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Fertilizing irrigated meadows in Colorado

E. G. Siemer and R. H. Follett[1]

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Quick Facts

- The primary objective of forage fertilization programs is to increase forage production and quality.
- Most irrigated mountain meadows are nitrogen deficient and will respond to nitrogen fertilization.
- Nitrogen must be applied annually for dependable grass yields.
- It is not economical to fertilize droughty, poorly irrigated and weedy meadows. Similarly, fertilizer responses may be low in excessively wet, boggy areas.

The average hay yield of meadows in Colorado is about 1.3 tons per acre. Fertilization is probably the best way to increase forage production on irrigated meadows. To be profitable, however, a fertilization program must be based on knowledge. Fertilization, like any good tool, should be used when and where it will be beneficial. The purpose of this publication is to present a list of widely accepted generalities about meadow fertilization and to give some hints about how to make meadow fertilization profitable.

Fertilizer Recommendations

Fertilizer recommendations, based on soil tests, attempt to bring nutrients into balance to achieve some specified yield goal. The key to a highly profitable fertilizer program begins with selecting and applying at the proper rate those nutrients required to achieve a specific yield goal. Ranchers can be guided in these decisions by soil and tissue testing, field history and experience.

Colorado is fortunate in having fertile mountain meadow soils. Nitrogen and phosphorus are the nutrients most frequently limiting production in the mountain areas. Yield increases resulting from the application of potassium, sulfur and micronutrients have not been verified on mountain meadows in Colorado.

Generalities About the Fertilization of Irrigated Meadows

Nitrogen (N)

1. Virtually all irrigated mountain meadow soils are nitrogen deficient and will produce more hay with nitrogen fertilization. The response to nitrogen fertilizer can vary greatly from 7 to 45 pounds of hay per pound of nitrogen. The average response is about 20 pounds of hay per pound of nitrogen (Table 1).

2. "A pound of N is a pound of N," regardless of the nitrogen carrier. The fertilizer industry provides a wide array of highly water-soluble products. Both dry and liquid products are available and can be used successfully on forage crops. Perhaps of most concern relative to sources of nutrients is urea versus other nitrogen products. There are numerous reports in the literature of significant amounts of topdress N from urea being lost through volatilization into the air. This does not appear to be a serious problem in the intermountain meadow forage production primarily because temperatures are cool in the spring and early summer when nitrogen is applied. Table 2 summarizes research conducted in Gunnison and Jackson Counties, Colorado, comparing several N sources. The differences among the N sources were not significant.

3. Nitrogen fertilization can increase grass flowering, and, thus, forage yield.

4. Nitrogen must be applied annually for dependable, high grass yields.

5. Nitrogen fertilization does not pollute surface runoff and ground water with reasonable management.

[1]*E. G. Siemer, CSU professor and superintendent, Mountain Meadow Research Center, Gunnison, and R. H. Follett, CSU professor, agronomy (revised 10/85)*

Table 1: Hay yields and fertilizer N efficiency summarized across 10 diverse Colorado Meadow hay fields.

Nitrogen* lbs/A	Yield T/A		Fertilizer efficiency lbs hay/lb N	
	Average	Range	Average	Range
0	1.4	0.9-2.0	—	—
80-fall	2.2	1.2-3.4	20	7-45
80-spring	2.2	1.3-3.1	18	10.22

**Ammonium nitrate topdressed either in late fall or early spring. Source: Rumburg and Siemer, unpublished.*

Table 2: Nitrogen sources produce similar meadow hay yields.

Fertilizer	Gunnison[1]	Jackson County[2]	
		Field 1	Field 2
	Tons/A (12% moisture)*		
Control	3.0	2.1	2.2
Ammonium nitrate	4.2	3.1	3.4
Urea	4.1	2.9	3.0
Urea ammonium sulfate	—	3.4	3.2
Urea ammonium polyphosphate	4.1	3.1	3.1

**Differences in yield not significant at 5% level of probability.*
[1]Averaged across 60, 120, 180 and 200 lbs/A of N.
[2]Averaged across 80, 160 and 240 lbs/A of N.
Source: Ludwick, Rumburg and Siemer, 1978.

Phosphorus (P)

1. Relatively few mountain meadows are phosphorus deficient. Phosphorus deficiencies can be determined by soil testing.

2. Broadcast phosphorus stays very near the soil surface (within two inches) and is not susceptible to leaching losses.

3. Phosphorus sources are similar in their fertilizing effects.

4. Phosphorus fertilization can improve the growth of clover and other legumes.

5. There usually is a season's delay in a meadow's response to applied phosphorus fertilizer. Fall topdressing of phosphorus fertilizer is preferable to waiting until spring. This allows additional time for the fertilizer granules (assuming dry products) to dissolve and move through the thatch and into the surface inch or so of soil. Table 3 illustrates the advantage of fall P application in Gunnison County, CO. Similar results have been reported in other western states.

Table 3: Topdressing of phosphorus on mixed grass forage in fall is superior to spring.

P_2O_5* lbs/A	Fall	Spring
	tons/A (12% moisture)	
0	1.8	1.8
40	4.4	2.4
80	4.1	2.9
120	5.0	2.9

**All treatments received 160 lb/A of N, soil test: P – low*
Source: Ludwick and Rumburg, 1976.

Potassium (K)

1. Meadow soils usually are high in potassium.

2. Meadows rarely produce more hay with added potassium.

3. Potential potassium deficiencies and requirements can be determined by soil tests.

Hints For Achieving Profit From Fertilizer

- A soil test should be the basis for a fertilizer program for mountain meadows.
- Do not fertilize droughty, poorly irrigated, weedy meadows; fertilizer responses will be low. Similarly, fertilizer responses may be low in excessively wet, boggy areas.
- Grassy meadows will give hay yield increases with nitrogen fertilization—especially ones with smooth bromegrass, timothy, slender wheatgrass, intermediate wheatgrass, meadow foxtail, meadow bromegrass, etc.
- Under a single late cutting harvest system, the most economical responses to added fertilizer nitrogen will be when nitrogen is applied at the 70 to 100 pound-per-acre rate. Higher rates of nitrogen usually are required to increase protein content in hay (150 to 250 pounds of nitrogen).
- If you use a two-cutting system, split your nitrogen application and apply about 2/3 of the nitrogen in early May for the first cutting's growth and 1/3 after the first cutting.
- Fertilizer nitrogen is taken up quite rapidly by growing plants. In order to get maximum yields, do not graze mountain meadows in the late spring.
- Phosphorus fertilization can increase protein in hay by stimulating growth of legumes such as clover, so fertilization can increase both quality and yield of hay. Likewise, phosphorus fertilizer will tend to encourage clover growth.
- Research has shown that there is little difference in yield response of mountain meadows for various fertilizer sources. Cost should be the primary factor in the selection of either nitrogen and/or phosphorus sources.

For More Information

Hart, R. H. et al. 1980. *Mountain Meadow Management: 12 Years of Variety, Fertilization, Irrigation and Renovation Research.* USDA-ARS, No. ARR-W-16. (Available from High Plains Grasslands Research Station, 8408 Hildreth Road, Cheyenne, WY 82001.)

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