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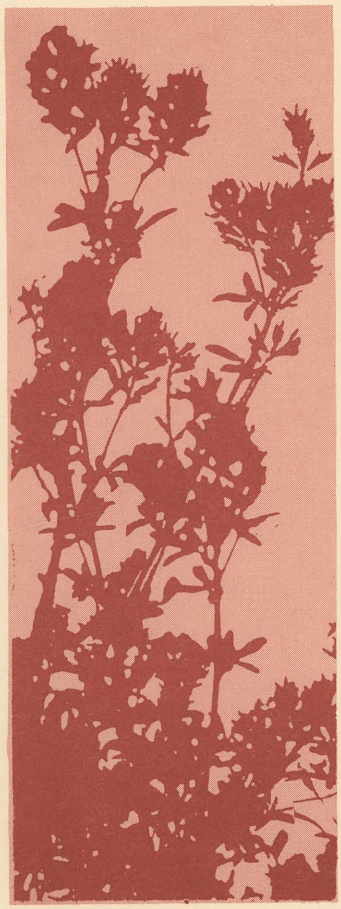

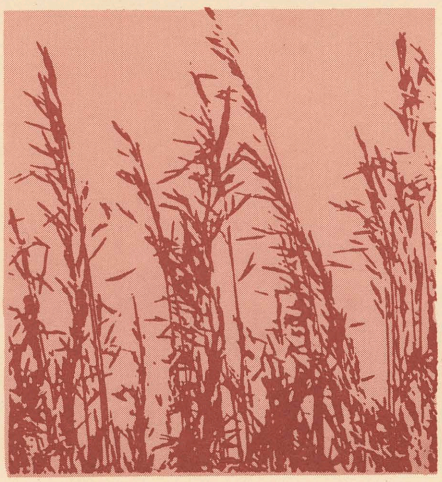

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HOW TO ESTABLISH FORAGE GRASSES

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The margin for error in establishing forage grasses is much narrower than when planting most other crops. With annual crops, you can do a better job next year, if necessary. With perennial grasses, you still have the same inadequate stand and poor production next year, and the next.

If your stand is so poor that you have to rip it out, you must write off your labor, seed cost, machinery costs, and any benefits you might have gained off the field if it had been sown properly.

All those difficulties can be avoided, or at least minimized. Successful grass seedings are the result of careful planning, using proven techniques, and luck. Grass is difficult to establish, but a good stand is well worth the effort you will put in.

Seedbed preparation

Weed considerations

If the field has been continuously cropped, you should seed on recently worked ground to minimize weed competition. On fallow, seed on undisturbed stubble that has had good weed control during and after crop harvest.

Herbicide carryover, especially on row crop ground, can prevent establishment of grass seedlings. **Always** check herbicide labels for the possibility of carryover problems. If weeds are not under control prior to seeding, it may be better to hold off a year on seeding and concentrate on controlling weeds this season.

Conventional

Good soil-to-seed contact maintains an adequate amount of moisture near the seeds. This moisture is critical for germination and for development of root systems of young grass seedlings. A firm seedbed is required for good soil-to-seed contact.

The seedbed is firm enough if you can walk across without sinking into the soil more than one-half inch. This type of seedbed allows infiltration of rainfall and moisture storage, and it minimizes air spaces in the soil.

A tightly packed soil also encourages some of the stored moisture to move upward and prevents the upper layer of soil from drying out. A poorly packed seedbed is more subject to drying and is, therefore, more likely to result in seedling death.

Methods of seedbed preparation depend upon soil type, degree of slope, and existing vegetation. Moldboard plowing is often necessary in eastern South Dakota on sites having an existing cover of perennial species. Disking and harrowing are usually needed to break apart large clods and work out air pockets.

Before seeding, firm the seedbed with a roller or cultipacker. In some instances, it may be wise to pack the seedbed after seeding as well.

Inadequate seedbed preparation is a leading cause of stand failure.

No-till establishment

Standing, weed-free sorghum or small grain stubble provides an excellent seedbed for grasses. The firm soil surface will provide proper seed placement.

The key to successful establishment is the control of weeds prior to and for approximately 6 weeks after seedling emergence.

Table 1 measures the production of alfalfa, grass, volunteer wheat, and weeds during the first season of no-till establishment. Table 2 expresses the second year's production of the 1986 experiment.

Two more experiments were conducted in April 1987. One evaluated stand establishment of alfalfa and crested wheatgrass, the second evaluated stand establishment of a mixture of warm- and cool-season grasses.

The alfalfa stand was excellent but the warm- and cool-season grass stands were very poor in June 1987. The failure was due to extremely dry conditions after seeding. Herbicides improve chances of success, but there are no guarantees.

