

# TURFGRASS TRENDS

Volume 9, Issue 2 • February 2000

## GENETICS

### Poa Annua-Free Turf A Dream or Newfound Reality?

By Crystal Rose-Fricker, Turf-Seed Inc.

**W**e all struggle with the never-ending battle with annual bluegrass (*Poa annua*). From the grass seed grower and sod farmer trying to produce a clean turfgrass product, to the homeowner, golf course superintendent, and sports turf manager. Ugly light green patches with short prolific seed heads cropping up year round plague the grass seed grower, the professional turfgrass manager and the homeowner. The homeowner works for the seemingly unattainable perfect, weed-free lawn. He or she crawls on hands and knees pulling weeds to have "the best lawn on the block." Golf course and sports turf professionals work towards a pristine turf environment for clients to enjoy. It's no wonder that we fight a perennial problem with a life cycle of 38 days from germination to the next generation of seed. Annual bluegrass seems virtually unstoppable — or is it?

A new avenue of control is now available in two species of turfgrass and on the horizon for other species of turfgrass. After ten years of natural plant breeding tolerance to low rates



Pure Gold tall fescue and Aurora Gold hard fescue (in rows) have exhibited superior tolerance to glyphosate in trials. Off-types between rows dead after application.

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of glyphosate (Roundup) are evident in grass seed production trials and turf trials in Oregon. With the banning of field burning, grass seed growers need another tool to help control weed problems such as annual bluegrass and annual ryegrass in seed production fields.

Over the past several years, research has been ongoing to evaluate two new glyphosate (Roundup) tolerant varieties—Pure Gold tall fescue and Aurora Gold hard fescue. Trials in seed production fields were very promising with 85 percent control of poa annua and 90 percent control of annual ryegrass in pure Gold tall fescue with one application of 12 oz. per acre glyphosate sprayed in the fall. A 95 percent control rate of annual bluegrass in Aurora Gold production fields was also achieved with one application of 16 oz. (1 pint) per acre of Roundup in the winter.

Aurora Gold hard fescue has shown significantly higher turf quality ratings in turf than other fine fescue varieties when sprayed with 16 ounces of glyphosate in a turf trial in Oregon. Seed yields and germination rates were not significantly reduced with up to 16 ounces of glyphosate per acre sprayed in one application anytime from

November through February. Adequate weed control was achieved with 8 ounces of glyphosate per acre with little crop damage.

Pure Gold tall fescue also shows significant tolerance to 16 ounces of glyphosate sprayed 8 May 1998 in a turf trial in Oregon. Seed yields of Pure Gold were not significantly damaged at 8 ounces/acre when applied in November, December, January or February after a fall planting. A 16-ounce/acre rate was not detrimental when sprayed November or January for seed yield. Germination percentages of Pure Gold from field trials were not reduced by applications of up to 32 ounces of glyphosate per acre from November through April.

The savings to growers and the ability to produce higher quality seed lots of Pure Gold and Aurora Gold is but one benefit that also trickles down to the consumer in cleaner seed available to purchase for sod growers, homeowners and golf course superintendents. A seed production label has been approved by the EPA (with assistance from Monsanto) to allow grass seed growers to spray up to 1 pint of glyphosate on their production fields of Pure Gold and Aurora Gold.

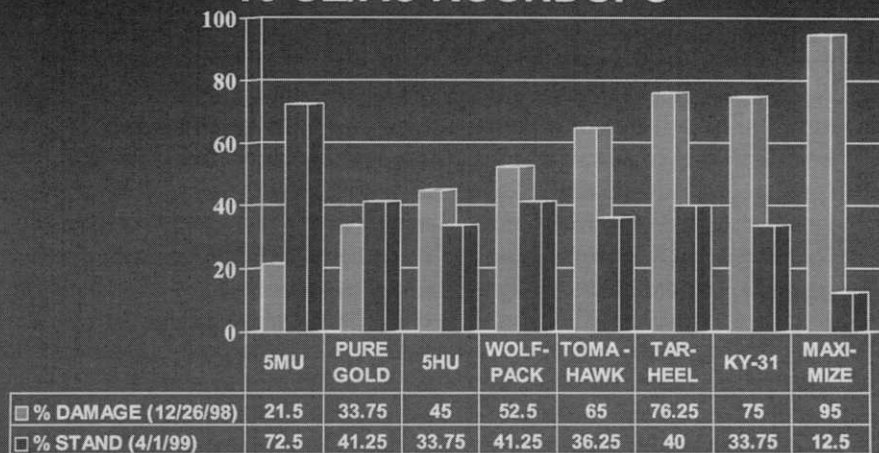
## Pure Gold Tall Fescue Glyphosate Damage Ratings Sprayed 10/29/98

	12/11/98 (43 DAYS)			1/14/99 (77 DAYS)			2/12/99 (106 DAYS)			3/12/99 (134 DAYS)			3/30/99 (154 DAYS)		
ROUND-UP RATE (OZ./AC.)	CROP	AR	AB	CROP	AR	AB	CROP	AR	AB	CROP	AR	AB	CROP	AR	AB
4	4.3	2	6.3	2.5	3	5.3	0.8	1.0	0	0.8	1	0	0	--	--
8	5.5	3	6.8	5.3	5	7.0	2.8	5	6.3	2.8	6	7.3	0.3	--	--
12	6.8	3.8	7.0	7.0	7.5	7.0	4.0	7	7.3	4.0	8	8.3	1.3	--	--
0 = NO CONTROL      10 = COMPLETE CONTROL															

Tall fescue tests results.



