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— cerere —

## Botany Of Main Winter Cereals

Cultivation of cereals began over 10,000 years ago, in concomitance with the transition from a nomadic to a settled way of life. Species such as wheat, rice, corn, rye, barley and sorghum are present in many parts of the world.

### The importance of the Poaceae family

Cereals belong to the Gramineae (or Poaceae) family, which is one of the most varied and important, both from an ecological standpoint and for its economic importance, given that cereals are the basis of human nutrition.

The Poaceae family (*clade Angiosperms, clade Monocotyledons, order Poales*) contains 650 genera and 9,500 species and is one of the most widespread on a global level. The main cultivated genera belong to the Pooideae subfamily: these are *Zea*, *Triticum*, *Hordeum*, *Avena*, *Sorghum*, *Pennisetum*, *Oryza* and *Secale*, which include the species of corn, rice, wheat, barley, sorghum, oats and rye.

### Morphology of the Gramineae

These plants are generally herbaceous, with adventitious **root systems**.

The **stems** or culms are generally hollow, of circular section and with knots. An exception is corn that has filled internodes.

The **leaves** are arranged in opposite pairs and are parallelinerved; each leaf is made up of a sheath, a sessile lamina or leaf limb, a ligule and auricles.

Their **inflorescence** type may be spike (wheat, barley and rye), raceme or spadix (corn, oats, rice and sorghum), which in turn are formed by partial inflorescence called spikelets. The morphology of the spikelets and their position in the inflorescence determine the identification, classification and taxonomy of the Gramineae family.

Spikelets are formed by one or more flowers joined to the sides of an axis or rachis (*rachilla*), and by two sterile bracts called *glumes* (upper and lower).

The **flowers** can be hermaphrodites, sterile or, in some instances, unisexual. Each of them is protected by two bracts or glumes, the lower or external one (*glumella*) in which the flower is inserted, and the upper or internal one (*palea*) in which the floral peduncle is inserted. In addition, they are formed of two small scales or *lodicules*: generally the androecium has three stamens (but they can also have as few as one and as many as six), while the gynoecium is formed by an ovary with just one egg. In general, they are of two types with plumed stigmata.

The **fruit** is a caryopsis, a dry and indehiscent fruit, composed of a pericarp and a seed, also called wheat or a grain of wheat. Wheat is said to be husked when the glume of the flowers remains attached to the grain (barley, oat, rise), and naked in the opposite case (wheat, rye, corn, sorghum).



## Main characteristics of Triticum, Secale, Hordeum and Avena genera:

### Triticum:

- Single spikelets with 3-5 flowers, of which the upper ones are male flowers.
- Automatic self-pollination (cleistogamy)
- Superficial roots
- Ligule and two small stipules with hairs

### Secale:

- Single spikelets, with two hermaphrodite flowers
- Cross-fertilization (allogamy)
- More extended roots
- Very short ligule and almost without stipules

### Hordeum:

- Three spikelets with one fertile floret (the two on the sides are male flowers )
- Self-fertilization (autogamy)
- Roots are more superficial compared to wheat
- Ligule and two hairless stipules

### Avena:

- Spikelets with 2-6 flowers (or more)
- Self-fertilization (autogamy)
- Deeper roots
- Ligule without stipules

Tribes	Genera	Species	Common Name	Uses	Botanical Characteristics
Triticeae	Triticum	<i>T. monococcum subsp. boeoticum</i>	Wild einkorn wheat, wild monococcum, wild monococcum wheat	Bread	
		<i>T. monococcum subsp. monococcum</i>	Cultivated or domesticated einkorn wheat, cultivated monococcum, cultivated monococcum wheat	Bread	
		<i>T. turgidum subsp. dicoccoides</i>	Wild emmer wheat, wild dicoccum wheat	Bread	Husked
		<i>T. turgidum subsp. dicoccum</i>	Emmer wheat, cultivated or domesticated dicoccum wheat	Bread	Husked
		<i>T. turgidum subsp. durum</i>	Durum wheat	Pasta and semolina	Husked
		<i>T. turgidum subsp. polonicum</i>	Kamut		Naked. 2-4 fertile flowers per spikelet. Vitreous grain.
		<i>T. turgidum subsp. turanicum</i>	Kamut	Pasta	Naked
		<i>T. aestivum subsp. aestivum</i>	Soft wheat	Bread	Naked. 2-5 fertile flowers per spikelet. Mealy grain.
		<i>T. aestivum subsp. spelta</i>	Spelt, dinkel wheat, hulled spelt, spelt grain	Bread	Husked
		<i>T. aestivum subsp. compactum</i>	Club wheat	Cookies	Naked. Mealy grain.
	Secale	<i>Secale cereale</i>	Rye	Bread	Naked. Two fertile flowers per spikelet. Low gluten, not very suitable for bread making.
	Hordeum	<i>Hordeum vulgare</i>	Barley, cultivated barley	Animal fodder	Husked. Six rows of caryopses per spike. Straws empty. One fertile flower per spikelet.
		<i>Hordeum distichum</i>	Row-barley, French barley, barley for beer	Beer	No gluten. Husked. Two caryopsis on the spike. Straws empty. One fertile flowers per spikelet.
Aveneae	Avena	<i>Avena sativa</i>	Oats	Food for infants	Husked. 1-3 fertile flowers per spikelet.

Table 1. Classification and characteristics of main species of winter cereals.

## References

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