EXECUTIVE SUMMARY

IMPROVEMENT OF *POA REPTANS* FOR GOLF TURF

UNIVERSITY OF MINNESOTA

PROGRESS REPORT # 11, NOVEMBER 1994

- Three selections (MN#42, #184 & MN#208) were approved for release by the Minnesota Agricultural Experiment Station-Horticultural Plant Release Committee.
- Decision has been reached to concentrate on introduction of MN#42.
- A new, 5 acre Breeder's seed planting of MN#42 was planted in early Nov. 94.
- Seed field plantings of 1 acre each of Minnesota numbered selections, #42 and # 184, and 2 acres of #208 was seeded on November 12, 1993 at as site in the Willamette Valley, Oregon under agreement with the Peterson Seed Company. Certified Perennial Ryegrass was grown on the land for the last four years. The land has never been in bluegrass production. Planting was completed at a rate of 1 pound of seed per acre. The Grower indicated that 12 Nov. was far too late for an intended seed crop the following summer. Two methods of seed harvest were tried, one with a grass catcher and one with a standard windrower. The seed crop was respectable and the windrower worked well. MN#42 produced the most uniform heading and least shattering. MN#184 and MN#208 exhibited some uneven ripening and shattering. This may indicate the possibility of two harvest a season.
- Conclusions: 1) the late planting was successful; 2)Harvesting can be accomplished with standard equipment; and 3) each selection produced sufficient seed to warrant continued seed production.
- Crosses between annual & perennial types of poa indicate a 3 : 1 ratio of inheritance of continuous flowering to seasonal flowering.
- Results indicate that 4-8°C is the optimal vernalization temperature & that vernalization requires 10-12 weeks. It appears that critical photoperiod is between 10 & 12 hrs. and that 4 to 6 leaves are required for reception of induction stimuli.
- The top 2% of 1994 progeny were selected for further evaluation.
- Interspecific crosses between *Poa supina* and *Poa reptans* produced some unique plant types that were selected for further evaluation.
- New, promising materials, performing well under putting green conditions include progeny for F4 generations of MN#184 X 117 an 234 and F3 progeny of a MN#42 X MN#184 cross.
- Seed was furnished to the University of Nebraska for replicated evaluation and North Carolina State, Raleigh for an overseeding evaluation planting
- 1995 plans will concentrate of seed production, PVP, and establishing substantial evaluation plantings across the USA and in Canada.

IMPROVEMENT OF *POA REPTANS* FOR GOLF TURF

UNIVERSITY OF MINNESOTA

Progress Report # 11

1 November 1994

1. SEED PRODUCTION

Seed field plantings of 1 acre each of Minnesota numbered selections 42 and 184; and 2 acres of Minnesota #208 was seeded on November 12, 1993 at a site in the Willamette Valley, Oregon under agreement with the Peterson Seed Company (The grower and seed company both requested confidentiality of location). Certified perennial ryegrass was grown on the land for the last four years. Prior to that, certified Penncross bentgrass was grown there. The land has never been in bluegrass production. Planting was completed with a John Deere #450 double disk drill in 7½" rows, 1560 feet long, at a rate of 1 pound of seed per acre. Plots were treated with Roundup on 10 and 28 November 1993.

The grower indicated that November 12 was far too late for an intended seed crop the following summer. Germination (emergence) was first observed on January 15, 94. Buctril and Banvel-D were applied on 25 March 94 with no apparent damage to the poa. Seed heads started to emerge around 10 May. As it turned out the seed crop was quite respectable considering the late planting.

Some of the seed was harvested with a John Deere lawnmower with a grass catching attachment and spread in windrows on paper to cure. However, most of the seed heads were cut with a standard grass seed windrower, which worked well. The grass was cut on 20 June 1994.

MN # 42 was the most uniform heading and exhibited the least shattering. MN # 184 and MN# 208 exhibited some uneven ripening and shattering. There are some indications that 2 harvests per season may be possible.

Plants in the mid portion of each plot exhibited substantially greater vigor than plants at the north and south ends of the rows. Apparently the more vigorous plants (mid-plot area) received more water than the ends. On that basis the middle of each plot and the ends were harvested separately. The difference in production ranged from 2 to 3.4 times more seed from the interior of the planting. MN # 42 produced 291 total pounds of seed; MN # 184 produced 170 total pounds and MN # 208 produced 305 total pounds of uncleaned seed.

