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Tef (Eragrostis tef) grain

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Click on the "Nutritional aspects" tab for recommendations for ruminants, pigs, poultry, rabbits, horses, fish and crustaceans


Common names

Tef, teff, Williams lovegrass, Abyssinian lovegrass, annual bunch grass [English]; teff, tef [French, Spanish, Portuguese, Indonesian]; mtefi [Swahili]; [Amharic]; 苔麸 [Chinese]; בן-חילף טף [Hebrew]; テフ [Japanese]; Теф, Тефф [Russian]

Species

Eragrostis tef (Zuccagni) Trotter [Poaceae]

Synonyms

Eragrostis abyssinica (Jacq.) Link, *Poa abyssinica* Jacq., *Poa tef* Zuccagn

Feed categories

- Cereal grains and by-products

Related feed(s)

- Tef (Eragrostis tef) straw
- Tef (Eragrostis tef) hay

Description

Tef (*Eragrostis tef* (Zuccagni) Trotter) is a dual purpose cereal, valued for both grain and forage production in dry areas with short rainy season. Tef grain is rich in protein, carbohydrates and fibre and is mainly used for human food, particularly in Ethiopia where it used for the production of the bread (*injera*) and beer (*tela*). Until recently, little was known about the nutritional composition and potential health benefits of teff. This, along with technological limitations in processing teff, long prevented its widespread adoption as a cereal grain outside Ethiopia (Baye, 2015). However, since the late 1990s, the recognition of tef as a gluten-freen cereal of good nutritional value has resulted in newfound interest (Baye, 2015). Tef straw, the crop residue of grain harvest, is a major livestock fodder in Ethiopia. In other countries, like Australia, South Africa, and United States, tef is principally used as a forage crop for ruminants and horses (Baye, 2015). For more information about those products, see the Tef straw and Tef hay datasheets.

Due to the importance of tef grain in the food security of Ethiopia - the export of tef grain is banned since 2006 -, its use as livestock feed is unlikely in the short or medium term in this country. However, as the worldwide demand for this high-quality, gluten-free cereal is increasing, there may be opportunities in the future to use tef grains as feeds.

Morphology

Teff is an annual, leafy, tufted grass that reaches 150-200 cm high at maturity. The culms are fine, erect, simple or sparsely branched, prone to lodging. The root system is shallow and fibrous. Tef is a leafy species. Its leaves are glabrous, linear, 25-45 cm long x 0.1-0.5 cm wide. The seed head is a long panicle, 10-65 cm long, bearing 10-40 slender racemes which may be either very loose or very compact. Panicles bear 30-1100 spikelets. Fruits are ellipsoid, minute (1-1.5 mm x 0.5-1 mm), yellowish-white to deep brown caryopsis (grain) (Tefera et al., 2006; Seyfu Ketema, 1997). Tef is possibly the smallest cereal grain with an average length of about 1 mm. The average thousand kernel weight of 12 teff varieties was 0.264 g (Geremew Bultosa, 2007). The word "tef" is connected by folk etymology to the Ethio-Semitic root "ṭff", which means "lost" (because of the small size of the grain).

Uses

Tef grain is a staple food in Ethiopia. It has a high nutritive value and is used to prepare several dishes, the main one being *injera*, a popular fermented and flattened sour bread (Tefera et al., 2006). Tef grain is one of the cereal grains used in the production of Ethiopian beer (*tela*). Due to the minuteness of tef grains, they are difficult to decorticate, and the cereal is consumed as a wholegrain (Baye, 2015). There are many varieties of tef. The Hagaiz type has white seeds, matures slowly (150 days), makes higher demand on soil and cannot be grown above an altitude of 2500 m. The Tseddia type has brown seeds, matures early (90 days), can be grown above 2500 m and is superior for fodder production (NRC, 1996). Three major categories exist on the market: white (*nech*), red (*quey*) and mixed (*sergegna*). Wholesalers subdivide white tef into very white (*magna*) and white (*nech*), though these categorizations remain subjective (Baye, 2015). Consumers prefer white tef over darker coloured types, but red tef, which is believed to be more nutritious, is also gaining popularity among health conscious consumers in Ethiopia (Tefera et al., 2006; Baye, 2015)

