USGA PROGRESS REPORT - 1986

Breeding, Evaluation and Culture of Buffalograss for Golf Course Turf

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NEBRASKA PROJECT

A. Overall Objective Accomplishments

This project has been active for slightly less than two and one-half years, but significant progress has been made toward the overall objective of the U.S.G.A./G.C.S.A.A. project. At this time, buffalograss clones have been identified which have an improved turf quality suitable for golf course roughs, but still have the lower energy requirement advantages of buffalograss. Although we are still early in our breeding improvement project, progress to date has been better than any of us expected. Selected clones have better turf quality than anticipated, they are possibly adapted to a larger area of the country than originally thought, and propagation by seed or vegetative means seem very feasible.

B. Plant Collection and Evaluation

One hundred and forty one turf-type buffalograss clones were collected in Kansas in 1986. These were collected under both dry and wetland conditions. These will be transplanted to the field during 1987. An additional 82 buffalograss clones have been selected for additional evaluation from the 1985 plantings. These clones will be vegetatively increased into larger replicated turf plots. Ten clones have been identified as the best buffalograss plants in our program at this time.

C. Buffalograss Plant Breeding

During 1986, a seed increase planting and synthetic plantings were made. Seed will be harvested from these areas late in 1986 and again in 1987. Individual plant hybridization will be made in the greenhouse during spring 1987.

D. Mill Seeding Rate Study

This study has shown that the multiple noted caryopses can be efficiently removed from the hard to germinate buffalograss burr. In the field these hulled seeds germinate much more rapidly and at a higher rate than the burrs.

E. Buffalograss Seed Storage

Hulled buffalograss seed stored for 3 months had an overall 94% germination and at 9 months, 92%. A germination test will also be made at 15 months.

F. Buffalograss De-hulling

A barley pearler was evaluated as a means of removing the multiple buffalograss caryopses from the burr. An average of 2.3 caryopses were obtained from each burr and germination was much more rapid for the excised caryopses.

G. Vegetative Establishment

Six studies using pre-rooted and non pre-rooted plugs demonstrated that vegetative establishment is improved using pre-rooted plugs. Spacing requirements, herbicide and fertilizer rates, and pre-rooting times were determined from these studies.

H. Buffalograss Rhizotron Study

No significant differences were obtained in root development of pre-rooted and non pre-rooted plugs in the rhizotron. Differences were possibly masked by environmental or soil factors.

I. Project Budget

During 1985-6 and again in 1986-7 we will be spending 10-15% more than the $18,000 we receive from the U.S.G.A. This deficit spending is a problem, but more significant is the problem that all of this amount is going for salary, benefits and overhead. There are currently no funds available for plant collection, student labor or operating expenses. If this funding situation continues, the progress and accomplishments of the project could be negatively affected.

Index

1. Plant Collection and Evaluation

A. Collections

Buffalograss was collected in the ten north central counties of Kansas during August 18-20, 1986. Turf-type ecotypes of buffalograss were collected in the following ten counties: Republic, Jewell, Smith, Phillips, Norton, Graham, Rooks, Osborne, Mitchell and Cloud. We collected the buffalograss samples between and during showers in the eastern counties of Republic, Jewell, Cloud and Mitchell. The corn and sorghum in these counties showed no sign of drought. However, in the western counties, the sorghum showed signs of drought. These counties were Phillips, Norton, Graham and Rooks. There was a transition from wet to dry conditions in Smith and Osborne county. In one trip we were able to select plants that exhibited good turf-type under wet condition or dry conditions. Desirable ecotypes of buffalograss were collected from roadsides, in old cemeteries, golf courses, courthouse lawns, pastures and rest stops. In a few of the cemeteries, the headstones dated back to the 1830's. In many sites in these counties, the soil seemed sandier than the other areas where we collected buffalograss. Blue grama, sideoats grama and buffalograss were growing in these sites. At the Elks Golf Course in Phillipsburg, Kansas, there was a good stand of buffalograss and blue grama on the fairways. 141 different samples of buffalograss were collected. They were transplanted to cone-tainers in the research greenhouse in Lincoln. They will be transplanted to the field in June of 1987.

B. Evaluation

During 1986 an additional 82 buffalograss clones have been selected from the 1985 plantings. These clones are displaying good color, density, turf quality, how growth habit, or other interesting characteristics. During 1987 these plants will be vegetatively increased into larger, replicated turf plots for evaluation. These clones are listed in Table 1.

Ten buffalograss clones have been selected from the 1986 Advanced Turf Evaluation area as the best plants in the program at the present time. Additional land has been requested in order to vegetatively increase these clones into quarter acre blocks for seed increase, vegetative increase for nationwide testing, and cultural practice evaluation. It is planned that at least two off-station tests of these ten clones will be established during 1987, with additional tests established in 1988.

Table 1 - 1986 Selections:

Plot #	Plant #	Plot #	Plant #
132	85-190(NE)	102	85-317(NE)
204	84-60(NE)	219	85-478(NE)
213	84-31(CO)	321	85-342(NE)
219	84-15(CO)	411	85-321(NE)
232	85-111(NE)	417	85-448(NE)
307	84-24(CO)	813	85-487(NE)
313	84-31(CO)	821	85-340(NE)
317	84-21(CO)	650	Bird
318	84-925(NE)	919	85-468(NE)
505	84-15(CO)	1002	85-467(NE)
514	84-49(CO)	1218	85-187(NE)
517	85-32(NE)	1221	85-337(NE)
518	Bird	1410	Holmes
602	Bird	1419	85-308(NE)
607	84-17(CO)	1504	85-378(NE)
622	84-803(AZ)	1506	85-177(NE)
630	85-160(NE)	1508	85-192(NE)
733	85-216(CO)	1523	Holmes
728	85-40(NE)	1619	85-176(NE)
707	84-923(NE)	1819	85-155(NE)
806	Bird	1920	85-158(NE)
830	85-113(NE)	2013	85-214(CO)
921	85-152(NE)	2017	85-143(NE)
923	85-193(NE)	2023	Holmes
1028	85-131(NE)	2215	85-210(CO)
1210	84-33(CO)	2219	85-486(NE)
1225	85-11(NE)	2222	85-167(NE)
1104	84-19(CO)	2226	85-401(NE)
1214	84-12(CO)	2415	85-452(NE)
1312	Bird	2425	85-436(NE)
1329	85-120(NE)	2659	T2
1331	85-444(NE)	2961	T2
1406	85-117(NE)		
1407	84-407(TX)		
1424	84-17(CO)		
1429	85-120(NE)		
1413	84-13(CO)		
1434	85-42(NE)		
1506	84-24(CO)		
1521	84-72(NE)		
1530	84-89(NE)		
1608	Bird		
1626	85-341(NE)		
1717	84-40(CO)		
1719	84-7(CO)		

Table 2. 1986 Advanced Selections

10 Selected plants:

84-506	Unknown, Tx
84-409	Wharton, Tx
84-315	Fillmore, NE
84-205	Swisher, Tx
84-483	Colorado
84-514	Falls, Tx
84-252	Colorado
84-304	Martin, Tx
84-104	Unknown, Tx
84-609	Unknown, Tx (possibly Austin)

2. Buffalograss Plant Breeding

There have been two major plantings made during 1986 relating to the plant breeding area of the project. Plans have also been made for spring 1987 greenhouse hybridization.