The Grower agreed to continue this planting for at least one more year.

Costs for planting, management, harvest, and seed cleaning for this planting exceeded $14,000.

Three important conclusions from this experimental planting are:

1) The late planting was far more successful than could be expected;

2) harvesting can be accomplished with standard equipment and practices;

3) each of the selections produced sufficient seed to warrant continued seed production and introduction.

2. PICKSEED SEED INCREASE

In addition to the above seed plots, small plots of five selections were maintained for the project at PickSeed West for another year.

3. RELEASE OF SELECTIONS

Three selections (Minnesota #'s 42, 184, & 208) were approved for release by the Minnesota Agricultural Experiment Station - Horticultural Plant Release committee (see attached) on 14 February 1994. Materials were approved for release under exclusive agreement to Peterson Seed Co., Savage, Minnesota. An exclusive agreement was subsequently executed by the University of Minnesota Office of Research and Technology Transfer (Patents and Licensing) and Peterson Seed Company.

On the basis of the seed harvest and other factors, we decided, in consultation with Peterson Seed Company, to concentrate on MN # 42 as the first introduction from the program.

4. BREEDERS SEED FIELD SEEDING

On the basis of the decision to concentrate on the introduction of MN#42, a new 5 acre planting of MN # 42 was seeded in Oregon around 1 November 1994 for the production of breeder's seed.

5. CYTOLOGY - FLOW CYTOMETRY (DNA ANALYSIS)

The cytology - flow cytometry research has been essentially completed and is currently being written up. Earlier studies documented the occurrence of diploid (2N=2X=14) and tetraploid (2N=4X=28) *Poa annua* in our breeding populations. Subsequent field sampling on one golf green revealed the presence of diploids to a level of approximately 24% of the population on greens. Interestingly, no 2N=14 types have been found in either the fairway or the rough poa populations. The diminutive stature, fine texture, slow growth, and persistence appear to be clear indicators of the 2N=14 types. All of the 2N=14 types observed to date have been sterile.

6. INHERITANCE OF FLOWERING HABIT

A. The inheritance of flowering habit and expression of characteristics, under our observation, is influenced by environmental conditions. Differences in greenhouse grown and field grown plants indicate the environment can modify flowering and field selection of flowering type is most efficient.

Observations of crosses between annual (continuous flowering) and perennial (seasonal flowering) types of poa indicate a 3:1 ratio of continuous flowering to seasonal flowering types. If the model holds, it could indicate a single gene difference between continual and seasonal flowering perennial types. In addition, there is evidence of loci that modify the major gene effects and indications of maternal inheritance factors.

B. Numerous investigations continue to determine critical photoperiod and vernalization requirements of flower induction in our four genotypes. Preliminary observations indicate that 4-8°C is the optimal vernalization temperature and that vernalization is required for 10 - 12 weeks. Plants require no fewer than 4 to 6 leaves in order to be receptive to these flower induction stimuli. For at least 2 of our genotypes, the critical photoperiod appears to be between 10 and 12 hours.

7. MIXTURE (OF SELECTIONS) TRIAL

Seed mixtures of MN #42, MN #184, and MN #208 were sown for evaluation for compatibility and performance under putting green conditions. Performance will be evaluated against the individual genotypes.

8. CROSSING BLOCK ESTABLISHMENT

Crossing blocks have been constructed to maximize natural crossing and to develop populations for future selection. Parents include MN # - 177, 184, and 234.

9. NEW SELECTIONS

The top 2% of new progeny materials were identified for further evaluation. Plants were identified using selection indexes of growth habit, color, disease resistance, vigor and density. These plants will be selfed to observe uniformity and stability of the characteristics.

10. INTERSPECIFIC CROSSES

Plants resulting from seed of interspecific crosses between *Poa supina* and *Poa annua* have produced some unique plant types which exhibit dark color and vigorous growth habit. Observation will continue with these materials for several generations and to evaluate them as parents.

