PROGRESS REPORT # 6

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Improvement of *Poa annua* for Golf Turf

The University of Minnesota

Department of Horticultural Science

Project: Biology and Utilization of Turfgrasses

and

The United States Golf Association

Cooperating

PERSONNEL

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EXECUTIVE SUMMARY

"Improvement of _Poa annua_ for Golf Turf", 1989 Annual Report, University of Minnesota

Replicated plantings of 8 advanced selections were established as sods and sent for evaluation by cooperators at the Universities of Massachusetts, Ohio State, Nebraska -Lincoln, Texas A&M -Dallas Station, and Washington State -Puyallup Station. In addition, the University of Nebraska was furnished enough material of selection #117 for 576 3 inch plugs for a long term golf course experiment. Reports of evaluation of the 8 selections from the golf course planting across the country indicate that most of the eight selections are performing well across all environments. Most reports indicated some outstanding performers. Progeny testing continued for heritability of desirable characteristics. Several of the 8 selections exhibit excellent heritability and uniformity of progeny from seed. Initial seed production plantings were harvested and indicated that most of the 8 advanced selections produced seed heads between 8 and 12 inches tall. This is considered within the range for mechanical harvest. 75 new materials were added to the program from Georgia, Wisconsin, North Carolina, Minnesota, Montana, Washington, Virginia, Ohio, Kentucky, Florida, South Carolina, New York, Tennessee, California, New Jersey, and Indiana. Research continues on developing improved breeding techniques and in executing crosses to combine desirable characteristics within _Poa annua_ and _Poa supina_. For the first time, 6 interspecific crosses between the two species have been accomplished. Seeds are currently being germinated and will be closely observed for heritability of desirable characteristics. Cytological studies will also be conducted on the seedlings. 50 additional crossed were accomplished between _Poa annua_ selections that exhibit superior traits. Research indicates that sucrose and water alone offer the best media for floral pic culture of excised flowers for crossing. Preliminary investigation reveals that fogging maturing flowers may offer an easy aid to techniques for emasculation of flowers. If this is successful, it could dramatically reduce that work involved in accomplishing controlled crosses. A computerized record system was developed and installed to document pedigrees and keep track of all breeding data. The record system currently accommodates over 1300 individual accessions under field and greenhouse evaluation and 8500 seed accessions as well as on-going breeding efforts. Research indicated that _Poa annua_ seed can absorb moisture, start to germinate, and be dried without killing the seed. In addition, several cycles of wetting and drying results in synchronized germination of virtually all of the viable seed within a 24 hour period. Work for 89-90 will continue to focus on vegetative evaluations and seed production of the 8 advanced selection as well as breeding and collection efforts.

I INTRODUCTION

The following is a report of the research conducted under the project: "Improvement of Poa annua for Golf Turf" for 1989. The activities pursued during the year are summarized and are offered in outline form. More detail is available upon request.

II ENVIRONMENT 1988-89

Actually both years must be considered in order to develop an appropriate perspective for 1989. The years of 87 and 88 were some of the hottest and driest in the history of Minnesota. The soils went into the winter of 88-89 in a water deficit condition. The winter of 88-89 was relatively mild with reasonable snow cover and very little frost penetrating the soil. In late winter, rainfall densified the snow pack and the spring thaw was rapid enough to produce abundant water at the surface. Several sharp freezes were experienced during this melting period resulting in severe damage to Poa annua on many golf greens in the area. The conditions also placed selection pressure on some of the field space planting evaluations.

The summer of 89 was much closer to normal than the previous 2 summers. However, during late summer, and particularly after 4 September, no measurable rainfall was experienced until 29 October. While the space plantings have been irrigated, most of the soils in the region are going into the winter in a deficit condition greater than in 1988.

III SPACE PLANTINGS

The 1987 space planting was continued under minimal maintenance for the purposes of selecting out stress tolerant biotypes after the winter of 89-90. Surviving materials will be identified and propagated during the spring of 1990.

The 1988 space planting was maintained and generated the first seedhead and seed production data on field grown materials. The Poa annua portion of this planting was subjected to run-off water during the sharp freezes in the spring and many selection suffered. Seed was harvested and the data on flowering, seed production and seed head height are currently being processed. In addition this planting served to generate data on vegetative characteristics including color, texture, vigor, and general quality.

Flowering / seeding heights will be one of the critical factors in determining the feasibility of seed production in Poa annua and Poa supina. Seed head heights varied from a minimum of 10 cm (4") to a maximum of 35cm (14") and averaged between 18-23cm (7"-9"). The superior selections fell into the average or above average in height. The conclusion one can draw is that seed could be harvested from these materials. (figs. 21-30)

The 1989 space planting was devoted primarily to progeny evaluation, for uniformity and variability of offspring for self and cross pollinations. Seed was also harvested for further evaluation of these materials as parents. The materials in this planting also furnished pollen and flowers for evaluating specific combinations of individuals with superior characteristics.

