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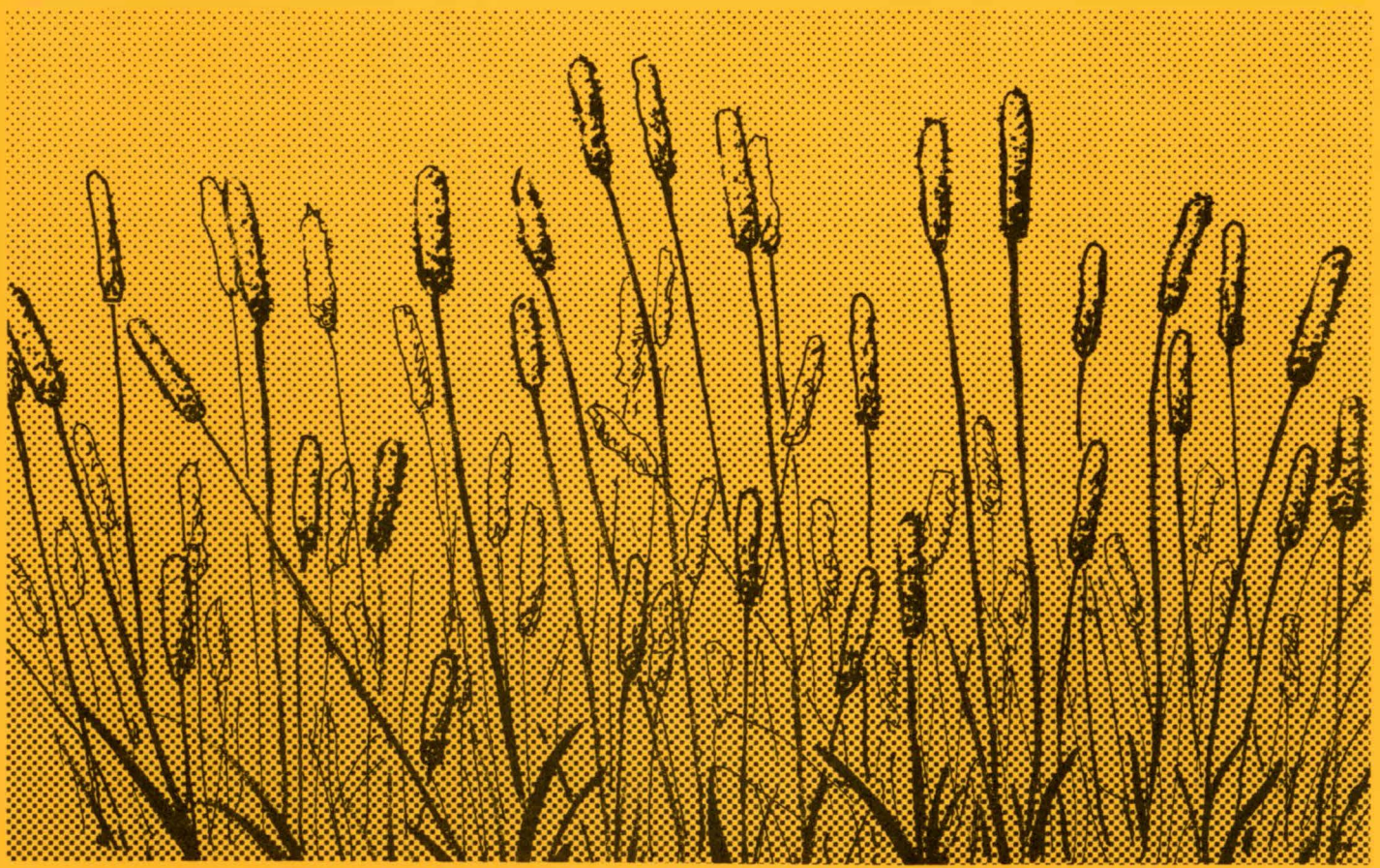

Agricultural Experiment Station
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Fertilizing for Grass Seed Production

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Seed production from grass is highly dependent upon favorable moisture and good soil fertility. **Both** moisture and fertility must be present; one does little good without the other.

A good grass seed crop needs about the same amounts of nutrients as either corn or oats. Table 1 shows relative comparisons of nutrients taken up by comparable-yielding crops.

