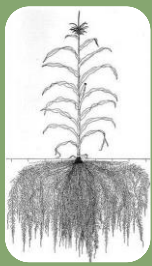
Zea mays L.

Source: www.agroatlas.ru

Source: floridata.com



Sources in the clockwise direction : www.polypompholyx.com, www.ds9.botanik.uni-bonn.de, www.plants.usda.com

Origin and diffusion

Origin: Central America
Distribution: worldwide cultivated, not known in the wild
Invasive potential: non-invasive

Introduction

Zea mays is an annual herb, short-lived and fast growing. It usually develops with a single main culm and one or two lateral branches in the upper part of the stem; broad, sword-shaped leaf blades are produced along the main culm. This plant find its origins in Central America; maize species is the only domesticated taxon in the genus *Zea* and it is not known in the wild. The genetic plasticity of maize has enabled it to move into a wide range of environmental niches the world over. In fact, it represents a staple food for a significant proportion of the world's population and can also be used as a biofuel source or for animal feeding.

Common names: Corn, Maiz (English), Mais, Granoturco (Italian)

Description

Life-form and periodicity: annual

Height: 1-4 m

Roots habit: It has a coarse fibrous root system which spreads widely and penetrates deeply, the latter is usually mycorrhized which facilitate the supply of nutrients. Conventional roots are supplemented with aerial brace roots, which protect against lodging.

Culm/Stem/Trunk: strong and hollow culm, occasionally with 2 lateral branches in the upper part of the plant.

Fam. *Poaceae*

Description

Leaf: alternate, with broad, sword-shaped leaf blades, parallel veins. Upper surface is hairy, lower surface hairless

Rate of transpiration: 4.20±1.14 mm/day (measured as described in Jara *et al*., 1998)

Reproductive structure: normally a monoecious plant; the male and female flowers are separated but on the same plant. On the branches, only female organs (called ears) develop in the florets while the male part of the flower (the tassel) produces pollen and is at the top of the plant.

Propagative structure: the fruit is a caryopsis, a dry, single-seed fruit known as kernel; it can differ significantly in color from white to yellow and red. Differences in the shape and size of the kernels are dependent on different genetic pools. Kernels are grouped in a cob (or ear) which normally contains 800 seeds attached in rows.

Development

Sexual propagation: from each male flower a style begins to elongate towards the tip of the cob, forming long threads (silks), helping to transfer pollen grains. Receptive silks are moist and sticky. In Zea mays cross pollination occurs more often than self-pollination. The pollen is shed continuously for a week or more from each plant, starting a few days before silk emergence.

Asexual propagation: no present under natural conditions

Growth rate: fast

Habitat characteristics

Light and water requirement: full sun, it grows best in 600–1,500 mm rainfall environments and has a high requirement for water. Not drought resistant but will tolerate temporary dry conditions when young. Drought-avoiding short season cultivars have been developed for regions with short rainy seasons.

Soil requirements: high nutrient demand for optimum growth and responds strongly to fertiliser when grown on infertile soils. It is adapted to well-drained soils of neutral to mildly alkaline reaction. Alluvial loams, deep latosols and clay loams are preferred for its growth.

Tolerance/sensitivity: It is particularly susceptible to water stress at the flowering step. Frost susceptible. It has a low to moderate tolerance of soil salinity.

Phytotechnologies applications

As maize is a widely cropped annual cereal that grows rapidly, produces extensive fibrous root system with large shoot biomass yield per hectare, and can be used as biofuel source, it has been generally considered as a good candidate for phytoremediation researches. This species has been described as an **heavy-metal** tolerant plant, with moderate bioaccumulation factor. Given these attributes, its fast growth and its high biomass yield, maize is capable of continuous and consistent phytoextraction of metals from contaminated soils by translocating them from roots to shoots (Nascimento and Xing, 2006, Wuana et al., 2010), especially when it forms an association with arbuscular mycorrhizal fungi (Pawlowska et al., 2000); however, as stated by Lin et al. (2008), the ability of metal phytoextraction would be inhibited under co-contamination of high level of pyrene in highly Cu-polluted soil. Additionally, maize may create particularly good environmental conditions for soil microorganisms and microfauna, enhancing the degradation of **organic pollutants** and the mobilization of metals (Mench, 1991). Dillewijn et al. (2007) reported that the extractable **TNT** content in rhizosphere soil associated to maize roots decreased by more than 96% in 60 days regardless of inoculation and considered that under field conditions, maize is potentially useful alternative to remediation surface soils contaminated with medium levels of TNT. The use of the whole plant for industrial purposes seems to be currently the only realistic scenario to combine phytoremediation with risk-based soil management, nevertheless, more insight is needed in the fate of heavy metals during and following biogas production (Meers et al., 2010).

Experimental studies

Reference	Meers, E., Van Slycken, S., Adriaensen, K., Ruttens, A., Vangronsveld, J., Du Laing, G., ... & Tack, F. M. G. (2010). The use of bio-energy crops (Zea mays) for 'phytoattenuation' of heavy metals on moderately contaminated soils: A field experiment. Chemosphere, 78(1), 35-41.
Contaminants of concern	Cd, Zn, Pb
Mechanism involved in phytoremediation: Phytostabilisation/rhizodegradation/phytoaccumulation/phytodegradation/phytovolatilization/ hydraulic control/ tolerant	Phytoextraction and Phytoattenuation, (namely risk-reduction of metals in the produced biomass while allowing maximum economic valorisation of marginal land as main objectives)
Types of microorganisms associated with the plant	Not reported in the publication
Requirements for phytoremediation (specific nutrients, addition of oxygen)	Fertilization regime: 50 [kgN/ha]

Phytotechnologies applications

Soil characteristics	Site located in Flanders (Belgium): pH= 6.1-7.4 [-] OM = 5.0 ±0.1 [%] Sand = 88 [%] Silt = 8 [%] Clay = 4[%]
Laboratory/field experiment	Field experiment
Length of experiment	~ 6 months
Age of plant at 1st exposure (seed, post-germination, mature)	Seeds
Initial contaminant concentration of the substrate	Cd = 5.7±2.1 - 67±2.3 [mg/kg] Pb=135±46 - 189±37 [mg/kg] Zn = 266±96 - 398±73 [mg/kg]
Post-experiment contaminant concentration of the substrate	Not explicitly mentioned; Low Cd and Pb removal, meanwhile Zn removal is more significant
Post-experiment plant condition	The biomass production ranged between 36-52*103 [kg/ha]. This low production is attributed to the relative low fertilization regime.
Contaminant storage sites in the plant and contaminant concentrations in tissues (root, shoot, leaves, no storage)	The majority of contaminants has been stored in the shoots of the plants. Zn: total shoots = 124-191 [mg/kg] Pb: total shoots = 2.24-3.09 [mg/kg] Cd: total shoots = 0.58- 0.68 [mg/kg] Metal concentrations in grains was very low and remained below European animal feed criteria.