

PROGRESS REPORT #1

Improvement of Poa Annua for Golf Turf

The University of Minnesota
Department of Horticultural Science and Landscape Architecture
Project: Biology and Utilization of Turfgrasses

and

The United States Golf Association
Cooperating

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INTRODUCTION.

The activities to date with this project focus primarily on expanding the research efforts to a serious level and relate more to progress and development than to results. Most of the activities are on-going and in the initiation phase of the project.

PROJECT ACTIVITIES AND FINDINGS.

1. USGA Committee Visits.

Dr. James Watson has reviewed the project 2 times and Dr. Paul Rieke has reviewed the project one time.

2. Collections.

The project now has material collections from New York, Michigan, Minnesota, and Canada. The new materials are in the process of being propagated in order to develop a population sufficient to evaluate and participate in the crossing program once it is initiated.

3. Pollen Investigations.

Anthesis and pollen shedding patterns have been observed and recorded. Anthesis has been found to occur at all of the daylight hours in both Poa annua and Poa supina. On a spot check basis, Poa annua was observed to shed pollen between 01:00 and 02:00 hours. Stigma receptivity has yet to be evaluated, however the apparent non-specificity in anthesis may simplify the job of making crosses. Anthesis will continue to be observed during the normal operations of the project.

4. Pollen Tube Growth.

Investigations into pollen tube growth have been initiated. This kind of information is critical to understanding the breeding behavior of the materials that are to be used in the development of improved "Poas". The initial work involved development of techniques for observing pollen tube growth. Flowers were pollinated and the culms involved excised and protected from contamination. After 12 to 48 hours whole

inflorescences were fixed in CRAF III for at least 2 hours. Samples were then prepared using a typical squash technique and observed at 100-400X.

Initial observations indicated that separation of the lemma and palea results in greater exposure of the flower parts, especially the stigma. In general, the stigma in both the P. annua and P. supina emerged before the anthers. Analine-blue was used to stain callose to produce a fluorescent green color under a fluorescent illumination. The callose plugs located at the tip of the pollen tube and callose in the ungerminated pollen grain offer easy observation of whether the grains are full (ungerminated) or empty (germinated). Future investigations will examine the possibility of pollen pollinating the stigma of the same flower.

5. Preliminary observations of pollination compatibility.

Initial observations indicate there was no pollination with selfed P. supina. Successful pollinations were achieved with P. annua and with open pollinations. Selfing was observed with P. annua flowers.

Observations of pollen tube growth reaffirm that P. supina is self incompatible and that there is a strong possibility that the apparent self compatibility in P. annua may really be the expression of pseudo-self compatibility.

6. Tissue Culture techniques for increasing selections.

Work on fine tuning tissue culture techniques for increasing desirable selections continues. A 2x2x5 factorial experiment with 15 replications was recently initiated to determine optimum 2,4-D levels for 2 lines in both Poa annua and Poa supina. The lines under investigation are clones of superior selections from the program.

7. Selections and characteristics of Minnesota pedigrees.

Plant materials have been categorized according to original source of materials, which we are calling pedigree families. The following is an enumeration of some of the family characteristics

and identification of some special selections of Poa annua and Poa supina. These family selections have been identified for use in the breeding program.

- A. Pa#2 (Poa annua): above average vigor, moderate flowering habit, above average density, strong stoloniferous habit, medium to fine texture, acceptable to above average color ratings, slower vertical growth than average.
- B. Pa#3 (Poa annua): above average vigor; wide range of flowering habits; above average density; several are strongly stoloniferous; fine textured; above average color; specific selections have been identified for dark green color and compact habit of growth. Selection #3A is a superior plant in many characteristics.
- C. Pa#4 (Poa annua): very vigorous; wide range of flowering habits, all have long culms with the flowerheads well elevated above blades; above average density; strongly stoloniferous; leaf texture= medium to coarse; above average color. No individual selections have been made from this source, however the material has been maintained as part of the germ plasm base for the future.
- D. Pa#5 (Poa annua): above average vigor; wide variability in flowering habit, some long culms ; maybe more highly self incompatible than most other Poa annua families; strongly stoloniferous; medium to coarse texture; dark green color; Seed production may be affected by lower than average self compatibility. This may be a valuable clone just from the compatibility stand point.
- E. Pa#6 (Poa annua); below average seedling vigor but superior mature plant vigor; F-1 is a prolific seeder; wide range in density between plants; growth habit of plants from seed range from very compact to upright habit; strongly stoloniferous; medium to coarse texture; above average color; large flower heads. Some specific selections have been identified in this family.
- F. Pa#7 (Poa annua): Wide range in seedling vigor among progeny with good mature vigor; slower than average to flower; wide range in density - most are above average; superior stoloniferous; Texture = coarse to medium; much diversity in this family.