In Ethiopia, a country of nearly 90 million people, approximately 6 million households grow teff. The production and consumption of tef grain are matters of national policy, since food insecurity remains a serious problem. Tef is now considered a luxury cereal and its consumption is mostly an urban experience, as most rural people are unable to afford teff and rely mostly on less expensive grains to make injera. The Ethiopian governement banned the export of tef grain (but not of injera) in 2006 (Crymes, 2015). Demands for teff grain by African diasporas, health conscious and gluten intolerant individuals in industrialised countries have led to increased production of teff internationally (Miller, 2010; Crymes, 2015; Baye, 2015). Though there is hardly any literature on the use of tef grain as a feed for livestock, its valuable nutrient composition could make it useful in animal production.

Distribution

Tef is thought to have originated in Ethiopia, where it started to be used as a food grain between 4000 and 1000 BCE. It is mainly cultivated in its native range (Ethiopia and the highlands of Eritrea) and in neighbouring northern Kenya. It has been introduced into South Africa, the USA, Canada, Australia, the Netherlands and Yemen for small-scale production of gluten-free grain (Tefera et al., 2006). In the tropics, tef is particularly suited for altitudes ranging from 1300-2800 m, but can grow from sea level to an altitude of 3400 m. Only brown/red tef is grown above 2500 m. Tef is particularly valued for areas too cold for sorghum or maize, and it can be found in places where -15°C occurs provided the frost does not last too long (NRC, 1996). In Ethiopia, tef grows where annual rainfall ranges between 950-1500 mm with a growing season rainfall of about 450-550 mm (Tefera et al., 2006). Tef cannot withstand more than 2 500 mm rainfall. However tef can adapt to growing conditions ranging from drought to waterlogging. It is able to withstand wet conditions perhaps better than any cereal other than rice. Tef is mainly grown on sandy loams, but it can grow on black, heavy clay soils (black cotton soils) provided they are well drained and have sufficient N fertility. Neutral or slightly acidic soils are preferred (Tefera et al., 2006).Tef can withstand as much or more salinity than alfalfa (Miller, 2010). A C4 plant, tef makes efficient use of water and heat. It can grow in places prone to drought after short rains (Tefera et al., 2006).

Tef grain production accounts for 25% of total cereal production of Ethiopia and was reported to be about 4.3 million t in 2015, up from only 1.4 million tons in 2001 (Lyddon, 2015; Alemayehu Refera, 2001).

drilling management

Tef is an fundamental food crop in Ethiopia due to its specific agronomic capabilities. It is possible to harvest tef after a first cereal harvest in the same year (NRC, 1996). Tef may be used as an emergency crop when harsh conditions occur. Farmers can still sow tef when their other crops are failing and subsequently get grain only two months after and use it as a famine food (NRC, 1996).

Establishment

Tef is propagated through seeds and should be used in sole cropping systems as tef does not withstand intercropping (Ecocrop, 2016). Tef is commonly grown in rotation with cereals, pulses and niger (Tefera et al., 2006). Tef requires a weeded, well-prepared, firm seed-bed. It can be planted, broadcast or sown at 15-20 kg/ha in rows, no deeper than 1 cm, and subsequently rolled (Ecocrop, 2016; Tefera et al., 2006). It must be regularly weeded. N fertilizer should be provided in low amounts, or tef should be sown after an N-legume in order to reduce the risk of lodging. Tef requires little care after establishment . Its rapid growth outcompete weeds. It suffers few diseases and pests attacks. In Yemen, it is considered a "lazy man's crop" as it does not require any care between sowing after flash flood and harvesting (NRC, 1996).