Successful grass seed production also requires an adequate stand, weed control, and use of adapted varieties. These are discussed in C 244, "Grass Seed Production: Guidelines," available from your county Extension agent.

Soil testing

As with all other crops, a soil test—either under an existing stand or of a field being considered for grass production—is one of your most important tools.

For stand establishment, take samples from an 0-6 inch and a 6-24 inch soil depth (see FS 633, Taking soil samples). The deep-depth sample will measure any residual soil-available nitrogen. High soil-available nitrogen may lead to excess weed or companion-crop growth in the year of establishment. (Follow guidelines in FS 525P for current weed control methods for forage grasses.)

An excellent time to broadcast and work in nutrients other than nitrogen is before planting. After stand establishment, you are limited to surface broadcasting in solid stands.

Nitrogen

Nitrogen (N) is almost always the most limiting nutrient for grass seed production in South Dakota. With low N, grasses become pale green, stunted, and do not tiller. Established stands can soon become unproductive and "sodbound."

Grass usually has its best seed yields within the first 3 to 5 years after establishment. Seed yields will then begin to drop (Table 2), although sufficient fertilizer N will slow that decrease appreciably. (The lack of response to fertilizer during the first 2 years in the study may have been due to an already high level of available soil N.)

Table 1. Nutrient quantities contained in smooth bromegrass, oats, and corn for comparable yields.

		Nutrient			
Crop	Yield	N	P_2O_5	K_2O	S
		lb/A			
Corn	100 bu/A	140	50	150	17
Oats	100 bu/A	130	39	120	18
Smooth bromegrass	4 ton/A	128	33	172	20

Table 2. Grass seed yields as affected by year and N level.

	N	Year after establishment						
Grass	level	1	2	3	4	5	6	7
	lb/A	lb/acre						
Smooth bromegrass[1]	0	445	306	162	282	96	—	—
Smooth bromegrass	100	535	294	183	548	234	—	—
Crested wheatgrass[2]	0	378	406	207	290	279	—	—
Crested wheatgrass	100	295	391	220	453	342	—	—
Intermediate wheatgrass[3]	0	393	186	129	65	118	—	—
Intermediate wheatgrass	100	367	161	133	104	207	—	—
Smooth bromegrass[4]	0	310	121	204	167	47	19	2
Smooth bromegrass	133	264	127	114	480	222	178	131

[1]Average of seven varieties at Fargo, ND.
[2]Average of two varieties at Fargo, ND.
[3]Average of three varieties at Fargo, ND.
[4]Lincoln smooth bromegrass at Fargo, ND.
Source: Dodds et al, 1987.

Although seed yields decline after the year of establishment, with or without N, seed and forage yields from even a 6-year old sodbound stand can be improved dramatically when N is applied (Table 3).

Table 3. Influence of nitrogen fertilizer on seed and forage yields of a "sodbound" smooth bromegrass stand.

*Rate of N**	*Seed yield*	*Hay yield*
	lbs/A	
0	199	1940
30	391	3760
60	641	5160
90	858	6020
120	1008	6840

*Applied in fall, all treatments had 80 lb/A P_2O_5.
Source: Carson, 1950.

Rate of nitrogen

Grass forage production requires about 25 lb N per ton of hay. Seed yields are related to forage yields (Fig 1): For every 100 lb of forage, approximately 8 lb of seed is produced.

Although crude, this gives you a way to determine a realistic seed yield from forage yields of your area. The N rate recommendation for grass seed in Table 4 is a general guideline only.

Your yield goals also depend on available stored soil moisture and expected moisture. Set an optimistic but realistic goal. If very good moisture conditions exist, a 3-to 4-ton forage yield may be expected in western South Dakota. If soil moisture is low or droughty soils exist, a 1- to 2-ton forage yield can be expected in eastern South Dakota.

Table 4. South Dakota grass forage and seed nitrogen recommendations.