A. Seed Increase Planting The purpose of this planting is to estimate seed yields of the outstanding buffalograss clones selected during 1985 and to generate seed for progeny tests and plot evaluations. During 1986 most clones have made outstanding growth and seed harvests will be made once the grasses are dormant this fall. This planting will be maintained and harvested again in 1987.

B. Buffalograss Synthetic Planting The purpose of this planting is to generate seed from the outstanding female buffalograss clones selected during 1985. These female clones area being hybridized with selected outstanding male plants in an effort to combine characteristics from plants with better turf quality. Seed will be collected later this fall from the female plants, yields will be estimated, and the seed will be used for the next generation of progeny testing.

C. Greenhouse Hybridization During this fall male and female plants will be brought into the greenhouse and planted in large pots. These plants will be maintained in the greenhouse and induced to flower in growth chambers. Ideally, crosses will be made in the early spring so that seedlings can be field planted by next summer.

A. Mill Seeding Rate Study

INTRODUCTION: Buffalograss has a low germination rate taking two to five years to produce a good stand. This is possibly due to an inhibitor in the burr which slows germination. In this study a barley pearler was used to remove the burr from around the multiple caryopses in an attempt to increase germination. The process removed nearly all of the caryopses, leaving very few undestroyed burrs. A germination rate of 95 % was achieved in the laboratory with germination occurring within 15 hours.

OBJECTIVES: The objectives of this study are: 1) To determine if removing the caryopses (by destruction of the burr) would increase the germination rate of the burrs. 2) To determine if removing the caryopses would decrease the germination time compared to the burr. 3) To determine if a lower seeding rate could be used with the caryopses compared to the normal 2 LB. seeding rate used with burrs. 4) To determine if a good stand would be obtained by the end of one growing season. 5) To determine if a seeded stand (using caryopses) will survive the winter.

MATERIALS & METHODS: One pound of KNO_3 treated burrs were processed through the barley pearler, all material was collected and put through a blower and a series of screens to remove the chaff. The caryopses were then weighed again and 1/4, 1/2, 3/4, 1 and 2 lb/1000 sq. ft. seeding rates were weighed. One pound of non-KNO_3 treated burrs were treated in the exact manner described above and the same seeding rates were weighted. Each of the twelve treatments was replicated four times in 8 x 5 ft. plots at the UNL Agricultural Research and Development Center near Mead. Data was taken every week (following a July 22 planting), using a 4 x 3 ft. frame and dropping it randomly within the plot three times and counting the seedlings present within the frame. Treatments are shown on page 7.

RESULTS & CONCLUSIONS: Results show that the 2 lb. treated seed treatment has 300 times as many seedlings germinating the first week compared to the burrs and three times as many seedlings during following weeks. This treatment also shows approximately three times as many seedlings as the 1 lb. seed treatments and the 2 lb. untreated seed treatment (figures 1-4). This test indicated that not only was the germination rate increased but that the germination time needed for the maximum number of seedlings to germinate was decreased from two weeks in the burr to one week for hulled seed. Results show that TRS 7, 8, and 9 are comparable to the 2 lb. burr seeding rate (TR 12) as far as the number of total seedlings germinating and the caryopses germinated sooner than the burrs. This indicates that a lower seeding rate could be used and a comparable stand could be obtained. Treatment 10 far exceeds all other treatments and this seeding rate would give a very dense stand filling in quickly.

This high seeding rate is probably not necessary unless a dense stand is desired quickly. Data will be taken next spring to see if any of the plots winter kill. It is felt that the difference between the non-KNO3 treated seed and the KNO3 treated seed, is due to the untreated seed being from a second harvest (with fewer seeds in the burrs) rather than the treated seed actually being influenced by the KNO3 treatment. Next summer we will repeat the study with seed from the same seed lot.

An initial study planted June 22, 1986 was carried out exactly as the above study except that two weeks following planting 1 lb. of simazine per acre was applied. Figures 5 & 6 show the results. It is felt that at the early stages of growth naked buffalograss seedlings are not tolerant to simazine and that the burr helps to protect the seed. Early data is similar for both tests, but test 1 shows a drastic decline in seedling numbers, except in TRS 11 and 12, during the weeks following.

Possible advantages of establishing buffalograss by use of seed would be 1) the seeding rate could be reduced from 2 lb. to 1 lb., 2) the KNO3 treatment could be dropped, and 3) seed could be planted using a regular broadcast spreader.

TR 1 = 1/4 LB. UNTREATED SEEDS
TR 2 = 1/4 LB. TREATED SEEDS
TR 3 = 1/2 LB. UNTREATED SEEDS
TR 4 = 1/2 LB. TREATED SEEDS
TR 5 = 3/4 LB. UNTREATED SEEDS
TR 6 = 3/4 LB. TREATED SEEDS
TR 7 = 1 LB. UNTREATED SEEDS
TR 8 = 1 LB. TREATED SEEDS
TR 9 = 2 LB. UNTREATED SEEDS
TR 10 = 2 LB. TREATED SEEDS
TR 11 = 2 LB. UNTREATED BURRS
TR 12 = 2 LB. TREATED BURRS

