1987
SEED PRODUCTION RESEARCH
AT OREGON STATE UNIVERSITY
USDA-ARS COOPERATING

Edited by Harold W. Youngberg

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INTRODUCTION

R.E. Welty and H.W. Youngberg

Several major staffing changes have occurred in the forage seed production research group on the OSU campus during the past year. The National Forage Seed Production Research Center has occupied the new building for about one year. A staff of four scientists, Dr. Ron Welty, Plant Pathologist; Dr. Jim Kamm, Entomologist; Dr. George Mueller Warrant, Weed Scientist, and Mr. Arnold Berlage, Agricultural Engineer, moved into the facility on January 6, 1987. They have been joined by Dr. Gary Banowetz, a Plant Physiologist/Microbiologist investigating plant hormone production during meristem development to learn more about how these substances control vernalization and differentation; Dr. Stephen C. Alderman, a Plant Pathologist studying factors relating to the development of epidemics of the blind seed and ergot diseases; and Mr. Donald B. Churchill, an Agricultural Engineer developing a decision-support system for forage seed conditioning.

Staff additions approved for 1988 included a Plant Physiologist to study nutrient transfer from site of manufacture and storage (roots, stems, leaves) into flowers and seeds. Recruitment is in progress for an Agronomist to investigate the agronomic factors affecting seed yield and yield components from forage legume species used in present forage legume systems, with emphasis on special-purpose forage legume species. A final position is for a Geneticist/Agronomist to address forage and turf grass seed production technology. These three positions will be filled as soon as possible; perhaps by July 1, 1988.

Staffing this facility is the culmination of cooperative efforts by a great number of people in federal and state governments, and by local, regional, and national industry groups. The present facility became a reality when Congress appropriated money in the fall of 1983 to prepare the plans and drawings for the building. In the fall of 1988, the process will be completed, and the ten research projects and the research facility will be fully staffed and operational. Significant changes have occurred during these past five years making this the largest program in the world dedicated to the single purpose of forage and turf grass seed production.

Dr. William C. Young, III was appointed to the position of Assistant Professor, Seed Production Physiology, in the Crop Science Department on November 1, 1987. Dr. Young will be responsible for seed production agronomy research and extension in grass and legume seed crops.

SEED CONDITIONING RESEARCH

A. G. Berlage, D. B. Churchill, T. M. Cooper, and D. M. Bilsland

Image Processing. Internal stress cracks caused by a combination of thermal, moisture, and mechanical stresses are difficult to identify in corn kernels. These very fine fissures in the kernal endosperm are about 53 μm in width and half the kernal thickness in depth. The present method of candling the kernels with a bright light source is time consuming and fatiguing.

A Machine Vision System (MVS) with various lighting configurations was used to analyze individual corn kernels. Front-lighting and side-lighting did not produce sufficient contrast to identify the internal stress cracks. A black background with a 2.4-mm hole for back-lighting of the kernel provided the best contrast when using white light. Double stress cracks were the easiest to detect with the light directed at the center of the kernel.

Single and multiple stress cracks were more difficult to detect because the position of the kernel over the light aperature was more critical. Image acquisition and processing were performed using a variety of processing algorithms available with the vision system. An image processing algorithm was developed to produce the effect of high-pass filtering and thus extract the pixels representing the stress cracks as streaks or lines. Stress cracks in 90% of the kernels examined were detected using the MVS.

Seed Separation. Gravity table, pneumatic, and magnetic seed separators were used to separate viable 'Wrangler' alfalfa seed from chalcid-infested seed. In tests using the gravity table, six density fractions were obtained for analysis. The three lightest fractions contained all of the infested seed and consisted of 42% of the sample by weight. Two tests using the magnetic separator were made using two quantities of magnetic fluid. This method failed to remove all infested seed with a 32% reduction in weight. The pneumatic separator was most efficient removing 99% of the total chalcids while recovering 79% of the germinable seed.

SOIL PESTS OF GRASS SEEDLINGS

J.A. Kamm

In the Willamette Valley of Oregon, fall seedings of various grasses often appear stunted or fail to become a vigorous stand. A variety of soil arthropods occur in the root zone, some of which are known pests while others are beneficial in recycling old plant residues. Affected seedlings have fewer roots or in some cases seedlings are damaged slightly below the soil surface. Close inspection of the root zone may or may not reveal the pest responsible for damage to the seedlings. Springtails, March flies, wireworms, symphylids, and slugs are common in Willamette Valley soils. The latter three pests are known to destroy seedlings. Springtails and March flies are often present in large numbers when soils are high in organic matter and play a valuable role in the decomposition of dead and decaying plant residues. During 1977-79 and 1985-86, enormous numbers of March fly *Bibio xanthopus* (Wiedemann), were present in new fall seedings of various grasses. In an effort to obtain information useful in dealing with infestations in commercial fields, observations of March flies were made during and between these outbreaks. Also, laboratory studies were conducted to assess the potential of larvae to damaged seedlings.

Adult flies begin to emerge in late March and continue through April. Both males and females are attracted to blooming trees and shrubs, including willow. Flies mate close to the blooming tree, and the males die soon after. The bodies of dead males often litter the ground near the trees where they fed on blossoms. After mating, females fly off in search of a suitable site to lay eggs. They dig a hole 1-4 in. in depth and deposit all of their eggs (150-200 eggs) at the bottom of the hole. The eggs hatch in the spring. The subsequent larvae are gregarious and tend to aggregate in a ball during the early instars. Larvae feed very little during summer and are believed to aestivate until the advent of cool temperatures and fall rains.

In a laboratory feeding trial, culture dishes (2 by 5 in. diam.) were provisioned with moist peat moss to obtain the following treatments: 1) peat moss infested with 25 larvae per dish, 2) peat moss infested with 25 larvae and seeded to annual ryegrass, 3) peat moss seeded with ryegrass but no larvae. One month later, larvae were active and growing in all treatments, including the treatment with only peat moss. The growth of ryegrass seedlings was identical in treatments with or without March fly larvae. No feeding injury was evident to either roots or shoots of the ryegrass. Larvae in all treatments pupated and emerged as adults. No feeding damage to the ryegrass seedlings of any kind was found during this test. Thus larvae clearly utilize dead organic matter as food. When larvae are abundant during outbreak years, they may inadvertently damage small seedlings as they work their way through the soil or possibly when dead organic matter is in short supply. Control of this insect is of questionable value in most situations.

