Breeding Turf Varieties To Resist Weeds

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Breeding turfgrasses for weed resistance has traditionally taken a backseat to breeding for other pests. Great strides have been made over the past 50 years in developing cultivars with resistance to diseases and insects. Nonetheless, research suggests a potential for developing turfgrasses with improved resistance to weeds as well.

The National Turfgrass Evaluation Program (www.ntep.org) regularly evaluates cool- and warm-season cultivars for a number of indigenous pests, at 20+ test locations across North America. On occasion, evaluators have uncovered differences among cultivars in resistance to annual bluegrass (*Poa annua* L.), crabgrass (*Digitaria* spp.), and other weeds in Kentucky bluegrass (*P. pratensis* L.), perennial ryegrass (*Lolium perenne* L.), and bermudagrass (*Cynodon* spp.). Weed reductions as great as 80% have been found in some resistant cultivars.

How do certain cultivars resist weeds? The underlying mechanism is still a matter of speculation and debate. Several explanations are tenable:

- The leading hypothesis is that vigorous cultivars are able to reproduce vegetative tissue more rapidly than can weeds. As a result, after a given time interval, the stand of a resistant cultivar is composed more of turf than of weed. Added vigor may be the result of better genetics, superior physiology, or possibly an offshoot of a plant's resistance to diseases or insects.
- Another hypothesis is that certain cultivars are able to "crowd out" weeds by physical competition for space. But as Brede and Duich (A.D. Brede and J.M. Duich. 1982. Cultivar and seeding rate effects on several physical characteristics of Kentucky bluegrass turf. Agron. J. 74:865-870) explain, physical crowding in a lawn is unlikely: "Considering the mean sheath width [of a turf shoot is] 1.1 mm, the sheath of an average bluegrass tiller would occupy less than 0.9 mm^2 of ground space. At a [typical] density of 300 tillers dm^{-2}, less than 3% of the total ground surface would be occupied by tiller bases."
- Surface shading and rapid germination are prime factors in weed competition. Weed seeds are light induced. A cultivar that effectively shades the ground will reduce weed seed germination. Likewise, a fast germinating cultivar will minimize proliferation of weed seedlings in a new stand.
- Allelopathy is defined as the effect of plant A on plant B as the result of a chemical produced by plant A. Although sporadic examples can be found in the literature of allelopathy in grasses, it is unlikely allelopathy plays a major role in lawns.

Modern breeding programs, such as the one at Jacklin Seed, are discovering genetic resistance to annual bluegrass in perennial ryegrass and other turfgrasses. This is important because chemical control of annual bluegrass is ineffective or prohibitively expensive for most lawn and sports turf. In the trial results below, perennial ryegrass cultivars were screened for

resistance to annual bluegrass. Results show that breeding for annual bluegrass resistance is practical. Reductions in annual bluegrass populations of 40 to 50% can be seen over common-type cultivars such as Linn.

Cultivars with high turf quality tend to have the least *P. annua* encroachment. This phenomenon can be seen in a 1999 Kentucky bluegrass turf trial in Idaho. A significant inverse correlation was found between turf quality and annual bluegrass population: correlation *r*-values were -0.21, -0.23, -0.48, and -0.63 in yearly 2000, 2001, 2002, and 2003 means, respectively, indicating an accelerating trend for cultivars with higher turf quality to have the lowest percent annual bluegrass.

Annual bluegrass encroachment into two perennial ryegrass turf trials in Post Falls, ID. The first trial (left columns) was planted in 2002 and the second (right columns) in 2001. Trials were mowed at 1¼ inch, watered to minimize stress, and evaluated monthly. Experimental breeding populations are designated with a number.

Cultivar	% *Poa annua*
02-8011	5
Gator 3	5
Kokomo	7
Prelude III	7
Amazing	8
Caddieshack	8
Palmer III	8
Pizzazz	8
Admire	10
All*Star 2	10
Brightstar II	10
Goalkeeper	10
Monterey II	10
Radiant	10
Top Gun	10
Accent	12
Calypso II	12
Excel	12
Extreme	12
Paragon	12
Repel III	12
ASAP	13

Cultivar	% *Poa annua*
01-8014	0
01-8004	5
Laredo	5
Secretariat	5
Admire	7
ASAP	7
Caliente II	7
Goalkeeper	7
Caddieshack	8
Paragon	8
SR 4200	8
Accent	10
Pizzazz	10
Wizard	10
Cathedral II	12
Extreme	12
Monterey	12
Monterey II	12
Omega III	12
Pennant II	12
Top Gun	12
Brightstar II	13
JR-147	13
Prelude III	13

Manhattan 3	13
MardiGras	13
Prowler	13
Secretariat	13
Seville II	13
Phantom	17
Premier II	17
SR4420	17
Imagine	18
Pennant II	18
Linn	50
$LSD_{0.05}$	12

Radiant	13
Repel III	15
Saturn II	15
Line Drive	17
Phantom	18
Advent	20
Prowler	20
APM	30
Palmer III	30
B7E	40
Linn	40
$LSD_{0.05}$	27