Figure 1

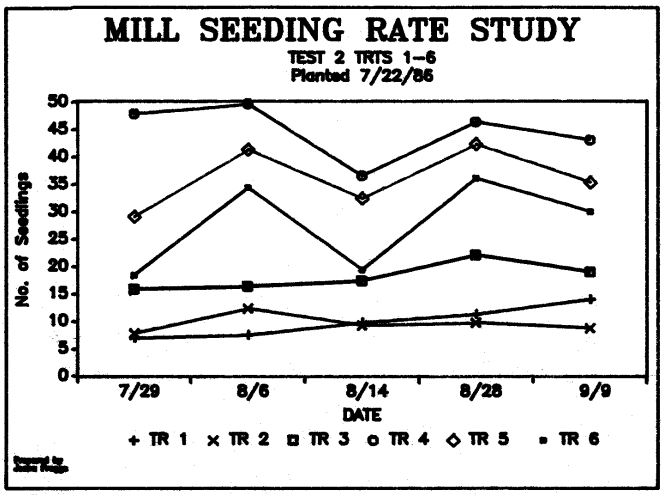


Figure 2

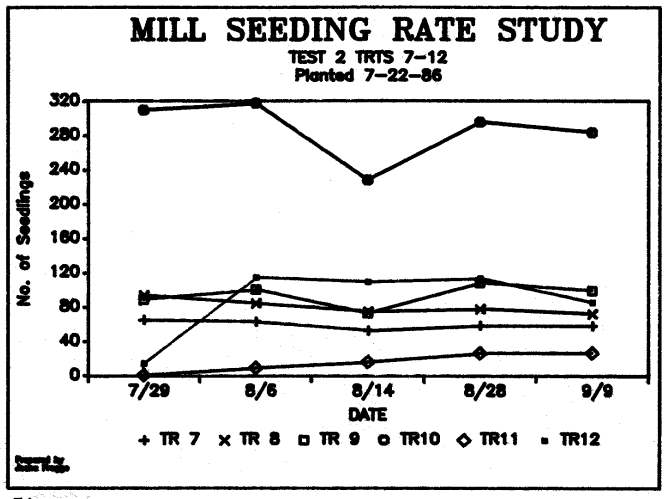


Figure 3

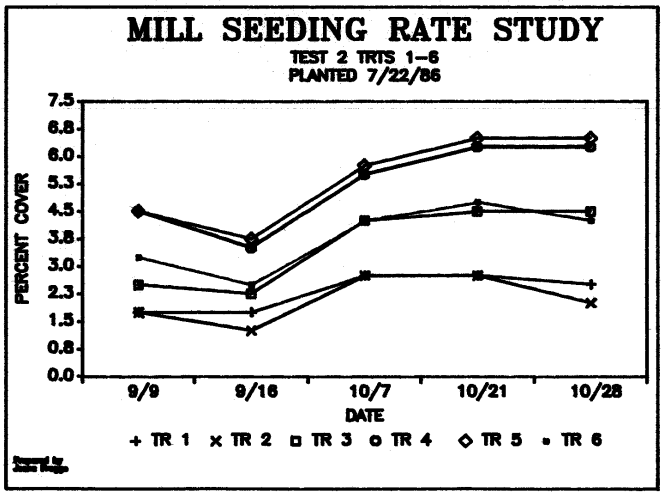


Figure 4

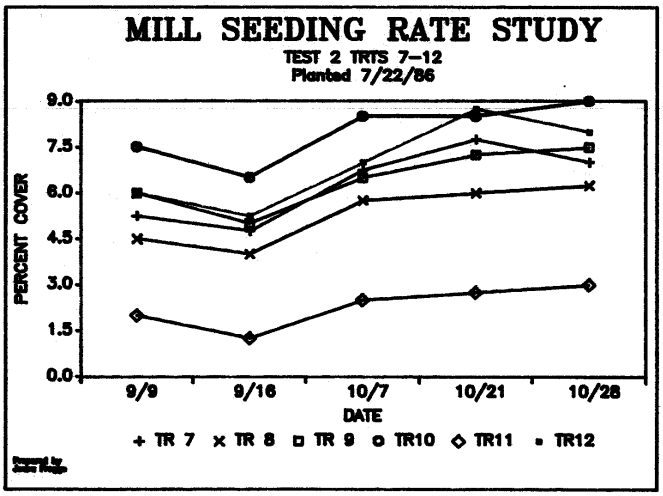


Figure 5

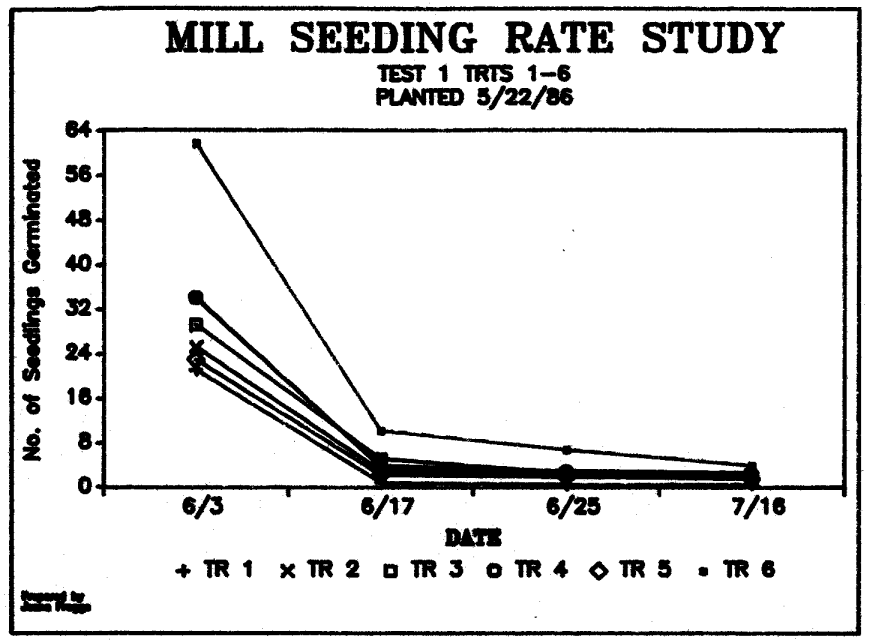
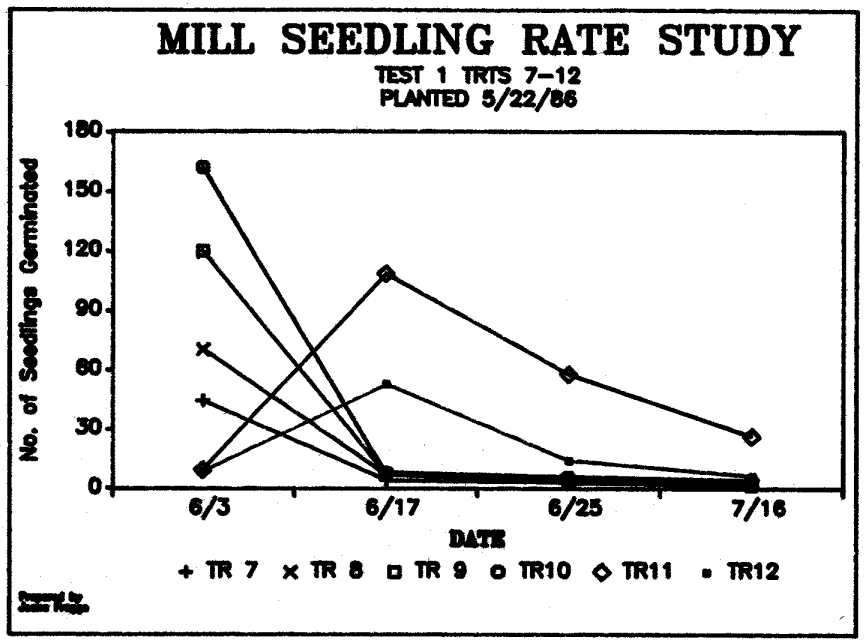