11. GA_3 TREATMENTS TO ENHANCE FLOWER REMOVAL

Preliminary experiments were conducted to investigate the potential for using gibberellic acid to aid in the removal of flowers on *Poa annua* turf. Some concentrations of GA induced sufficient culm elongation to allow removal of substantial portions of flowers under normal mowing conditions. It appears that there is an optimal concentration above which the turf goes off color with substantial yellowing. The best treatments in the 1994 experiments were treated twice at relatively low concentrations. The first application applied about 7 days after flowering was observed and the second during the peak spring flowering period gave the best results. A rate of 0.028 grams of GA_3 per 1,000 square feet resulted in sufficient elongation for removal of flowers with a minimum of off coloring. A higher rate of 0.283 grams per 1,000 square feet produced sufficient elongation for removal of flowers but negatively affected color and density. A low rate of 0.0028 grams/1,000 ft^2 did not result in sufficient elongation for removal of flowers. Results indicate the need for further investigation of concentration and timing of application.

12. SEED INCREASE OF NEW SELECTIONS

Seed increase efforts were initiated with several progeny that resulted from crosses of advanced selections. The materials show promise for out-performing their parents. Evaluation of these materials will continue as seed becomes available. Promising materials, performing well under putting green conditions, include progeny from the F4 generation of 184 X 117 and 184 X 234 and F3 of 42 X 184.

13. NEW EVALUATION LOCATIONS

Seed has been furnished to the University of Nebraska for a replicated evaluation planting and to the University of North Carolina, Raleigh, for an experiment in overseeding bermudagrass.

14. PUBLICATIONS

1993 Agronomy Abstracts, p. 159
Requirements for Flower Induction in *Poa annua* L..
P.G. JOHNSON* and D.B. WHITE, Univ. of Minnesota
Photoperiod and vernalization requirements for flowering vary among University of Minnesota *Poa annua* genotypes, although the literature describes the species as day-neutral. Growth chamber and field experiments indicate day-neutrality for PA-2283, long-day induction for PA-234, and a vernalization (cold) requirement for PA-42, 117, & 184. Short days partially substitute for vernalization in PA-117. Day-neutral types produce flowers anytime environmental conditions are favorable for growth and development. Long-day induced genotypes are characterized by late spring initiation and continual summer flowering. Genotypes responsive to only vernalization show a flush of flowers in spring, and no later season flowering. In genotypes where short days substitute for vernalization, flowering occurs as a flush in spring, no flowers in summer, and a few flowers in fall. Vernalization requirements appear controlled by one or few genes. Photoperiod responses may be quantitatively inherited.

1994 Agronomy Abstracts, p. 185
Inheritance of Flowering Pattern in *Poa annua reptans* (Hausskn.)
and *Poa annua annua* (L.).
P.G. JOHNSON* and D.B. WHITE, Univ. of Minnesota.
Poa annua reptans is a perennial which may exhibit a continual flowering (flowering throughout the growing season) or seasonal flowering (spring-only flowering) habit. *P. annua annua*, the annual form, flowers continuously until its death. F_1, F_2, F_3, and S_1 progenies from crosses of four true breeding *P. annua reptans* parents were observed in field and greenhouse environments replicated over two to three years. Segregation of flowering type appears to be governed by one locus with continual flowering completely dominant to seasonal flowering. Inheritance is modified by environment and possibly other genes. Inheritance patterns of flowering habit in *annua* x *reptans* crosses exhibit similar, simple genetic control. Because the flowering traits are simply inherited, selection for uniform flowering type should be rapidly achieved.

Minnesota AES Horticultural
Plant Release Committee Meeting Minutes
February 14, 1994

I. Attendance: Richard Wenkel, Dave Wildung, Harold Pellett, Lynn Steiner, Mike Zins, Don White, Frank Pfleger, Jerry Theis, Don Selinger, Gary Gardner, George Klacan, Dave Davis, Gary Holleman, Jim Severson, Rita Pasini, Jim Luby, Signe Betsinger, Peter Hemstad, David Bedford.

II. Presentations

A. Don White presented three potential turf cultivars for approval to release. They are as follows:

Poa reptans cultivar #UM-42, perennial, stoloniferous, fine textured grass for golf course use. Method of breeding: recurrent selection. Committee voted approval of release for development under exclusive agreement to Peterson Seed Co., Savage, MN.

Poa reptans cultivar #UM-184; perennial, stolonferous, fine textured, dark green grass for golf course use. Method of breeding: recurrent selection. Committee voted approval of release for development under exclusive agreement to Peterson Seed Co., Savage, MN.