IV NEW COLLECTIONS

New materials were received and added to the program from 25 locations including: Sapphire Valley, GA; Schuss Mountain, WI; Carolina Trace in Sanford, NC; Pinehurst National, NC; Southern Pines, NC; Buffalo Hills, MT; Orchard Hills, WA; Farmington, VA; Green Meadow, MT; University of Minnesota, MN; Piqua CC, OH; Big Springs, KY; Stone Mountain, GA; University of Florida, FL; Forsyth, NC; River Hills, SC; Cherry Valley, NY; Cherokee, TN; Crispin, WA; Coyotes, CA; Virginia, CA; Old Ranch, CA; LaJolla, CA; Pennsauken, NJ;Highland CC, IN. These collections represent approximately 75 new accessions into the program.

V GOLF COURSE EVALUATION PLANTINGS

Eight biotypes selected as holding the most promise for early introduction from the program were distributed to 18 golf courses across the country in the fall of 1988 for initial field evaluation. The plants were placed in nurseries or in collar plantings and maintained under the same program as the surrounding turf. See fig. 12 for an example.

Reports during the growing season varied somewhat by biotype, however, generally all reports of established materials were positive for at least two out of four materials at each site. Three clubs reported lost materials or other problems. Evaluations from a few test sites are offered as samples of performance by these materials.

1. Oswego CC, W. Lynn OR, Dick Fluter, Superintendent

This golf course lost 6 greens over the winter of 88-89. The area experienced very warm temperatures for 2 weeks in January and the grasses started to grow. Overnight the weather changed to expose the turf to wind-chill temperatures of -50F. Although turf on much of the course was damaged or killed, only one plot in the test planting was lost and two of the selections looked particularly good.

2. Old Ranch CC, L.A., CA, Don Parsons, Superintendent

All of the materials survived and were growing well. Three biotypes appear to be superior under the conditions of this test. Two exhibited bentgrass invasion. Several of these are aggressive spreaders under limited competition and appear to be less aggressive under competition. These materials were established in collar areas.

3. Pinehurst CC, Pinehurst, NC,Mr. Brad Kocher, Director of Golf Maintenance, Mr. Paul Jett USGA test planting contact.

This area experienced and extreme amount of rainfall last spring and early summer. All the selections were performing well. They experienced snow mold in February which hit up to 80% of the turf in some plugs, however, all fully recovered.

4. Reports of excellent performance were also received from Ohio, Massachusetts, Utah, Virginia, and others. Substantial variation in flowering was reported from several locations.

VI EVALUATIONS AT COOPERATING UNIVERSITY LOCATIONS

All eight selections were sent (in September or October) to the following Universities for further evaluation under field conditions.

1. University of Massachusetts, Amherst, MA. Dr. Richard Cooper will be conducting the evaluations.

2. Ohio State University, Columbus, Ohio. Dr. Carl Danneberger will be conducting the evaluations.

3. The University of Nebraska, Lincoln, NE. Drs. Terry Riordan and Robert Shearman will be conducting the evaluations.

4. Texas A & M University, Dallas Station. Drs. Milt Engelke and Bridget Ruemmele will be conducting the evaluations.

5. Washington State University, Puyallup, WA. Dr. Stanton Brauen will be conducting the evaluations.

6. In addition to the above evaluation sites, enough material of selection # 117 was produced to furnish a minimum of 576 three to four inch plugs for planting in an experiment on a golf course outside of Lincoln Nebraska. Dr. Robert Shearman and Dr. Terry Riordan will be conducting this long term experiment.

7. Further evaluation of these selected materials has substantiated previous observations that #208 is very shade tolerant and maintains color and vigor under drought, shade competition, and very low fertility. Conversely #117 appears to perform in a superior way under moderate to high fertility and regular moisture supply.

VII BREEDING AND GENETICS

Breeding and genetic work has continued during 1989 focussing on developing breeding techniques and selective crossing within Poa annua and Poa supina, as well as efforts to complete interspecific crosses between the two species.

A. INTERSPECIFIC CROSSING

If, indeed, Poa supina is one of the evolutionary parents of Poa annua, then it could be expected that a certain amount of cross compatibility might exist. Until recently, very limited success has been accomplished in making crosses between these two species. Crosses that appeared to result in seed did not result in viable plants.

Recently, however the following crosses have been successfully completed:

302 (PS) X 184 (PA 16-B)
184 (PA) X 302 (PS)
357 (PS) X 223 (PA)
343 (PS) X 223 (PA)
596 (PS) X 14 (PA)
14 (PA) X 358 (PS)

Seeds have been harvested and plants are being grown to ascertain the breeding behavior of these materials and heritability of desireable characteristics.

Approximately 50 additional designated crosses have been accomplished between Poa annua materials which exhibit superior traits.

