OTS HIGHLIGHT
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Rhizomatous Tall Fescue and Regenerating Perennial

Rhizomatous Tall Fescue (RTF) and Regenerating Perennial Ryegrass (RPR) have been discussed quite a lot in the turf industry. There are three questions asked: 1.) What is RTF and RPR? 2.) Are they different from conventional tall fescue and perennial ryegrass? and 3.) Can they be used for sports fields?

Rhizomatous Tall Fescue (RTF)

Before we can look at RTF in sports fields, we need to examine tall fescue itself, because not all the tall fescue is the same. Tall fescue [*Festuca arundinacea* Schreber; or *Lolium arundinaceum* (Schreb.) Darbysh.; or *Schedonorus arundinaceus* (Schreb.) Dumort.] is actually a species complex of three different and distinct morphotypes. The three morphotypes are: 1.) Continental (CTF); 2.) Rhizomatous (RTF); and 3.) Mediterranean (MTF). Each of these morphotypes differs significantly morphologically, genetically, physiologically and geographically. It has been proposed that these hexaploid (2*n*=42) tall fescues evolved separately on the north and south sides of the Alps and Pyrenees Mountain Ranges. Part of this proposition is also based on the fact that there is often a lack of observed infertility between crosses of the three ecotypes.

Continental tall fescue (CTF) is the morphotype in which the majority of the turf and forage varieties originate. This northern morphotype evolved in Europe, mainly north of the Pyrenees and the Alps. The other two morphotypes (Rhizomatous and Mediterranean) evolved independently south of the Alps and Pyrenees Mountain Ranges. The southern ecotypes range from Iberia (Spain, Portugal), Northern Africa, and Italy. Also, the RTF and MTF harbor endophytes that are genetically, biochemically and morphologically distinct from *N. coenophialun* which is found consistently in the Continental (northern) ecotype.

CONTINENTAL TALL FESCUE (CTF) IS THE MORPHOTYPE IN WHICH THE MAJORITY OF THE TURF AND FORAGE VARIETIES ORIGINATE.

CTF is winter dormant, summer active, with or without short rhizomes (but inconsistently produces these rhizomes), and contains the *Neotyphodium coenophialum* endophyte. The ancestors of the Continental types are theorized to be *Festuca fenas* Lag. (syn.= *Festuca arundinacea* subsp. *fenas* (Lag.) S. Archang.) (2*n*=28) and meadow fescue (*Festuca pratensis* Huds.) (2*n*=14,28).

The Rhizomatous (RTF) morphotype is found mainly in the Pyrenee Mountains, northern Spain and Portugal. This morphotype is distinguished by the presence of longer and higher number of rhizomes (than either the Continental and Mediterranean ecotypes), summer and late fall active, more active in fall and winter than Continental morphotype in mild temperate climates, but less than Mediterranean morphotypes. The ancestors of the RTF morphotype are theorized to be a *Festuca* fenas-like species and meadow fescue, because the endophyte, morphology, distribution and physiology of the RTF are different from the Continental type. Also, the high degree of sterility often observed in progeny of crosses between RTF and CTF is an indicator that the ancestry of the RTF group is probably different from the Continental TF.

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Ryegrass for Sports Fields?

The Mediterranean (MTF) morphotype ranges south of the Alps and Pyrenees, from Iberia (Spain, Portugal), Northern Africa, and Italy. This morphotype is distinguished by being winter active but lack of winter hardiness, summer dormancy, with or with short rhizomes (but inconsistently produces these rhizomes). Currently there are no Mediterranean types known to be used in turf. The few varieties of the Mediterranean ecotype commercially available are used for forage. The ancestry of the MTF is very different from the other two morphotypes (RTF and CTF), with the putative ancestors being even different species than those ancestors of RTF and CTF.