A few March fly larvae can be found in fields between outbreaks, and often thin stands can be found where no March flies are present. After fall rains begin, soils have numerous passageways made by furrowing March flies and earthworms or from decomposition of straw, roots, or other organic matter. These passageways permit symphylids, wireworms, and false wireworms to move freely up and down in the soil profile. These pests spend a substantial amount of time below the plow zone and can be found only when they move up into the root zone to feed. During dry or cold weather, they move down in the soil profile and may not feed for long periods of time. Many soils have a high water table that restricts their movement in the soil. Well-drained soils, ridges, or high spots in the field are preferred sites. Seedling stand and vigor in chronically thin stands can be improved by application of insecticide at the time of seeding.

DISEASE CONTROL RESEARCH

R.E. Welty

Leafspot and headblight diseases of grass crops grown for seed were less severe in 1987 than in other years (1984-1986); rust diseases were generally more severe than previous years. Stem rust of tall fescue was found in many growers fields in 1987; some fields were severely infected. The distribution of stripe rust in orchardgrass continues to be sporadic and was severe in some fields. This changing pattern of disease was attributed to higher-than-normal average temperatures (F) for March (+2.5), April (+3.8), May (+3.5), and June (+3.1); and lower-than-normal rainfall (inches) in March (-0.93), April (-0.90), May (-0.52), and June (-0.91).

Orchardgrass (Hallmark and Potomac), previously established at the Hyslop Field Lab and Botany and Plant Pathology Field Lab, were sprayed with 1-3 applications of Bravo (3 pt/a) or Tilt (8 oz/a) alone, or in combination (Bravo 2 pt/a and Tilt 4 oz/a). No fungicide treatment resulted in a significant increase in seed yield or a significant reduction in disease; seed yields from treated plots were 98 to 114% of the nontreated control. 'Pennlate' orchardgrass was sprayed 1-3 times with Tilt (8 oz/a), Bayleton (8 oz/a), or Folicure (24 oz/a) to control stripe rust. No significant yield increases were found; fungicide-treated plots yielded 85-116% as much as the nontreated controls.

Tall fescue (Fawn) was sprayed with 4 applications of a single fungicide to control leaf diseases and increase seed yields (Hyslop Field Lab). Fungicides tested included Benlate (1 lb), Bravo (3 pt), Difolatan (1.5 lb), Folicure (24 oz), Mertect (20 oz), Rovral (1 lb), and Tilt (8 oz) rates per acre, respectively. None of the fungicides tested resulted in a significant increase in seed yield. Leafspots from 100 plants were studied in the laboratory, and pure cultures of several pathogens were obtained. Research will be conducted this winter in the greenhouse to evaluate their importance.

Perennial ryegrass was sprayed with one of six fungicides (Tilt, Bayleton, Folicure, Sisthane, Bravo, and Nustar) at lowest and highest rates recommended on the label. Compared with the nonsprayed control, all fungicides increased average plot yields from +19% to +39% at the lowest rate and +11 % to +46% at the highest rate. Yields from these small plots (5 foot by 8 foot) were not statistically larger than the nonsprayed control. Lack of significant difference in yield was attributed to variation within the plots due to heavy weed infestations. A new planting was established for the 1988 fungicide trials.

In 1987, seed was harvested from tall fescue plantings of endophyte-free 'Forager' and endophyte-infected G1-307 at the Hyslop Field Lab, Corvallis, and at the Columbia Basin Agricultural Research Center, Pendleton. Representative seed samples were examined for endophyte by seed stain. Through four years of testing, seeds of Forager continue to be free of endophyte infection, and seeds of G1-307 continue to be heavily infected (Corvallis 82% and Pendleton 81%). Half of the G1-307 plants at Corvallis were burned in the fall of 1986, the others were not burned. Endophyte-infected seeds from burned plants totaled 94% (187 of 200 seeds examined); endophyte-infected seeds from nonburned plants totaled 82% (164 of 200 seeds examined). This is the second year in which burning did not influence level of endophyte-infected seeds harvested from endophyte-infected plants. Two studies were established at Pendleton to determine if: 1) endophyte-free plants of G1-307 would become infected when planted 12 inches from an endophyte-infected G1-307 plant, and 2) if endophyte-free Forager plants would become infected when planted 12 inches from an endophyte-infected Forager plant. Seeds were examined by seed stain; no transmission of endophyte from endophyte-infected plants to endophyte free plants occurred.

Tests for 1988 will include applying fungicides to control leafspots, stem blights, ergot, and rust diseases. Hosts will include orchardgrass, tall fescue, perennial ryegrass, and Kentucky bluegrass.

Acknowledgement: The technical expertise and assistance of Mark Azevedo, Kathy Cook, Tom Garbacik, Shannon Houston, Lisa Nelms, Laird Nicholson, and Peter Ryan to execute and complete these field experiments in 1987 is gratefully acknowledged.

CONTROL OF ROUGHSTALK BLUEGRASS IN PERENNIAL RYEGRASS

G. W. Mueller-Warrant

Roughstalk bluegrass (*Poa trivialis*) has become a serious concern to growers of perennial ryegrass in the Willamette valley. This weed has the potential to rapidly increase in abundance from one year to the next, quickly forcing a ryegrass stand out of production. Previously reported research not only documented the relative ineffectiveness of many commonly used herbicides against this weed, but also uncovered several possible candidate herbicides for selective control of this weed in perennial ryegrass. Additional testing of these promising herbicides has led to the registration of one of them (Horizon 1EC or fenoxaprop) for use in Oregon.

