Progress Report on Grass Seed Production Research

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Kentucky Bluegrass:

- Selection of Kentucky Bluegrass Varieties for Seed Production
- Seeding Kentucky Bluegrass in Northern Minnesota
- Residue Management in Kentucky Bluegrass Seed Production

Timothy:

- Selection of Timothy Varieties for Seed Production Qualities
- Seeding Timothy for Seed Production
- The Interaction of Variety by Fertilizer Rate for Seed Production (in cooperation with Dr. John Grava, Department of Soil Science)
- Residue Management in Timothy Seed Production

Selection of Kentucky Bluegrass Varieties for Seed Production

More than 90 percent of the Kentucky bluegrass being grown in northern Minnesota is the 'Park' variety. This variety is well adapted for the region, has been well tested and is a prolific seed producer.

Other varieties are available for seed production, but generally they present production problems which have not been fully answered. Most of our work has been directed toward improving seed production of Park with limited effort directed toward seed production of other varieties.

Some factors to consider in selecting a variety for seed production are the market and production potentials. A number of Kentucky bluegrass varieties are available, but some appear to offer much less seed production potential than Park. For example, 'Nugget' is a variety from Alaska which is quite short and is not prolific for seed production. A grower should have some assurance of adequate seed production when he selects a new variety to grow. Also, he should recognize that in many cases a given variety may require considerably more production care than Park. For example, 'Pennstar' is a choice Kentucky bluegrass variety for sod or turf production. However, it has yielded consistently and significantly less seed than Park in northern Minnesota. Preliminary studies suggest that by accomplishing a heavy burn in July the production of Pennstar may be adequate, if a premium price is received for the seed. There is usually more risk with varieties like this, but the return may be worth the risk.

Seeding Kentucky Bluegrass in Northern Minnesota

Seedbed preparation - Seedbed preparation for Kentucky bluegrass is similar to that for other small-seeded grasses and legumes. Whether the ground is prepared by field cultivation, plowing, or disking, it should be worked to a fine condition, harrowed and packed before seeding.

Dates of seeding - When bluegrass is seeded with a companion crop, it should be seeded as early as practical to produce the companion crop. When bluegrass is seeded alone, it may be seeded later. Generally in northern Minnesota, moisture conditions are such that bluegrass can be seeded any time during the summer. However, earlier seeding (by July 15) will give more chances for a seed crop the first crop year than late seeding. Bluegrass may be seeded in late August or early September, but there would be little chance of a seed crop the next year.

Methods of seeding - Bluegrass is usually seeded like any of the small seeded grasses or legumes. A drill with a grass seeder attachment dropping the seed behind the discs is acceptable. Sometimes a harrow is pulled behind the drill. If equipment is available, it may be desirable to seed with special seeders such as the Planet Jr. gang seeders. These are more precise in distributing and placing the seed. Another method which normally requires two field operations is to use a standard drill to seed the companion crop and a cultipacker seeder to seed the grass. The companion crop should be seeded first with this method.

Rates of seeding - Seeding rates generally depend on the precision of seeding. One pound of seed per acre is adequate, but poor methods of seeding require 2 to 4 pounds of seed per acre. Only seed with high germination should be sown.

Companion crops - Companion crops should be selected for early maturity, short straw and resistance to lodging. Lodging on a Kentucky bluegrass stand is just as detrimental as on alfalfa or timothy. Tall, late-maturing varieties compete with the bluegrass for light, moisture and other elements needed for early growth and hinder the growth and establishment of bluegrass. The removal of the companion crop for hay or silage instead of grain also helps the seedlings to establish better. Nitrogen fertilizer should be used sparingly on a companion crop which is underseeded. High fertility makes the companion crop more competitive and causes greater risk of lodging in the companion crop.

Establishing bluegrass does not seem to be a serious problem. However, the plants require considerable time to establish so they will produce a good seed crop.

Seeding bluegrass has not seemed to be a problem; therefore, we have not done extensive research in this area. There have been very few cases reported where the seeding failure has occurred because of poor seeding methods, germination or companion crops.