Harvest

Tef is one of the fastest maturing cereal crops. Grain maturity occurs 2 months after sowing in very early-maturing types, in 3-9 months after in early-maturing types and 6 months after in late-maturing types. Tef maturity is indicated by the yellowing of the stalks bearing the spikelets (NRC, 1996). Harvesting after physiological maturity may result in seed shattering, especially in windy and rainy conditions. In Ethiopia, harvesting is done between November and early January. Tef is hand-harvested. The plants are cut at ground level with sickles and then transported to the threshing ground (Tefera et al., 2006). Threshing is done by animal trampling or by using treshers. All grain cannot be completely removed from the straw (Seyfu Ketema, 1997; Alemayehu Refera, 2001). Tef straw is soft and fast drying (NRC, 1996). Tef has a low estimated percentage post-harvest loss, about 3%, compared to the other cereals such as maize (25%) and wheat (26%) (Kassier, 2002).

Grain yields

Tef grain yield ranges from 0.2 to 2 t/ha (Lyddon, 2015; Alemayehu Refera, 2001).

Storage

One advantage of tef grain is that it can be stored for an extended period of time, at least five years, under traditional storage conditions. The seed remains viable under such conditions for up to three years. It is no attacked by weevils or fungi, which reduces postharvest costs, as no protective chemicals are required for storage (Kassier, 2002).

Environmental impact

Erosion control, ground cover, green manure

Tef can serve as a temporary ground cover. Its very fast germination and fibrous root system development makes it an excellent choice for erosion control (Miller, 2010).

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Nutritional attributes

The nutritional value of tef grain is comparable to that of other major cereals. Tef is relatively rich in protein, though the literature reports a wide range of values: Baye, 2015 reports a range of 9-12.5% (DM) while the CGIAR/ILRI Subsaharan feed database reports an average of 13.2% DM and a range of 8.4-19.4% (CGIAR, 2009). Tef has a good amino acid composition, with lysine levels (3.7% protein) and sulphur amino acids levels (methionine 4.1% protein) higher than those of wheat or barley (Lester et al., 1981). Tef contains about 73% starch, similar to maize grain and higher than for wheat and barley. The crude fibre content (3-4%) seems to be slightly higher to that of wheat and maize, and lower than than of barley. Crude fat (2.5-3.4%) is similar to that of other cereals (Baye, 2015). Tef contains high amounts of phytate (0.6-1.4%) comparable to those of other cereal grains, with a wide range of variability, probably due to differences in varieties and growing conditions. Tef has a higher iron, calcium and copper content than other common cereals (Mengesha, 1966). However, the difference in mineral content between and within teff varieties is wide ranging. Red tef has a higher iron and calcium content than mixed or white tef while the latter has a higher copper content than red and mixed tef (Abebe et al., 2007). The very high mineral content of tef has attributed to soil contamination, and particularly to the traditional threshing method by cattle trampling (Baye, 2015).

ruminants

No scientific studies are available (as of 2016) on the utilisation of tef grain for ruminants. Because it is widely and safely used in human nutrition, grains discarded for food should be usable in the manner of other cereals, notably maize (large starch content) or wheat (good protein content). Its relatively high content in sulphur amino acids may be valuable.

Pigs

No scientific studies are available (as of 2016) on the utilisation of tef grain for pigs. Because it is widely and safely used in human nutrition, grains discarded for food should be usable in the manner of other cereals, notably maize (large starch content) or wheat (good protein content). Its relatively high content in sulphur amino acids and low fibre content may be valuable for pigs.

