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Fertilization of Improved Pastures

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Fertilizer costs represent over one half of the yearly pre-harvest cost of pasture or hay. Many producers decrease or eliminate fertilization of improved pastures in tight economic times, but elimination of fertilizer can be a very expensive decision. It will not necessarily reduce the cost per ton of forage or reduce the cost of producing beef, but it does reduce pasture fertility.

Cutting back on fertilization WILL NOT lower fixed land costs such as taxes or rent, cost per cow or cost per ton of forage. Nor will it increase profits per animal or per acre.

Cutting back on fertilization WILL decrease yields, longevity of grass stands, forage quality and drought tolerance. Cutting back will increase the number of acres needed per cow, the cost per ton of forage and the possibility of weed invasions.

Improved Grasses Need Proper Fertility

A ton of forage has approximately 50 pounds of nitrogen, 40 pounds of potassium and 10 pounds of phosphorus. Without these nutrients a ton of forage simply *will not* be produced. Most soils in Texas only have enough nitrogen to produce 1 to 2 tons of forage. Of the improved grasses now being used, most were selected for improvements in yield due mainly to their response to fertilization. Without adequate fertilization these grasses lose their advantage over native grasses. Although grasses need 16 essential plant nutrients, the main response comes from the application of nitrogen.

Proper forage fertilization with nitrogen, phosphorus and potassium will double or triple yields (Table 1). Increased nitrogen will increase the forage's protein percentage. Proper nitrogen fertilization will promote a high quality, leafy growth from grasses. Providing adequate rainfall occurs, nitrogen fertilizer will promote grass growth when it is needed for livestock. Proper fertilization can reduce the cost of producing a ton of forage (Table 2). Tables 3 and 4 translate these costs into cost per ton of hay and pasture cost per cow using different fertilizer rates.

Table 1. Average production due to nitrogen fertilization. (From research in Texas, Alabama, Georgia, Mississippi and Louisiana.)

	Tons of Dry Forage Per Acre					
Nitrogen/acre*	Bahia	Common Bermuda	Coastal Bermuda	Dallis	Klein 75	Johnson grass
(Pounds)						
0	1.75	1.00	1.33	1.56	1.50	2.12
50	1.84	1.20	1.46	2.03	2.00	4.09
100	2.87	2.20	3.61	2.57	-	4.47
150	3.33	-	-	-	3.00	-
200	3.95	-	4.78	3.65	-	-
300	4.65	-	4.73	-	3.20	-
400	-	-	5.80	-	-	-
600	-	-	6.50	-	-	-

*Phosphorus and potassium levels were adequate.

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Table 2. Estimated cost per ton of forage under different fertilizer treatments.*

	Fertilizer Rates		
	No Fertilizer	100 lbs. N	200 lbs. N
Nitrogen cost/acre	0	$23.00	$ 46.00
Phosphorus cost/acre	0	10.00	10.00
Fertilizer application	0	6.00	8.00
Other variable cost/acre	9.30	9.31	9.31
Fixed cost/acre	$27.12	27.12	27.12
Total preharvest cost/acre	$36.42	$75.43	$100.43
Yield ton/acre**	1.3	3.6	4.8
Preharvest cost/ton forage	$28.01	$20.95	$ 20.92
Expected % protein**	6	8	11

*Cost taken from Budget 705, Texas Agricultural Extension Service
**Yield from Research Monograph 6. Texas A&M University.

Table 3. Cost per ton of round baled hay.*

Hay Acres	Fertilizer Rates/acre		
	0	100 lbs. N	200 lbs. N
50	$131.00	$58.45	$49.04
100	84.00	41.23	36.13
150	68.00	35.59	31.75

Based on cost per acre in Table 2 and cost per acre of owning and operating hay harvesting equipment of $135, 73, and 52 for 50, 100 and 150 acres, respectively. (Source Art Gerlow: Economics of hay harvesting).

Table 4. Pasture cost per cow.

	Fertilizer rates per acre		
	0	100 lbs. N	200 lbs N
Acres need/cow	4.5	2	1.5
Pasture need/cow	$163.00	$150.82	$150.62
Pounds of supplement needed based on % crude protein	210	105	0
Cost supplement	$ 23.00	$ 11.55	0
Total Pasture cost/cow	$186.10	$162.37	$150.62

How Much Fertilizer to Use

The amount of fertilizer to use per acre depends on the amount of nitrogen, phosphorus and potassium in the soil; the desired production level (tons/acre, stocking rate), and whether the pasture will be used for hay, grazing or both.