Residue Management in Kentucky Bluegrass Seed Production

In the first or second production year Kentucky bluegrass seed production does not seem to be inhibited by excess plant residue from previous crops. The plant residue buildup occurs from the aftermath, straw and stubble left in the field. One to two tons of dry matter per acre is normally deposited each year. Higher fertilizer rates increase the quantity of residue deposited and cause lower seed yields unless the residue is removed.

In 1967 residue removal studies were initiated on the Helmstetter Farm, Roosevelt, Minnesota; and the Kveen Farms, Roseau, Minnesota. We have studied methods and times of residue removal including:

1. Check - the loose straw was raked from the plot, leaving the stubble and aftermath.

2. July-burn - the stubble, aftermath and straw were burned as soon as convenient after harvest (July or early August).

3. September-burn - the stubble, aftermath and straw burned in early September or late August.

4. April-burn - the stubble, aftermath and straw burned following April.

5. September-clip - the plants mowed 1 1/2 inches high and all loose material removed from the plots in September.

6. July-clip - plants mowed 1 1/2 inches high and all loose material removed from the plots in July.

7. July-clip-torch - plants mowed 1 1/2 inches high, all loose material removed from plots and the areas burned with propane torch in July.

8. Check-burn - after several years as check plots, these were mowed 1 1/2 inches high, let dry and burned in July.

We had little information on which to select our treatments at the outset; therefore, it was not surprising that we should add other treatments during this study. After two years it was obvious that the April-burn did not improve seed production, and it was very difficult to get a complete burn in the spring. The September-burn was consistently lower than the July-burn. The September-clip was consistently low, and we changed to July-clip to determine whether the date would significantly affect seed yield.

It has been obvious throughout these studies that the complete removal of the residue by fire gives the best seed yield. By clipping the material, raking off the residue and flaming the plot area with a propane torch we initiated the clip-torch treatment. This treatment produces less smoke than the July burn. In practical operation, the grower would remove the straw, stubble and aftermath for feed or bedding then flame the field with a propane burner.

Varieties like Primo or Pennstar do not burn as readily as Park. It is possible to clip the material, let it dry and burn the field. However, it is time consuming and costly to mow a field with a standard mower. The desiccate-burn treatment serves the same purpose. A dessicant is sprayed on the field to dry the aftermath. After at least 48 hours, the material is burned. This has been effective, although more costly than the July-burn.

The check-burn treatment originated when a check plot was burned in 1969 by mistake and the 1970 seed yield was very good. This treatment has been studied to determine whether a field with excess residue can be brought into good production in a short time.

Yields from the treatments are given in the table. Although all treatments were not included each year, we believe we have enough comparisons for valid conclusions. We studied three levels of fertilizer on each treatment area each year. The first two years the fertilizer treatments were 30+15+15, 60+30+30, and 90+45+45. In 1970 we changed to 40+20+20, 80+40+40, and 120+60+60. Fertilizer treatments are shown as low, intermediate and high.

The seed yields of the check and April-burn treatments were low in each test. Nearly complete residue removal as accomplished by the July-burn, the July-dessicate-burn, July-clip-torch, and the check-burn treatments has consistently produced the highest seed yields. The July-burn treatment has been included in each test each year. This treatment with high fertility has produced over 550 lbs seed per acre each year. (Note: These yields may not be comparable to farmer fields as our clean-out is not as severe.) July-clip-torch was somewhat lower, but comparable, and July-dessicate-burn has been equal too.

Initially we used the September date for clipping and removing residue. The yields were not comparable to July-burn, and we changed to July date for clipping, which is more nearly comparable. However, these yields were not equal to those where the residue was removed by fire.

The check-burn treatment was introduced after a check plot was burned by mistake and the following year the seed yield was exceedingly good. We were interested in how quickly satisfactory yields could be recovered where the residue had built up. These yields are very good, which indicates that timely and complete residue removal gives quick recovery of satisfactory seed yield.

The difficulty of burning some varieties and the Park variety under adverse weather conditions has been a concern. Some growers have clipped fields, let the material dry, and then burned with good success. However, this is time consuming and costly. As an alternative a dessicant was sprayed on the plots with no straw removed and 48 hours or more later burned. This treatment produces less smoke, gives rapid and relatively complete residue removal and gives good seed yields.