B. EMASCULATION TECHNIQUES

Successful emasculation techniques are necessary to ensure breeding behavior and success or failure of designed crossing or other breeding efforts. Work continues on developing a reasonable emasculation technique for these grasses.

1. Manual Technique

To date, the manual technique has been the most successful. However it is the most tedious and time consuming because the flowers and flower parts are very small and held tightly in the flower until just before pollen-shed. The procedure follows: 1) remove all but 3-5 spikelets at the top of the culm using a surgical blade so as to minimize damage to the remaining flowers; 2)open florets carefully with dissecting needles and coax out the anthers without disturbing the style. The first floret is not disturbed because it is usually male sterile.

2. Hot Water Technique

Dr. Reed Funk et. al. have shown that these anthers are more temperature to heat than the styles. Efforts to develop this method have been disappointing. Dr. Funk's and our own experiences have convinced us to try to find other ways.

3. Fogging Technique

We recently learned that many years ago Dr. Glenn Burton developed a mist or fog treatment technique that appeared to have promise. The technique consists of subjecting plants that are about to flower to a misted environment to delay pollen shed. Preliminary observations indicate the under the mist the pollen shed is inhibited, the flowers open, and the anthers are extruded and easily removed. It appears that drying for about one hour will result in pollen-shed. Research with this method will continue.

C. FLORAL PIC METHOD OF FLOWER CULTURE

Experiments were conducted to complete necessary research on the "Pic Method" of flower culture that we have employed in our crossing program.

Result indicate that the use of the biocide, 8HQC, is unnecessary and contrary to previous work with other plants, there is no advantage to using it with Poa flowers.

Results also indicate that use of distilled water does offer distinct advantages over plain tap water. Work with other plants indicated that plain tap water was better than distilled water in supporting flowers.

No differences were observed between the use of either fructose (the more common sugar in grasses) or sucrose which is cheaper and easier to acquire. The optimum concentration was observed to be 2%.

Additional observations indicated that the optimum time for seed ripening in the picks is 15 days after pollination at which time seed can be harvested. Contrary to field observation where seed often shatters when ripe, the seed is held for extended periods in the pic method.

This is the most promising technique to surface to date and will be the subject of continued experimentation.

VIII SYNCHRONIZED SEED

Poa annua seed was included in an experiment, that although not related to this project, aimed at developing synchronized germination in seed lots. Preliminary results indicated that Poa annua seed can become hydrated and start to germinate and then tolerate a drying period without damage to the seed. Indeed, the seed was subjected to a series of wetting and drying cycles with no apparent deleterious affects on the viability of the seed. After accumulating several cycles, the seed was placed in a moist environment; resulting in 95% germination within 24 hours. This research has potential implications for the handling and marketing of any cultivars introduced from this project.

IX PLANT HANDLING AND COMPUTERIZED RECORD SYSTEMS

A substantial portion of the past year's work focussed on re-organization and computerization of the record and plant handling systems for this breeding project.

A computerized record system was developed and implemented to document: 1) pedigrees of all accessions and materials in the program; 2) all data generated about all individual materials in the program; and 3) field plans, planting maps and off campus evaluations.

The record system currently accommodates over 1300 individual accessions under field and greenhouse evaluation and 8500 seed accessions, as well as current breeding and research efforts. We are now up-to-date with a very functional record system. Figure 39 offers an example of a typical record sequence.

Plant handling systems for both field plot and greenhouse collections were developed. Methods for propagating and shipping material for use in regional cooperative evaluation plantings were also developed. In order to provide cooperators with larger-sized samples that would be better able to compete during establishment, Poa annua / supina sod pieces were produced. Individual tillers were planted on 1 inch centers in a high sand medium in 6 by 9 inch plastic packs. The packs were initially filled to 1/2" below the top. Over a period of several weeks the plants were heavily topdressed to cover stolons. This encouraged the plants to spread and develop new crowns as the nodes rooted. Grass was clipped with a mechanical pot mower to allow the finished sod to be maintained at 1/2". Flowers were routinely removed by hand to preclude contamination of the clonal selections with seedlings. Sod was shipped with approximately 1/2" of soil/mat. Tests showed this thickness provided adequate handling strength without inhibiting re-rooting and establishment. (figs. 33-36)

FIGURES

1. 1988 field space planting taken in late fall 1988.