Fenoxaprop was tested at rates of 0.125, 0.25 and 0.375 pounds a.i. per acre in five field tests during the 1986-87 growing season, using application dates ranging from Nov. 6 to April 24. All tests were conducted in actual stands of perennial ryegrass infested with roughstalk bluegrass. One of the sites was abandoned due to extremely high weed pressure from rattail fescue (*Vulpia myuros*), which masked any problems due to roughstalk bluegrass. Roughstalk bluegrass control was rated at all remaining sites, and ryegrass seed yield was measured at three of them. Seed yield was not measured at the most severely infested site, due to the very erratic nature of the ryegrass stand, but it was obvious that competition between crop and weeds was extreme, and very little ryegrass seed was produced in untreated plots.

Table 1. Response of roughstalk bluegrass and perennial ryegrass to herbicides applied in the fall and spring at three locations in western Oregon.

Herbicide	Treatment[1] Rate	Date	Roughstalk bluegrass control 10[2]	12	13	Ryegrass injury 10	12	13	Ryegrass seed yield 10	13
	(lb/a)		(%)						(lb/a)	
Untreated			0	0	0	0	0	0	709	1171
Simazine	2.0	9/29-10/2	25	0	0	0	0	0	690	1022
Atrazine	1.2	9/29-10/2	--	0	0	--	0	0	--	1005
Cinch	0.5	9/29-10/2	10	11	53	0	0	0	716	1235
Fenoxaprop	0.125	11/6	35	28	0	0	0	0	707	822
Fenoxaprop	0.125	2/24-26	83	76	98	10	0	0	863	1133
Fenoxaprop	0.125	3/24	86	76	98	20	2	0	690	1231
Fenoxaprop	0.125	4/24	83	89	82	17	3	3	756	889
Fenoxaprop	0.125	3/24	86	76	98	20	2	0	690	1231
Fenoxaprop	0.25	3/24	94	90	100	25	4	0	692	1258
Fenoxaprop	0.375	3/24	94	96	100	34	8	0	669	1185
Dalapon	1.0	3/24	67	61	75	13	10	3	873	1154
Dalapon	1.5	3/24	88	86	89	43	26	7	680	1247
Dalapon	2.0	3/24	98	89	96	42	41	8	688	1086
LSD 0.05			16	15	11	11	7	5	178	212

[1]Applications of fenoxaprop and dalapon in the spring were made to plots which had previously received 1.2 lb/a of atrazine or 1.0 lb/a of Nortron in the fall.
[2]Site number

In 1987, the optimum time to apply fenoxaprop appeared to be around March 1. When it was applied on February 24, some of the roughstalk bluegrass was able to recover from injury in time to head out and make a little seed before harvest. Plots treated with fenoxaprop in February reached a peak in visual weed control ratings in early May, and then declined slightly in control as time progressed on through the month. March 24 application gave good roughstalk control at all rates tested, but ryegrass growth was slightly restricted compared to plots which received only standard herbicides such as simazine, atrazine, and Nortron in the fall. This injury was especially noticeable at higher herbicide rates and at the site which had received less nitrogen fertilizer. April 24 application was too late to prevent seed production by the roughstalk bluegrass. Late fall application failed to seriously inhibit the growth of the weed.

Recommended program for perennial ryegrass production in fields containing roughstalk bluegrass would include open field burning to kill weed seeds, use of highly effective, fall-applied, soil-residual herbicides to control most of the seedlings, fertilizing with fairly high rates of nitrogen to produce a vigorously growing crop, and application of fenoxaprop in late winter to early spring at rates of 0.125 to 0.25 lb/a. Application timing should be based on return of good spring growing conditions acting to break winter dormancy of the grasses, looking for ryegrass to be between 3 to 6 inches in height. Applications made to ryegrass beyond 6 inches in height may be associated with stunting of the crop and leaf abnormalities (fusion of one immature leaf to another). Fenoxaprop should be applied between the dates of Feb. 20 and April 1, treating in the first half of that time period during years with unusually good winter growing conditions and in the second half of the period during more normal years with substantial winter dormancy of the grasses. Use of simazine or Cinch gave partial control of roughstalk bluegrass, controlling only seedlings and not old, well established plants.

SPRING ESTABLISHMENT OF ORCHARDGRASS AND TALL FESCUE SEED CROPS WITH CEREAL COMPANION CROPS

T.G. Chastain and D.F. Grabe

Orchardgrass and tall fescue seed crops are commonly spring-planted in Oregon, but do not produce a marketable crop during the first growing season. Establishing orchardgrass and tall fescue with cereal companion crops would provide income during the seeding year and could increase seed production profits. This study was conducted to evaluate the feasibility of establishing orchardgrass and tall fescue seed crops with spring wheat, barley, and oats, and to examine the morphological, physiological, seed yield, and economic responses to competition with cereals. 'Hallmark' orchardgrass and 'Bonanza' tall fescue were interplanted with 'Waverly' wheat, 'Steptoe' barley, and 'Cayuse' oats in 6- and 12-inch rows at right angles to grass rows in March 1985 and 1986 near Corvallis, OR.

Spring cereals reduced the light available for grass seedling growth, causing temporary increases in chlorophyll content and lower soil temperatures. Soil water content was also depleted, causing increased moisture stress on the grass plants. Reductions in light and soil water were responsible for poor stand establishment and grass crop growth. The negative effects on seedling establishment persisted after cereal harvest and delayed grass regrowth until the following spring, resulting in low fertile tiller populations. Consequently, first-year orchardgrass seed yields were reduced by 40 and 53% in the two trials, whereas first-year tall fescue seed yields were reduced by 61% in both trials. First-year seed yields were reduced to the same extent by all three cereals. Second-year orchardgrass seed yield was not influenced by companion cropping, but second-year tall fescue yield increased by 15%. Cereal row spacing had no effect on grass seed crop growth, physiology, or seed yield.

Although seed yields were reduced, seeding orchardgrass with spring wheat in 12-inch rows increased net income by $85 per acre over a 3-year period under average crop market conditions. Tall fescue planted with spring oats in 12-inch rows earned $56 per acre more than planting alone. Drier than normal conditions increased the competitive effects of cereals, reducing first-year seed yields and economic return.

Although these results were successful, previous studies with red fescue lead us to expect still more favorable returns from companion cropping by establishing in the fall and/or providing irrigation.