As mentioned, the Continental (CTF) morphotype is the group from which the majority of all turf and forage varieties originate. There are only a few turf varieties known to have been developed from the Rhizomatous tall fescue morphotype germplasm. The Royal Barenbrug Group has released 'Labarinth' (US 6,677,507 B2 patent) and the following varieties developed under that patent: Barspider, BAR Fa7676, BAR Fa 9125, and BAR Fa 9017.

Studies have demonstrated that the RTF morphotype makes significantly more rhizomes and longer rhizomes than CTF morphotypes, even on different soil

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Table 1. Number of Rhizomes per Tall Fescue Plant at two locations: Albany and Boardman, OR. 30 plants measured.

	Average
Labarinth	10.2
Kentucky 31+	1.0
Rebel II	0.9
Silverado	0.5
Bonanza	0.6
Shortstop	0.4
Bonsai	0.2
Rebel Jr	0.3

The LSD values for comparing two varieties within the same sampling period and two sampling periods within the same variety at 5% level of significance is 2.4 rhizomes/plant.

Table 2. Average Length* of Rhizomes per Tall Fescue Plant at different Sampling Periods (averaged across two Locations). 30 plants measured.

	Average (cm)
Labarinth	7.3
Rebel Jr	5.0
Silverado	4.8
Shortstop	4.6
Kentucky 31+	4.3
Bonanza	4.2
Rebel II	4.1
Bonsai	3.5

The LSD values for comparing two varieties within the same sampling period and two sampling periods within the same variety at 5% level of significance is 1.9 cm.
*Average data from only plants with rhizomes

types (Table 1 and 2). Rhizome studies have also be conducted on RTF and those CTF varieties that can produce some rhizomes. In one study nine varieties were measured: Labarinth (RTF); F1B (RTF); Blade Runner (CTF); Grande (CTF); Grande II (CTF); Titan (CTF); Titan LTD (CTF); Rendition (CTF) and Barrington (CTF). Twenty-five plants per replication (3 replications) were measured (75 plants per variety) for one year. The characters measured: 1) Number of rhizomes per plant; 2) percentage of plants with rhizomes (at least 1); 3) percentage of plants with more than one rhizome; and 4) average length of rhizome. The results showed that the RTF morphotypes made significantly more rhizomes (at least 20 times more than the CTF rhizomatous varieties), higher percent of plants with rhizomes and longer rhizomes (Tables 3, 4 and 5). The RTF morphotypes will continue to make rhizomes even when mowed as turf.

Since RTF and CTF are different morphotypes we can now ask the question of how the RTF morphotype does on sports fields. Studies have also been conducted on the use of RTF ecotypes on sports fields at the University of Illinois. One of the studies evaluated RTF®, CTF, and Kentucky bluegrass (KBG) sod under mechanical traffic simulations. The traffic machine is a modified Brinkman weighing ~2,000 lbs which

RTF HAS BEEN WIDELY BEEN USED ON SPORTS FIELDS IN USA AND CANADA.

applies both shear force and vertical compression to a depth of ~1/2 inch. Traffic was applied once a week with several passes per week for the month of August. The results were that intense traffic does reduce quality of all the entries studied, but that the RTF® + KBG and KBG sods were the best for traffic and the RTF® without KBG was as good as CTF + KBG. So, the rhizomatous tall fescue morphotype can be used in sports field situations. RTF has been widely been used on sports fields in USA and Canada. It has performed very well and users are re-purchasing RTF® as it performs for them. The root system and the rhizomes make a more stable rootzone on sand based sports fields. This means that less damage is done to those types of fields. RTF® is an asset for sand based sports field situations. For more information go to barusa.com.