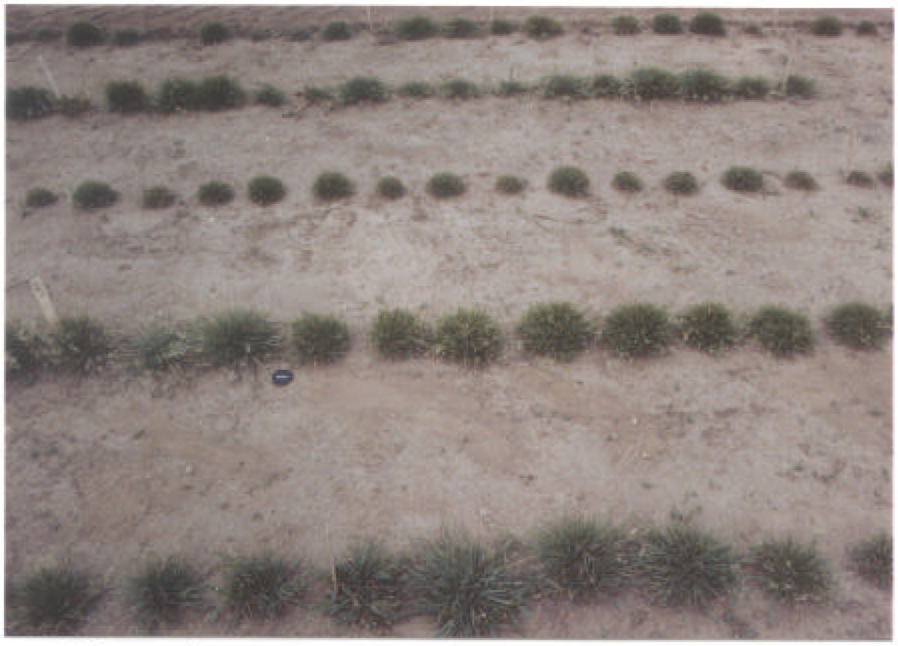
2. 1988 space planting (foreground) taken Spring 89. The newly planted 1989 space planting may be seen in the background.

3. <u>Poa</u> <u>annua</u> selection #117 (10C) in 1989 field space planting. Note minimum flowering.

4. Two <u>Poa</u> <u>annua</u> plants showing seedling variation in family #20. Note wide variation in habit and vigor.

5. Flowering habit of a new accession planted in the 1989 space planting. Note the desireable upright habit.

6. Flowering habit of *Poa annua* accession #255 in 89 space planting. Note upright habit.



7. Seedlings in space planting representing a wide range of <u>Poa annua</u> materials.

8. <u>Poa annua</u> plants from open pollinations. Note vigor, prostrate habit and variability.

9. F2 generation of Poa annua seedlings from #184 (this one is in the golf trials). Note uniformity in type, vigor, color, texture and habit of growth.

10. Vigorous Poa annua plant resulting from a cross of 2 inbred lines, combining color, vigor, and growth habit.

11. Poa annua seedlings displaying uniformity of type in density, color, texture and vigor.

12. Planting of _Poa annua_ and _Poa supina_ selections at the Milwaukee CC. Taken 5/28/89 by J. Latham.

Each evaluation site received a planting plan containing special code numbers for the selections. The following key describes the codes used at Milwaukee CC:

Old Name	Accession #	Code
PA 16B	#184	MN88A01
PA NY12	#493	MN88A02
PA 3A	#42	MN88A03
PS 55D	#417	MN88A08

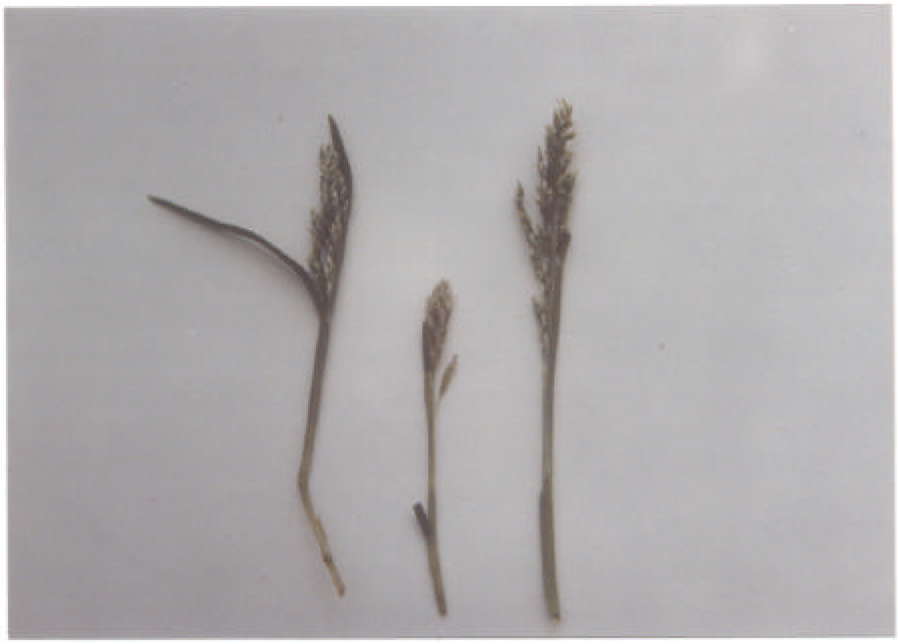
The other four selections in the golf course trials (but not at Milwaukee) are:

Old Name	Accession #
PA 21	#234
PA 18D	#208
PA 10C	#117
PS 29F	#391

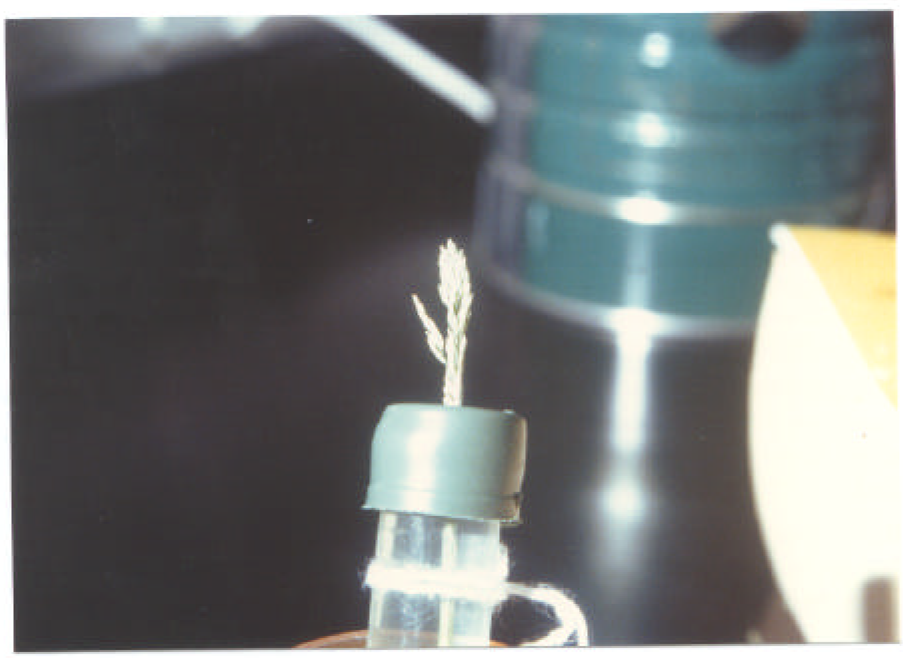
13. Poa annua selection #42 at Milwaukee CC. Note fine texture, dark color, and flowering. Taken 5/28/89 by J. Latham.

14. Poa supina #417 at Milwaukee CC. Note vigorous habit. Taken 5/28/89 by J. Latham.

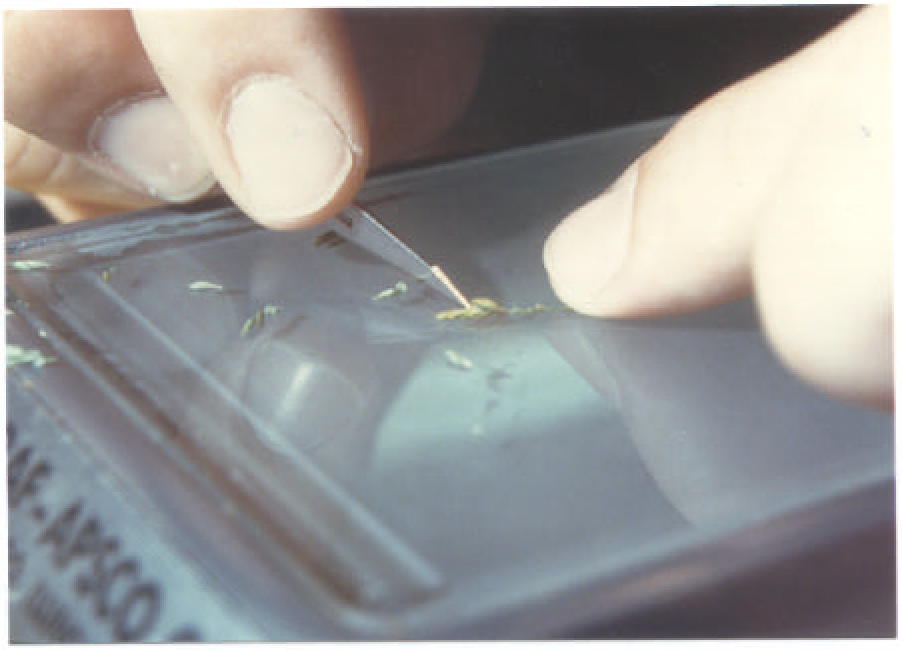
15. Poa supina #417 and Poa annua #42 in test planting at Milwaukee CC. Taken 5/28/89 by J. Latham.