Poultry

Although no scientific studies are available on the nutritive value of tef in poultry (as of 2016), the chemical composition and the lack of major antinutritional factor suggest that its value is close to that of other cereals. Tef has higher protein content and slightly lower energy content than maize or sorghum, and its value would be closer to that of wheat or oats. Tef grain seems to be relished by birds as growing recommendations for tef crop include bird protection (Yifru Teklu et al., 2005). Tef grain was reported to be fed to captive buff-spotted flufftail (*Sarothrura elegans*) in southern Africa (Taylor, 2010). When available it is used by scavenging chicken (Hayat et al., 2016).

Rabbits

No scientific studies are available (as of 2016) on the utilisation of tef grain for rabbits. Because it is widely and safely used in human nutrition, grains discarded for food should be usable in the manner of other cereals, notably maize (large starch content) or wheat (good protein content). Its relatively high content in sulphur amino acids may be valuable for rabbits, but attention should be paid to its low lysine content, as for other cereal grains.

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Tables of chemical composition and nutritional value

- Tef (Eragrostif tef), grain

Avg: average or predicted value; SD: standard deviation; Min: minimum value; Max: maximum value; Nb: number of values (samples) used

Tef (Eragrostif tef), grain

Main analysis	Unit	Avg	SD	me	Max	Nb
Dry matter	% as fed	88.3	1.1	86.0	90.3	146
Crude protein	% DM	13.2	3.0	8.4	19.1	147
Crude fibre	% DM	4.1				1
Ether extract	% DM	3.4				1
Ash	% DM	1.6	0.5	0.3	3.3	145
Gross energy	MJ/kg DM	18.8				*

Minerals	Unit	Avg	SD	me	Max	Nb
Calcium	g/kg DM	1.5	0.2	1.0	2.1	141
Phosphorus	g/kg DM	3.6	0.9	1.5	5.1	141
Potassium	g/kg DM	4.7	0.4	3.8	5.5	143
Sodium	g/kg DM	0.0	0.0	0.0	0.0	29
Magnesium	g/kg DM	1.8	0.2	1.5	2.1	thirty
Manganese	mg/kg DM	65	41	25	193	133
Zinc	mg/kg DM	29	2	26	34	27
Copper	mg/kg DM	15	4	3	26	143
Iron	mg/kg DM	161	111	8	544	140

Amino acids	Unit	Avg	SD	me	Max	Nb
Alanine	% protein	5.8	0.1	5.5	6.0	11
Arginine	% protein	5.1	0.5	4.5	6.2	11
Aspartic acid	% protein	6.7	0.3	6.2	7.2	11
Cystine	% protein	1.0	0.1	0.7	1.1	11
Glutamic acid	% protein	23.9	0.6	23.1	24.9	11
wistaria	% protein	4.0	0.1	3.8	4.1	11
Histidine	% protein	3.2	0.3	2.8	3.7	11
Isoleucine	% protein	4.0	0.1	3.8	4.2	11
Leucine	% protein	8.5	0.2	8.3	8.8	11
Lysine	% protein	3.7	0.3	2.9	4.0	11
Methionine	% protein	4.1	0.4	3.1	4.6	11
Phenylalanine	% protein	5.7	0.1	5.4	5.9	11
Proline	% protein	5.5	0.5	4.7	6.3	11
Serine	% protein	5.2	0.1	5.1	5.6	11
Threonine	% protein	4.3	0.0	4.3	4.4	11
Tyrosine	% protein	3.8	0.1	3.6	4.0	11
Valine	% protein	5.5	0.3	5.1	5.9	11

Ruminant nutritive values	Unit	Avg	SD	me	Max	Nb
OM digestibility, ruminants	%	85.5				*

Pig nutritive values	Unit	Avg	SD	me	Max	Nb
Energy digestibility, growing pig	%	83.7				*

DE growing pig	MJ/kg DM	15.7	*

The asterisk * indicates that the average value was obtained by an equation.