Figure 6



B. Evaluation of Time and Storage Conditions on Buffalograss Caryopses Germination

OBJECTIVES: The objectives of this study are 1) to determine the effect of storage time on buffalograss germination of treated and untreated burrs and caryopses, and 2) to determine the effect of storage conditions.

MATERIALS & METHODS: Three thousand KNO_3 treated burrs and three thousand non-KNO_3 treated burrs were counted out by hand and 1500 burrs of each were placed in cold storage and 1500 burrs of each were placed at room temperature. At the same time, 3000 KNO_3 treated burrs and 3000 non-KNO_3 treated burrs were processed in a barley pearler to separate the caryopses from the burr. The remaining material was put through a blower and a series of screens to separate the chaff from the caryopses. From each treatment, 1500 of the exposed caryopses were placed in cold storage and 1500 were placed at room temperature. The burrs and caryopses were put in marked paper sacks to prevent accumulation of moisture and premature germination. Treatments were assigned as follows:

TRT 1 = Treated burrs at room temperature
TRT 2 = Untreated burrs at room temperature
TRT 3 = Treated seed at room temperature
TRT 4 = Untreated seed at room temperature
TRT 5 = Treated burrs in cold storage
TRT 6 = Untreated burrs in cold storage
TRT 7 = Treated seed in cold storage
TRT 8 = Untreated seed in cold storage

Four replications of each treatment will be germinated with 125 caryopses or burrs per petri dish. Analyses are being made at 3, 9 and 15 months. Three months was chosen to determine a base germination, nine months was chosen because of federal seed testing requirements and fifteen months was chosen to test shelf life from harvest of one season to the planting season of the following year. The petri dishes were put in a growth chamber where light requirements of 16 hours and temperature requirements of a minimum 70° F and a maximum 95° F were met. Seedling counts were taken at 4 days, 7 days, and 14 days.

RESULTS & CONCLUSIONS: After three months of storage the caryopses showed 94% germination. After nine months of storage the germination of the caryopses dropped off only slightly to 93% germination with caryopses stored in the cold room having a lower germination than the caryopses stored at room temperature. They also seemed to germinate a little slower during the first two days. The burrs showed a significant drop in germination after nine months of storage compared to three months in storage and the treated burrs in cold storage had a slightly higher germination than those stored at room temperature (figures 7-12). The final storage period of 15 months will be analyzed in April 1987.

Figure 7

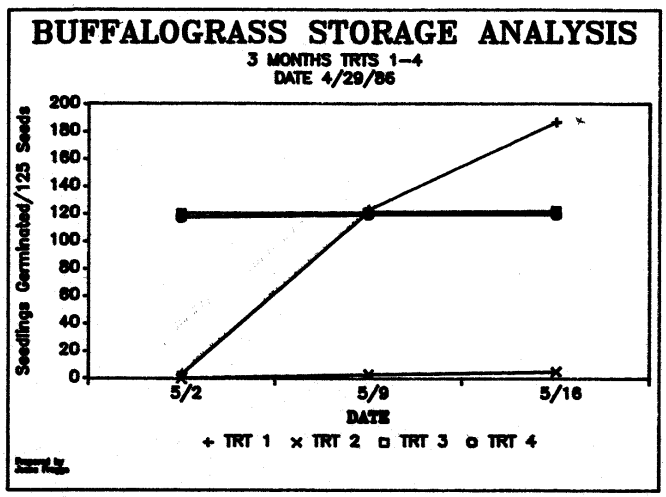


Figure 8

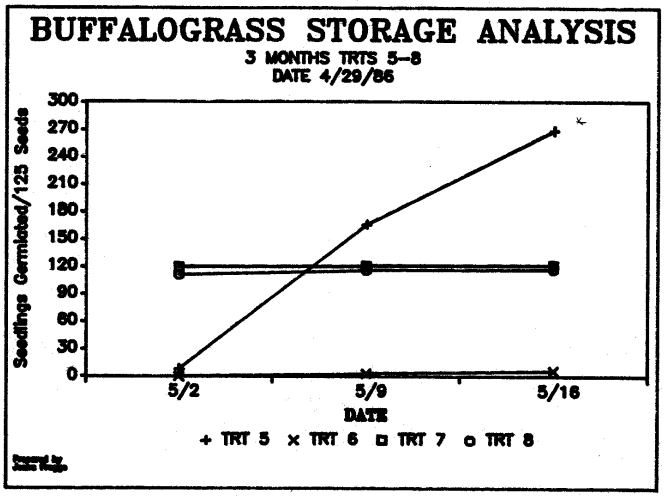
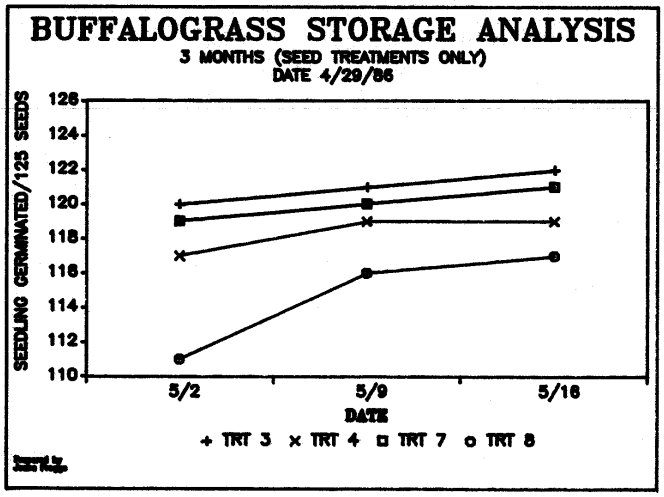