## TALL FESCUE % DAMAGE & STAND RATINGS SPRAYED NOV. 19, 1998 16 OZ/AC ROUNDUP®



*Fall applications of glyphosate at 16 oz. per acre revealed natural tolerance.*

Trials with these two glyphosate tolerant varieties have been exciting to say the least. Annual bluegrass infested turf with a 90 percent reduction of annual bluegrass after one application of Roundup are possible; with a light rate (4 oz. to 16 oz. per acre) application of Roundup most annual bluegrass is eliminated within the first year. Fall and spring 4 oz. to 8 oz. per acre applications of Roundup can be the answer to annual bluegrass free turf.

Being able to spray with low rates of Roundup several times is a much safer and economical way to solve the annual bluegrass problem. On a golf course, eliminating annual bluegrass on roughs and fairways will help cut down on the amount of annual bluegrass seed tracked onto greens and tees.

Natural phenotypic selection for tolerance to herbicides such as Roundup is a long and sometimes frustrating process. Ninety-nine percent of the plants we work with are very sensitive to Roundup. For many years (cycles of selection) the survival rate was 1-2 percent of the population sprayed. Different rates sprayed at different growth stages over a span of 8 to 10 years

resulted in populations of over 90 percent survival at 16 oz. of glyphosate per acre.

Natural Roundup tolerance in Pure Gold and Aurora Gold appear to be controlled by several minor recessive genes which were gradually "uncovered" each generation or year of selection and compiled in an additive

manner in a population. By applying appropriate selection pressure we were able to discover natural resistance already inherent in a few plants in a population. This differs from transgenic breeding for herbicide resistance where a single dominant gene is introduced in a plant

usually from a different organism such as bacteria. The resistance of a transgenic variety to a herbicide will usually tolerate very high rates up to 10 times the labeled rate. The exception to this is when multiple copies of the gene occur in the transformed

*By applying appropriate selection pressure, we were able to discover natural resistance already inherent in a few plants. This differs from transgenic breeding for herbicide resistance where a single dominant gene is introduced in a plant.*



*Breeding projects to develop herbicide-tolerant creeping bentgrass, Colonial bentgrass, perennial ryegrass, Kentucky bluegrass, tall fescue and fine fescue varieties will revolutionize the way we deal with weeds in turf.*

plant and gene silencing occurs. This occurs when a biolistic gene is used to put the gene into a plant. This results in progeny or seeds produced by the transformed plant, which die when sprayed with the herbicide.

Naturally tolerant Aurora Gold and Pure Gold can be killed with high rates of Roundup such as 2 quarts/A. When these two varieties out cross to non-tolerant grasses, they will not easily spread via pollen to create other Roundup tolerant varieties or weeds. When transgenic, open pollinated crops out cross to neighboring fields or weeds, they can create herbicide resistant plants unless a male sterility system (no fertile pollen) is used.

The solutions to all our turf management problems are not available yet but with continued research they appear to be coming. Annual bluegrass free turf is quickly becoming a reality as a label for turf use of Roundup on Aurora Gold hard fescue and Pure Gold tall fescue is in process.

For the future, many research projects are underway at several universities and private grass seed companies. At Pure Seed

Testing, Inc., we are working with both conventional breeding and Biotech techniques to develop turf and forage grass varieties with naturally inherited and/or transgenic resistance to herbicides. Breeding projects to develop herbicide tolerant creeping bentgrass, Colonial bentgrass, perennial ryegrass, Kentucky bluegrass, tall fescue and fine fescue varieties will revolutionize the way we deal with weeds in turf. Cooperative programs between universities, chemical companies and grass seed companies are allowing major strides in the advancement of new technologies combined with conventional techniques to produce varieties with the ability to perform above and beyond past expectations.

It has been most exciting to see the yellowing of weeds in turf and field production trials next to bright green, healthy Roundup-tolerant varieties. Imagine how the turf consumer will feel to finally get the upper hand in the war against weeds!

Certified seed of both Pure Gold and Aurora Gold are now available through Turf-Seed, Inc. Utility patent application number 09/098,691 has been issued for Pure Gold tall fescue and Aurora Gold hard fescue.

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*The author in research fields in Oregon.*