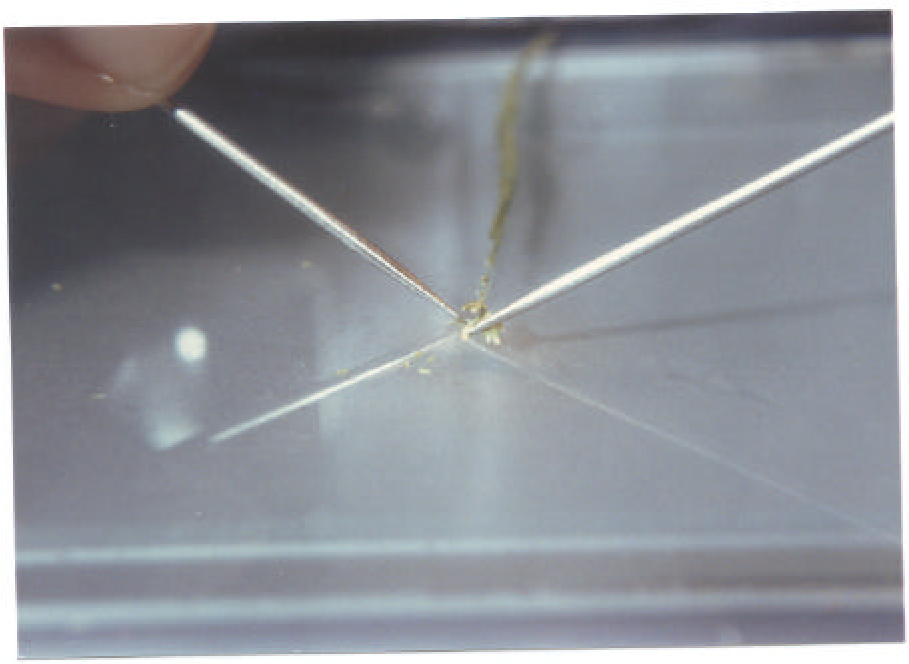
16. *Poa annua* flowers to be prepared for crossing in floral pics.



17. *Poa annua* flower in floral pic prior to flower opening and emasculation.



18. Poa annua flower showing removal of extra spikelets in preparation for emasculation of remaining florets.



19. Emasculation (removal of pollen bearing anthers) with dissecting needles prior to placement in floral pic.

Fig. 39

K-10 FIELD PLANTING

1989: DATA

FR LO DW	N FM LB DR	D E A D	DR CS LI NS	D(IC AM M)	H(GC HM T)	A(C RSM EQ. A.)	V(C DCM LU. M.)	ASPCT RATIO HT VS DIAM.	NOTES
E	150	0	2	15	8	47	377	0.53	(PA 18-F-5) SEED 10
F	1	0	2	10	6	31	188	0.60	(PA 18-F-5) SEED 2
F	2	0	2	12	7	38	264	0.58	(PA 18-F-5) SEED 3
F	3	0	1	8	4	25	100	0.50	(PA 18-F-5) SEED 4
F	4	0	3	14	5	44	220	0.36	(PA 18-F-5) SEED 5
F	5	0	3	15	9	47	424	0.60	(PA 18-F-5) SEED 6
F	6	0	3	13	8	41	327	0.62	(PA 18-F-5) SEED 7
F	7	0	3	14	8	44	352	0.57	(PA 18-F-5) SEED 8
F	8	0	3	17	8	53	427	0.47	(PA 18-F-5) SEED 9
F	9	0	3	14	6	44	264	0.43	(PA 18-F-3) SEED 1 Pkt 5143 group very uniform
F	10	0	2	14	7	44	308	0.50	(PA 18-F-3) SEED 10 ""
F	11	0	2	13	7	41	286	0.54	(PA 18-F-3) SEED 13 ""
F	12	0	3	14	9	44	396	0.64	(PA 18-F-3) SEED 14 ""
F	13	0	3	17	10	53	534	0.59	(PA 18-F-3) SEED 15 ""
F	14	0	3	15	9	47	424	0.60	(PA 18-F-3) SEED 2 ""
F	15	0	3	17	8	53	427	0.47	(PA 18-F-3) SEED 3 ""
F	16	0	3	15	9	47	424	0.60	(PA 18-F-3) SEED 4 ""
F	17	0	3	21	9	66	593	0.43	(PA 18-F-3) SEED 6 ""
F	18	0	3	20	8	63	502	0.40	(PA 18-F-3) SEED 7 ""
F	19	0	3	24	10	75	754	0.42	(PA 18-F-3) SEED 8 ""
F	20	0	3	19	9	60	537	0.47	(PA 18-F-3) SEED 9 ""
