NOT FOR PUBLICATION

PROGRESS REPORT # 12

NOVEMBER 1995

IMPROVEMENT OF *POA REPTANS* FOR GOLF TURF

UNIVERSITY OF MINNESOTA

DEPARTMENT OF HORTICULTURAL SCIENCE

Project: Biology and Utilization of Turfgrasses

and

The United States Golf Association

Cooperating

NOT FOR PUBLICATION

EXECUTIVE SUMMARY

IMPROVEMENT OF *POA REPTANS* FOR GOLF TURF

UNIVERSITY OF MINNESOTA

PROGRESS REPORT #12, NOVEMBER 1995

- On the basis of second year seed production and performance under mowing trials, it was decided that the first introduction will be MN#184 instead of MN#42 as originally indicated.
- On that basis 15 acres was seed to MN#184 in Oregon in October for production of "breeder's" seed in 1996. An additional planting of 6 acres is planned for the spring of 1996
- All three selections under consideration for introduction maintained trueness to type in the seed field
- Selection MN#184 performed exceptionally well during the 1994-95 growing season.
- All three selections responded equally to herbicide treatments. No phytotoxicity was observed on "Poast" (herbicide) treated *Poa reptans* selections in the seed field. This is a major plus for keeping the seed fields free of bentgrass and weeds. Poast will be the chemical of choice for seed production.
- Late planting can be far more successful than might be expected.
- Seed harvest can be accomplished with standard equipment and practices.
- Each selection produced sufficient seed to warrant continued production
- We continue to observe 5 selections under trial at Pickseed West's research area.
- Vernalization and photoperiod requirements are major determinants to perenniality.
- Vernalization requirements are met between 4C and 8C after 10-12 weeks exposure.
- Some perennials are induced to flower under short days while others are induced under long days and some are day neutral but require vernalization.
- Inheritance investigations into flowering patterns indicate a 3 : 1 ratio of continual to seasonal flowering which fits a genetic model involving one locus with continual flowering being dominant to seasonal.
- Plants resulting from seed of interspecific crosses and reciprocals, between *Poa supina, Poa infirma* and *Poa reptans* exhibit some unique plant types that warrant continued evaluation.
- Plans include expanding the number of evaluation sites in the cool season turfgrass area; continuing efforts into improving seed production; and establishing replicated plantings to evaluate potential use for winter overseeding.

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1 November 1995

1. SEED PRODUCTION

The seed field plantings of 1 acre each of Minnesota numbered selections MN#42 and MN#184; and 2 acres of Minnesota MN#208 that were seeded on November 12, 1993 at a site in the Willamette Valley, Oregon were continued under agreement with the Peterson Seed Company (The grower and seed company both requested confidentiality of location). All selections continued to grow well under seed field conditions. All of the plantings maintained trueness to type and displayed increased vigor over the 1994 season. Both MN#184 and MN#208 produced substantially more seed heads in 1995 season as compared to 1994. Selection MN#184 performed exceptionally well during the 1994-95 growing season.

An herbicide trial was initiated on the seed increase planting in December of 1994. Eight different herbicides were applied in strips across the plantings. Herbicides included: Sinbar @ .5, 1.0, 1.5 lb./a; Diuron 4L @ 12, 24, 36 oz., Goal @ 12, 24, 36 oz.; Nortron @ 1.5 pt., 3.0, 4.5 pt.; Poast @ 32 oz., 64 oz, 96 oz.; Atrazine 90 @ 1, 2, 3 Lb.; Sencor @ 4 0z, 8, 12 oz.; and Prowl @ 3.5 pt., 7.0 pt., 10.5 pt. The remainder of the planting was treated with Poast herbicide @ 32 oz. per acre. On April 3, '95, MCPA at 24 oz. and Banvel-D at 6.0 oz. per acre were applied to the total planting. In addition, in April 1995, a late application of Poast was applied to the herbicide trial area and on two other areas in the field at 24 oz. per acre. The plots were hand weeded on 2 different dates in April and May of '95. No phytotoxicity to the *Poa reptans* selections was observed with Sinbar, Diuron, Goal, Atrazine, Sencor, or Prowl. However none of these exhibited satisfactory weed (especially bentgrass) control. Nortron treatments exhibited substantial phytotoxicity, however the *poa reptans* survived. No phytotoxicity was observed on the Poast treated areas except for the late application in April of 1995 where some injury was observed. It appears that Poast is the chemical of choice for continued use in *Poa reptans* seed production.