Paraquat at 1½ pt/A or 12 ounces of Roundup plus ammonium sulfate are preferred herbicides to be applied 4 to 7 days prior to seeding. Landmaster contains 2,4-D which may cause injury to germinating seedlings.

More research into no-till establishment of cool- and warm-season grasses is needed to determine optimum seeding times and methods. It also appears that insects, particularly grasshoppers, are encouraged by no-till conditions.

Seed selection and quality

Seeding failures are frequently blamed on fertility, weather, and many other factors when poor quality seed is the real problem.

Purchase **certified seed** from a reliable source and use it to assure varietal purity. Certified seed costs more, but it is usually worth the extra price.

Both native and tame grasses must be regionally adapted to be successful, and "region" is very narrowly defined. Cultivars of warm-season grasses moved over 150 miles south or 300 miles north of their origin generally perform poorly. Cool-season grass cultivars should also be regionally tested for their suitability.

Purchase on the basis of pure live seed (PLS). PLS testing establishes mechanical purity, germination, and amount of inert matter and weeds. The percentage of PLS in a seed lot is determined by multiplying the germination percentage by the purity percentage and then dividing by 100. These two values are listed directly on the seed analysis tag.

If seed has been stored, always have it tested before seeding. Storage conditions can have a dramatic effect on seed germination.

The value of knowing PLS is apparent when pricing seed. Table 3 illustrates how the "real" cost of seed varies directly with its PLS determination.

This example shows that at a constant price, the seed lot with a 99% PLS is the better buy. However, a seed lot with a PLS of 75% can be as economical as one of 90%, as long as their prices on a PLS basis are equivalent. Most seed sold in this region is sold on a PLS basis.

Time of seeding

Cool-season grasses

Seed cool-season grasses in the early spring, late summer, or late fall.

Early spring (about April 1-15) is optimum because the cool, moist conditions present at this time are favorable for germination and seedling growth. If seeding occurs substantially after April 15, the seedlings may not become well established and may be damaged by the hot, dry weather typical of summer months in most years.

Weed competition is also usually more severe with late-planted seedings.

Cool-season grasses can be seeded in the late summer from August 1 to September 20 if moisture is adequate. About 2 feet of adequate soil moisture is necessary.

Late August is the optimum seeding time because the grass seedlings have ample time to develop a crown and crown buds and to build up energy reserves for the winter. The likelihood of seeding failures generally increases as seeding time is delayed into mid-September.

Table 1. No-till alfalfa and grass plots established in April 1986 and harvested in August 1986. *

Treatment	Rate of product, oz/A	Alfalfa	Grass	Volunteer W wheat	Weeds
			lb/A		
Preplant					
Roundup	8	1078	197	0	1121
Roundup	12	1145	209	0	1123
Landmaster	40	1041	168	0	1551
Paraquat	16	413	68	1809	688
Paraquat	24	496	79	2147	724
Cultivated	chk	1043	354	702	581
Uncultivated	chk	214	123	547	607
Post plant					
Roundup	8	700	72	36	1415
Roundup	12	995	215	15	840
Landmaster	40	719	58	490	1208
Paraquat	16	143	13	4926	320
Paraquat	24	351	154	2241	430
LSD (.05) lb/a		464	168	1073	719

* Plots harvested on August 4-5, 1986

Table 2. No-till alfalfa and grass plots established in April 1986 and harvested in June 1987. *

Treatment	Rate of product, oz/A	Alfalfa	Grass	Volunteer W wheat	Weeds
			lb/A		
Preplant					
Roundup	8	1360	3464	284	262
Roundup	16	1301	4907	577	257
Landmaster	40	815	3019	1472	193
Paraquat	16	502	2133	1133	324
Paraquat	24	903	2920	1060	550
Cultivated	chk	680	3188	1178	283
Uncultivated	chk	530	2837	1571	791
Post plant					
Roundup	8	1226	4261	337	272
Roundup	16	1042	4411	761	477
Landmaster	40	905	3975	472	334
Paraquat	16	959	4251	671	80
Paraquat	24	1063	3633	1425	457
LSD (.05) lb/A		529	1859	1148	—

* Plots harvested on June 24-29, 1987

Table 3. Influence of PLS on real cost of three seed lots.

Bulk weight	PLS	Price	Real cost*
100 lb	99%	$600	$606.06
100 lb	90%	$600	$666.66
100 lb	75%	$600	$800.00

* Calculated as: price/PLS x 100

Dormant seedings (after November 1) can be made after the possibility of germination in the fall has passed. The seed will be in place and ready to germinate in the spring. Dormant seeding success is enhanced when seeds actually take up moisture prior to freeze-up.