Area of state	*Hay yield*	*Seed yield*	*Recommended nitrogen*
	ton/A	*lb/A*	*lb/A*
Western SD	1	150	25
	2	300	50
Central SD	3	450	75
	4	600	100
Eastern SD	5	750	125

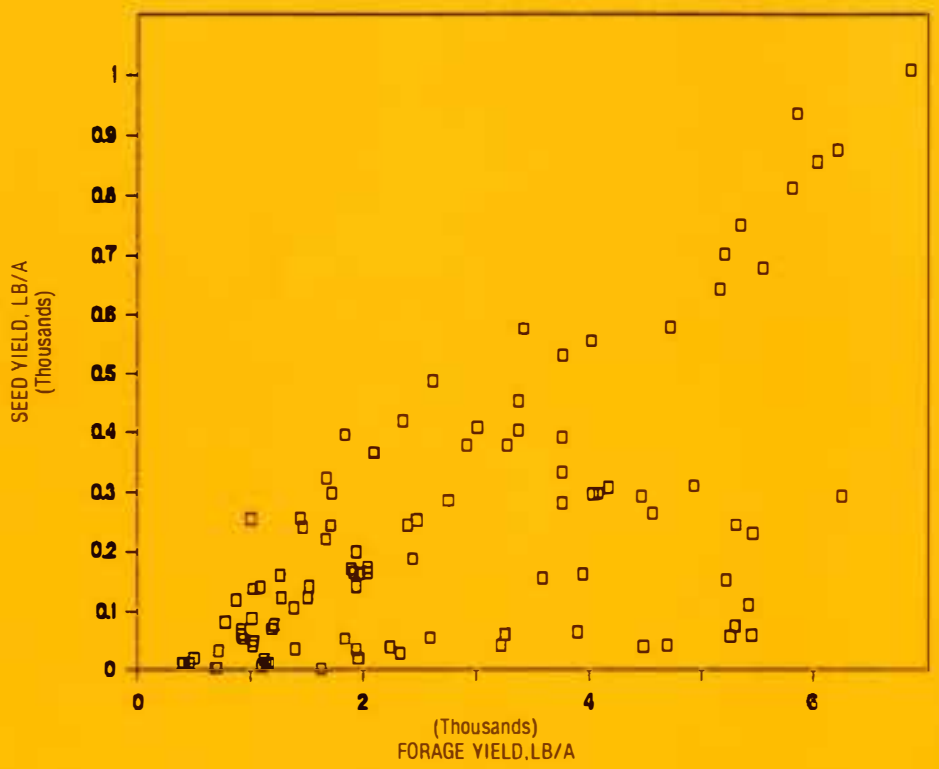

Fig 1. Relationship of grass seed yield to grass forage production.

It is often said that high N rates lead to decreased seed yields. This has not been verified by research in the Northern Great Plains. Forage yield and seed yields have generally increased proportionately with increasing N rates.

Even with N applied above nutritional needs, seed yields are not adversely affected (Table 5).

If production is severely limited (usually because of lack of moisture) all of the applied N may not be utilized. Lower the following year's N application by 20-30%. The nitrate-nitrogen soil test has not been calibrated for established grass as it has with other crops in South Dakota. Therefore, it is not used for grass.

Table 5. Seed and forage yields from Northern smooth bromegrass at six nitrogen levels.

Fall broadcast nitrogen	*Seed yield*	*Forage yield*
lb/A		*ton/A*
0	18	1.19
33	61	1.55
66	104	2.30
133	130	2.90
200	129	3.61
266	159	3.71

Source: Carter, 1961.

Lodging can occur when taller grass varieties are overfertilized. Lodging usually happens when wind and rain coincide with a heavy seed set. The seed usually can be picked up with a stripper, swather, or combine, and the heavier seed yields usually offset any costs for added harvest time due to lodging.

In some varieties, such as green needlegrass which is very susceptible to seed shattering by wind, lodging actually may be an advantage, since it will decrease shattering. The seed heads, being closer to the ground, will be more protected from wind.

If the N rates in Table 4 are followed, lodging should not be a major problem.

Do not apply N when starting new grass stands; you will only get a flush of weed growth. Wait until the grass seedlings are well

established and weeds are controlled. Then spread 30-50 lb N. Fertilizer N usually is not needed for stands seeded on summer fallow until after the establishment year.

Timing of nitrogen application

Many cool-season grasses initiate the tiller buds (which produce the next year's seed heads) in the preceding fall. Consequently, grass plants need adequate nutrition at this time (Tables 6 and 7).

