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INTO THE WEEDS

Why is The Land Institute Focused on Grain Crops?

Grain crops are the staple foods of humanity, providing more than half of modern society's food calories and occupying two-thirds of the cropland. Several non-grain crops—potato, sweet potato, cassava, yam, plantain, breadfruit—serve as the primary staples in particular regions and contribute carbohydrates to the global food system. However, the global production of grains is much higher, and grains are considerably more likely to enter the international market because they are small, hard, and dry, and therefore easier and more economical to transport. They are far less delicate and perishable than most fruits, vegetables, and tubers. This, combined with their small size, allows them to be handled and stored in pipes and tanks almost like a liquid.

What are grain crops?

Hundreds of domesticated plants produce edible seeds, but only a few dozen have ever been considered grain crops. Some experts equate grains with cereals—grain crops from the grass family. Today, grains are defined as crops that resemble the first domestic cereals, rice and wheat, especially in the way they are harvested. The seeds typically dry on the plants prior to harvest and are harvested and threshed *en masse*. Grain crops are grown and processed primarily for the seeds, and grains are valued primarily for providing the staple nutrients: starch, oil, and protein. The closer a plant comes to being harvested and used like the archetypal grains, the more often it will be described as a grain crop.





What are the different kinds of grain crops?

Grain crops from the **cereal family** are high in carbohydrates (60–80%), though they also provide some protein (on average 7% in rice and 13% in wheat). Cereals are the most productive and iconic grains, including maize (corn), wheat, rice, barley, oat, rye, sorghum, and several kinds of millet.



How did grain crops originate?

Grain is still harvested from wild plants in a few parts of the world but the economically and environmentally important grains come from domesticated plants—plants genetically modified through generations of selective breeding beginning about 10,000 years ago.

Compared with their wild ancestors, domesticated grain species have larger seeds that germinate more readily. The plants are usually less branching, bearing fewer—but larger—flowering structures, and these structures (“heads”) are produced nearly synchronously and at a uniform height. Whereas the ripe heads of wild plants break apart or otherwise release their seeds, ripe heads of domestic plants retain the seeds,

making it much easier for farmers to gather the heads.

The heads must then be threshed to release the grain. Grains that thresh free of the other parts of the head and can be directly ground or cooked are preferred, and the most widely grown grains have acquired this trait.

After a break of thousands of years, grain domestication has relaunched at TLI as illustrated by Kernza® perennial grain (left) improved from wild intermediate wheatgrass (right).



Several grain crops from other plant families that have a starch and protein content similar to cereals are termed **pseudo-cereals**. These include buckwheat, amaranth, and quinoa.

Grain crops from the pea family—**grain legumes** or **pulses**—are seeds rich in protein (20–40%) and can be grown in soils with poor nitrogen content.

Legumes use nitrogen from the air, while other grains require more rare forms of soil nitrogen.

The last category of grains, the **oilseeds**, contains plants from several families. The soybean can be categorized as either an oilseed because it is rich in oil (20%) or a grain legume because it is in the pea family and high in protein (37%). Other important oilseed grains include canola, sunflower, safflower, linseed, and sesame. There are several oil crops that are not grains, including olive, oil palm, coconut, and peanut.



Join Us on the Journey

The scale of grains on the landscape and in the human diet present an immense opportunity to transform the global food system from extractive to regenerative. Perennial grain crops protect soil from erosion and improve soil structure, increase ecosystem nutrient retention, carbon sequestration, and water infiltration, and can contribute to climate change adaptation and mitigation. **We imagine a future where new perennial grains cover the world's agricultural soils and feed the global population.**

We invite you to be part of this perennial agriculture by funding our work. Learn more or make a donation at landinstitute.org or by contacting Amy Cole, Director of Development, cole@landinstitute.org / (785) 823-5376.



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