Dormant seedings are recommended for western wheatgrass and green needlegrass because these species have high levels of dormancy. But dormant seedings are sometime risky; they run the chance of either fall germination and winterkilling or very early spring germination and killing by freezing temperatures.

Experiences have generally been good throughout South Dakota for dormant seeding of cool-season grasses. Dormant seeding is often preferred by producers who find it difficult to seed in the spring.

Warm-season grasses

These grasses do not germinate until the soil becomes relatively warm. Seedings made during the early spring are generally unsatisfactory. However, if you are using a mixture containing cool-season species, it is better to plant in early spring.

Generally, soil temperatures good for corn germination are good for warm-season grass germination. The optimum time to seed is May 15 to June 15.

It is usually not advisable to seed later than July 1 because hot, dry weather may impair germination. Competition from weeds is a serious problem with warm-season grasses.

Seeding depth

One of the most common causes of seeding failures is planting seed too deep. Placement needs to be shallow, but the seed must be covered with soil.

As a rule, grass seeds should be placed no deeper than ¼ to 1/2 inch. Deeper seeds may emerge, but they will be so weak that their survival is doubtful. Conversely, seed germinating on the soil surface will most likely lack adequate moisture to become established.

Seeding equipment

Equipment that packs the soil around the seed is imperative for successful establishment. Packing puts the seed in contact with the soil, prevents the soil from drying out, and allows moisture to be retained near the soil surface for the developing seedlings.

Broadcast seeder

This is the least desirable implement for seeding grasses. It does not allow good soil-to-seed contact, and many seeding failures have resulted from its use.

If you use a broadcast seeder, increase your chances by rolling or cultipacking the seedbed before and after planting. Excessively high seeding rates may be necessary to compensate for seedling losses.

Grain drill

Grasses may be seeded with a conventional double-disk grain drill equipped with a grass-seeding attachment. These drills commonly have short tubes that scatter seed in front of the furrow openers. Use depth bands to ensure that seeds are not planted too deep.

Lightweight grass seeds, such as smooth bromegrass, may "bridge" in the drill box and not feed down the seed tubes. Mixing the grass seed with rolled oats or cracked corn may improve seed flow and should alleviate problems caused by seed "bridging."

Press drill

This is one of the best implements to use on fields that contain crop residue. It will also work on clean-tilled land if depth bands are used to ensure proper seeding depth.

Problems associated with seed bridging may occur.

Cultipacker seeders

Several types of seeders are available that plant and pack in one operation. The majority consist of a seed box mounted on top of a frame between two corrugated rollers. Seed drops between the rollers which pack the soil around the seed.

These seeders do an excellent job because they assure a firm seedbed and an even distribution of seed into the soil. They provide the best means of seeding free-flowing grasses such as reed canarygrass; however, they do a poor job with fluffy, lightweight grasses such as big bluestem and Indiangrass.

Grassland drill

This implement has been developed to handle the fluffy seed of most native grass species. It has depth bands that ensure a uniform, shallow depth of seeding and packer wheels to give a firm seedbed. It has a large hopper equipped with agitators that permit the seed to be delivered at a uniform rate.

When available, a grassland drill should be the drill of choice.

Seeding rate/drill calibration

Rate of seeding will depend on many factors, including firmness of the seedbed, type of seeding

equipment used, and amount of weed competition with the seedlings.

As a general rule, an adequate grass stand can be obtained by planting 20 pure live seeds per square foot into a firm seedbed with proper seeding equipment.

The recommended seeding rates in Table 4 will provide an adequate stand without planting excess seed. Seeding less than recommended rates can result in sparse, less productive stands, while exceeding these rates can waste both seed and money.

Calibrate the drill to deliver the correct amount of seed. There are many ways to do this; one of the easiest and most accurate is to measure the amount of seeds distributed per foot of row.

Lay a canvas or tarp on top of the ground, put the seed into the drill box and select a drill setting, engage the drill, and drive over the canvas or tarp at field speed.

Then count the seeds in each row over a distance of several feet. Find the seeds per foot of row and use Table 5 to determine the number of seeds per square foot delivered by the drill. Repeat with a new drill setting until you get the desired rate.

This method can be modified for cultipacker seeders by counting all seeds in a pre-selected area and dividing the number of seeds by the number of square feet in the area.

As an example, suppose the row width of a drill is 8 inches and the average number of seeds delivered by the drill in a foot of row is 20. From these values in Table 5, you find a seed density of approximately 30 seeds per square foot at this particular drill setting.

This value is for bulk seed. The seeding rate still needs to be adjusted to a PLS basis. If, in this example the PLS percentage is 70%, then the actual seeding density will be 30 seeds/sq ft x 0.70 = 21 pure live seeds/sq ft.

