nitrogen fertilizer was applied to seasonlong grazed rangeland in Dickinson Experiment Station studies (Table 2). Both ammonium nitrate and urea increased cool-season grasses more than warm-season grasses and forbs. All treatments were applied annually, except the 100 lb N/a for each nitrogen source was applied every other year. Application of ammonium nitrate at 60 lb/a increased cool-season grass production more than 60 lb/a of urea, and applying 100 lb/ac of urea almost doubled cool-season grass production.

Table 2. Mean aboveground production from native range fertilized with two nitrogen sources at the Dickinson Experiment Station in 1982-1985.

Treatment	Cool-season graminoids	Warm-season graminoids	Forbs	Total Production
..... lb N/a[1]	..... pounds dry matter per acre			
Control	603	271	218	1092
Ammonium nitrate[2]				
40	971	263	316	1550
60	1041	367	269	1677
100	1099	348	255	1702
Urea[2]				
40	947	248	294	1489
60	964	271	212	1447
100	1203	334	270	1807

[1]Pounds of active ingredient, not bulk. Urea contains 46 percent active ingredient, ammonium nitrate 33 percent.

[2]Fertilizer applied annually.

Source: Hill, A. 1987. M.S. Thesis. **North Dakota State Univ., Fargo.** 98p.

Warm-season grasses did not respond significantly to nitrogen fertilization. Perennial forbs, such as fringed sage, green sage and locoweed, increased in production when nitrogen fertilizer was applied. Annual and biennial forbs decreased in production with ammonium nitrate and urea fertilization compared with control.

Fertilization of high and moderate levels of phosphorous on native rangeland decreases and can eliminate the mycorrhizal fungi that are a major component of the symbiotic relationship with desirable grasses. Fertilization of nitrogen on an annual basis in excess of 50 pounds per acre has negative effects on the soil microorganisms, causing a reduction in symbiotic rhizosphere activity and giving a selective advantage to the plants that are not dependent on soil organism activity. Single applications of nitrogen greater than 400 pounds per acre also are detrimental to the soil microorganisms.

Fertilization with phosphorous and annual applications of nitrogen on native rangeland should be avoided. Nitrogen can be added to rangeland once at rates between 50 and 400 pounds per acre without causing long term detrimental effects to the soil organisms. The commonly used herbicides such as 2,4-D, picloram, dicamba, and glyphosates have not been shown to cause major detrimental effects on the soil organisms.

Fertilizing consecutive years promotes a cool-season grass response, causing a direct change in species composition and unbalanced combination of warm- and cool-season grasses. Spring and fall applications that increase herbage production can be attributed to an increase in high producing cool-season grasses. When nitrogen fertilizer is placed within the range ecosystem, those plant species which begin growing first are able to utilize these added nutrients. These plants have an increase in growth, using up a larger portion of the stored water in the soil and occupying a larger portion of space early. Top growth of the cool-season grasses is more rapid and if not grazed, shades the slower growing warm-season grasses, giving them a competetive advantage when nitrogen fertilizer is added. Losses in summer and fall grazing will occur when pastures are dominated by cool-season grasses. One year of fertilizing is recommended for native rangeland renovation, but applying on the third year may be needed for full renovation.

Grasslands

Domesticated grassland pastures need renovation because of reduced vigor of the major grass species which has been caused by a depletion of soil nutrients. Domesticated grass species are not dependent on soil organism activity and generally absorb nutrients directly from the soil. At about the third or fourth production year, yield potential remains at relatively low levels. This condition, referred to as "sod-bound," is caused by low levels of available nitrogen, which eventually reduces leaf growth production. Addition of the needed nutrients by proper fertilization will improve most domesticated grassland pastures in low production levels.

It is highly recommended that complementary grazing systems be incorporated into ranch management plans. Use of domestic grasses to complement native rangeland is a favorable plan to eliminate early grazing of native grasses and allows for new alternatives for fall grazing. For more information on grazing systems, read circular R-559, Grazing Systems.