Regenerating Perennial Ryegrass (RPR)
Stoloniferous perennial ryegrass
[*Lolium perenne* L. subspecies *stoloniferum* (Lawson) Wipff]

Regenerating Perennial Ryegrass (RPR) is a subspecies of perennial ryegrass that produces stolons. Stolons can be classified into two types: determinate- and indeterminate-stolons. A determinate-stolon is an above-ground horizontal stem which roots at the nodes and does not produce aerial shoots indeterminately, but the apical apex will eventually terminate with an inflorescence (e.g., referred to herein as *Lolium perenne* subsp. *stoloniferum*). An indeterminate-stolon is an above ground stem which roots at the node and from which shoots are produced progressively

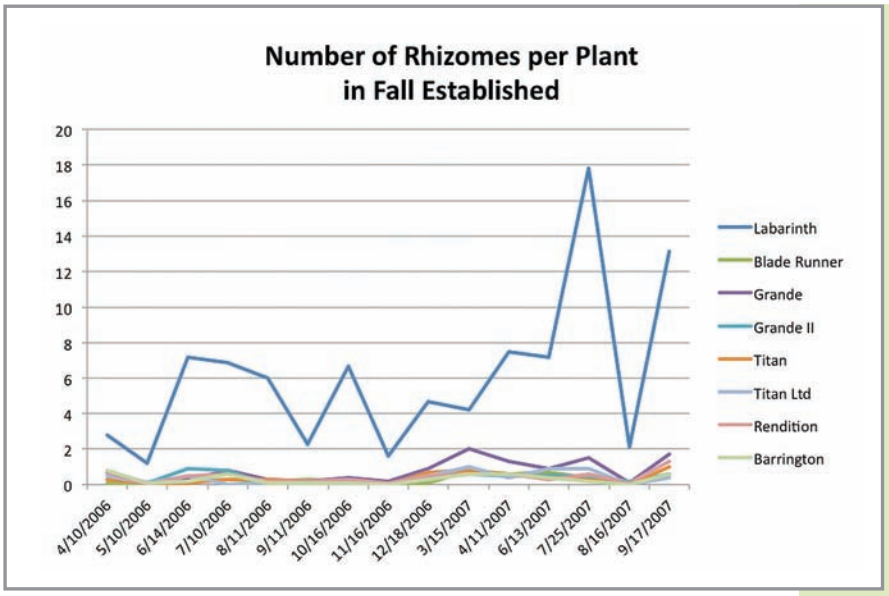

Table 3. Only Labarinth RTF® exhibited a significant number of rhizomes throughout year.

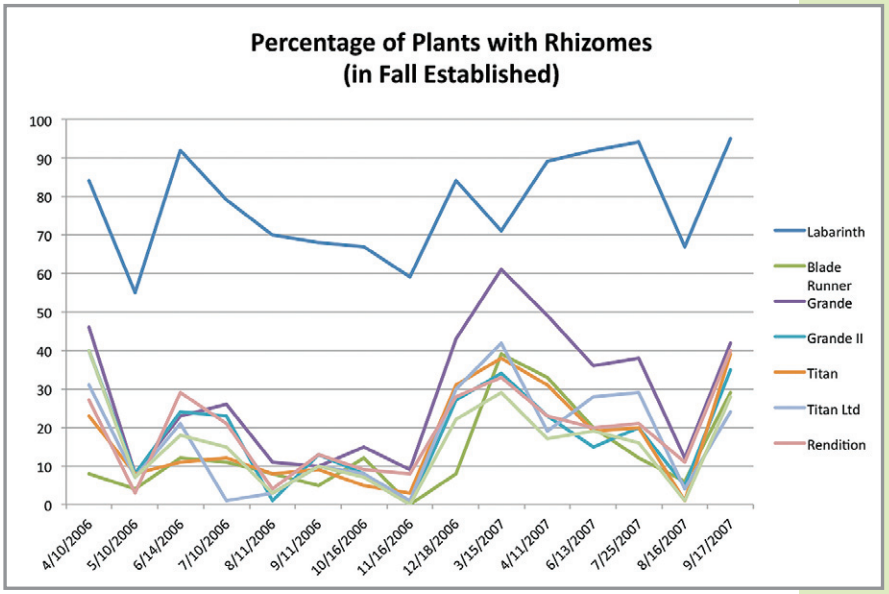

Table 4. Labarinth RTF® plants consistently exhibited greater rhizome production that the other varieties.