References

CGIAR 2009 ; CIRAD 1991 ; Lester et al., 1981

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Abebe Y. ; Alemtsehay B. ; Hambidge, K. M. ; Stoecker, B. J. ; Bailey, K. ; Gibson, R. S., 2007. Phytate, zinc, iron and calcium content of selected raw and prepared foods consumed in rural Sidama, Southern Ethiopia, and implications for bioavailability. J. Food Comp. Anal., 20 (3): 161-168

Adebowale, A. A. ; Naushad Emmambux, M. ; Beukes, M. ; Taylor, J., 2011. Fractionation and characterization of teff proteins. J. Cereal Sci., 54 (3): 380-386

Alemayehu Refera, 2001. TEF: Post-harvest Operations. INPhO - Post-harvest Compendium, AGSI/FAO

Baye, K., 2015. Teff: nutrient composition and health benefits. ESSP Working Paper 67. Washington, D.C. and Addis Ababa, Ethiopia: International Food Policy Research Institute (IFPRI) and Ethiopian Development Research Institute (EDRI)

Bultosa, G., 2007. Physicochemical characteristics of grain and flour in 13 Tef [*Eragrostis tef* (Zucc.) Trotter] grain varieties. J. Appl. Sci. Res., 3 (12): 2042-2051

CGIAR, 2009. SSA Feeds - Sub-saharan Africa feed composition database. CGIAR Systemwide Livestock Programme

Crymes, A. R., 2015. The international footprint of teff: resurgence of an ancient Ethiopian grain. Washington University Open Scholarship. Electronic Theses and Dissertations. Paper 394

Ecocrop, 2016. Ecocrop database. FAO, Rome, Italy

FAO, 2016. Grassland Index. A searchable catalogue of grass and forage legumes. FAO, Rome, Italy

Geremew Bultosa, 2007. Physicochemical characteristics of grain and flour in 13 tef [*Eragrostis tef* (Zucc.) Trotter] grain varieties. J. Appl. Sci. Res., 3 (12): 2042-2051

Geremew Bultosa, 2008. Tef (*Eragrostis tef*) grain and its crop residue utilisation. Dpt Food Sci. Post Harvest Technol., Haramaya University

Hayat, N.; Solomon, D.; Meseret, M., 2016. Chemical composition of scavenging feed resource of indigenous chickens. Asian J. Anim. Sci., 10 (3): 182-188

Kassier, S. B., 2002. Comparative responses of fodder and grain teff (*Eragrostis tef* (Zucc.) Trotter) cultivars to spatial, temporal and nutritional management. Thesis (M.Sc.Agric.)-University of Natal, Pietermaritzburg

Lyddon, C., 2015. Focus on Ethiopia. World Grain, Sosland Publ. Co.

Mengesha, M. H., 1966. Chemical composition of teff (*Eragrostis* tef) compared with that of wheat, barley and grain sorghum. Econ. Bot., 20 (3): 268-273

Miller, D., 2010. Teff grass: Crop overview and production guide. Cal/West Seeds

NRC, 1996. Lost Crops of Africa. Volume I Grains. National Research Council, USA

Seyfu Ketema, 1997. Tef - *Eragrostis tef* (Zucc.) Trotter. Promoting the conservation and use of underutilized and neglected crops, Vol. 12, Biodiversity International publ., Rome

Taylor, B., 2010. A guide to Rails, Crakes, Gallinules and Coots of the World. Bloomsbury Publishing, August 2010, 600 p.

Tefera, H.; Belay, G., 2006. *Eragrostis tef* (Zuccagni) Trotter. In: Brink, M.; Belay, G. (eds), PROTA (Plant Resources of Tropical Africa/Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands

Tolera, A., 2008. Feed resources and feeding management: A manual for feedlot operators and development workers. Ethiopia SPS-LMM - Texas Agricultural Experiment Station (TAES)/TAMU, Addis Ababa

Yifru Teklu; Hailu Tefera, 2005. Genetic improvement in grain yield potential and associated agronomic traits of tef (Eragrostis tef). Euphytica, 141 (3): 247-254

22 references found

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