The data in the table indicate that with good residue removal additional fertilizer produces higher seed yields. The check and April-burn treatments do not give sufficient seed increase to warrant application of additional fertilizer.

Weed control in burned areas is important. Dandelions seem to establish more readily in areas which have been burned, but we have noted little change in other weed populations.

The Capsus bug is effectively and practically controlled when the residue is removed by burning. The highest incidence of Capsus bug damage (silvertop) is observed in the check plots when not sprayed with an insecticide. Clipping, whether in July or September, seems to reduce the incidence of Capsus bug, but does not give practical control of the pest. All burn treatments give essentially perfect control of Capsus bug and silvertop damage. We believe there is no reason to apply an insecticide for Capsus control when the residue is removed by fire. The meadow plant bug is also controlled effectively by burning.

Growers may burn seed fields when they obtain proper permission. However, the grower is urged to cooperate to the fullest extent so that smoke from his fields does not drift across populated areas and/or locations where numbers of people are gathered. Also, he is urged to respect his neighbor and not burn when smoke will drift across the neighbor's farmstead. It is understood that growers will burn fields only when smoke does not cross a public road and/or highway, airport or other public installation. Adherrence to common sense rules is the best assurance of continued permission to burn residue from the seed fields in northern Minnesota.

Pounds of Kentucky bluegrass seed per acre from several residue treatments and fertilizer applications at three locations.

Treatment	Fertilizer rate*	Locations		
		Helmstetter	Kveen (East)	Kveen (West)
Check	Lo	122	100	142
	Int	144	153	248
	High	161	160	255
July-burn	Lo	401	376	319
	Int	506	547	517
	High	586	650	613
July-clip	Lo	261	-**	170
	Int	291	-	319
	High	346	-	457
July-clip-torch	Lo	426	-	278
	Int	545	-	472
	High	596	-	536
September-clip	Lo	211	180	224
	Int	270	220	401
	High	319	301	416
September-burn	Lo	281	176	-
	Int	364	289	-
	High	454	495	-
April-burn	Lo	120	184	-
	Int	151	209	-
	High	171	185	-
July-spray-burn	Lo	425	-	266
	Int	524	-	452
	High	554	-	643
Check-burn	Lo	412	-	258
	Int	570	-	457
	High	834	-	509

* Fertilizer rates for 1968 and 1969 crops were:
Lo = 30+15+15
Int = 60+30+30
High = 90+45+45
These changed in 1970 to:
Lo = 40+20+20
Int = 80+40+40
High = 120+60+60

** Treatment not conducted in this trial.

Selection of Timothy Varieties for Seed Production Qualities

Several characteristics should be considered in selecting timothy varieties for seed production in northern Minnesota. The four we believe most important are: (1) seed yield per acre, (2) plant height, (3) maturity date, and (4) standability.

We have observed a striking range for seed yield among the varieties grown in northern Minnesota. Two, S-50 and Sport, are turf type timothies, (Phleum nodosum) and have yielded very little seed. Other varieties vary for inherent seed production, but are more productive than these two varieties. Maturity may affect the value of a given variety because the harvest date may conflict with other varieties and/or crops. Lodging will make swathing and combining difficult, usually resulting in seed loss.

1970, 1971 and 1972 data for varieties being grown at that time are shown in the table. The yields and maturity and lodging scores are averages of the three years. The plant height is the 1972 measurement which we believe is our truest mature plant height measurement. This information was obtained in 1-row plots replicated twice and in 4-row plots replicated four times. The data from the two seedings are quite comparable. This is particularly true for height, maturity and lodging. The yields from the two seedings vary, but generally give the same relative rank. These data are presented to show production potential in northern Minnesota.

The price and other contract terms may offset the differences in seed yield and should be considered in selecting varieties. One factor which appears to warrant consideration is that most of the lower yielding varieties appear to be those with late maturity. These are usually pasture types and mature later than the hay types. Also, they were probably selected for pasture forage performance and with less emphasis on seed potential. Other data suggest that additional fertilizer may increase yields of these varieties, but the seed yields reported here were produced with a 100+50+50 fertilizer application each year.