Figure 9



* More than one seed can germinate per burr

Figure 10

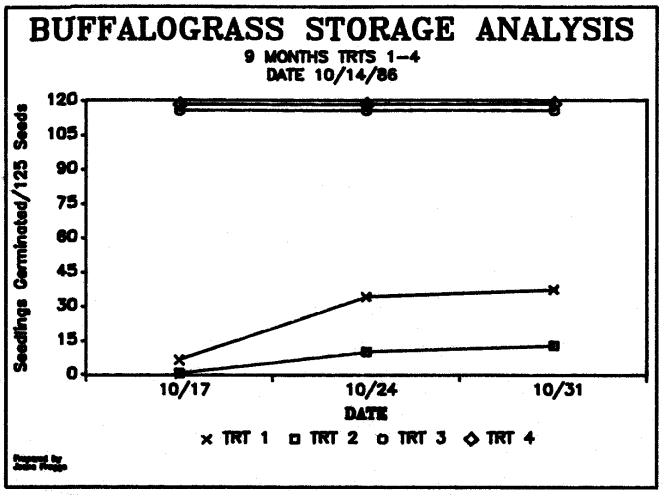


Figure 11

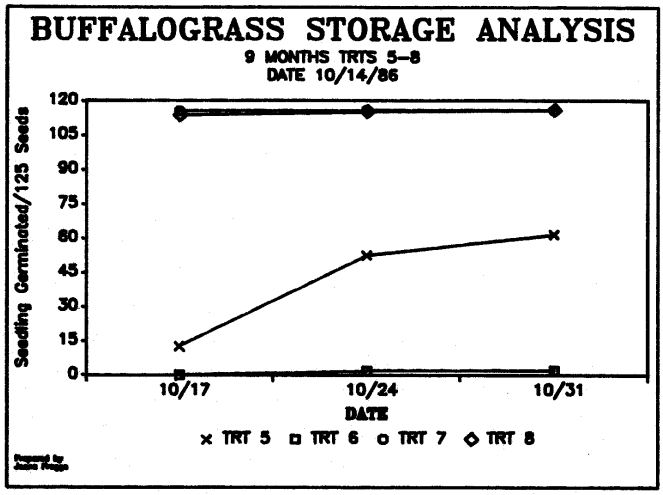
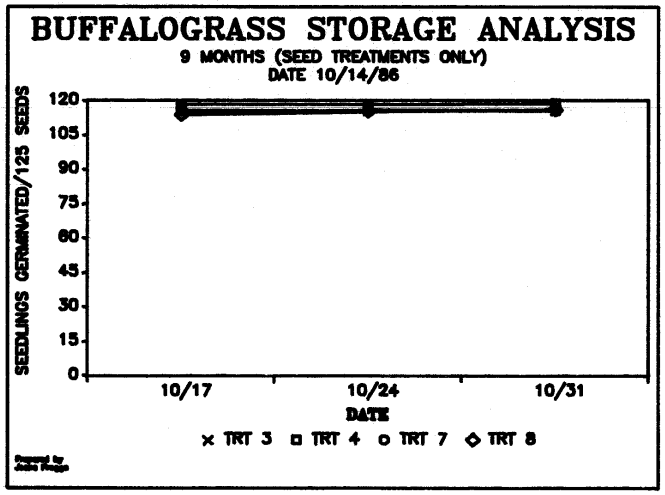


Figure 12



C. Using a Barley Pearler to Increase Germination in Buffalograss

INTRODUCTION: Buffalograss seed is relatively expensive and is slow to germinate and establish. The major reason for this is that multiple seeds are surrounded by a very hard burr. Work has been going on at UN-L to improve a method of mechanically removing the caryopses from the burr, therefore increasing the number of seedlings germinating and decreasing the amount of time required for germination. Presently, the commercially used technique is a KNO_3 cold solution treatment which has improved germination of burrs from 40% to almost 80%. The method used at UN-L involves a barley pearler which completely destroys the burr without damaging the multiple caryopses. In preliminary analysis, this method has shown a 95% germination rate.

OBJECTIVES: The objectives of this study were 1) to determine if hulled buffalograss caryopses germinate faster than the buffalograss burrs, 2) to determine if the number of hulled caryopses germinating is comparable to the number of caryopses that germinate within the burr, 3) to determine if there is a difference between the number of germinating hulled caryopses (originating from KNO_3 treated burrs) compared to the number of hulled caryopses germinating which originate from non-KNO_3 treated burrs, 4) to determine what percentage of seed was still enclosed in the partially deteriorated burr and 5) to determine the average number of seeds per burr.

MATERIAL & METHODS: The results of this study are based on two similar tests. Test one consisted of treatments one, two, three and four. Test two consisted of treatments one, two, three, four, five and six. Treatments five and six were added to the second test to determine what percentage of seed was previously being thrown away in test one as partial burrs from the pearler.

Treatment one of this study consisted of 500 burrs of Hays treated (KNO_3) buffalograss placed into petri dishes to germinate and treatment two consisted of 500 burrs (Hays treated) processed in a barley pearler. All chaff and dust was separated from the caryopses by screening and hand separation. The caryopses were collected, counted and placed into petri dishes. Treatment 3 consisted of 500 burrs of untreated buffalograss placed in petri dishes and treatment 4, 500 (untreated) burrs processed in the barley pearler. The caryopses were collected, counted and placed in petri dishes to germinate. Treatment 5 consisted of any treated burrs left from the original 500 burrs of treatment 2 that were not broken down in the pearler and treatment 6 consisted of treated burrs left from the original 500 burrs of treatment 4.

The caryopses and burrs were divided up evenly and placed into four petri dishes per treatment. All the caryopses collected from treatments two and four were used even though the number of

caryopses exposed by each replication of 500 burrs through the pearler was different. Treatments three and four had 500 burrs per replication. Treatments five and six also had a different number of burrs left over so that the number per replication varied.

The petri dishes were spread out across a lab table in a completely random design. Enough water was added to each petri dish to dampen the germination paper and dishes were kept moist throughout the study. Germination counts were taken at 4 days, 11 days and 18 days after initiation of the study.

RESULTS & DISCUSSION: The first objective of this study was to see if the exposed buffalograss caryopses germinated faster than buffalograss burrs. Figures 13 and 14 indicate that the means of treatments two and four are much greater than the means for treatments one and three for all the dates, indicating that the caryopses did indeed germinate faster than the burrs. By removing the burr from the caryopses the germination rate increases. In a field situation this would mean a better established turf sooner during the growing season and possibly a better winter survival rate.

