Origin
amenity solutions

Tetraploid Technology

What is a tetraploid?

Tetraploid perennial ryegrass technology explained

Origin Amenity Solutions, a leading force in the UK amenity industry

An insight into the technology of tetraploid perennial ryegrasses, which are highly valued for their fast establishment, cool temperature recovery, high root mass and greater stress tolerance

Ploidy

Ploidy refers to the number of complete sets of chromosomes within the nucleus of each plant cell. Polyploid plant cells contain more than two sets of chromosomes, which are thread-like structures arranged in pairs, each made of protein and a single molecule of hereditary DNA (deoxyribonucleic acid). Chromosome is derived from the Greek *chroma* (colour) and *soma* (body). This provides a clue as to how tetraploids have the capability to deliver some exceptional benefits.

Polyploidy is naturally occurring in many wild and cultivated plant species however, it can also be induced in plants through the application of the natural alkaloid plant hormone colchicine, derived from *Colchicum autumnale* (Autumn Crocus). Colchicine acts as a mitosis inhibitor, resulting in chromosome doubling within each cell, thus diploid (2n) becomes tetraploid (4n).

Induced Polyploidy

Perennial ryegrasses bred for amenity use are historically diploid, having two paired sets of chromosomes within each cell. Tetra is the Greek translation for four, meaning tetraploids have four paired sets within each cell, doubling the number of chromosomes per cell compared with diploids. It is this physiological characteristic that delivers such exceptional benefits to the plant.

Mitosis is a part of the cell cycle in which chromosomes are separated into two identical sets, each paired set ending up inside an identical diploid cell. Microtubules are microscopic structures that help cells maintain their shape and assist in forming the cell spindle which during cell division, divides the chromosomes into pairs. In the creation of a tetraploid the hormone disrupts the microtubules, preventing formation of the spindle that divides the genetic material. The process of mitotic polyploidy results in cell enlargement, doubling the sets of chromosomes (four pairs) in each new daughter cell. The outcome is a high energy, robust, hard-wearing, healthier plant with improved stress tolerance and recovery capability, even in cooler temperatures.

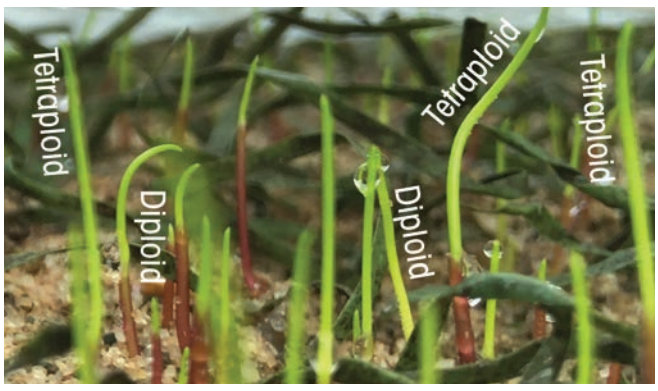
Energised

Chloroplast comes from the Greek translation *chloros* (green) and *phyllon* (leaf). Tetraploids contain double the cellular chloroplast of a diploid and this increased chloroplast benefits the plant by boosting chlorophyll production for energy absorption and processing. Thylakoids inside the chloroplast contain the light harvesting complex, including the chlorophyll green pigments essential to photosynthesis, absorbing sunlight in energy rich molecules. Photosynthesis converts the light energy into chemical energy which is stored as carbohydrate and synthesized with water and carbon dioxide gas to produce energy for the plant. In a nutshell, double chlorophyl harnesses more available light, extremely useful in stadiums, during shorter daylength, on overcast days and in natural shade.