The primary purpose of this information is to help growers and seedsmen recognize the inherent differences between varieties, and to help them decide which variety(ies) they are interested in producing.

Seed yield, height, date maturity and lodging for timothy varieties seeded Roseau, Minnesota in 1969. Figures are average of 3 years, except plant height is 1972 reading.

Variety	1-row plots				4-row plots			
	Seed Yield (lbs/ac)	Height (ins)	Maturity (date)	Lodging* (1-5)	Seed Yield (lbs/ac)	Height (ins)	Maturity (date)	Lodging* (1-5)
Aberystwyth S- 48	381	36	8/17	3.0	387	38	8/19	2.5
Aberystwyth S- 50	44	24	8/17	1.0				
Aberystwyth S- 51	396	48	8/14	1.5	383	42	8/12	4.0
Aberystwyth S-352	393	43	7/29	1.5	403	43	8/1	2.0
Bariton	340	40	8/19	2.5	400	37	8/16	3.2
Barmoti	542	43	8/2	1.0	586	43	8/2	3.2
Clair	505	45	7/29	2.0	429	45	8/1	2.1
Climax	428	49	8/1	1.0	403	49	8/1	1.6
Comet (Combi)	348	32	8/19	4.0				
Engmo	503	40	8/1	3.0	597	41	8/2	4.0
Erecta RVP (Melle)	411	43	8/4	2.5	436	44	8/2	2.3
Eskimo	517	45	7/29	2.0				
Essex	363	43	8/10	2.0	375	46	8/10	3.0
Heidemij	409	38	8/17	1.5	472	39	8/18	2.0
Intenso (Sceempter)**					375	41	8/17	3.0
Itasca	351	48	7/30	1.5	447	46	7/31	1.6
King	305	37	8/19	2.5				
Landsberger	488	42	8/1	2.2				
Lorain	421	49	8/2	1.5	406	48	7/31	1.0
Motim	463	42	8/15	2.5	444	39	8/16	4.0
Olympia (Vertas)	353	38	8/19	3.5	381	36	8/18	2.3
Sata	475	43	8/1	4.0	496	41	8/1	3.3
Sport	36	26	8/18	1.0				
Tammisto**					563	40	8/2	3.0
Tarmo	542	40	8/2	2.5	568	41	8/1	3.6
Timfor	497	48	7/29	1.0				
Timo	297	38	8/16	2.5				
Tiran (Samo)	355	35	8/17					
Verdant	340	48	8/3	2.0	384	46	8/2	2.6
Vertas (Olympia)	304	37	8/19	3.0				
Wisconsin T-10	433	49	8/2	1.0	465	50	8/2	2.3

* Lodging: 1 = most erect, to 5 = severely lodged.

** 1968 Timothy Variety Trial data for 1970 and 1971, not the same year as other entries.

Seeding Timothy for Seed Production

The usual practice is to have the seedbed well worked, whether prepared by plowing following a grain crop or following fallow or whatever the previous history of the soil. Generally, the preparation should include the necessary tilling, harrowing and packing of the soil. The seedbed should be so prepared that small seed, properly placed at a proper depth and proper coverage will give a healthy stand.

Date of seeding - There is some choice in date of seeding timothy in northern Minnesota. If one seeds with a companion crop, he must seed early to produce the companion crop. There is considerably more latitude in date of seeding if you seed without a companion crop. Our experience has shown that seeding in June, July or early August is feasible when the timothy is seeded without a companion crop. Almost without exception it will be essential to use cultural practices or chemicals to control weeds and volunteer plants when you seed without a companion crop.

The income from the land the year of seeding, the establishment of the timothy plants and weed control may influence greatly whether you seed early or late and with or without a companion crop.

Methods and rates of seeding - We have seeded timothy in northern Minnesota in 18-inch rows at 1/3, 1/2, 2/3, 1 and 1 1/3 lbs per acre, and in 6-inch rows at 1.0, 1.5 and 2.0 lbs per acre. There appears to be little, if any, difference in total seed yield from these rates and row widths (see table). The rate of seeding may be dependent upon the quantity of available seed. The smaller seeding rate will permit seeding a much greater acreage with a limited seed supply. Often, the most lucrative variety has a very limited supply of stock seed.

