

Teff: the future for sustainable and gluten-free diets

The worldwide gluten-free (GF) market is expected to grow by 9.8% yearly to reach 13.7 billion \$ (£10.9 billion) by 2030¹. One of the drivers of such a trend is the high prevalence (1.4%)² of people with coeliac disease together with an increasing number of health-conscious consumers. Coeliac disease, an autoimmune disorder affecting the small intestine, and characterized by intolerance to gluten proteins, can only be treated with a strict GF diet.

Thus, there is interest by the worldwide food industry (driven by the U.S. and the UK) to meet consumers' needs and to diversify the market options availability, especially in the bid to address food and nutritional security.

Why teff could be the solution?

Teff is a staple crop that originated in Ethiopia and Eritrea. Being a **naturally GF** grain it is suitable for people with coeliac disease who have specific dietary needs. It is considered a “**supergrain**” due to its excellent nutritional profile that contributes to human health and well-being (Table 1).

Table 1. Comparison of nutritional properties of teff vs durum wheat for 100 g of uncooked products. (Green arrow: increased concentration in comparison to durum wheat, *% amino acid g/16g nitrogen)

Nutrients	Teff	Durum wheat	Comparison
Carbohydrate (g)	71.8	71.1	=
Fat (g)	2.2	4.5	↓
Protein (g)	13.1	13.9	=
Calcium (mg)	180	34	↑
Iron (mg)	7.6	3.5	↑
Fiber (g)	8	3.4	↑
Calories (kcal)	356	339	=
Lysine*	3.70	2.10	↑

When compared with durum wheat, the 4th most cultivated grain worldwide³, teff showed outstanding nutritional attributes (Table 1, green arrows). Teff stands out for its **calcium** and **iron** content which are x5 and x2-fold higher, respectively than durum wheat. Due to its small size (<1mm, Figure 1), teff flour is usually wholegrain implying a high content of **fiber**. It is a **protein-rich grain** particularly abundant in some **essential amino acids** (EAAs), like lysine (Table 1), which are very limited in other cereals. The high amount of EAAs represents a unique attribute to promote teff within nutritive diets.

Such remarkable nutritional properties of teff reflect in a wide range of health benefits such as, among others, prevention of chronic diseases (e.g. type 2 diabetes), osteoporosis and anaemia.



Figure 1 - Teff grains

Teff is a **versatile crop**. It is **resilient** and can adapt to a wide range of agroclimatic regions and is produced in Africa, North America, Europe (e.g. Spain, Netherlands) and Australia. Indeed, teff is hardy, able to withstand both drought and waterlogged soils, and is a pest-resistant crop. Teff can also be **transformed into multiple food products**. From the Ethiopian traditional flatbread named *injera* to alcoholic beverages, porridge, cake, muffins, biscuits, etc. Moreover, its by-products are used as animal feed, to build basic constructions and fuel implying its **sustainability** and adaptability to the **circular economy**.

These attributes of nutritious and sustainable crop, qualify teff as a valid alternative to other more popular and consumed grains such as wheat, spelt, barley and rye.

What are we waiting for?

Teff supply chain needs good practices development against **mycotoxins contamination**. The latest are toxic compounds produced by filamentous fungi along the supply chain. Stored Ethiopian teff grains showed that 22.9% and 27.3% of samples were contaminated with aflatoxin B₁ (AFB₁) and ochratoxin A (OTA), respectively. Mean values for AFB₁ were 3-fold higher than the maximum limit for EU/UK regulation (2 µg /kg for cereals) while OTA was found to be 7-fold higher than the EU/UK maximum limit of 5 µg/kg for cereals⁴. These two compounds are classified as human carcinogen and possible human carcinogen, respectively, according to the [International Agency for Research on Cancer](#). To prevent mycotoxin occurrence, training, and development of good practices in the supply chain are vital.