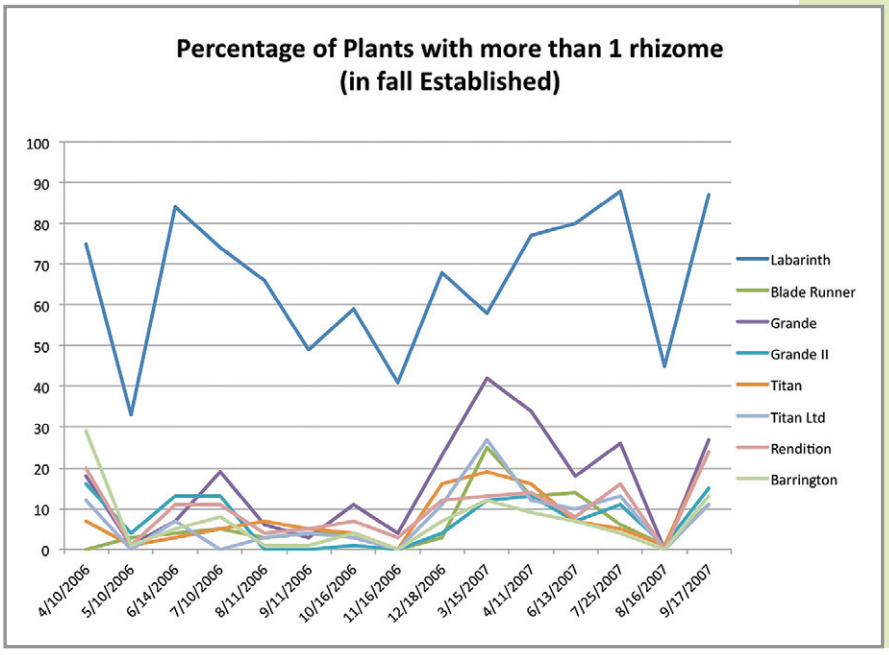

Table 5. Labarinth RTF® produces more rhizomes per plant that the other varieties.

and this horizontal stem will never terminate with an inflorescence, but apical apex remains vegetative (e.g., bermudagrass and creeping bentgrass). See Figures 1 and 2.

Perennial ryegrass is an important species for sports fields. Though perennial ryegrass is one of the most wear tolerant cool-season (temperate) turfgrasses available, the demand for more wear tolerance has increased due to increased use of sports fields, parks, golf courses, and recreational areas. Improvements in summer wear tolerance have been achieved previously indirectly by increasing shoot density. Winter wear on European sports pitches has been reduced partly by empirical evaluation of wear-resistance of ryegrass varieties using artificial wear machines with studded rollers and using those varieties most wear-resistant. These were only evaluations done on finished varieties to determine if some may happen to have some wear tolerance. However, no selections were performed and no new wear-resistant varieties were developed from these studies. Traffic simulation is mainly performed to evaluate the wear-resistance of already released cultivars (e.g., for athletic field research). So, traditionally, especially in the USA, traffic tolerance is only a characteristic determined once a variety has been commercially (or about to be) released, and not part of its developmental history. Whether a variety (not developed for traffic tolerance) has some traffic tolerance, is no indication that it can actually recover from traffic injury. In fact, we see that these varieties are not able to recover from the traffic damage. So, it is critical that perennial ryegrass being used on a sports field is bred from the beginning under traffic stress. Which is exactly the way the RPR, with a strong recuperative ability was discovered; under long term, intense, traffic stress.

The importance and benefit of RPR is only realized because it was developed under intense traffic stress. Subjecting millions of genotypes, for many years,

Figure 1 and 2. Regenerating perennial ryegrass is a subspecies of perennial ryegrass that produces stolons. Here, stolon of *Lolium perenne* subsp. *stoloniferum*.