Choice of companion crop - Generally, we assume that oats, wheat or flax are feasible as a companion crop in seeding timothy. We suggest that the variety be one which possesses good standability to prevent lodging on the underseeded timothy. Also, we suggest that limited supplies of nitrogen fertilizer be applied to grain crops in which timothy is underseeded. High rates of nitrogen fertilizer may cause severe lodging of the companion crop.

Some people have found it expedient to seed two rows of the companion crop and seed the third row of the timothy. Others permit the seeds to "dribble" behind the discs from the grass seeder attachment. Several methods may give good results, but when one carefully considers the size of the seed, the quantity he is applying, the condition of the soil, he should carefully select his method of seeding to give the best possible chance for a good vigorous stand.

Pounds of seed per acre from different rates of seeding and fertilizer.

Row width	Seeding rate	Welin farm				Baade farm			
		Fertilizer rate*			Average of all treatments	Fertilizer rate**			Average of all treatments
		Lo	Int	High		Lo	Int	High	
18" rows	1/3#/Ac	400	498	561	487	244	295	386	308
	2/3#/Ac	395	465	555	472	244	341		328
	1 1/2#/Ac	386	481	522	463	230	349	284	321
6" rows	1 #/Ac	377	482	534	464	250	346	407	335
	2 #/Ac	402	489	519	470	224	340	381	315

* Fertilizer rate:
Lo = 30+15+15
Int = 60+30+30
High = 90+45+45

** Fertilizer rate:
Same as Welin for three years, then,
Lo = 40+20+20
Int = 80+40+40
High = 120+60+60

The Interaction of Variety by Fertilizer Rate for Seed Yield in Timothy

Most of the fertilizer studies conducted by the University of Minnesota researchers have been in a field of a given variety. Some people have suggested there may be rather specific requirements for various varieties. As a preliminary study to determine whether varieties respond differently to fertilizer rates, we seeded three varieties, Climax, Evergreen and Heidemij. These were seeded in replicated trials at three seeding rates in two row widths: 18-inch rows at 0.5 and 1.0 lbs per acre and in 6-inch rows at 1.5 lbs per acre. In the fall of 1969 for 1970 seed production, we applied two fertilizer rates, 50+25+25 and 100+50+50. In 1970 for 1971 production, we applied 60+30+30 and 120+60+60, and for 1972 production 60+30+30 and 100+50+50. The reason we changed rates was the severe lodging observed in 1971 production from the 120+60+60 rate. We maintained the 60+30+30 as the lower rate for 1972 production.

Seed yields are shown in the table. Heidemij seed yields from the higher fertility rate were considerably greater in 1972 than from the low rate. The response of Heidemij to the high rate was considerably more than the response of Climax in comparable comparisons. We have chosen to omit the yields from Evergreen since the seed stock used for this seeding was not typical for the variety.

Seed yields of Climax and Heidemij timothy at three seeding rates and two fertilizer rates for three years.

Variety	Fertilizer rate	Seeding rate in pounds per acre								
		0.5			1.0			1.5		
		1970	1971	1972	1970	1971	1972	1970	1971	1972
Climax	Low*	503	464	343	493	397	336	604	445	350
	High**	432	458	415	492	425	312	558	492	445
Heidemij	Low*	545	447	212	579	440	240	574	438	163
	High**	630	484	360	659	538	538	702	466	456

* Fertilizer rate for 1970 crop was 50+25+25, for 1971 and 1972 60+30+30.
** Fertilizer rate for 1970 and 1972 crops was 100+50+50 and 1971 120+60+60.

This preliminary study suggests that a higher rate of fertilizer should be applied on older stands of Heidemij than on Climax. Heidemij matures about 18 days later than Climax and appears to produce more leaves and regrowth.

We are not sure that other varieties will respond to fertilizer as Climax and Heidemij have done. However, varieties like Bariton, Comet, Intenso, King and S-48 appear to have growth habits much like Heidemij. The maturity of Heidemij and

these pasture types is very similar. Growers may wish to consider a higher fertilizer rate on these types of varieties than normally applied to Climax.