- G. Pa#8 (Poa annua): Vigorous; wide range of seed production; wide range in stoloniferous habit; medium texture; wide range in color but most above average; compact growth habit.
- H. Pa#10 (Poa annua) Original = average vigor, most progeny = superior vigor; heavy seed production; above average density; medium stoloniferous habit; medium to coarse texture; above average color; dense, compact growth habit; large inflorescence; vigorous rooting habit.
- I. Pa#11 (Poa annua): moderate seedling vigor; extremely vigorous mature growth pattern; high seed production; wide range in density; vigorous stoloniferous growth; decumbent habit; fine to medium textured; largest inflorescence of all Poa annuas; very long culms; outside of density progeny = very uniform.
- J. Pa#12 (Poa annua): Average seedling vigor; above average mature vigor; tends to very dense; wide range of growth habits from bunched habit to stoloniferous; medium to fine textured; superior dark green color; selections have been made from this family for continued evaluation.
- K. Pa#14 (Poa annua): Extremely vigorous; average seed production; tends to high density; above average stolon production; medium to coarse texture; average to above average color; superior root vigor and habit (may be the most vigorous rooting of any of the materials).
- L. Pa#15 (Poa annua): vigorous; above average seed production; dense: range from strongly stoloniferous to bunchy habit; medium to coarse; above average dark green color; small inflorescences, long culms; superior rooting habit.
- M. Pa#16 (Poa annua): Seedlings in this family are some of the finest selections in the whole program; above average vigor; definite seasonal flowering habit; develops extremely dense turf; tends to thatch; wide range of stoloniferous habit ranging from average to very vigorous; medium to fine texture; color average to better with 16B being the darkest of all progeny; 16A and 16C are similar to 16B all are in the selection phase of the program.

- N. Ps#1 (Poa supina): Above average vigor; medium texture; above average color; dense; strong stoloniferous habit.
- O. Ps#23 (Poa supina): Strong stoloniferous habit; medium to fine texture; above average color; above average vigor.
- P. Ps#29 (Poa supina): Progeny tend to be very fine textured (finer than most of the Poa annua; superior density, above average vigor.
- Q. Ps#33(Poa supina): Above average vigor, fine texture; dark color; dense.
- R. Ps#51(Poa supina): above average vigor; fine textured; strongly stoloniferous; dark color; dense.
- S. Ps #53(Poa supina): wide variation in texture; highly stoloniferous; dark color.
- T. Ps #81 (Poa supina): Leafy; strongly stoloniferous with very long stolons; medium to fine texture; dark green color.

8. Field plantings.

Several field plantings were established in 1984. Included are space plantings of both Poa annua and Poa supina; plantings to maintain germ plasm while being maintained under both collar and golf green heights of cut. Plantings were also maintained to ascertain competitive ability between Poa annua, Poa supina and creeping bentgrass (Agrostis palustris).

9. Budget.

Received-
from U. S. G. A

Research Foundation \$11,600.00

Amount committed to
one graduate assistantship

\$9,200.00

Amount expended
for miscellaneous help,
field services,
greenhouse and
miscellaneous supplies.

\$2,400.00

Total Commitments

\$11,600.00

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10. Plans for 1985.

Plans call for continuing current efforts but we are close to the limit of work that can be accomplished under the current support level. Most of the efforts that were initiated or expanded in 1984 will be operating through 1985.

Within the constraints, plans include increasing the collection process with the cooperation of the USGA Green Section and other Turf Professionals around the country. In addition I hope to be able to collect material of Poa annua, Poa supina, and Poa infirma while attending the International Turfgrass Research Conference in Europe next summer. No USGA funds are allocated to support that trip.

Tissue culture research will continue with the primary purpose of integrating findings into and enhancing the Poa breeding project.

Incompatibility research will continue with several experiments aimed at elucidating the genetic mechanism(s) involved. Along the same line, we have already initiated selection for self incompatibility in Poa annua. If this characteristic can be incorporated into superior breeding lines it could greatly simplify seed production of uniform F-1 hybrids and interspecific crosses as well as facilitating other genetic research with the species in question

A selective crossing program will be initiated during the spring 1985 flowering season aimed at investigating combining ability (combining desirable characteristics) of different progeny families.

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Fig. 1. Poa annua stolon used for tissue culture.



Fig. 2. Section of stolon used for explant. The prepared explant is shown above. Includes youngest clearly defined node plus shoot. Leaves are trimmed back to sheath.