Objective two of this study was to see if the number of caryopses that germinated was comparable to the number of seedlings that germinated from the burrs. Again looking at Figures 13 and 14 for the three dates, the number of caryopses germinating is greater in treatments 2 and 4 than in treatments 1 and 3. Approximately 3.5 times more seedlings germinated from the caryopses than from the burrs.

Objective three of this study was to see if there was a difference between the number of germinating hulled caryopses from KNO_3 treated burrs and the number of germinating non-KNO_3 treated burrs. Figures 13 and 14 can be used to test for differences. One can see that there is a significant difference between TRT 2 and TRT 4. It is suspected that the difference between the two treatments may be due to the untreated seed being from a second harvest (with fewer seeds in the burr) rather than the treated seed actually being influenced by the KNO_3 treatment.

Objective four of this study was to determine what percentage of seed was still enclosed in the partially deteriorated burr. Looking at Figure it can be seen that in the KNO_3 treated burrs (TRT 2 plus TRT 5) percent germination was improved by only 1%, whereas the non-KNO_3 treated burrs (TRT 4 plus TRT 6) was decreased by as much as 12%. This would indicate that the number of seeds retained in the partially deteriorated burr is minimal and the possibility of increasing the percent germination is very low.

The last objective of the study was to determine the average number of caryopses per burr. This was accomplished by counting

the amount of exposed caryopses from treatments two and four respectively and adding to it the number of seedlings that germinated from the partially deteriorated burrs of treatments five and six respectively and dividing that number by 500. It is realized that this is not an extremely precise number because not all of the caryopses in the burr may have germinated, but it does give us a good estimate of approximately 2.3 caryopses per burr.

CONCLUSIONS: From this study it is apparent that hulled buffalograss caryopses germinate faster than those enclosed in the burr, and the number of caryopses germinating is greater when removed rather than when they remain in the burr. This study also showed approximately 2.3 caryopses per burr and that the partially deteriorated burrs did not improve the percent germination of the caryopses significantly. Using the barley pearler is presently an economical way to process laboratory quantities of burrs to expose the caryopses. This process has the potential to improve sod establishment by increasing the number of seedlings and by decreasing the necessary time to germinate buffalograss. This is advantageous for establishment and winter survival in a species with a fairly short growing season.

Figure 13

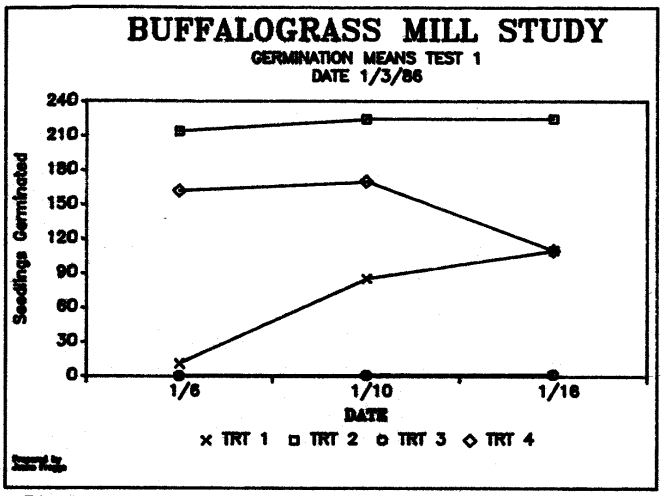


Figure 14

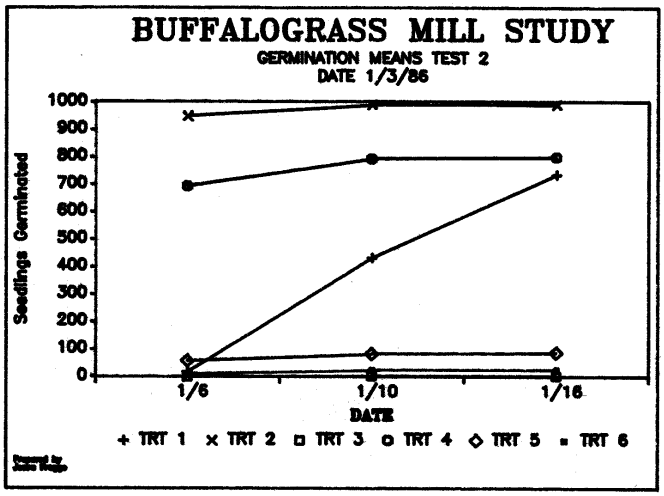
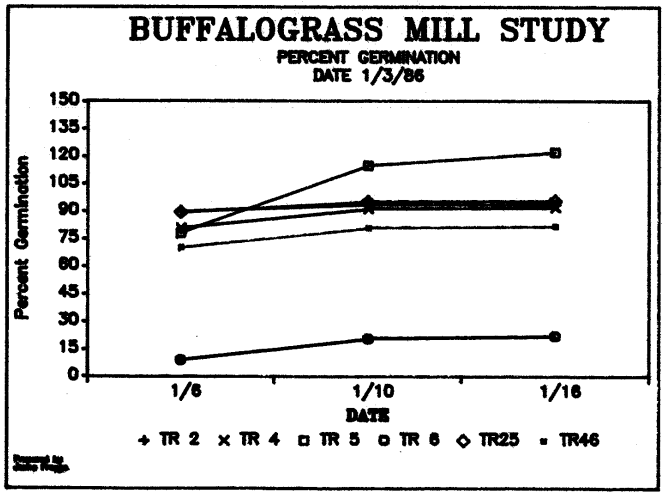


Figure 15



VEGETATIVE PROPAGATION

Vegetative propagation of buffalograss is an area that has had very little study. The possibilities of this form of propagation could lead to more rapid cover and a denser stand of buffalograss.

A. PREROOTING REQUIREMENTS

The first study involved prerooting of 2x2 inch buffalograss plugs. The objectives of this study were 1) to determine the optimum amount of greenhouse time necessary to promote prerooting that will promote growth and cover after transplanting, and 2) to determine if fertilizer is necessary to promote prerooting and further growth.

Plugs were non-prerooted (control), and prerooted in the greenhouse for 2, 4, or 8 weeks. These prerooted plugs were then either fertilized or not at the time they were brought into the greenhouse for prerooting. This gave us 7 treatments for comparison. The study was planted in the field on May 20, 1986.

The following observations were made after the initial establishment season, 1) all prerooted plugs established faster and had higher stolon counts initially, 2) fertilization at the time of prerooting did not appear to have a significant effect on establishment, and 3) after 14 weeks of growth, differences in coverage between treatments were not evident.