PERFORMANCE OF YIELD-ENHANCING AGENTS IN WINTER WHEAT

D.F. Grabe, F.E. Bolton and C. Garbacik

Yield trials were conducted for the second year to determine response to several compounds purported to have yield enchancing effects on winter wheat. The products tested included YEA!, containing chitosan, a derivative of crabshell; amplify-D, containing sodium phosphates and adenosine monophosphate; Cardak, containing super slurper, a starch derivative; and Golden X, containing *Aspergillus oryzae* in a carrier of sand washings. Another treatment consisted of passing the seed through a Bio-Mag magnetic seed treater. Controls consisted of untreated seed and seed treated with Vitavax 200.

The products were applied to Vitavax-treated seed at rates recommended by the suppliers. Three wheat varieties were used -- 'Hill 81', 'Malcolm', and 'Stephens'. Plots were established at Hyslop Farm, near Corvallis, and the Columbia Basin Agricultural Research Center, near Moro. The experimental design was a randomized complete block with four replications.

Yields at Moro were about the same as in 1986, but yields at Corvallis were much lower than last year due to moisture stress. None of the products increased wheat yields at either location (Table 1), confirming the similar findings of 1986.

The yield trials were re-established in the fall of 1987. In addition, the effects of seed moisturizing on wheat yields will be studied. Commercial moisturizing equipment has been developed in Canada and is being promoted as a way of increasing crop yields. The seed moisturizing process involves soaking seed in water under vacuum before planting.

Table 1. Yields of winter wheat treated with yield-enhancing agents, 1987.

Seed treatment	Corvallis				Moro			
	Stephens	Hill-81	Malcolm	Average	Stephens	Hill-81	Malcolm	Average
	(lb/a)							
YEA!	4259	4598	4427	4428	2083	2475	2313	2291
Cardak	4685	4245	4427	4452	2103	2427	2203	2242
Amplify	4453	4367	4451	4557	2224	2325	2260	2269
Golden-X	4466	4642	4575	4561	1820	2476	2485	2260
Bio-Mag	4623	4748	4274	4548	2155	2351	2404	2303
Vitavax-200	4392	4193	4533	4373	1999	2391	2306	2232
Untreated	4730	4669	4351	4583	2057	2479	2483	2340
Average	4572	4495	4434		2063	2417	2350	
LSD 0.05				NS				NS

MEADOWFOAM SEED MATURITY AND TIME OF HARVEST

S. Currans and D.F. Grabe

Development and maturation of meadowfoam seed was studied for the second year. Such information will aid in determining the earliest harvest date to obtain maximum yield with minimum shattering.

A bulk planting of 'Mermaid' meadowfoam was made at Hyslop Farm in October, 1986. The unusually warm and dry spring of 1987 hastened plant development so that peak flowering occurred on May 8, 1987, 17 days earlier than in 1986. Beginning May 15, developing seeds were hand-harvested at two-day intervals for 20 days and daily thereafter until the seeds were dry. At each harvest, determinations were made of 1000-seed weight, seed moisture, flower head moisture, and seed oil content.

Since meadowfoam flowers over a several-day period, all the seeds do not mature at the same time and it is difficult to determine a precise date when the seeds have first reached maturity. (Maturity is defined as the stage when seeds have obtained their maximum dry weight and oil content.) However, the overall pattern of development was as follows: Moisture content declined at a rate of 1.4% per day from 7 to 35 days after peak flow-

Table 1. Seed development and maturation of Mermaid meadowfoam in 1987.

Date		Days after peak flowering	1000-seed weight	Seed oil content	Seed moisture content	Flower head moisture content
			(g)	(%)		
May	15	7	1.6	1.4	81.9	85.7
	17	9	2.1	3.0	78.5	79.3
	19	11	2.2	2.5	78.8	80.0
	21	13	2.7	5.5	78.3	78.6
	23	15	3.4	10.6	74.9	75.7
	25	17	3.7	12.1	74.4	77.4
	27	19	4.2	15.4	73.1	74.3
	29	21	4.4	16.9	70.1	72.9
	31	23	5.7	19.2	74.4	84.3
June	2	25	5.4	23.8	66.2	69.9
	4	27	6.0	24.8	62.4	68.1
	5	28	6.0	25.0	62.7	68.7
	6	29	6.2	27.2	63.7	66.6
	7	30	6.3	27.8	60.3	66.3
	8	31	6.3	26.8	55.6	59.8
	9	32	6.8	29.6	49.7	57.6
	10	33	6.9	29.1	47.2	52.8
	11	34	6.8	28.0	43.8	48.5
	12	35	6.9	29.7	41.7	43.5
	13	36	7.1	29.1	34.8	36.7
	14	37	7.0	28.7	33.1	38.3
	15	38	7.4	30.5	29.1	27.7
	16	39	7.1	29.7	20.4	27.1
	17	40	7.1	29.5	17.8	20.2
	18	41	7.2	29.6	13.5	16.9
LSD 0.01			0.8	3.5	7.2	7.1
CV (%)			7.0	7.5	5.9	5.5

ering. Moisture loss accelerated to 4.7% per day during the following 6 days. This marked increase in rate of moisture loss occurred after the seeds reached 42% moisture and is typical of other crop seeds after they have reached maturity. At that stage, the seeds had reached their maximum dry weight of 7 grams per thousand seeds, and maximum oil content of 29.7% (Table 1). These results coincide with those obtained in 1986 and it is concluded that seed maturity in meadowfoam is attained at the time seed moisture has declined to 42%.

Seed maturity was attained 35 days after peak flowering in 1987 and in 26 days in 1986. Moisture content at maturity was 42% in both years, indicating that moisture content is a better index of seed maturity than is the number of days after flowering or the calendar date. Determining moisture content of immature seeds is a slow and tedious process, however. Moisture content of the entire flower head closely paralleled that of the individual seeds, but at a slightly higher level, reaching 44% at seed maturity. Flower head moisture can therefore also be utilized as an alternate index of seed maturity.