We have presented these data for your consideration. We have a more complete study seeded on the Magnusson farm which includes four varieties of the Heidemij type and two of the Climax type. These are seeded at two rates, 0.5 pounds per acre in 18-inch rows, and 1.0 pound per acre in 6-inch rows, with three residue management regimes and we will apply three fertilizer rates. Data should be available during the winter of 1973-74.

Residue Management in Timothy Seed Production

The value of removing Kentucky bluegrass residue for improved seed production has been well demonstrated. However, the value of residue management in timothy seed production is less certain. The grower should understand, recognize and consider certain practical considerations associated with timothy residue management. It appears doubtful that adequate seed production and weed control can be maintained if all the residue from timothy seed crops is left on the field.

In 1967 we initiated studies of some problems associated with residue management in timothy. The four treatments were:

1. Check - loose straw removed, stubble and aftermath left on plot.
2. September-clip - plants mowed 1 1/2 inches high and all loose material raked from the plot.
3. September-burn - straw, stubble and aftermath burned in September.
4. April-burn - straw, stubble and aftermath burned in April.

These studies were continued for three crop years on the Skrutvold farm (Climax variety) and two years on the J. C. Ellenson farm (Heidemij variety). Climax normally matures about August 1st and Heidemij about two and one-half weeks later. Heidemij appears to have more leaves than Climax, hence possibly a more rapid residue buildup.

The yields reported here suggest some response to burning, but the differences are not highly significant statistically and are less striking than we have seen for Kentucky bluegrass.

Pounds of seed per acre from residue management studies in timothy fields.

Residue treatment	Fertilizer application	Skrutvold (Climax) (3 year average)	Ellenson (Heimedij) (2 year average)
Check	40+20+20	311	313
	80+40+40	381	436
	120+60+60	427	435
September-clip	40+20+20	310	258
	80+40+40	469	379
	120+60+60	497	543
September-burn	40+20+20	356	358
	80+40+40	490	488
	120+60+60	524	552
April-burn	40+20+20	305	286
	80+40+40	408	400
	120+60+60	450	508

We superimposed three fertilizer rates on the residue management treatments. The highest fertilizer rates gave the highest seed yields; however, the residue management by fertilizer rate interactions were not significant. (Note: Another study indicates that in older stands it is more critical that a high fertility level be maintained for Heidemij than for Climax.)

There are practical problems associated with the residue management. Some of these are not well understood, although we will discuss them. It would be impractical to leave unchopped and well-spread straw on the field and expect to harvest the following year. It would interfere with swathing, threshing and spraying for weed control. If the straw from the combine were finely chopped and well-spread, it might not interfere with harvesting the following year, but it would interfere with the application of herbicides for weed control. Also, it is not well understood how this would interfere with the production of the succeeding crops and insect control. The practical methods of residue management in northern Minnesota seem to be: (1) to rake off residue and use as livestock bedding, (2) burn the residue in the fall, or (3) burn the residue in the spring.

The effects of spring burning versus fall burning are not well understood as we have little data to support various suppositions. There have been suggestions from growers that the stand is more severely damaged by fall burning than spring burning. The basis for this may be that normally the soil is warmer and drier and permits a higher ground temperature and longer and more severe burning of plant crowns. Spring burning is normally done when the ground is cold, wet and more resistant to severe crown burning. When stands are to be spring burned, they should be burned as early as possible. In the fall, if the straw is well spread and held off the ground on the stubble permitting a more rapid burn with lower ground temperatures, there seems to be less danger of plant kill. However, our studies did not show a difference in yield nor a difference in stand after two or three years of burning.

Plant residue removal appears necessary for effective weed control with herbicides. The residue shields the small plants from the herbicide. Burning in the fall permits fall regrowth of the plants and possibly earlier seed production the following spring than when the material is spring burned.

Burning residue will control the meadow plant bug. However, injurious insects are not as serious on timothy as they are on bluegrass. Therefore, burning of timothy fields is not considered as necessary for control of insects.