B. PLUG SPACING

This study looked at the spacing requirements for establishment of prerooted and non-prerooted plugs. The objectives of this phase were 1) to determine spacing requirements for buffalograss plugs when establishing a turf area vegetatively, and 2) to determine if prerooting has an effect on this spacing.

Non-prerooted plugs were compared to 8 week prerooted plugs in this study. The plugs were planted out on 6, 12, and 18 centers. This gave 6 treatments for comparison. The study was planted in the field on May 21, 1986.

The following observations were made on this study: 1) prerooted plugs appeared to establish more rapidly than non-prerooted plugs, 2) plots with 6 inch spacing appeared to have more rapid cover and a denser stand, and 3) plots with 18 inch spacing appeared to have lower stolon counts and establishment rates.

C. PLUG FERTILIZATION

This study determines the effect of fertilization at the time of planting, and the effects on establishment. The objectives of this study were 1) to determine the effects

of fertilizer on the establishment of buffalograss plugs, and 2) to determine if prerooting affects a fertilized buffalograss plug during establishment.
Non-prerooted and 8 week prerooted plugs were used in this study. The comparisons of fertilizing with 1 lb. of N/1000 sq.ft. versus non-fertilization were used. This provided for 4 treatments in this section. The study was planted in the field on May 20, 1986.
The following observations were made: 1) plugs that were fertilized at planting appeared to have better initial growth, 2) prerooted plugs appeared to establish more rapidly and produce higher stolon counts, and 3) after 14 weeks of growth, differences in coverage between treatments were not evident.

D. HERBICIDE TREATMENT

The objectives of this study were 1) to determine the effects of herbicide on the establishment of buffalograss plugs, and 2) to determine of prerooting affects the establishment of buffalograss plugs treated with herbicide.
Non-prerooted and 8 week prerooted plugs were used in the study. Plots were treated with Simazine at a rate of 1 lb./acre after planting, with the control plots being untreated. This gave 4 treatments to be observed. The study was planted to the field on May 21, 1986.
The following observations were made: 1)prerooted plugs appeared to establish more rapidly than non-prerooted plugs, 2) plots treated with Simazine appeared to produce a more dense, higher quality stand, and 3) plots not treated with Simazine had a difficult time competing with the weeds and did not appear to produce a quality stand.

E. MOWING TREATMENT

The objectives of this study were: 1) to determine the effects of mowing on the establishment of buffalograss turf, and 2) to determine the effects of prerooting on the esablishment of mowed buffalograss turf.
Non-prerooted and 8 week prerooted plugs were used in this study. After 7 weeks of growth the test plots were mowed to a height of 2 inches on a weekly basis. The control plots remained unmowed. This provided 4 treatments for this study. The study was planted in the field on May 20, 1986.
The following observations were made: 1) prerooted plugs appeared to establish more rapidly than non-prerooted plugs, and 2) there did not appear to be any noticable differences between prerooted and nonprerooted plugs and those that were mowed and the controls.

F. WINTER SURVIVAL

The objectives of the study are: 1) to determine of prerooted plugs will have a higher survival rate than

non-prerooted plugs, and 2) to determine fall planting date possibilities.

Non-prerooted and approximately 4 week prerooted plugs are being used in this study. Planting dates are September 4 and 16, and October 6 and 28.

Spring observations will be made on this study and on all of the other components of the overall study. This winter statistical analysis will be done on the studies carried out this summer. Data includes at stolon counts that were taken early in the study, cover ratings taken for the entire summer, and also color ratings. Further studies will begin this winter examining the non-structural carbohydrate analysis of buffalograss in differing stages of growth and from various plant parts.

Also under investigation will be plant hardiness of different buffalograsses that are in the studies. Both heat and cold tolerances will be evaluated.

All phases of this project should lead us to conclusions and recommendations for successful vegetative bufflograss establishment.

5. Cultural Practices

During the period of this report most cultural practice research involved the evaluation of mowing, fertilization, and herbicide treatment on plug establishment. This will be reported on in that section.

A. Advanced Evaluation Area

The 1986 Advanced Evaluation Area was vegetatively planted during July and has been mowed regularly since August. This test will be mowed at two mowing heights, 1 and 1-1/2 inches, and be fertilized at 2 nitrogen levels, 1 and 3 lbs./growing season, during 1987.

B. Buffalograss Rhizotron Study

INTRODUCTION: Previous studies at UNL using pre-rooted and non-pre-rooted buffalograss plugs showed differences in the establishment of a quality turf. The pre-rooted plugs showed more stolon growth both in numbers and in length and they had a higher percent cover and were greener in the first three weeks of establishment than the non-pre-rooted plugs. The rhizotron provided an opportunity to observe the structure of the root systems of pre-rooted and non-pre-rooted plugs.

OBJECTIVES: The objectives of this study were 1) to study the root growth of pre-rooted and non-pre-rooted buffalograss plugs for an entire growing season, 2) to determine if pre-rooted plugs have a deeper or denser root system compared to non-pre-rooted plugs, and 3) to determine if root growth affects winter survival.

MATERIALS & METHODS: Pre-rooted and non-pre-rooted buffalograss plugs were each planted in two rhizotron boxes (12 per box). The boxes were fertilized after planting with a liquid starter fertilizer at a 1/2 lb./1000 sq. ft. rate and watered every day for the first three weeks and every other day thereafter.

RESULTS & CONCLUSIONS: The results do not show the advantages or disadvantages of pre-rooted plugs (Figure). One of the pre-rooted boxes shows excellent growth, exceeding the non-pre-rooted boxes, but the other pre-rooted box fell below both non-pre-rooted boxes (figure). Because both of the boxes on the south end of the rhizotron fell below the other two boxes it is felt that the differences may be due to the rhizotron environment. We hope to increase the number of replications in this study and to improve on a technique for collecting and analyzing data.