Little shattering had occurred at the time seeds reached maturity. The stems were still green and pliable, suggesting that windrowing at this time would produce maximum yield and minimum shattering.

Plots were windrowed at near-daily intervals from June 9 to June 17, during which time the seed moisture content declined from 50 to 18%. Plot yields were somewhat erratic due to difficulty in obtaining uniform windrows in small plots. Highest yields without excessive shattering occurred when plots were windrowed at 42% moisture, confirming the results of the maturity study.

EFFECTS OF THE TIMING OF NITROGEN APPLICATIONS ON KENTUCKY BLUEGRASS

John A. Yungen

Growers of Kentucky bluegrass in southern Oregon usually apply nitrogen fertilizers in the fall, mid-winter, and early spring. An adequate, but not excessive amount of N in the fall benefits the floral induction process. This report summarizes the effects of four split N treatments on Kentucky bluegrass grown for seed.

The stand was established by planting sprigs at a row spacing of 40 inches in March of 1986. The first nitrogen variables were broadcast in a 20-inch wide band over the rows November 25 while the bluegrass was still growing and developing new tillers. The rates were 30, 60, 120, and 150 pounds per acre, applied as ammonium sulfate.

Winter treatments were applied January 22, again as ammonium sulfate. Rates were 150, 120, 60, and 30 pounds of N per acre to the respective fall-treated plots to provide a total of 180 pounds per acre for the season. Irrigation was done with overhead sprinklers. The bluegrass was swathed June 11, and combining was done June 20.

There was considerable lodging when the bluegrass approached maturity, but it did not appear to be related to the timing of N applications. Seed yields were moderately low, ranging from 261 to 380 pounds per acre with a mean of 310 pounds. Seed yields were increased more by the high rates of N applied in January than by the same rates applied in November and only 30 N was applied in January (Table 1).

Test weights were not greatly affected by the timing of N applications. Each value was close to the mean of 25.5 pounds per bushel.

From the data, applying the major amount of N in January was more effective in increasing seed yield under southern Oregon conditions than applying it in November. Test weights were satisfactory for each of the split N treatments.

Table 1. The effects of N application timing upon the yield and test weight of 'Scenic' Kentucky bluegrass at Medford, 1986-87.

N applied, lb/a		Seed Yield	Test Weight
Nov. 25	Jan. 22	(lb/a)	(lb/bu)
30	150	380	26.2
60	120	304	24.9
120	60	294	25.9
150	30	261	25.0
Mean		310	25.5
LSD 0.05		59	N.S.
C.V. (%)		6.0	3.3

EFFECTS OF XE-1019 PGR ON KENLAND RED CLOVER GROWN FOR SEED PRODUCTION

T.B. Silberstein, H.W.Youngberg, and W.C. Young, III

Red clover grown for seed under western Oregon conditions often makes excessive growth and is difficult to harvest during late summer season conditions. Reducing vegetation volume with plant growth retardants would improve harvest conditions and possibly improve seed recovery. Preliminary studies in Oregon have indicated benefits from the use of growth retardants on red clover.

This is the second year of a two year study to evaluate the effects of two plant growth retardants on plant growth and seed yield on red clover grown for seed. 'Kenland' red clover was fall planted September 1986. The plots were flail chopped and residue removed to simulate hay cutting on May 22, 1987. Growth retardant treatments included soil and foliar applications of XE-1019 and Parlay.

Soil applications: Treatments using 50 WP were made early in the regrowth period (14 days after hay cut). Rates of application ranged from 0.125 to 2.0 lb a.i./a. Soil application was followed by a two-inch irrigation to diffuse the chemical into the root zone.

Canopy height in the first two months after treatment was significantly reduced by increasing rates of soil applied XE-1019. At harvest (August 28) canopy height was not significantly different yet three weeks earlier (August 7) there were significant differences in the XE-1019 treatments. The height compensation in the later growth stage appeared to be from increased etiolation of the flowering stem in the higher treatment rates. The etiolation was reflected in total dry matter which was significantly reduced by all but the lowest rate of XE-1019 and moderate rates of Parlay (0.5 to 1.5 lb a.i./a). As the rate of XE-1019 was increased, the total dry matter decreased significantly. Seed yield was not significantly different from the check for any treatment.

Foliar applications using 1.0 EC for XE-1019 and 50 WP (with sticker) for Parlay were split into two applications. Applications were made at canopy closure and early bloom stage, June 17 and July 10, respectively.

Though dry matter and seed yields were much lower than 1986 due to lack of moisture, the responses to the treatments were similar for the soil applied chemicals. No treatment response was noted from foliar applied treatments in canopy height or seed yield. This may be due to the dry season restricting plant growth and forcing early flowering. Bloom occurred approximately 3 weeks earlier in 1987 than in 1986.

MINIMUM TILLAGE SYSTEMS FOR CHANGING VARIETIES IN SEED PRODUCTION

W.C. Young III and H.W. Youngberg

Two studies were initiated in the fall of 1985 to evaluate certified grass seed crop establishment under minimum tillage systems. The first trial is investigating the effectiveness of a one- and two-year red clover crop, established in perennial ryegrass sod prior to rotating to the production of a perennial ryegrass seed crop of another variety. The second study compares the effectiveness of a one-year rotation to meadowfoam, and a meadowfoam/spring pea rotation (two-year) before changing to a perennial ryegrass seed crop of another variety. Both studies are evaluating the planting of the rotation crops in burned and non-burned stubble. Methods of establishment for each study have previously been reported (Dept. of Crop Sci., Ext/CrS 68, 4/87).

Both red clover and meadowfoam were successfully established in perennial ryegrass using minimum tillage. Competition and contamination from the previous crop appeared to have been eliminated by timely use of available herbicides. Red clover seeded into burned stubble established more rapidly and had greater hay yield. However, regrowth following haying and seed yield were greater in plots which were unburned at planting. Meadowfoam rapidly established across both burned and non-burned treatments with very little difference in vegetative growth, although seed yield was significantly greater where the perennial ryegrass was burned before planting.