F	21	0	3	17	6	53	320	0.35	(PA 16-B X-1 * PA 11-H X-1) SEED 1. PIC 1165 Sim. to other 16B types
F	22	0	3	14	6	44	264	0.43	(PA 16-B X-1 * PA 11-H X-1) SEED 2. PIC 1165 ""
F	23	0	3	15	7	47	330	0.47	(PA 16-B X-1 * PA 11-H X-1) SEED 3. PIC 1165 ""
F	24	0	2	10	4	31	126	0.40	(PA 16-B X-1 * PA 11-H X-1) SEED 4. PIC 1165 ""
F	25	0	3	12	5	38	188	0.42	(PA 16-B X-1 * PA 11-H X-1) SEED 5. PIC 1165 ""
F	26	0	2	12	5	38	188	0.42	(PA 16-B X-1)X SEED 1. PIC 1179
F	27	0	1	11	4	35	138	0.36	(PA 16-B X-1)X SEED 10. PIC 1179
F	28	0	1	12	5	38	188	0.42	(PA 16-B X-1)X SEED 3. PIC 1179
F	29	0	1	9	4	28	113	0.44	(PA 16-B X-1)X SEED 4. PIC 1179
F	30	0	2	12	5	38	188	0.42	(PA 16-B X-1)X SEED 5. PIC 1179
F	31	0	2	12	5	38	188	0.42	(PA 16-B X-1)X SEED 6. PIC 1179
F	32	0	2	9	5	28	141	0.56	(PA 16-B X-1)X SEED 7. PIC 1179
F	33	0	2	12	5	38	188	0.42	(PA 16-B X-1)X SEED 8. PIC 1179
F	34	0	2	12	5	38	188	0.42	(PA 16-B X-1)X SEED 9. PIC 1179
F	35	0	2	12	4	38	151	0.33	(PA 16-B X-1 * PA 16-B X-5) SEED 1. PIC 1169
F	36	0	3	8	3	25	75	0.38	(PA 16-B X-1 * PA 16-B X-5) SEED 10. PIC 1169
F	37	0	3	17	8	53	427	0.47	(PA 16-B X-1 * PA 16-B X-5) SEED 2. PIC 1169
F	38	0	2	17	7	53	374	0.41	(PA 16-B X-1 * PA 16-B X-5) SEED 3. PIC 1169
F	39	0	3	13	4	41	163	0.31	(PA 16-B X-1 * PA 16-B X-5) SEED 4. PIC 1169
F	40	0	3	14	6	44	264	0.43	(PA 16-B X-1 * PA 16-B X-5) SEED 5. PIC 1169 Best of seed pkt. group
F	41	0	2	12	6	38	226	0.50	(PA 16-B X-1 * PA 16-B X-5) SEED 7. PIC 1169
F	42	0	2	9	4	28	113	0.44	(PA 16-B X-1 * PA 16-B X-5) SEED 8. PIC 1169
F	43	0	2	10	5	31	157	0.50	(PA 16-B X-2)X SEED 1. PIC 778