Planting 20 pure live seeds/sq ft is recommended if a firm seedbed has been prepared and proper seeding equipment is used. If either or both of these is lacking, it may be advisable to increase the seeding rate to 25 or 30 pure live seeds/sq ft.

But you may want to plant a grass mix. In mixtures, it is not necessary to use the full seeding rates of each species for a full stand. Table 6 shows how to achieve a desired mixture based on a full seeding rate of 20 pounds PLS per acre.

Companion crop

Companion crops can be used when protection of seedlings and erosion control are needed. Sandy and/or hilly sites are most likely to benefit from the use of a companion crop.

Companion crops compete for moisture; they are not recommended unless the soil erosion potential is high. Use no more than half the normal seeding rate for the companion crop. It is extremely important that the companion crop not exert excessive competition on the grass seedlings.

Flax is the least competitive of the small grain companion crops. Spring wheat and oats make satisfactory companion crops. Avoid barley, if possible; it is very competitive because of its ability to produce a large number of tillers.

Table 4. Suggested seeding rates for perennial grasses seeded alone.

Species	*Seeds/lb*	*Pounds of pure live seed (PLS)/A**
Cool-season grasses		
Smooth bromegrass	135,000	6.5-8
Meadow bromegrass	90,000	10-12
Intermediate wheatgrass	90,000	10-12
Tall wheatgrass	80,000	11-14
Crested wheatgrass	190,000	5-7.5
Western wheatgrass	110,000	8-10
Reed canarygrass	550,000	6-8
Creeping foxtail	450,000	5-8
Green needlegrass	170,000	5-7
Russian wildrye	175,000	5-7.5
Orchardgrass	654,000	5-8
Kentucky bluegrass	2,177,000	5-10
Warm-season grasses		
Switchgrass	390,000	2.5-5
Indiangrass	175,000	5-8
Big bluestem	160,000	5.5-8
Little bluestem	260,000	3.5-5
Sideoats grama	200,000	4-7
Blue grama	850,000	2-3

* Lower rates provide approximately 20 PLS/sq ft.

Table 5. Seeds per foot of row needed to achieve desired seed densities from drills at various row widths.

Drill row spacing in inches	*Desired seed density (seeds/sq ft)**				
	15	*20*	*25*	*30*	*35*
	seeds/ft of row				
6	7.5	10.0	12.5	15.0	17.5
7	8.8	11.7	14.6	17.5	20.4
8	10.0	13.3	16.7	20.2	23.3
9	11.2	15.0	18.7	22.5	26.3
10	12.5	16.7	20.8	25.0	29.2

* Seed density = Seeds per ft of row x 12/ row spacing.

Table 6. Calculation of seeding rates for mixtures.

Species	*Full seeding rate*	*Percent of each species desired*	*Seeding rate to achieve desired mix*
Big bluestem	8 lb PLS/A	60	4.8 lbs PLS/A*
Indiangrass	8 lb PLS/A	10	0.8 lbs PLS/A
Switchgrass	4 lb PLS/A	30	1.2 lbs PLS/A
Total	20 lb PLS/A	100	6.8 lb PLS/A

* Calculated as: 8 lb PLS/A x .60 = 4.8 lb PLS/A

The companion crop should be planted first at its proper depth, and then the grass should be drilled at right angles to the direction in which the grain was seeded.

Any small grain companion crop will suppress seedling growth if it is allowed to mature and is harvested for grain. A companion crop is best utilized and exerts the least amount of competition if it is harvested for hay or silage at early maturity stages (before flowering).

Management of new seedings

Keep a close "weed watch" on new seedings. Weeds may be a problem in spring plantings and should be mowed if they exert competition on the new seedlings.

Weeds are best controlled if permitted to grow tall and then mowed short. Selective herbicides may also be used in certain situations to control broad-leaved weeds. Timely control will prevent excessive shading or moisture use by weeds.

Insects may cause severe damage to new seedlings. Monitor for potentially hazardous insects throughout the seeding year. Entire stands can be lost in a few days following insect outbreaks.

Crickets, grasshoppers, and cutworms can all be devastating. If these insects begin to increase, consult your county extension agent for pesticide and other control recommendations.

In some instances, especially in the eastern portion of South Dakota, spring-sown cool-season grasses can be grazed to a 4-6 inch stubble height in the seeding year. Do not graze after September 1 in the first grazing season; energy reserves need to be stored for the winter. In the central and western portions of the state, grazing should be avoided during the entire first growing season.

For warm-season grasses, clipping may be needed to control weeds. When clipping, leave at least 6 inches of stubble and do not clip after July 15.

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