Agrostis tenuis Sibth.


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Origin and diffusion

Origin: Eurasia
Distribution: Sub-cosmopolitan
Invasive potential: high

Introduction

Agrostis tenuis, forms a dense sward of quite fine leaves; at flowering, a reddish-purple inflorescence forms an haze over the mat of leaves; the flowering panicle is finely branched with numerous very small spikelets. This species is highly variable with many cultivars recognized; it easily adapts to environmental stresses, by adapting genetically, and through plasticity. Like many other members of the *Agrostis genus*, is a valuable agronomic species when used for fodder and it can also be used in golf courses or in home lawn. It is known to invade disturbed areas and also frequently grows along roadsides. *A. capillaris* is abundant in wetlands including moist grasslands and open meadows as well as cultivated areas.

Synonyms: *Agrostis capillaris* L.

Common names: browntop, colonial bent or colonial bent grass (English), capellini delle praterie (Italian).

Description

Life-form and periodicity: caespitose herb, perennial

Height: 30-50 cm

Roots habit: Roots have rhizomes and occasionally stolons. Depth to which many roots extended: 50 cm; depth to which a few roots extended: 63 cm

Culm/Stem/Trunk: culms usually unbranched, glabrous.

Fam. *Poaceae*

Description

Leaf: green leaves with linear, flat and narrow shape and rough blade.

Rate of transpiration: -

Reproductive structure: Florets and spikelets well-spaced on pyramidal shaped panicle resulting in very tine texture.

Propagative structure: seed is a caryopsis with adherent pericarp, ellipsoid; 1 mm long, smooth. Endosperm farinose. The seeds are brown and requires natural seasonal disturbances for germination.

Development

Sexual propagation: by seed; moderate seed spread rate. Seeds spread by wind and by attachment to animals. Some seeds can be also accidentally ingested and dispersed internally by grazers. Dispersal by animals can spread seeds over considerable distances.

Asexual propagation: by rhizomes and sod; rapid vegetative spread rate.

Growth rate: fast

Habitat characteristics

Light and water requirement: full sun, high water demand.

Soil requirements: coarse and medium texture. It is found growing in neutral to acidic soils, poorly drained.

Tolerance/sensitivity: it thrives in waterlogged soils and seasonally flooded grasslands. Hardy to European winters. It is aerosol and soil salt tolerant. It exhibits medium tolerance to burning, probably due to rhizome system. Low drought tolerance.

Phytotechnologies applications

A. tenuis has been used for the reclamation of metalliferous sites, being tolerant to acid **lead/zinc** wastes, and **copper** wastes (Smith & Bradshaw, 1979). His metal tolerance may result from the metal exclusion strategy, comprising avoidance of metal uptake and restriction of metal transport to the shoots, this plant is therefore used to revegetate bare soil areas (e.g. in phytostabilisation technology), i.e. where the lack of vegetation results from excessively high metal concentrations (Dahmani-Muller *et al.*, 2000). The behavior of the plant with respect to metals depends from the specific ecotype of this species, as reported by Gregory *et al.* (1964) and by Wainwright *et al*. (1977). *A. tenuis* is one of the commonest plants living on the highly **arsenic** polluted sites; Porter and Peterson (1975) studied arsenic distribution in different aged leaves, founding 150-1100 mg As/g of dry mass.

Experimental studies

Reference	T. Thayalakumaran, B.H. Robinson, I. Vogeler, D.R. Scotter, B.E. Clothier1 & H.J. Percival, 2003. Plant uptake and leaching of copper during EDTA-enhanced phytoremediation of repacked and undisturbed soil. Plant and Soil 254: 415–423
Contaminants of concern	Cu
Mechanism involved in phytoremediation: Phytostabilisation/rhizodegradation/phytoaccumulation/phytodegradation/phytovolatilization/ hydraulic control/ tolerant	Phytoaccumulation
Types of microorganisms associated with the plant	Not reported in the publication
Requirements for phytoremediation (specific nutrients, addition of oxygen)	EDTA
Soil characteristics	Sandy loam of volcanic origin. The top 100 mm had a bulk density of 0.9 Mg m−3, a relatively high cation exchange capacity of 22 cmolc /kg, and an organic matter content of 12–16%. The pH of the soil in a 1:2.5 water suspension was 5.6.
Laboratory/field experiment	Laboratory experiment (greenhouse)
Length of experiment	72 days after seedlings emergence the grass was harvested to analyse the plant material.

Phytotechnologies applications

Age of plant at 1st exposure (seed, post-germination, mature)	Seed
Initial contaminant concentration of the substrate	The soil contained up to 400 µg/g of copper due to a history of fungicide spraying.
Post-experiment contaminant concentration of the substrate	According to the number of EDTA applications (0, 2, 18), the concentration of Cu in the herbage (Conc. x DM, µmol) was respectively: 1.54, 7.8 and 14.9, for the repacked soil columns and 0.4, 1.2 and 3.2, for the intact cores.
Post-experiment plant condition	There was no observable decrease in yield attributable to EDTA application.
Contaminant storage sites in the plant and contaminant concentrations in tissues (root, shoot, leaves, no storage)	Contaminant was found in roots and leaves. The addition of EDTA to the copper contaminated soil resulted in a substantial increase in the copper concentration in the leaves of A. tenuis. In the absence of EDTA, copper uptake was minimal.

Reference	Gregory and Bradshaw, 1964. Heavy metal tolerance in populations of Agrostis tenuis sibth. and other grasses. New Phytologist, Volume 64, Issue 1, pages 131–143.
Contaminants of concern	Cu, Zn, Pb, Ni
Mechanism involved in phytoremediation: Phytostabilisation/rhizodegradation/phytoaccumulation/phytodegradation/phytovolatilization/ hydraulic control/ tolerant	Tolerant plant
Types of microorganisms associated with the plant	Not reported in the publication
Requirements for phytoremediation (specific nutrients, addition of oxygen)	Choice of specific adapted ecotypes
Laboratory/field experiment	Plants after collection were grown outdoor in pots and then tested by allowing them to root in solutions of heavy metals.
Soil characteristics	Debris of old mines and some normal pastures.

Phytotechnologies applications

Length of experiment	More than six months
Age of plant at 1st exposure (seed, post-germination, mature)	mature
Initial contaminant concentration of the substrate	Metal content of the soils of origin: Cu: 90-2300 ppm Control: 50 ppm Zn: 75-40000 ppm Control:20-50 ppm Pb: 80-3600 ppm Control: 20-25 Ni: trace-1150 ppm Control: trace-3 ppm
Post-experiment contaminant concentration of the substrate	Not measured
Post-experiment plant condition	Tolerance of individual clones of a population varied significantly. There must exist in A. tenuis a mechanism with three specificities of tolerance to copper, or lead, or zinc and nickel, which can distinguish between these different metals. These three specificities can be present singly or in combination. The tolerance mechanism must, therefore, render the metals innocuous within the plant and distinguish between the three groups.
Contaminant storage sites in the plant and contaminant concentrations in tissues (root, shoot, leaves, no storage)	From experiments it is clear that the metals enter the plant and that similar amounts enter both tolerant and non-tolerant types.