Towards teff implementation

The [Applied Mycology Group](#) (AMG) at [Cranfield University](#), has more than +35 years' experience in developing applied solutions and practices for the agrifood

industry towards preventing mycotoxin occurrence and achieving sustainable food chains. Intrigued by this “**supergrain**”, [Dr Carla Cervini](#), member of the AMG, has explored teff supply chain to evaluate its potential use in sustainable diets. She is leading the research towards removing these food safety concerns while maintaining teff’s nutritional value. Her work has already been awarded best public vote winner by the [Sustainable Food Challenge 2023](#), with a project (“Teff Nexus”, figure 2) and is currently being supported by the [EWA-BELT](#) project (Horizon 2020) towards promoting a mycotoxin-safe production chain of teff in East African countries.

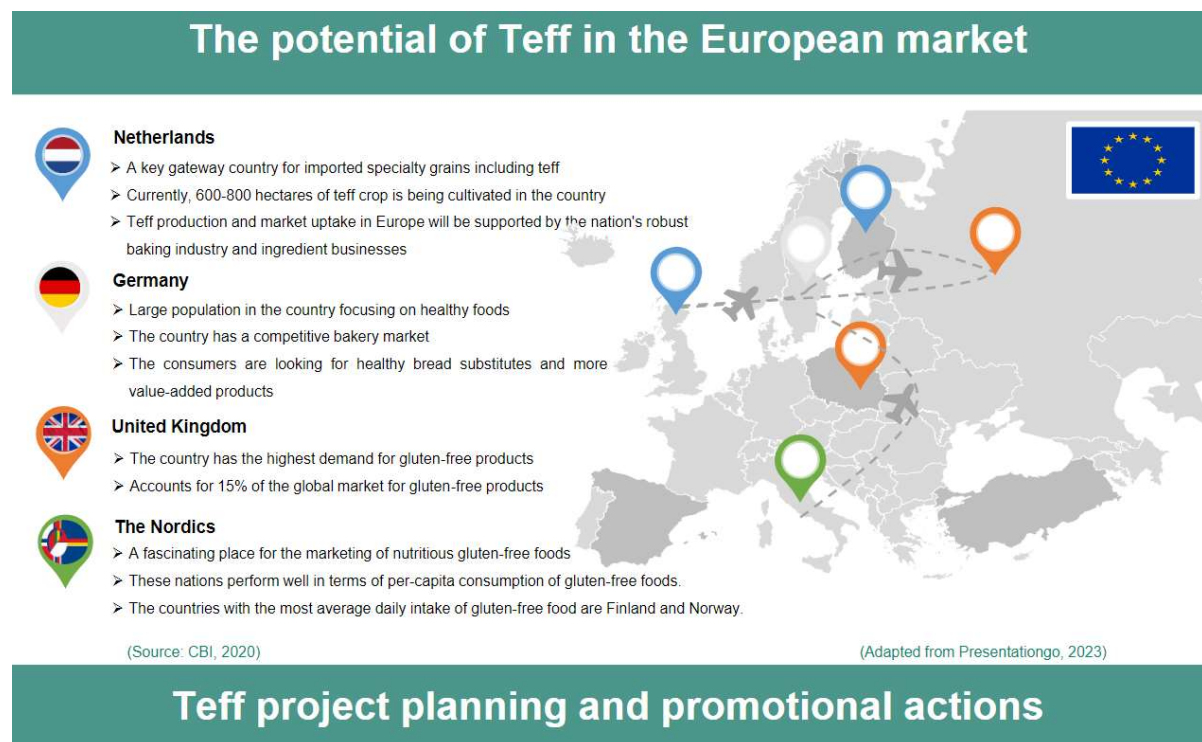


Figure 2 - Extract of the Teff Nexus project presented at the Sustainable Food Challenge 2023 and awarded the best public vote winner.

Welcome to the team!

Working towards implementation requires close relationship between interested processors, the supply chain and food safety experts. The AMG is willing to lead and build new **relationships with the food industries** to continue developing solutions for teff implementation and expansion in Europe and more.

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