On September 19, 1986, a tetraploid perennial ryegrass variety was seeded into one half of both the red clover stand and the meadowfoam stubble. Meadowfoam stubble not seeded to tetraploid perennial ryegrass was seeded with a high-protein spring pea in February, 1987. Second year red clover, spring pea, and tetraploid perennial ryegrass seed yields following both rotations are reported. In addition, this report summarizes the impact of non-burning on the subsequent crop purity and the acceptability of these systems to meet the standards of the Oregon Seed Certification Service.

Second Year Red Clover

The red clover stand, established in the fall of 1985, regrew vigorously during the fall of 1986. There was no visual difference between the burned or flail-chopped treatments present at the time of establishment. The stand received two applications of 0.3 lb a.i./a MCPA on October 1 and 22, 1986 for the control of broadleaf weeds. Two additional herbicide applications were made for the control of broadleaf and grass weeds during the winter, a tank mix of Paraquat plus Karmex 80W and Kerb 50W in February. Excellent weed control was apparent during the late-winter months.

Hay yield estimates were collected prior to flail-chopping on May 22, 1987, to simulate the harvest of a hay crop. There was no significant difference in hay yield between the two previous post-harvest treatments.

The red clover stand began to regrow uniformly following removal of a hay crop, however, the extremely dry June considerably reduced the subsequent plant growth. The crop regrowth was less than optimum when plants began to bloom in early July. All plots were harvested on August 20. Seed yield was very low, as the only rain in August was too late to significantly benefit seed filling, and no significant difference between treatments were observed.

Spring Peas

In order to provide for a two-year rotation cycle, the remaining half of the meadowfoam stubble was maintained in a fallow condition through the summer, fall, and early-winter prior to planting 'Miranda' spring peas. The area was sprayed on October 22, 1986 with a tank mix of 2,4-D Lo-Vol plus dicamba to remove volunteer meadowfoam seedlings and any other broadleaf weeds present. Another application was made using a tank mix of 2,4-D Lo-Vol plus dicamba to remove the second flush of volunteer meadowfoam seedlings and any other broadleaf weeds present on February 5, 1987. In addition, an application of Roundup^R herbicide was applied on February 6, 1987, for control of grass weeds and any remaining traces of the previous perennial ryegrass crop.

A preplant fertilizer application of 300 lb/a 10-20-20 was applied and Miranda spring peas were seeded using the John Deere Powr-Till^R (minimum tillage) drill on February 26, 1987. Spring seeded peas are best established in a loose, well prepared seedbed; thus, their establishment under minimum tillage conditions was less than ideal. By April 1, 1987, the peas were well established, although, in our opinion the stand was thin. However, there was no difference in stand density due to previous post-harvest residue management.

The peas were attacked by slugs, and the pea leaf weevil (*Sitona lineata*). SlugGeta^R and Pydrin^R were used to control these pests. Pydrin^R was applied during late-bloom to protect the developing pods from the pea weevil (*Bruchus pisorum*).

Weather also adversely affected the peas as February, March, April, May and June were all drier than normal months. By late-May the peas were 6-8 inches tall and beginning to fill pods. The Miranda spring peas reached a maximum height of only 10-12 inches in early June. The stand continued to appear quite thin, with very little branching on the main stems. By mid-June the leaves began to senesce, and very little green was apparent by the end of the month.

On June 30, 1987, plots were hand harvested, threshed, cleaned and weighed for determination of seed yield estimates. No significant difference was observed in seed yield or mean seed weight.

Tetraploid Perennial Ryegrass

A tetraploid perennial ryegrass variety was selected and seeded into both the red clover and meadowfoam stubble. On September 19, 1986, 7.5 lb/a of tetraploid perennial ryegrass was seeded using the John Deere Powr-Till^R drill. A fertilizer application of 185 lb/a 16-20-0 was made on October 14, 1986. The herbicides dicamba and 2,4-D Lo-Vol ester were applied on October 22, 1986, to selectively kill either the red clover stand or volunteer meadowfoam in the areas seeded to perennial ryegrass.

Spring management included a tank mix application of 2,4-D Lo-Vol plus dicamba herbicides on February 5, 1987, and on February 20, 1987, 300 lb/a of 40-0-0-6(S) fertilizer was applied. On March 12, 1987, a standard seedling inspection was made by the Oregon Seed Certification Project to evaluate the stand for the presence of off-types and seedlings outside of the drill row. The actual number of seedlings were counted between April 2-4, 1987, to determine the affect of previous residue management.

Two applications of Tilt[R] fungicide were made for rust (*Puccinia* spp.) control on May 19, 1987, and June 5, 1987. All plots were harvested at about 35% moisture content on June 30, 1987. Plant material was threshed, seed cleaned, weighed, and subsampled for determination of the occurrence of diploid perennial ryegrass contaminates via the ploidy test by the OSU Seed Laboratory.

Soil moisture at planting and the rainfall that followed was adequate for rapid germination. The seedling ryegrass crop came under increasing light competition as the red clover stubble also began to regrow. However, the herbicide application made four weeks after seeding effectively eliminated any subsequent effect on the perennial ryegrass stand. By late December 1986, almost no trace of the previous red clover crop could be found and an excellent perennial ryegrass crop was established. Volunteer meadowfoam seedlings in the meadowfoam/perennial ryegrass rotation were not as competitive as red clover stubble. Furthermore, no difference was observed between treatments which were burned or flail-chopped prior to establishment of either the previous red clover or meadowfoam crop.

During the late-winter, many ryegrass seedlings were observed between the drill rows. These could be from the planting units on the minimum tillage drill or from volunteer seed remaining from the previous seed crop. The source of the contaminants could be determined by the ploidy of the seed produced. Spilled seed would be tetraploid while volunteer contaminants would be diploid.

The mean number of seedlings were recorded for treatments which were burned or flail chopped prior to establishment of the previous red clover crop and the previous meadowfoam crop (Table 1). Significantly fewer ryegrass seedlings were found outside the drill row in plots where the previous perennial ryegrass stubble had been burned. This suggests that post-harvest burning had a beneficial affect on the current crop, measured after a one year rotation to red clover or meadowfoam. However, the experimental sites would not have passed the standard seedling inspection made by the Oregon Seed Certification Service in March, 1987, due to an excessive number of seedling present outside of the drill row.