Seed was harvested using standard equipment although other details of production were not available at the time of this report, indications are that seed production was more than adequate to continue production. The grower has agreed to maintain the planting at least one more year.

Important conclusions from this experimental planting reinforced the 1994 observations:

1) The late planting can be far more successful than might 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.

4) Selections MN#184 and MN#208 produce more seed in the second seeding year.

5) All three selections responded equally to the herbicide treatments.

6) On the basis of performance under seed production and mowing trials it was decided that the first introduction would be MN#184 instead of MN#42 as originally planned.

2. PICKSEED SEED INCREASE

In addition to the above seed trial, small plantings of five selections were maintained for the project at PickSeed West research area for another year. These plantings were evaluated in April and June and will be continued for at least one more year. Seed was hand harvested from these plantings and is being processed for use in further trials.

3. BREEDERS SEED FIELD SEEDING

On the basis of seed production results and field performance evaluations under mowed conditions, a 15 acre "breeder's" seed planting of MN #184 was seeded on 5 October 1995 in Oregon. Plans include installing another 6 acres during the Spring of 1996. The Spring planting is not expected to produce seed until 1997. The first substantial supply of "Breeder's" seed is expected from the October 1995 planting in the summer of 1996.

4. INHERITANCE OF FLOWERING HABIT

Paul Johnson completed his research, and Ph.D., in June. The following is a summary of the results of that research which has direct bearing on the *Poa annua* breeding project and how we proceed in the future.

Poa annua is usually described as a continuously flowering species under golf course conditions. However, over the years, great variation in flowering habit has been observed in the accessions and progeny under observation under this project. Observations revealed that flowering varied from continuous over the growing season to restricted seasonal flowering only in the Spring. On that basis a systematic effort to elucidate the controlling mechanisms and factors in flowering in

Poa annua was initiated. Experiments were conducted to investigate the role that vernalization, photoperiod, juvenility and inheritance might play in the flowering process in this species. This information would be extremely valuable to continuing breeding efforts under this project.

Vernalization

Three experiments were conducted to determine if any of the genotypes expressed vernalization requirements to flower. Experimental materials included one annual type and 3 perennial types with different flowering habits. Experiments were designed to: 1)determine the length of the vernalization period, if any; 2) determine the effective temperature regime to fulfill the requirement; and 3) determine if juvenility played a role in vernalization of seedling plants. Only the annual type plant did not respond to vernalization treatment. The perennials were fully vernalized at both 4 and 8C, after 10 to 12 weeks of exposure. Inflorescence development was initiated by 8 weeks, but flower development was not fully initiated until the 10 to 12 week period was completed. One genotype (MN#42) expressed the shortest requirement, with the requirement being fulfilled in 8 to 10 weeks. In addition, MN#42 produced significantly larger numbers of inflorescences due to the production and flowering of secondary tillers. This phenomena has also been observed in the field with MN#42. Vernalization did not occur at or above 12C. Seedlings generally responded to the vernalization stimuli after approximately 4 to 5 weeks, or at the 3 -5 tiller stage of development. Although the seedlings exhibited a juvenile period, individual meristems did not appear to require a minimum number of leaves for vernalization and floral induction. Vernalization requirements are one fundamental difference between annual and perennial forms, and influence partitioning between vegetative and reproductive traits. This variation might be useful in balancing turf characteristics and seed production in developing new varieties.

Photoperiod

Three experiments were conducted to determine the role photoperiod might play in the flower induction process in *Poa annua.* Photoperiod effects were investigated: 1) without vernalization; 2)during vernalization; and 3) after vernalization requirements had been satisfied. The annual genotype is day neutral and exhibited no photoperiodic response. One of the perennial genotypes (MN#234) was induced under long days, without vernalization. Two perennial genotypes (MN#42 and MN#117) were induced under short days without vernalization. One genotype (MN#184)exhibited no photoperiodic response. Night break treatments were effective in producing the long day responses. Photoperiod did not influence the vernalization process. However, floral development by long days was favored by vernalization. It was concluded that photoperiodism is associated with perennial genotypes and is probably important in the natural selection processes that occur in golf course turves. certainly, this phenomena must be taken into consideration in the continuing efforts of this project.