However, research does not always show that early fall fertilizing is any better than in early spring or late fall (Table 8). The N nutrition of an adequately fertilized grass stand is sufficient when tiller buds are induced in the fall.

When applying N to cool-season grasses in the spring, do it as early as possible. Delaying until after the grass greens up may limit seed yields (Table 9).

On sandy soils where N leaching may be a problem, a split application (a third of the N in the fall and the rest in the spring) is desirable. Any fall applications on sandy soils should be applied late (after the soil temperature is below 50 F). If less than 2 or 3 inches of snow cover exists, winter application is acceptable unless slopes are greater than 2%. If there is no snow cover, N can be applied any time.

For warm-season grasses, apply N just prior to the start of growth in the spring, usually from May 1 to May 15 in South Dakota.

Sources of nitrogen

The most common dry N fertilizer is urea. Urea can be susceptible to volatilization (gaseous loss of N) if not worked into the soil. However, a number of studies comparing urea to ammonium nitrate (which is not subject to volatilization) has shown little forage yield difference between the two N sources (Table 10). Most South Dakota studies indicate a small advantage for ammonium nitrate.

If possible, apply urea when the chances of precipitation are greatest, usually preceding weather fronts that contain rain or snow. Cool weather inhibits volatilization of urea. Applications made after October, through the winter, and into early spring will be safe from volatilization.

Table 6. Influence of time of nitrogen application on Russian wild ryegrass seed and forage production.*

Time of application	*Seed yield*	*Forage yield dry matter*
	———lb/A———	
After seed harvest (July)	143	2340
September 15	49	2320
October 15	35	2400
April	68	3320
D (0.05)**	22	320

*Mean of 3 years, N application at 50 lb/A.
**The difference required for means to be "significantly" different.

Source: Lawrence and Kilcher, 1964.

Table 7. Influence of time and rate of nitrogen application on crested wheatgrass seed production.

Nitrogen	*—Time of application— Fall*	*Spring*
lb/A	*———lb/A seed———*	
0	25	25
20	143	53
40	187	132
60	285	144
120	574	233

Source: Brage, 1951.

Table 8. Effect of time and rate of N application on smooth bromegrass seed production.

	Fertilized early[1]				*Fertilized late*[2]			
	Years				*Years*			
N	*60*	*61*	*62*	*Ave.*	*60*	*61*	*62*	*Ave.*
	——————————lb/A——————————							
0	576	336	51	321	576	336	51	321
33	569	459	153	394	651	608	187	482
66	558	636	226	473	552	697	389	546
100	545	810	163	506	629	836	152	539
133	508	825	125	506	518	807	119	481
Ave.	577	664	145	462	596	700	175	490

[1]Early—10/29/59, 8/30/60, 8/7/61.
[2]Late—Spring 60, 10/7/60, 10/5/61.
Source: Dodds et al, 1987.

Table 9. Effect of time of nitrogen application on smooth bromegrass seed production.

	Site 1		*Site 2*	
	Date fertilized			
Nitrogen	*10/27/49*	*5/12/50*	*10/27/49*	*4/10/50*
	——————————lb/A——————————			
0	243	260	175	175
50	700	375	332	324
80	812	387	529	562
120	877	512	937	828

Source: Carson, 1950.

Liquid N should be as effective as dry N sources. Apply liquid N prior to green-up.

Anhydrous ammonia is a suitable N source for grass seed production if grass is grown in rows.

Phosphorus

Even if soil tests for phosphorus (P) are low (Tables 11 and 12), it appears grass is less responsive to added P than are other crops.

Mycorrhizal fungi commonly grow on perennial grass roots. These fungi are known to make soil P more available to plant roots. Or adequate P may be supplied from decomposition of root and thatch material.

Table 11. Influence of added* phosphorus and nitrogen on smooth brome grass seed production.

Nitrogen	Phosphorus rate, lb/A P_2O_5 — 0	40	80
lb/A	seed yield, lb/A		
0	166	175	199
30	378	332	391
60	553	529	641
90	577	678	857
120	751	937	1008

*Fall applied. Soil test was very low in phosphorus.

Source: Carson, 1950.

Table 12. Influence of added phosphorus and nitrogen on creeping meadow foxtail seed yields.

Nitrogen	Phosphorus rate*, lb/A P_2O_5 0	40
	lb/A	
0	3	3
30	13	18
60	36	53
120	156	161
240	245	310

*Soil P test = 8 lb/A, fall fertilized.