Domesticated grass renovation studies have indicated an increase in forage production with applications of nitrogen fertilizer. Studies by the NDSU Extension Service indicated an annual application of nitrogen fertilizer produced greater forage yields than with no fertilizer (Table 3). It is recommended that nitrogen fertilizer be applied annually to perennial domesticated grass pastures such as crested wheatgrass, smooth bromegrass and altai wildrye to help maintain productivity and to increase palatability and livestock distribution.

Table 3. Average dry matter yield of domestic grasses fertilized at different rates at Golden Valley, Morton, Kidder, Rolette, and Richland counties in North Dakota from 1972 to 1978.

	Western	Central			Eastern
Treatment	Golden Valley	Morton	Kidder	Rolette	Richland
--- lb/a[1] ---	pounds dry matter per acre				
Control	1562	2387	1480	2040	1320
40 P_2O_5	1664	2409	1438	2484	1962
30 N	2525	3145	1804	3000	2994
60 N	2170	3637	2449	4488	3600

[1]Pounds of active ingredient, not bulk.

Source: Dodds, D.L. 1978. **Crop Production Guide.** Annual Agricultural Short Course and Trade Show, Nov 19-21. pp. 285-287.

The cost of annual fertilization on crested wheatgrass has more than paid for itself in increased beef production on all trials at the Dickinson Experiment Station. Even during periods of drought, applying nitrogen fertilizer annually has been economically feasable.

ANNUAL APPLICATION OF NITROGEN FERTILIZER IS A BENEFICIAL PRACTICE FOR DOMESTICATED GRASSLAND PASTURES.

Nitrogen fertilizer and herbicides for weed control can be applied as companion practices on native range and domesticated grasses containing perennial weeds. Perennial weeds respond to the application of nitrogen fertilizer similar to grass. Use of herbicides to control weeds, if necessary, and the application of nitrogen fertilizer are complementary practices. Research by the NDSU Extension Service field demonstrations have shown forage production and pasture stocking rates may increase with timely weed control and a good soil fertility program for domesticated grass pastures on productive soils.

Fertilizer Rate

The decision to fertilize with a renovation program must be based on the yield potential of the soils in your area and degree of range deterioration. Generally, soils with low water-holding capacities such as coarse-textured sands and sandy soils respond poorly to fertilizer application when compared with applications on heavier-textured soils unless they have a high water table or rainfall is above normal.

The kind and amount of fertilizer applied in a pasture or domesticated grass stand depends on yield potential of the soil (the soil's potential to store moisture and its nutrient status). Nitrogen is the primary nutrient limiting in rangeland forage production, but phosphorus also may be limited in some soils. Recommended nitrogen rates differ by regions of the state due to rainfall distribution patterns. Apply the nitrogen fertilizer rates recommended (Figure 1) or apply rates that best suit your farm or ranch soils based on your experience.

Phosphorus may limit forage production on low testing soils. If phopshorus levels are 5 lb/a or less or after several years of high nitrogen application rates, an application of phosphorus fertilizer may be needed. An application of 20 lb/a P_2O_5 on very low phosphorus testing soils in combination with nitrogen fertilizer will improve the yield response to nitrogen fertilizer application.

The best time to apply fertilizer is in late fall or early spring on nearly level to gentle sloping land. On rolling rangelands or those with relatively steep

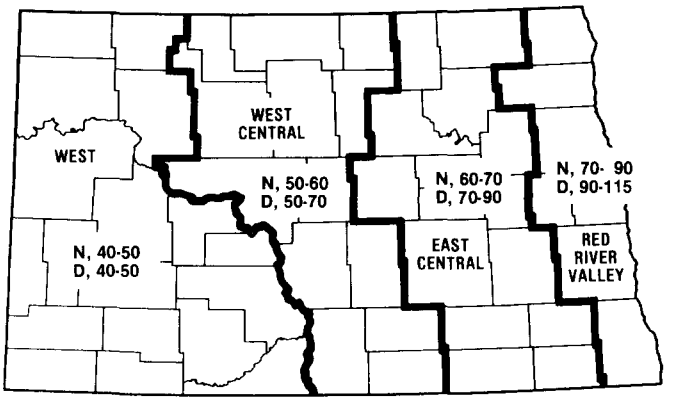

Figure 1. Fertilizer guide map and nitrogen fertilizer recommendations in lb/a for native (N) grass and established domestic (D) grass on productive soils. (Source: Dodds, D.L. and D.L. Van Der Puy. 1985. **North Dakota State University Extension Service** Circular R-544.)