It is not possible to distinguish between diploid and tetraploid seedlings by morphological characteristics, therefore, commercial fields in this situation are usually given a conditional pass subject to a ploidy test of the seed crop after harvest. There was, however, no significant difference in the percentage of diploid contaminants in the harvested seed lots due to post-harvest management (Table 1). These ploidy test results are well above the 2% level of diploid contamination allowed by Oregon Seed Certification standards in a tetraploid ryegrass seed lot.

Table 1. Inter-row spring seedlings counts and ploidy test results in the tetraploid perennial ryegrass crop of the perennial ryegrass/red clover and ryegrass/meadowfoam minimum tillage rotation study, 1987.

Treatment	Seedlings[1]	Tetraploid	Diploid
		------- (%)	--------
Perennial ryegrass/red clover			
Burn	32	91	11
Flail-chop	77	87	13
LSD 0.05	18	NS	NS
Perennial ryegrass/meadowfoam			
Burn	35	93	7
Flail-chop	55	91	9
LSD 0.05	12	NS	NS

[1]Number of seedings in 16 ft^2

There was no difference in total dry weight (straw production) at final harvest, and only a slight difference in seed yield in plots where the previous ryegrass crop stubble had been burned prior to seeding red clover. This difference in seed yield appears to result from a significantly greater 1000 seed weight (Table 2).

Table 2. Total dry weight, seed yield and 1000 seed weight in the tetraploid perennial ryegrass crop of the perennial ryegrass/red clover minimum tillage rotation study, 1987.

Treatment	Total Dry Weight	Seed Yield	1000 Seed Weight
	(ton/a)	(lb/a)	(g)
Burn	3.7	738	3.40
Flail-chop	3.8	607	3.08
LSD 0.05	NS	NS[1]	0.27

[1] P-value = 0.11

Almost identical perennial ryegrass data was collected following a one-year rotation to meadowfoam.

Summary
The tetraploid perennial ryegrass variety was successfully established in either red clover or meadowfoam stubble using minimum tillage techniques following a one-year rotation between a previous perennial ryegrass diploid variety. However, seedling counts of ryegrass plants outside the drill row and an excessive percentage of diploid seeds in the harvested crop will not support proposing any change in the present production practices required under the certification program or the commercial viability of a one-year rotation between perennial grass species. In addition, differences in diploid ryegrass contamination between the one-year rotation crop of red clover or meadowfoam as the intermediate crop were not apparent.

Although the seed yield of the second year rotation crops was disappointing, the opportunity to achieve some yield while managing a cropping system for a two-year rotation between perennial ryegrass crops is the primary research objective. Managing both rotation sequences through the second year crop before returning to another variety of perennial ryegrass will allow us to test the primary practical production program determined by the yield and level of contamination at the end of a two-year rotation out of ryegrass.

On September 19, 1987 the same tetraploid perennial ryegrass variety as used in 1986 was seeded into the remaining half of the second year red clover stubble and the spring seeded pea stubble to study effects of the second ryegrass crop in the two-year rotation. Cooperation with the OSU Seed Certification Project in this research is continuing.

Acknowledgement: The cooperation of Oscar Gutbrod of the OSU Seed Certification Service in this research is recognized.

EVALUATION OF PARLAY RESIDUAL EFFECTS IN GRASS SEED PRODUCTION

W.C. Young III and H.W. Youngberg

Residual activity of Parlay growth retardant in 'Hallmark' orchardgrass, 'Falcon' tall fescue, and 'Cascade' fine fescue was investigated in 1987. Research plots that had been treated with Parlay at three rates in the spring of 1985 and 1986 were evaluated for plant height, yield component data and seed yield in 1987. A control plot, which had no growth retardant applied during the two year study, was used as the standard. Growth retardant was applied at the floret initiation growth stage in both years at 0.22, 0.45 and 0.67 lb a.i./a. All plots received standard herbicide and fertilizer applications.

Visual evidence of Parlay residue in previously treated plots was noted during the spring months of 1987 in orchardgrass. Reduced plant height during the stem elongation (jointing) growth stage was also noted and this effect remained through maturity (Table 1). No restriction in growth was observed for tall or fine fescue, although, the combined weight of the seed and straw at harvest was significantly reduced in both orchardgrass and fine fescue at the highest treatment rate (Table 1). However, seed yield was not affected in the species evaluated. Fertile tiller number was significantly reduced in orchardgrass, however, increased 1000 seed weight may have compensated for fewer tillers (Table 1). The treatments appeared to have the least effect on tall fescue.

Minimum residual effect on seed yield was noted in the 1986-87 crop year following treatment with Parlay during the 1984-85 and 1985-86 crop years under environmental and soil conditions at the OSU Hyslop Crop Science Field Laboratory. Response on other soil types or environmental conditions may differ. Growth response due to soil residue in more sensitive crops could be larger than observed with grass seed crops.

Table 1. The influence of previous growth retardant treatment on selected components of three grass species, 1987.

Rate of Parlay Treatment in 1985 and 1986	Harvest Dry Weight	Seed Weight	1000 Seed Weight	Fertile Tiller Number	Total Tiller Length
(lb a.i./a)	(ton/a)	(lb/a)	(g)	(per ft^2)	(cm)
Hallmark Orchardgrass					
Control	2.5	874	1.09	73	128
0.22	2.5	1007	1.17	61	110
0.45	2.2	918	1.17	42	99
0.67	1.6	815	1.13	51	105
LSD 0.05	0.5	NS	0.48	22	NS[1]
Falcon Tall Fescue					
Control	2.1	624	2.32	30	121
0.22	2.0	714	2.33	37	122
0.45	2.2	799	2.34	32	123
0.67	1.7	711	2.32	37	113
LSD 0.05	NS	NS	NS	NS	NS
Cascade Fine Fescue					
Control	2.8	799	1.10	199	88
0.22	3.0	943	1.14	144	75
0.45	2.4	919	1.14	229	71
0.67	2.3	881	1.15	204	76
LSD 0.05	0.6	NS	NS	NS	NS

[1]P-value = 0.10

ESTABLISHING FALL-SEEDED RED CLOVER WITH A CEREAL COMPANION CROP

W.C. Young III and H.W. Youngberg

Red clover seed fields in western Oregon often fail to develop sufficiently to withstand cold winter weather when fall-seeded. In addition, fields are exposed to a greater potential of erosion. Interseeding with a cereal grain may be beneficial in protecting the crop from cold weather, and the soil from erosion. Herbicides are available to selectively remove the cereal crop from the clover before severe competition occurs in the spring.