A regular soil testing program is the only way to tell exactly what level of fertilizer to use. Soil tests should be taken every second or third year, and fertilization should be based on the results. As a rule of thumb, put out all the required lime, phosphorus and potassium at one time during the year. Then fertilize with at least 50 pounds of actual nitrogen per acre (100 pounds urea, 175 pounds ammonium nitrate, 250 pounds ammonium sulfate per acre) after each hay cutting or 2 to 3 times during the grazing cycle.

In grazing systems only a small amount of the nitrogen, phosphorus and potassium contained in the forage that a cow eats is retained in the animal's body (Table 5). Most is recycled by urine and/or feces back to the soil. Thus in grazing systems, once phosphorus and potassium levels are brought up to a high level, they should remain there without extra fertilization. Nitrogen will still be required.

In hay systems, every ton removed from the field will remove 50 pounds nitrogen, 10 pounds phosphorus and 40 pounds potassium. This will eventually have to be replaced by fertilization. Therefore, the best system is rotational grazing and harvesting hay from the excess growth in the spring and fall.

The fertilizer response curve for hay (Figure 1) illustrates that as the level of nitrogen fertilizer is increased (from 0 to 100 to 300 pounds per acre) there is an associated increase in production. A very big increase in production occurs when nitrogen is increased from 0 to 100 pounds per acre, followed by a smaller increase in production as nitrogen is further increased to 200 pounds per acre. An economic analysis of this response indicates than the most economical fertilization level (maximum hay profits) is about 250 to 300 pounds of nitrogen per acre in a normal year.

Table 5. Fertilizer removed by different forage management alternatives.

	Grazing Selling 500 pounds beef/acre	Hay Removing 6 tons hay/acre
	Pounds of nutrient removed per acre	
Nitrogen	18	300
Phosphorus	9	60
Potassium	I	240

Choosing a Nitrogen Fertilizer

A variety of nitrogen fertilizers are available for producers. Urea (46% N), ammonium nitrate (33% N), ammonium sulfate (21% N) and nitrogen solutions are the most commonly used fertilizers. The two most important considerations when selecting a fertilizer are cost differences and potential losses. Cost differences are based on the cost per pound of nitrogen, not the cost per ton of fertilizer.

Example: Urea ($130.00/ton) or Ammonium Nitrate ($96/ton)

	Cost/ton	Pounds Nitrogen in ton (200x% N)	Cost/lb. N
Urea (46%)	$130	920	0.14
Ammonium Sulfate (21%)	96	420	0.23

An example of potential losses would be if urea were placed on a dry soil surface when temperatures were about 80° F, a considerable amount of its