slopes and on coarse-textured soils, an early spring application is recommended to minimize losses through runoff and leaching. Late spring application of fertilizer is recommended for increasing forage production of warm-season grasses. Moisture is critical for full benefits of late spring applications. Even with good moisture, increases in warm-season grasses is low.

Herbicide Application

Timing of herbicide application to coincide with susceptible stages of weed growth is critical to achieve maximum weed control for least cost.

Annual weeds should be treated when they are young and actively growing. Weeds become more tolerant to herbicides as they approach maturity. Weeds also translocate less herbicide when under stress, such as drought, than when actively growing. Mowing of annual and biennial weeds may be desired over herbicide application. Mowing should occur before flowering to prevent seed production. Two mowings per year may be needed for some weeds.

Perennial weeds should be treated when actively growing, with some weeds also susceptible between mid August and mid September before a freeze. Treatments applied too late will result in limited herbicide translocation to crown and root tissue, which reduces effectiveness. A listing of the more common pasture weeds and methods of control is provided in Table 4.

Table 4. Common pasture weeds and methods of control[1].

Plant Name	Control
Absinth Wormwood	Perennial. A noxious weed that spreads mainly by seed but may spread by rootstock. Applying dicamba at 0.5 to 1.0 lb/A will give 80% to 100% control, 2,4-D at 1.0 to 2.0 lb/A will give 70% to 95% control, and picloram at 0.125 to 0.25 lb/A will give 90% to 100% control. Apply glyphosate at 0.25 to 1.0 lb/A in tree rows for good control. Apply these herbicides when plant is at least 12 inches tall and actively growing.
Buckbrush (Western snowberry)	Perennial shrub. Reproduces by seed and tillering. Apply 2 lb/A of 2,4-D in early June. Use a wetting agent in spray for best results. Some retreatment may be required the following year.
Burdock, Common	Biennial. Reproduces by seed. Several cuttings during the growing season will prevent it from seeding and eventually erradicate the plant. Control also possible by applying 1 lb/A of 2,4-D LVE in spring before the bud growth stage.
Crazyweed (loco)	Perennial. Reproduces by seed. Apply 2 lb/A 2,4-D in early bud stage. Dry growing conditions adversely affects control.
Downy brome (cheatgrass)	Annual. An early maturing annual or winter annualthat reproduces by seed. Mow early to prevent plant from going to seed. On rangelands apply 0.8 to 1.0 lb/A of atrazine (AAtrex) in the fall, late- September, in a minimum of 10 gal/A of water. Graze 7 months after treatment.
Goldenrod spp.	Perennial. Spreads by rhizomes and seed. Apply 2 lb/A 2,4-D with wetting agent in early-June, preferably after an earlier fertilizer application. Retreatment the following year may be necessary. Gumweed Biennial. Reproduces by seed; the plant dies after seed maturity. Two mowings, one in mid-July and one in late August will prevent seed formation. An application of 1 lb/A 2,4-D LVE in early-June will control gumweed.
Horseweed (Marestail)	Annual. Reproduces by seed. Mowing in the early bloom growth stage or earlier will prevent seed formation. It is somewhat tolerant to 2,4-D.
Leafy spurge	Perennial. A noxious weed spreading by roots and seeds. Application of 2,4-D LVE, oil soluble amine, or water soluble amine formulations at 1 to 2 lb/A (1 qt of a 4-lb/gal concentration) gives short term control of leafy spurge top growth but has little effect on reducing leafy spurge stand. Dicamba at 6 to 8 lb/A will give good leafy spurge control for one year. Picloram at 2 lb/A will give 90% or more control the first year. Retreatment will be necessary to continue control methods. For best results apply in mid- to late-June and a second, but less effective alternative, in early September. Research at NDSU has shown that a less expensive option for leafy spurge control is a tank mix of picloram at 0.25 to 0.5 lb/A + 2,4-D at 1 lb/A (1 qt of a 4-lb/gallon concentration) applied in June and repeated annually has given 85% to 95% control after four annual applications. For control in trees applying glyphosate at 0.75 lb/A will give 80% to 90% control of leafy spurge if applied from mid-July to mid-September.