A study, initiated in the late summer of 1985, was irrigated to start germination of the crop. Excellent winter cover was provided by the cereal crop. No difference in winter survival or seed yield was observed. The planting was managed for a second seed crop in 1987. The regrowth following the hay crop was very limited because of the dry June weather. No significant difference in hay yield, seed yield, or mean seed weight was observed between stands established with a wheat or oat companion crop or without a companion crop.

A second study was seeded on September 9, 1986 without irrigation. Kenland red clover was seeded in 12-inch rows oriented east-west while Malcolm winter wheat or Cayuse spring oats was seeded at 40 lb/a in north-south 12-inch rows. A check plot (no cereal companion crop) was included.

Weed control was less effective than previously because dinitro was no longer registered for use on seeding red clover. A broadcast application of 2,4-DB (ester) at 1.0 lb a.e./a was made across all plots on October 22, 1986. Kerb^R was applied at 2.0 lb/a on December 30, 1986 to remove the wheat and control annual bluegrass.

Unseasonably warm weather during the fall and early winter favored the rapid growth of weed species and spring oats. Both weeds and spring oats competed heavily with the seedling red clover.

The late spring and summer growth were affected by the dry May and July weather. No significant differences due to companion crop were observed in stand density (April 16, 1987), plant dry matter (April 16, 1987), hay yield (May 19, 1987), or seed yield (August 20, 1987).

Winter survival was not increased by companion crop planted with August or early-September planted red clover No seed yield loss was observed in either first or second year red clover seed crops from establishment with cereal companion crops. The early-season cover provided by the companion crop would offer protection from erosion during the winter months.

Fall establishment of red clover is dependent on effective weed control. The loss of herbicide registration for this purpose will limit the effectiveness of fall seeding.

Future studies should evaluate the effectiveness of this practice on erosion control.

AGRONOMIC STUDIES ON TURF-TYPE TALL FESCUE VARIETIES

W.C. Young III and H.W. Youngberg

Investigation continued during the 1986-87 crop year determine the effect of various management practices on seed yield of turf-type tall fescue. Four varieties of tall fescue (Falcon, Rebel, Bonanza turf-types and Fawn forage type) were seeded in August 1985 for a long-term study extending over four years. Factors under study include row spacing, time and rate of spring nitrogen fertilizer, and post-harvest residue management.

Each variety was seeded separately in 200-ft x 150-ft blocks planted in alternating strips 24-ft x 150-ft at either 12-inch or 24-inch inter-row spacing. Intra-row density was held constant in both 12-inch and 24-inch plantings by using a seeding rate of 7.0 lb/a and 3.5 lb/a, respectively. Plots were fertilized in the spring at either vegetative development, reproductive development or split equally between the two stages with urea applied rates equivalent to 90, 130 or 170 lb N/a. Seed yield was determined by using a small plot harvester. Following the first year seed crop half of the plots were burned two times with a propane flamer to simulate open field burning. Straw was removed from unburned plots with a flail chopper, leaving 3 to 4 inches of stubble, to simulate baling of post-harvest residue.

The second year seed crop averaged 40% greater than the first year harvest for Falcon and Fawn, and 85% for Bonanza; no difference between years was noted for Rebel. Burning residue after harvest produced more seed in all varieties. Seed yield was slightly greater for 12-inch row spacing for all varieties except Rebel, which was not affected by spacing. Time of spring N had little influence on seed yield. High rates of spring N did not significantly increase seed yield, indicating that lower rates may be adequate. However, these very general statements must not be assumed to be all conclusive as many significant interactions between factors under study have not been fully evaluated. A full and detailed statistical summary of the data must be prepared before an accurate assessment can be made.

In addition to the block plantings, two 33-ft diameter plant density circles were established for all varieties. One circle was calibrated to plant 7 lb/a of seed at 12-inch row centers, the second at 7 lb/a at 24-inch row centers. Each circle has 32 rays providing inter-row spacing from zero to 36 inches. Management of these plantings was 90 lb N/a during vegetative development, and burning of post-harvest residue. Second year seed yield data from hand-harvested micro-plots very clearly indicate an advantage where row spacing is greater than 18 inches. However, difficulty in accurately harvesting small sections of row at the narrower spacings is increasing with the age of stand for bunch-type grasses. Furthermore, a full assessment of the complete yield component data should be made prior to confirmation of the benefit of wider row spacings.

It is not appropriate to judge the benefit of one management practice over an another at this time. The intent of this report is to give an interim view of a study designed to provide a better understanding of the fate of fall and winter formed tillers, and to identify strategies for insuring their contribution to a high seed yield in the later years of production.

Acknowledgement: This research was supported by a grant from Oregon Tall Fescue Commission.

OREGON FORAGE AND TURF GRASS VARIETY SEED YIELD TRIAL, 1986-87

Harold W. Youngberg and William C. Young III

A fee-supported seed yield evaluation program has been conducted at Corvallis since 1981. Perennial species are planted in odd-numbered years and seed harvested for two years.

During 1987 a two-year trial was completed. This series, planted in May 1985 included forty perennial and 12 annual grasses varieties of perennial ryegrass, orchardgrass, Kentucky bluegrass, red fescue, Chewings fescue, tall fescue, and annual ryegrass.

Seed yield, total dry weight, thousand seed weight, heading date, anthesis date, first lodging date, lodging severity, plant height, harvest date, and harvest index are reported for each entry for the two years of the trial.

Complete reports of this and earlier seed yield studies are available on request from the authors.

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