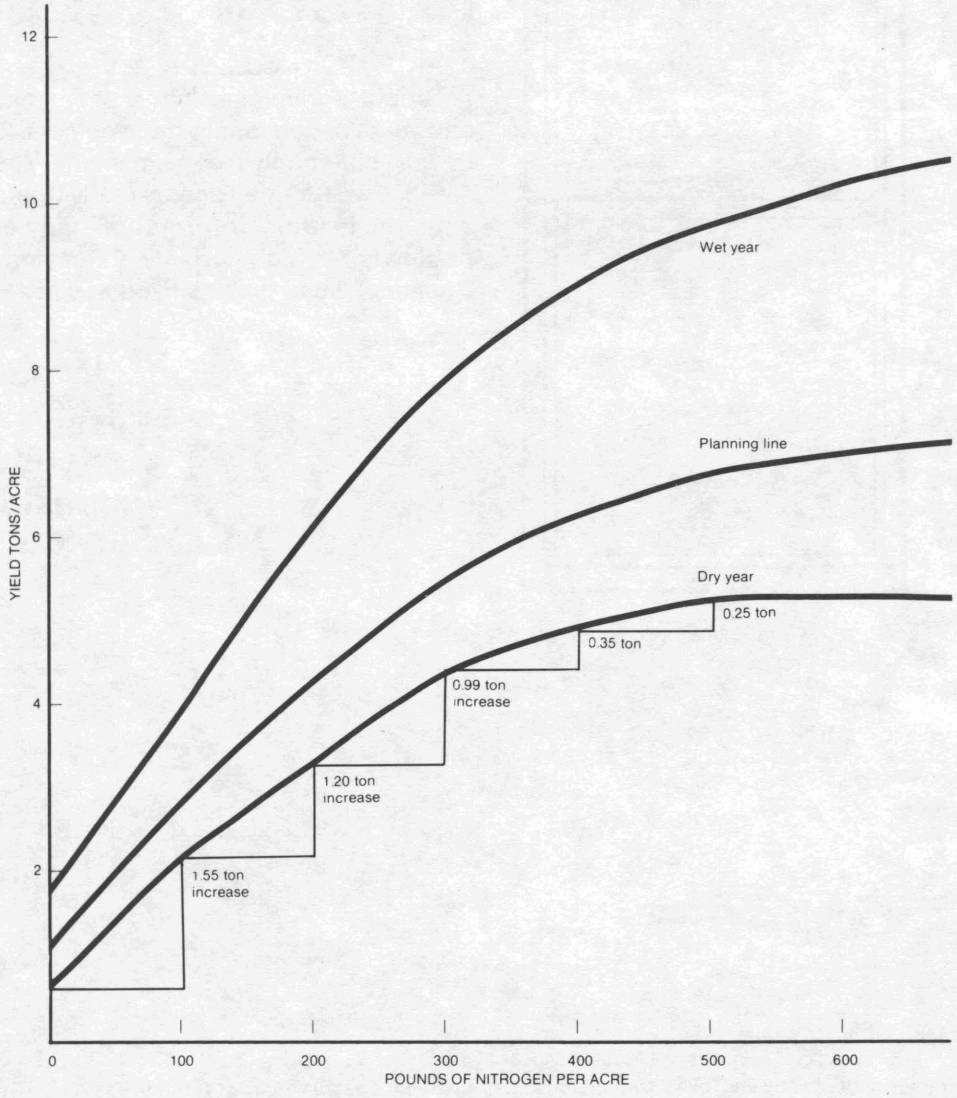
nitrogen would be lost within 2 to 3 days. This loss is due to a natural breakdown of urea, forming a nitrogen gas (ammonia). Therefore, urea should only be used when rain or irrigation is insured or in the early spring when temperatures are below 80° F.

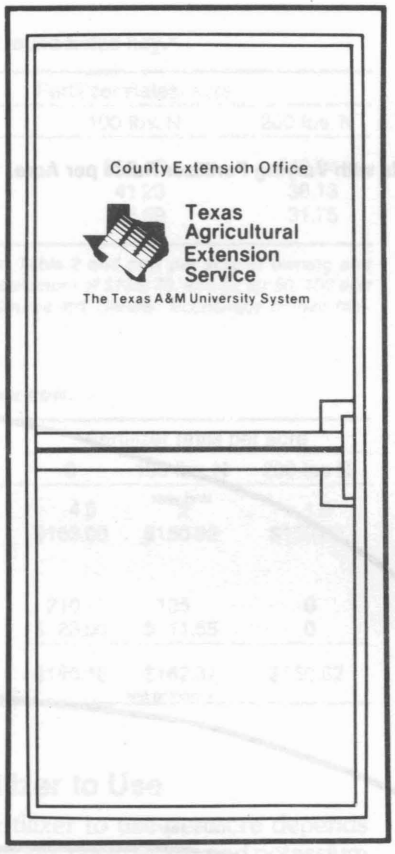
General Fertilizer Recommendations

In summary, the following forage fertilization recommendations are offered:

1. Fertilize according to a regular soil test program.
2. Do not apply nitrogen too early in the spring. Wait until grass is growing and can utilize the fertilizer.
3. Apply at least 50 pounds of nitrogen per acre per application.
4. Split nitrogen fertilizer into several applications (after each hay cutting or grazing cycle).
5. Put out recommended phosphorus, potassium and lime at one time. (If large quantities of potassium are required on a sandy soil, split into two applications).
6. Only fertilize acres you can utilize the forage from. Fertilized pastures that are under-utilized waste fertilizer dollars.
7. Calculate the relative cost of fertilizer sources to determine the most economical fertilizer to use.

Figure 1. Coastal Bermudagrass Hay Yields with Varying Fertilizer Rates per Acre.





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Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture. Zerle L. Carpenter, Director, Texas Agricultural Extension Service, The Texas A&M University System.
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