Figure 16

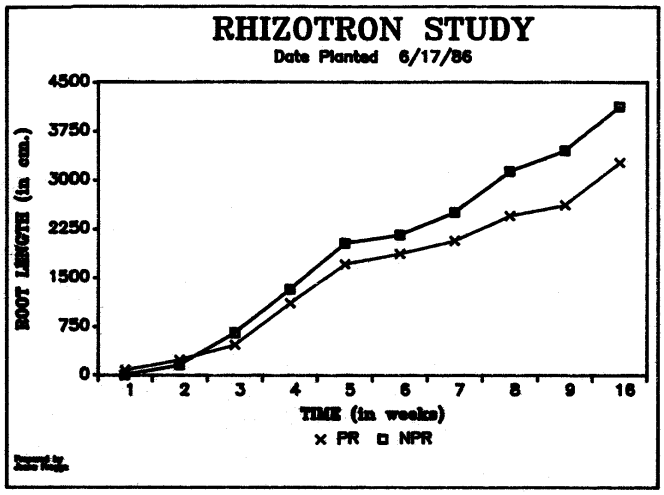
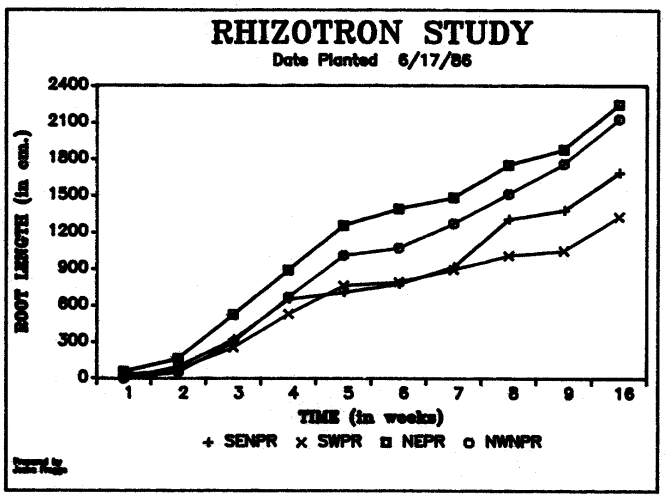


Figure 17



6. Buffalograss Project Budget 1985-86

Project expenses for the fiscal period November 1, 1985 to October 31, 1986 are summarized in Table . During this period $19,743.74 was expended on this project and an additional $1,859.73 was expended for indirect costs. We continue to reduce all expenses in an effort to stay within our current $18,000.00 appropriation. However, during the next fiscal period it is forecast that 114% of the $18,000.00 appropriation will be used for technical salary, benefits and indirect costs. This is our minimum cost of carrying out the project without cutting back to part time personnel. Our proposed budget for November 1, 1986 to November 1, 1987 is given in Table 3.

Table 3

1985-1986 USGA BUFFALOGRASS RESEARCH PROJECT BUDGET

	NOV Budget	DEC Budget	JAN Budget	FEB Budget	MAR Budget	APR Budget	MAY Budget	JUN Budget	JUL Budget	AUG Budget	SEP Budget	OCT Budget	TOTAL Budget
Personnel													
Technical	1094.00	1094.00	1641.75	1094.00	1094.00	1149.60	1149.60	1149.60	1750.00	1184.00	1184.00	1184.00	14788.87
Benefits	199.95	155.19	195.13	155.19	155.19	165.32	165.32	198.04	229.79	162.14	162.38	162.38	2106.02
Hourly	914.71	427.34	379.43	104.73	53.46	30.97	49.43	537.20	0.00	0.00	0.00	0.00	2497.29
Sub-Tot.	2209.54	1677.41	2216.31	1354.00	1303.55	1345.09	1364.35	1884.84	1980.59	1346.14	1346.38	1346.38	19384.18
Operations													
Photocopies	21.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.33
Photos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	10.00
Misc.	57.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.98
Sub-Tot.	79.31	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	89.31
Supplies													
Office	4.07	0.00	0.00	0.00	0.00	0.00	0.00	34.81	0.00	0.00	0.00	0.00	38.88
Photo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Laboratory	0.00	0.00	0.00	0.00	0.00	0.00	0.00	60.96	0.00	0.00	0.00	0.00	60.96
Sub-Tot.	4.07	0.00	0.00	0.00	0.00	0.00	0.00	95.77	0.00	0.00	0.00	0.00	107.84
Travel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	162.41	0.00	0.00	0.00	0.00	162.41
Sub-Total	2292.92	1677.41	2216.31	1354.0	1303.55	1345.09	1372.35	2153.02	1980.59	1346.14	1346.38	1346.38	19743.74
Indirect Costs													
16 % (ACT)	351.66	278.32	355.09	0.00	0.00	0.00	0.00	874.66	0.00	0.00	0.00	0.00	1859.73
Total Budget	2644.58	1955.73	2571.40	1354.00	1303.55	1345.09	1372.35	3027.68	1980.59	1346.14	1346.38	1346.38	21603.47

Table 4

1986-1987 USGA BUFFALOGRASS RESEARCH PROJECT BUDGET

	NOV Budget	DEC Budget	JAN Budget	FEB Budget	MAR Budget	APR Budget	MAY Budget	JUN Budget	JUL Budget	AUG Budget	SEP Budget	OCT Budget	TOTAL Budget
Personnel													
Technical	1184.00	1184.00	1776.00	1184.00	1184.00	1184.00	1184.00	1184.00	1829.20	1219.52	1219.52	1219.52	15551.84
Benefits	162.14	162.14	243.21	162.14	162.14	162.14	162.14	162.14	250.50	167.00	167.00	167.00	2129.69
Hourly	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-Tot.	1346.14	1346.14	2019.21	1346.14	1346.14	1346.14	1346.14	1346.14	2079.70	1386.52	1386.52	1386.52	17681.53
Operations													
Photocopies	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Photos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Misc.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-Tot.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Supplies													
Office	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Photo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Laboratory	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-Tot.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Travel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-Total	1346.14	1346.14	2019.21	1346.14	1346.14	1346.14	1346.14	1346.14	2079.70	1386.52	1386.52	1386.52	17681.53
Indirect Costs													
16 % (ACT)	215.38	215.38	323.07	215.38	215.38	215.38	215.38	215.38	332.76	221.84	221.84	221.84	2829.04
Total Budget	1561.52	1561.52	2342.28	1561.52	1561.52	1561.52	1561.52	1561.52	2412.54	1608.36	1608.36	1608.36	20510.57

Slide #

(1) Buffalograss Seeding Rate Study
#2 of untreated (non - KNO_3) burrs on the right.
#2 of treated (KNO_3) hulled seed on the left.

(2) Buffalograss Advanced Evaluation Area
The two flagged plants are 2 of the 48 best plants showing aggressiveness, good color, good density, and low leaf height. These plants will be placed under various cultural practices such as mowing height and fertilizer rates.

(3) Buffalograss Seed Increase Area
One of the best 48 selected plants, showing one season's growth. This female plant contains a high population of burrs which will be harvested in the fall.

(4) Vegetatively established 0 week in greenhouse
1 lb/A Simazine application (foreground)
Vegetatively established 8 weeks in greenhouse
no simazine application (background)