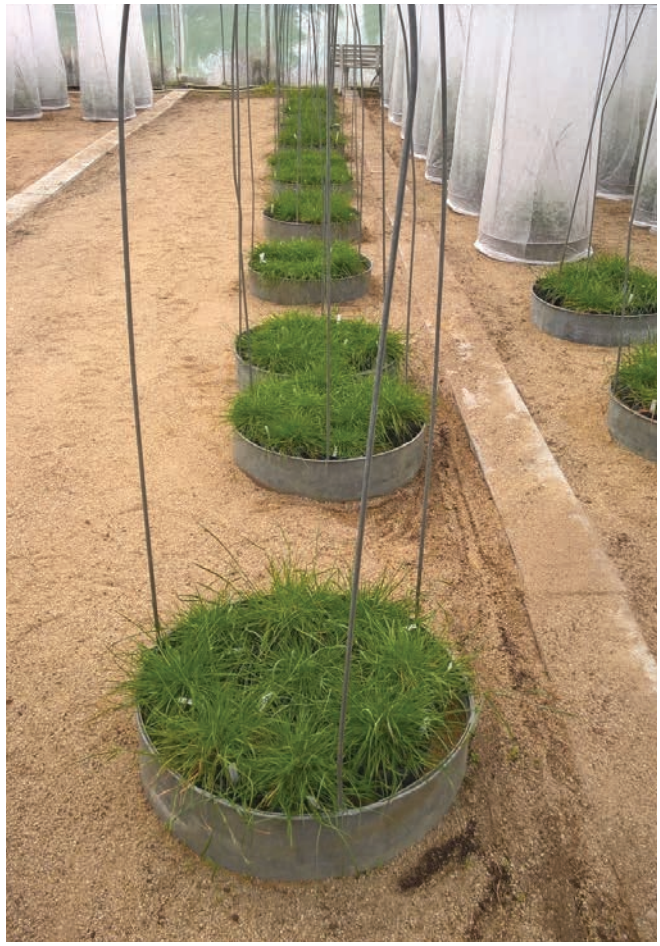
Development

A new tetraploid cultivar begins life as an amenity diploid. Selected for desirable characteristics, a few grammes of seed is treated with the hormone. Following treatment, its back to business as usual to select only the best. The seeds of the resultant plants are larger with high energy, around 500 seeds per gramme compared with 650 – 700 per gramme for sports diploids and up to 800 seeds per gramme for ultra-dwarf super fine ryes. Seed is multiplied in isolation to produce sufficient seed for further investigation. As with all new cultivars, the resultant progeny must conform to DUS protocols, that being distinct, uniform and stable in order to achieve plant breeders' variety rights and registration, a pre-condition for the certification of seed. To this end rigorous testing procedures are employed.

Young plants are grown under glass for observation with leaves and shoots having chromosome counts in the laboratory using flow cytometry, a laser based biophysical technology for cell counting. It may take



Tetraploid seedlings emerge faster than diploids



Seed being multiplied in isolation

several generations of tetraploid offspring to produce stability and viability for seed production. Several plants from the same parent are then multiplied together in isolation. The seed is harvested and used for field testing, the same process as for diploids. It's at this stage potential new cultivars are pushed to the limit and vital characteristics such as growth habit, wear, disease and drought tolerance, mowing height and visual merit are assessed. Only one or two will make it through this rigorous process from the many thousands of early selections.

Proven Performance

Tetraploid perennial ryegrass provides a host of invaluable characteristics. High energy seed and growth in cooler conditions from 4°C makes blends containing tetraploids such as R140 and R25 CRT perfect not only for construction and end of season renovation but also for cold temperature overseeding and repairs. Superior winter wear and robust re-growth helps keep surfaces in play though the high-pressure period. But tetraploids are not simply cold temperature performers, high root mass also provides survival and recovery from heat and drought, plus surface stability.

Fast establishment is of particular benefit when renovation windows are short any time of year. Sports pitches, golf tees and fairways, cricket outfields, bowlers' run-ups and walkways can all benefit from the speed of emergence and high root mass, helping restore the playing surface in the shortest possible time. Shade and wear trials at Les Alleuds Research Station demonstrates the latest tetraploid cultivars deliver greater wear performance in reduced light levels of 60% PAR (photosynthetic active radiation).

High disease pressure is devastating to the performance and visual qualities of the playing surface. Selecting cultivars with high disease tolerance is an important part of an integrated management approach. Whilst no grasses can offer complete resistance, the official testing programme for the GEVES Turfgrass Testing System hi-lights greater tolerance of tetraploid cultivars to *Microdochium*, Leaf Spot, Red Thread and Rust diseases.

Tetraploid sample showing higher root mass, delivering greater drought tolerance and stability

Shade and wear trial, Les Alleuds Research

The Go-to Choice

Climate extremes and exceptionally high-performance demands relentlessly challenge the management of amenity turf. Plant breeders' skills are delivering a new generation of exceptional tetraploid amenity perennial ryegrass cultivars with:

- High energy seed, fast establishment
- Germination and growth from just 4°C
- Double chloroplast for increased energy production
- Superior winter wear with robust re-growth
- Stronger, deeper, denser root mass for tensile strength and drought tolerance
- Faster recovery from heat stress
- Greater tolerance to Leaf Spot, *Microdochium*, Red Thread and Rust
- Excellent colour and presentation

Proven performance makes them highly valued for natural and hybrid grass surfaces across a wide range of applications. Blended with diploid ryegrasses or mixed with fescues, they are reliable performers that always deliver. With mixes available for sports pitches, playing fields, racecourses, golf courses and landscapes, tetraploids really are the go-to choice.

For more information on the benefits of Tetraploid technology, please call **0800 138 7222** *or email* **sales@originamenity.com**

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