Fig. 3. Callus formed on explant. Auxin control is with 2,4-D. Explant has etiolated and senesced.

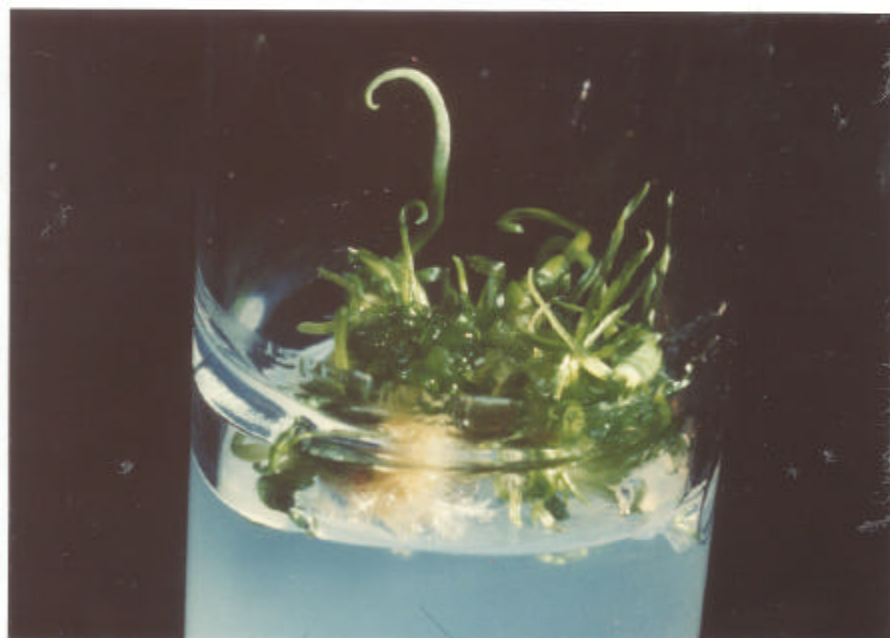


Fig. 4. Organogenesis and plantlet regeneration on callus.



Fig. 5. Proliferation of shoots. Cytokinin control is with kinetin.



Fig. 6. Regenerated *Poa annua* plant.



Fig. 7. Close-up of Poa supina pots. "Plugs" collected early 11-84 from the field from F-1 generation of original clones. They vary in color, leaf width and growth habit. Photographed 12-3-84.



Fig. 8. "Plugs" of Poa supina collected from F-1 after transfer to field. Collected 11-84. Materials vary in color & leaf width. Photographed 12-3-84.



Fig. 9. Poa supina #46 from original seed lot.
Excellent color.



Fig. 10. Poa supina #53 from original seed lot.
Dark color for a P. supina.



Fig. 11. Poa annua #16B. Dark green, fine-medium leaves.



Fig. 12. Poa annua. Comparison within and between half-sib groups; note leaf texture differences.



Fig. 13. Poa annua samples from Edmonton,
Canada.



Fig. 14. Poa annua samples from University of Minnesota Golf Course.



Fig. 15. Clones 16C and 16B. Poa annua.
Comparisons for color and leaf width.
7th generation from original clone.

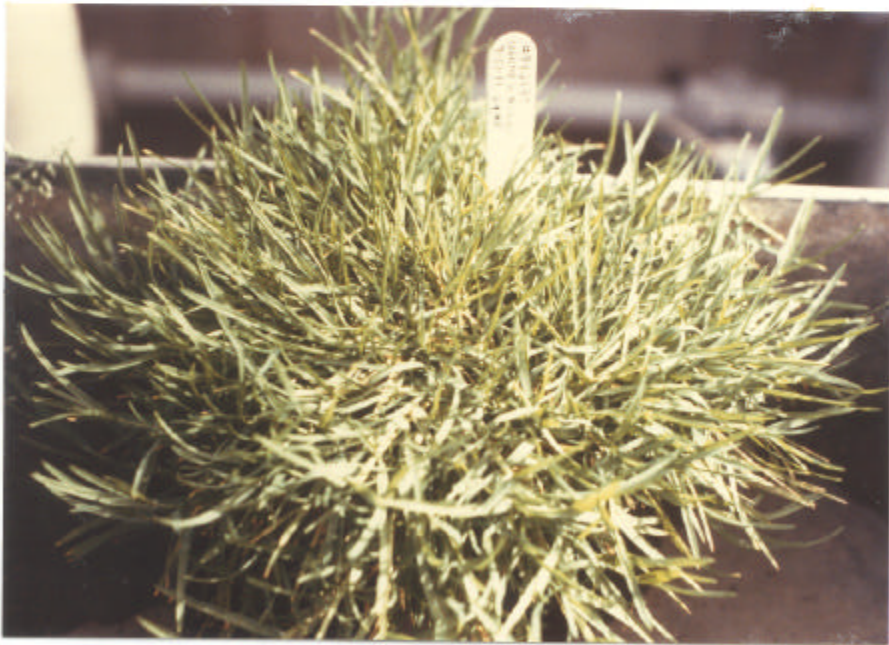


Fig. 16. Poa annua. Collected by Engelke from
Michigan golf course.