K-10 FIELD PLANTING

1989

FR LO DW	N FM LB DR	D E A D	F L A T	F. LR AO TW	F. LC AO TL	ACCESN NUMBER	F_PAR	M_PAR	SD_PKT	NOTES
E	150	0	315	10	E	0	966	0	5144	(PA 18-F-5) SEED 10
F	1	0	316	1	A	0	966	0	5144	(PA 18-F-5) SEED 2
F	2	0	316	1	B	0	966	0	5144	(PA 18-F-5) SEED 3
F	3	0	316	1	C	0	966	0	5144	(PA 18-F-5) SEED 4
F	4	0	316	1	D	0	966	0	5144	(PA 18-F-5) SEED 5
F	5	0	316	1	E	0	966	0	5144	(PA 18-F-5) SEED 6
F	6	0	316	2	A	0	966	0	5144	(PA 18-F-5) SEED 7
F	7	0	316	2	B	0	966	0	5144	(PA 18-F-5) SEED 8
F	8	0	316	2	C	0	966	0	5144	(PA 18-F-5) SEED 9
F	9	0	316	2	D	0	1228	0	5143	(PA 18-F-3) SEED 1 Pkt 5143 group very uniform
F	10	0	316	2	E	0	1228	0	5143	(PA 18-F-3) SEED 10 ""
F	11	0	316	3	A	0	1228	0	5143	(PA 18-F-3) SEED 13 ""
F	12	0	316	3	B	0	1228	0	5143	(PA 18-F-3) SEED 14 ""
F	13	0	316	3	C	0	1228	0	5143	(PA 18-F-3) SEED 15 ""
F	14	0	316	3	D	0	1228	0	5143	(PA 18-F-3) SEED 2 ""
F	15	0	316	3	E	0	1228	0	5143	(PA 18-F-3) SEED 3 ""
F	16	0	316	4	A	0	1228	0	5143	(PA 18-F-3) SEED 4 ""
F	17	0	316	4	B	0	1228	0	5143	(PA 18-F-3) SEED 6 ""
F	18	0	316	4	C	0	1228	0	5143	(PA 18-F-3) SEED 7 ""
F	19	0	316	4	D	0	1228	0	5143	(PA 18-F-3) SEED 8 ""
F	20	0	316	4	E	0	1228	0	5143	(PA 18-F-3) SEED 9 ""
F	21	0	316	5	A	0	1356	636	7151	(PA 16-B X-1 * PA 11-H X-1) SEED 1. PIC 1165 Sim. to other 168 types
F	22	0	316	5	B	0	1356	636	7151	(PA 16-B X-1 * PA 11-H X-1) SEED 2. PIC 1165 ""
F	23	0	316	5	C	0	1356	636	7151	(PA 16-B X-1 * PA 11-H X-1) SEED 3. PIC 1165 ""
F	24	0	316	5	D	0	1356	636	7151	(PA 16-B X-1 * PA 11-H X-1) SEED 4. PIC 1165 ""
F	25	0	316	5	E	0	1356	636	7151	(PA 16-B X-1 * PA 11-H X-1) SEED 5. PIC 1165 ""
F	26	0	316	6	A	0	1356	1356	7165	(PA 16-B X-1)X SEED 1. PIC 1179
F	27	0	316	6	B	0	1356	1356	7165	(PA 16-B X-1)X SEED 10. PIC 1179
F	28	0	316	6	C	0	1356	1356	7165	(PA 16-B X-1)X SEED 3. PIC 1179
F	29	0	316	6	D	0	1356	1356	7165	(PA 16-B X-1)X SEED 4. PIC 1179
F	30	0	316	6	E	0	1356	1356	7165	(PA 16-B X-1)X SEED 5. PIC 1179
F	31	0	316	7	A	0	1356	1356	7165	(PA 16-B X-1)X SEED 6. PIC 1179
F	32	0	316	7	B	0	1356	1356	7165	(PA 16-B X-1)X SEED 7. PIC 1179
F	33	0	316	7	C	0	1356	1356	7165	(PA 16-B X-1)X SEED 8. PIC 1179
F	34	0	316	7	D	0	1356	1356	7165	(PA 16-B X-1)X SEED 9. PIC 1179
F	35	0	316	7	E	0	1356	1360	7155	(PA 16-B X-1 * PA 16-B X-5) SEED 1. PIC 1169
F	36	0	316	8	A	0	1356	1360	7155	(PA 16-B X-1 * PA 16-B X-5) SEED 10. PIC 1169
F	37	0	316	8	B	0	1356	1360	7155	(PA 16-B X-1 * PA 16-B X-5) SEED 2. PIC 1169
F	38	0	316	8	C	0	1356	1360	7155	(PA 16-B X-1 * PA 16-B X-5) SEED 3. PIC 1169
F	39	0	316	8	D	0	1356	1360	7155	(PA 16-B X-1 * PA 16-B X-5) SEED 4. PIC 1169
F	40	0	316	8	E	0	1356	1360	7155	(PA 16-B X-1 * PA 16-B X-5) SEED 5. PIC 1169 Best of seed pkt. group
F	41	0	316	9	A	0	1356	1360	7155	(PA 16-B X-1 * PA 16-B X-5) SEED 7. PIC 1169
F	42	0	316	9	B	0	1356	1360	7155	(PA 16-B X-1 * PA 16-B X-5) SEED 8. PIC 1169
F	43	0	316	9	C	0	1357	1357	6762	(PA 16-B X-2)X SEED 1. PIC 778

Fig. 39 continued

KEY TO DATA IN THIS RECORD EXAMPLE

FLD ROW	Row plant is in field.
FLD NMBR	Numbered position of plant in field row.
DEAD	Specimen is dead or missing in plot. (1=dead 0=living)
FLAT	Number of flat plant was propagated in before moving to field.
FLAT ROW	Row in propagation flat.
FLAT COL	Column in propagation flat. Use of the three flat numbers serves as a unique ID for each individual until such time it is deemed valuable enough for a permanent accession number.
ACCESN NUMBER	Accession Number (=0 when not applicable).
F_PAR	Accession Number of female parent.
M_PAR	Accession Number of male parent (=0 when pollen source unidentified).
SD_PKT	Seed packet number that individual's seed had come from. Seed packet registry serves as cross record. Use of this number here assists in defining individuals from identical but unrelated crosses.
NOTES	Other names, cross info., collection source, general observations.
DCLN RSIS	General quality during heat/drought/disease induced summer decline (0=dead; 1=poor; 2=fair; 3=good, only some loss of color or leaf spotting; 4=excellent, apparent complete resistance, no loss of color or disease symptoms.
DIAM (CM)	Width of plant across row in centimeters.
HGT (CM)	Typical height of unmowed leaves in centimeters

Fig. 39 continued

AREA
SQ.CM Square area (plant assumed to be a perfect circle for calculation purposes)

VOLM
CU CM Cubic volume (plant assumed to be a perfect cylinder for calculation purposes).

ASPCT
RATIO Aspect ratio calculated by dividing height by diameter. This gives a measure of habit of growth. (.01-.50 = prostrate, >.51 = upright)