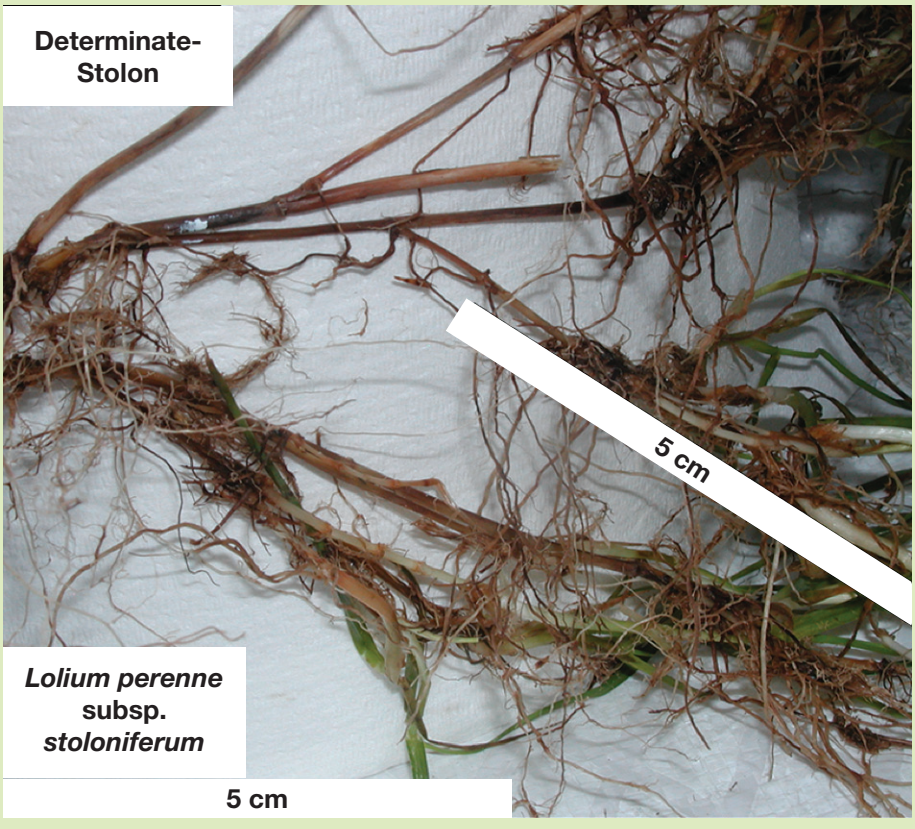

Figure 3. The RPR in traffic wear trial. RPR (right) and non-RPR (left).

to intense traffic wear reduced the population to approximately 3,000 initial selections. From these initial 3,000 selections only five populations of RPR were discovered. This type of selection not only translates into better traffic tolerance, but also positive recovery potential from traffic damage because of its stoloniferous habit. Our studies have shown that just because a ryegrass is stoloniferous, does not mean it can recover from an intense traffic event. What we found out was that only the stoloniferous varieties that were developed for traffic tolerance were able to recuperate from an intense traffic event. Though other ryegrass varieties can have some unintended traffic tolerances, they could not recover from the wear and actually have a negative recuperating potential (i.e. they don't recover.). This means that after the traffic simulation was completed, varieties were then studied for their ability to recuperate from the intense traffic wear, the varieties not developed for traffic tolerance actually continued to decline and did not recuperate from the traffic damage. Whereas, those developed under intense traffic selections protocols (i.e. RPR) did recuperate and in fact increased in coverage (Figure 3). As the turf canopy is opened up by traffic, RPR begins to produce stolons to fill in the open areas. This was first reported from research performed at The Ohio State University.

So, is RPR for sports fields? Yes, it was developed from day one for sports fields. RPR has been since day one mostly used on sports fields and golf courses with tremendous success. A lot of sports turf managers are sending feedback as to how much they like the performance and the wear tolerance of the RPR.

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