Poa reptans cultivar #UM-208, perennial, stoloniferous, fine textured grass for golf course use. Method of breeding: recurrent selection. Committee voted approval of release for development under exclusive agreement to Peterson Seed Co., Savage, MN.

B. Dr. Davis presented three breeding lines of garden peas, one variety of southernpea and one variety of squash for release.

1. MN 144, MN 313 and MN 314 - three garden pea lines resistant to Apahanomyces root rot. MN 144, MN 313 and MN 314 were developed from a long-term breeding program relying on the combining of moderately resistant genotypes from various U.S. breeding programs followed by repeated selection and screening progenies in the disease nursery located at Waseca, MN, in a pea production region. The resistance level of MN 144, MN 313 and MN 314 should be interpreted only as an incremental, albeit significant, gain beyond that of previous releases by pea breeders.

MN 144, MN 313 and MN 314 have averaged from 1 to 3 on a 0 to 5 visual rating scale in the disease screening nursery at Waseca, MN, for the past several years, whereas commercial varieties generally have averaged 4 to 5, where 0 = no symptoms and 5 = all plants dead. In 1993, tests of one

15. Plans for 1995:

Certainly efforts will continue to concentrate on continuation of this project and the introduction of a named variety according to our tentative timetable.

A. The first priority for the project will focus on seed production research and the production of Breeder's seed of sufficient amount to support the production of foundation seed for subsequent use in the production and sale of certified seed.

B. Complete the process of naming and application for PVP of the Poa reptans cultivated variety, MN#42.

C. Expand the field evaluations by establishing larger replicated test plantings at selected golf courses and universities in the cool season grass areas of the United States and Canada.

D. Establish replicated test plantings to evaluate the potential for winter overseeding at selected locations in the southern United States.

E. Expand research to determine optimum seed harvesting time.

F. Complete the current cycle of research into the inheritance of flowering.

G. Maintain all program materials and continue progeny evaluations and the directed crossing.

H. Increase seed and evaluation of promising materials in the program.

Thank you for supporting this project.

Respectfully submitted,

Donald B. White

Professor, Turfgrass Science

Fig. 1. General view of one half the space planting - 1994

Fig. 2. MN117 x MN2283 F2; Vigorous segregate from perennial x annual cross.

Fig. 3. MN42 x MN2283 F1; Vigorous segregate from perennial x annual cross.

Fig. 4. MN117 x MN184 F3; Vigorous segregate from perennial x perennial cross.

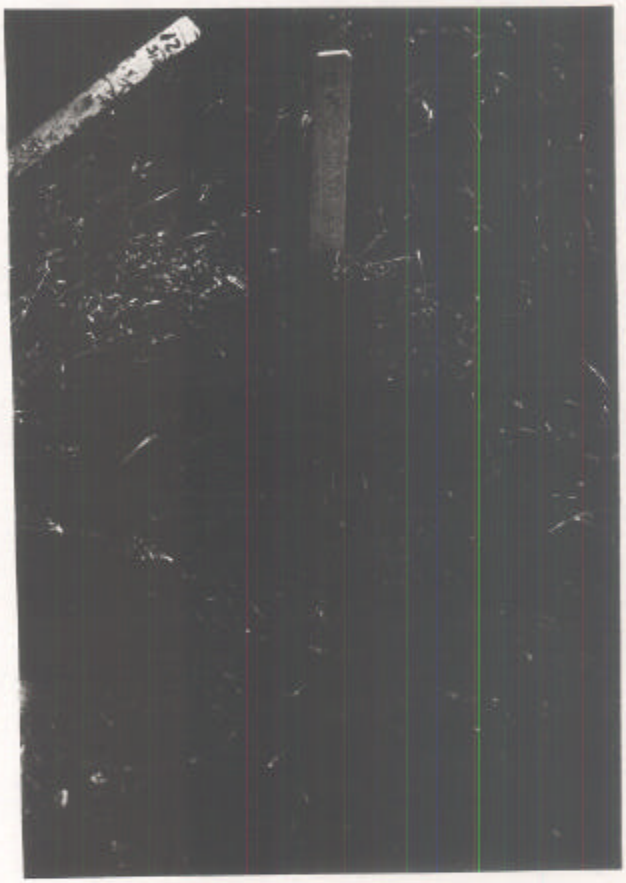

Fig. 5. MN42 S1; Typical 42 type. Note dense, vigorous habit and dark green color.