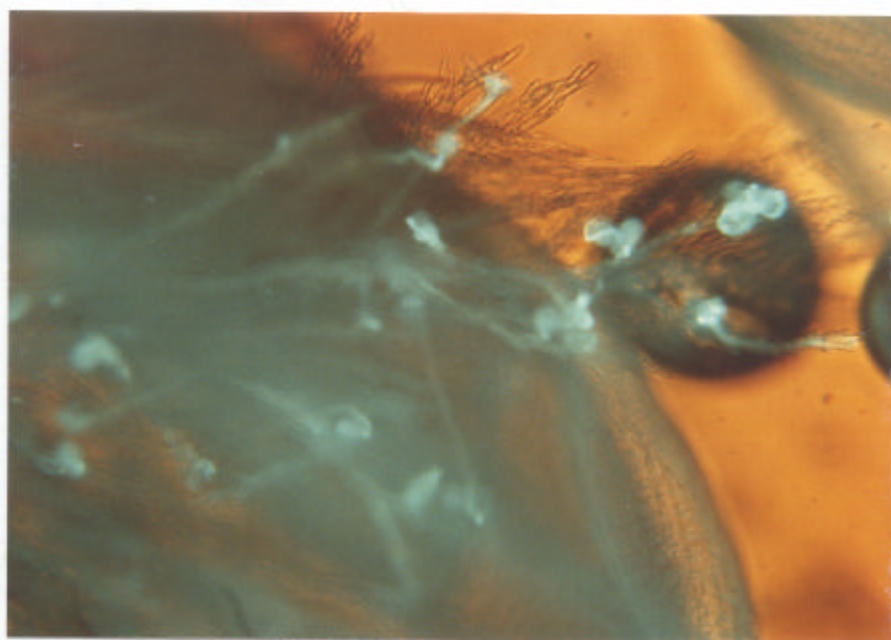


Fig. 17. *Poa supina* #02 open pollinated. Numerous pollen grains on stigma; at least 10 of which have started to germinate.

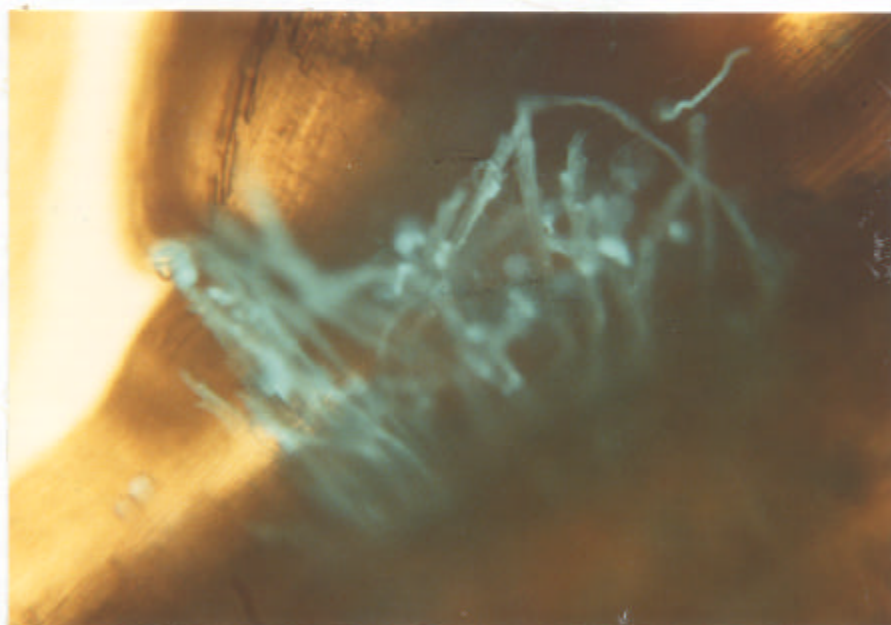


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Fig. 19. Overview of greenhouse section devoted to Poa annua / P. supina breeding program. Most of plants shown are Poa annua.



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