Source: Ward et al, 1968.

The response to P is not as pronounced if N level is low. Nor is response to N as good if P is low (Table 11). All nutrients must be adequate to get good seed yields.

The general P recommendation for grass seed production is shown in Table 13. Relative grass forage yield as affected by soil test is shown in Figure 2. With limited data, it appears that increased yield will be very slight above 15 lb/A of soil test P.

In general, if soil test P levels are low (less than 15 lb/A),

Table 10. Effect of nitrogen source on grass forage yields.

Grass	Nitrogen rate (lb/A) 0 Urea	AN*	70 Urea	AN	140 Urea	AN
	lb/A, 12% moisture					
Smooth bromegrass	1680		3984	4510	4424	4748
Native	1249		2708	2760	2881	2579
Native	3197		4250	4341	4957	4775
Switchgrass	3096		4235	4467	5468	5371
Big bluestem	1113		3698	4770	5561	5870
Average	2067		3775	4170	4658	4669

*Ammonium nitrate.
Source: Williamson and Carson, 1973.

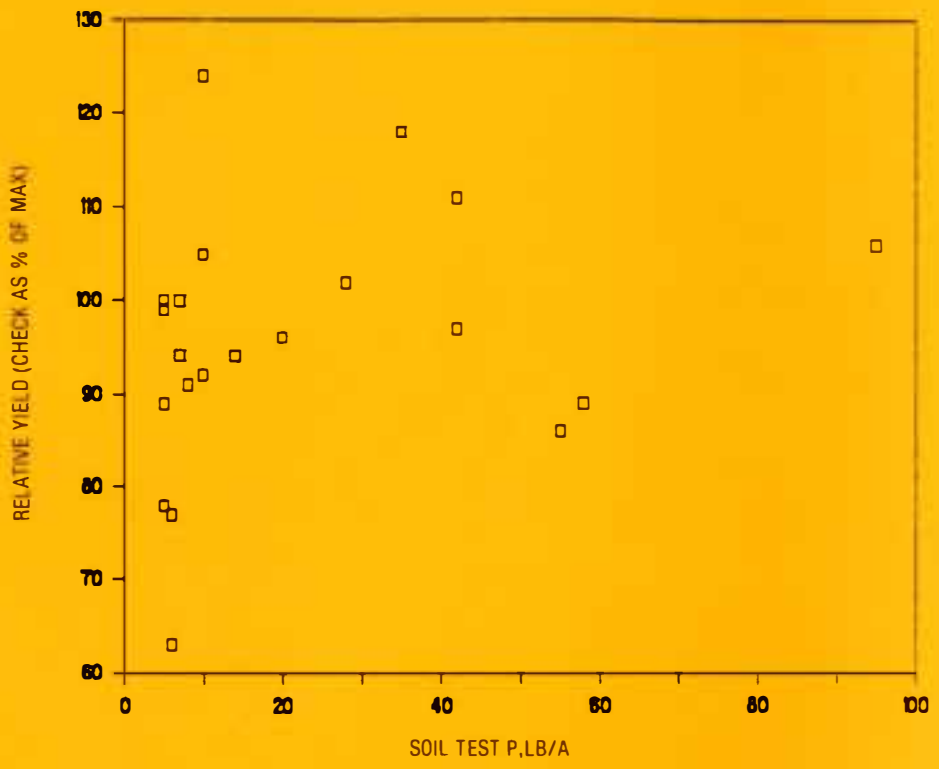

Fig 2. Relationship of relative grass forage yield to Bray-1 phosphorus soil test.

Table 13. South Dakota phosphorus recommendations for grass seed production.

Soil test P range	Phosphorus recommendation P_2O_5
	lb/A
<15	40
15-30	20
>30	0

fertilizer P should be applied before stand establishment. On established stands, surface-applied P will be used by grass, although there will be little increased yield if the surface soils are dry during the growing season.

Other nutrients

Sandy soils with low organic matter levels may be prone to sulfur deficiencies. A soil test will determine the nutrient status of potassium, sulfur, and other secondary and micro nutrients.

Data from South Dakota and other states in the Great Plains have not shown a large need for nutrients other than N and P for grass seed production.

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