Fig. 6. MN42 x MN117 F1; Evidence of maternal inheritance in this perennial x perennial combination. Note similarity to MN42 S1 in Fig. 5.

Fig. 7. MN42 x MN184 F2; Note dense, compact growth habit.

Fig. 8. MN42 x MN234 F2; Note more vigorous habit, donated by the MN234 parent.

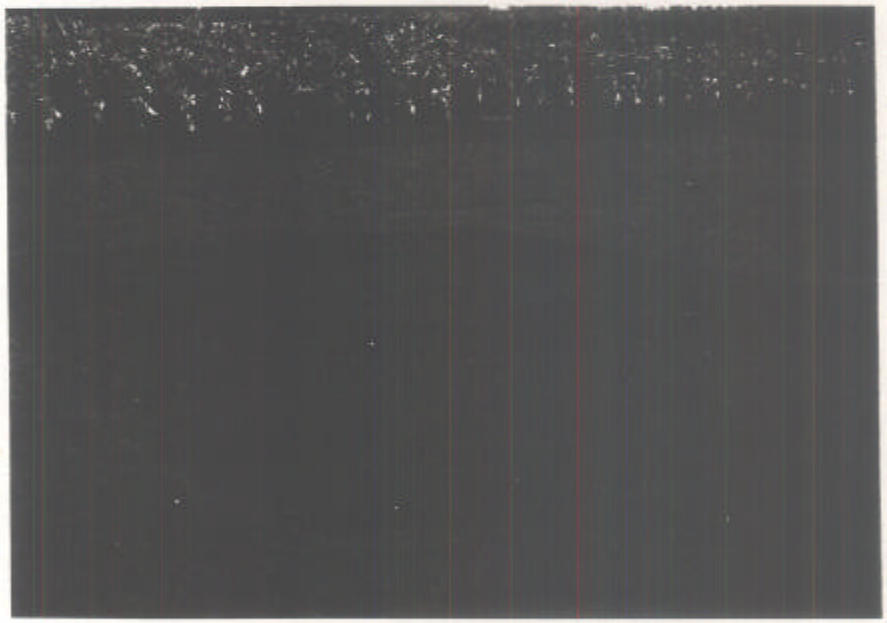

Fig. 9. Germination of 1994 green height planting - evaluation of new advanced selections.

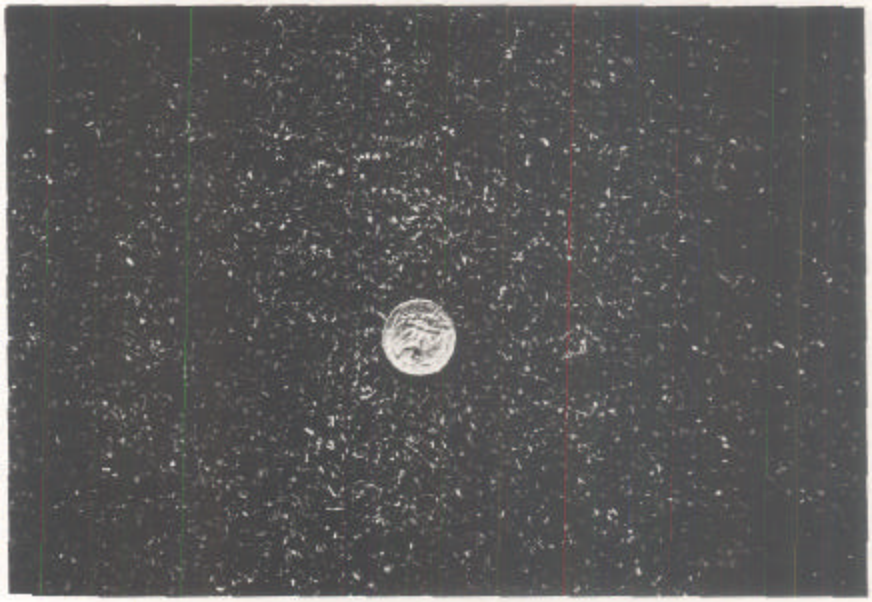

Fig. 10. MN184 at green height showing late summer quality.