Plant Name	Control
Fringed sagebrush	Perennial. Spreads by seed and roots. Apply 1 to 2 lb/A 2,4-D LVE with wetting agent in early-June. Moisture at time of treatment is critical. Poor control will prevail with dry conditions.
Big sagebrush	Perennial shrub. Apply 2 lb/A 2,4-D LVE, preferably butyl ester. Use oil (no lower than No. 2 diesel) for aerial application and water for ground sprayers. Six to 8 oz. wetting agent/100 gal of water should be used with ground spraying.
Green sagebrush	Perennial. Spreads by seed. Apply 2 lb/A 2,4-D LVE, preferably with wetting agent in early June. Fertilizing earlier enhances control.
White (pasture) **sage**	Perennial. Spreads by roots and seed. See remarks for fringed sagebrush. It is easier to control than fringed sagebrush with one application of 2,4-D LVE.
Silverberry	Perennial shrub. Spreads by roots and seed. Apply 1 lb/A of 2,4-D LVE with wetting agent in early June. Some retreatment may be necessary the following year.
Snakeweed, broom (Gutierrezia)	Perennial. Spreads by seed. Apply 2 lb/A 2,4-D LVE at the pre-bud growth stage for good control. Timing of application is critical.
Spotted knapweed	Short-lived perennial. Spreads by seed. Picloram at 0.25 to 0.5 lb/A will control spotted knapweed for 2 to 3 years. Apply herbicide when plant is in the rosette growth stage in the fall or in bud to bloom stage in the spring. Dicamba at 1 to 2 lb/A gives good control, but a follow-up treatment with 2,4-D at 1 lb/A will be necessary to control seedlings emerging the following year. 2,4-D at 1 or 2 lb/A will control top growth of spotted knapweed if applied in rosette growth stage in fall or early spring. 2,4-D will not provide residual control of seedlings emerging following treatment.
Thistle, Flodman (Prairie thistle)	Perennial. Spreads by roots and seed. Apply 1 lb/A 2,4-D LVE at the bud growth stage and again, if needed, in late-August to early-September. Dicamba at 0.5 lb/A or picloram at 0.25 to 0.5 lb/A will give good to excellent control. Early fall applications are the most successful. Retreatment using same rates may be necessary the following year.
Thistle, Musk	Biennial. A noxious weed, spreading by seed. Mow before seed set. Apply 1.5 lb/A 2,4-D LVE when plants are in the rosette growth stage. Dicamba at 0.5 to 1.0 lb/A also will give excellent control. Most effective control is obtained if herbicide is applied before flower stalk elongation.

[1]The rates per acre of 2,4-D (4 lb/gal concentration) and other herbicides are given in pounds of active ingredients. Read label to determine how much active ingredient a particular herbicide contains. Type of 2,4-D used can be a low volatile ester (LVE), oil soluble amine, or water soluble amine unless otherwise stated specifically. The use of 2,4-D is recommended for control of pasture weeds, unless otherwise specified. There are certain grazing restrictions with the use of herbicides on pastures. Read the label carefully for these restrictions and other pertinent information.

2,4-D at 1 lb/A is equivalent to 1 qt/A 2,4-D, dicamba (Banvel) at 1 lb/A is equivalent to 1 qt/A dicamba, picloram (Tordon) at 0.5 lb/A is equivalent to 1 qt/A picloram, and glyphosate (Roundup) at 0.75 lb/A is equivalent to 1 qt/A glyphosate.

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