Inheritance of flowering pattern

Inheritance of flowering pattern was investigated with four genotypes. The investigations were conducted to: 1) investigate the genetic control of flowering pattern; 2) relate that to the ecology of the species on golf courses; and 3) incorporate the findings into the breeding program. Four tetraploid (2N=4X=28 chromosomes) genotypes, previously identified to exhibit disomic inheritance, and cover the range of true annual to seasonal perennial were selected for the investigations. The materials were crossed in nearly all possible combinations and F_1, F_2, and in most cases F_3, populations were grown and observed under field conditions over the last 1 to 3 years. Each plant was evaluated for flowering pattern: seasonal (not flowering during the summer) or continual (flowering across the whole growing season). A distinct 3 : 1 ratio of continual to seasonal types was observed in the F_2 populations and segregating F_3 populations from crosses of continual by seasonal types. This indicates a genetic model involving one locus with continual flowering being completely dominant to seasonal flowering. There is the possibility of some modifying loci and increased expression of maternal traits in some populations. This simple inheritance may explain the high heritability of flowering traits and rapid evolution of plant types under golf course conditions. Qualitative inheritance also provides the opportunity for efficient selection of desirable seasonal flowering plant types. The information gained from these investigations is of great importance in offering the opportunity for improved efficiency in this breeding project.

5. MIXTURE (OF SELECTIONS) TRIAL

Seed mixtures of MN #42, MN #184, and MN #208 were sown in 1994 for evaluation for compatibility and performance under putting green conditions. Performance indicates potential for the use of mixtures in the future.

6. CROSSING BLOCK ESTABLISHMENT

Crossing blocks have been constructed to maximize natural crossing and to develop populations for future selection. Parents include MN#117, MN#184, and MN#234. Progeny will be evaluated during the 1996 growing season.

7. NEW SELECTIONS

Progeny from seed of 1994 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.

8. INTERSPECIFIC CROSSES

Plants resulting from seed of interspecific crosses, and reciprocals, between *Poa supina, Poa infirma* and *Poa reptans* have produced some unique plant types which exhibit dark color and vigorous growth habit. Observation will be continued with these materials for several generations for turf characteristics and to evaluate them as parents. Several of these progeny stood out throughout the 1995 growing season. Seed was collected and is currently in storage awaiting planting in the greenhouse.

9. SEED INCREASE OF NEW SELECTIONS

3200 progeny were established in space plantings for seed increase and continued evaluation. This planting included 550 previously selected material. The majority of the selected materials were the result of the crossing program..

10. NEW EVALUATION LOCATIONS

New, replicated plantings of MN#42, MN#184, and MN#208 have been installed (or seed has been furnished for installation) at:

Washington State University Puyallup, two plantings: one under sun and one shade

University of Rhode Island

University of Minnesota on a new 90:10 sand green

Les Bolstad Golf Course, University of Minnesota

Columbia Country Club, Columbia, Maryland

Interlachen Country Club, Edina, Minnesota

Olds College, Alberta, Canada.

Currently, we have more requests for trials than we can service. However, several new locations are planned for 1996, particularly in Michigan and on the west coast. We have also received several requests from Canada for trial plantings. Plans include continuing to establish trial plantings at selected, representative sites including several more universities.

11. PUBLICATIONS

Genetics and Physiology of Flowering in Selected poa annua L.; Paul G. Johnson, Ph.D. thesis submitted to the Faculty of the Graduate School, University of Minnesota. 1995

Implications of Flowering Pattern to Growth and the Culture of Annual Bluegrass (Poa annua L.) P. G. Johnson and D. B. White, Agronomy Abstracts. 1995.

Poa annua L. exhibits variation in flowering patterns during the year and in flowering requirements, especially between annual and perennial forms. Flowering during the year is detrimental to quality and stress tolerance of perennial turf communities. Annuals exhibit no flowering requirements and flower season-long. Perennial biotypes are sensitive to vernalizing conditions and a range of photoperiods. They are induced by either short days, long days, or induced only by vernalization. The perennials may flower only in the spring or season long. These flowering traits are inherited by a relatively simple genetic systems and are likely selected upon in golf course environments. These flowering requirements are likely to be important selection factors influenced by the intensive turf management practices and diverse *Poa annua* populations. *Poa annua* eradication programs may favor the less desirable annual types. More specific knowledge of the turfgrass environments and their effects on the plant populations contributes to understanding the ecology of *Poa annua* turf and how best to manage it.

12. Plans for 1996

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

A. The first priority for the project will focus, in cooperation with Peterson Seed Co., on continued seed production research and the production of Breeder's seed from the 15 acres planted this fall and the 6 acres to be planted in the spring of 1996. This should produce a sufficient amount of seed 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#184.

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

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

Thank you for supporting this project. We look forward to another year and being that much closer to introducing a cultivar into the marketplace.

Respectfully submitted,

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