



Eragrostis Teff as a specialised niche crop

By Trevor Lacey, Development Officer and Carol Llewellyn, Technical Officer, Northam

Background

Teff is a grass crop that is intermediate between tropical and temperate grasses with many favourable adaptations. Teff has been grown as a cereal for human consumption for thousands of years in Northern African countries.

Teff is one of the major cereal crops of Ethiopia, where it is believed to have originated. Teff provides over two-thirds of the human nutrition in Ethiopia, with a grain protein content similar to other cereals (10-12%). Besides providing protein and calories, Teff is a good source of minerals, particularly iron. It has a very high calcium content and contains high levels of phosphorus, copper, aluminium, barium and thiamine. The principal use of Teff grain for human food is the Ethiopian bread "injera", a soft, porous, thin pancake with a sour taste. However, Teff flour is also made into a gruel (*muk*), baked into cakes and a sweet dry unleavened bread (*kita*), plus homemade beverages.

Market demand

Some commercial production of Teff has occurred in countries such as South Africa and the United States to supply an increasing demand for Teff grain from;

- Ethiopians, Eritreans and Somalis living abroad,
- An increase in Ethiopian restaurants (throughout Europe, United States and other countries), and the increased familiarity with Ethiopian cuisine,
- Within the health food trade as it has a good balance of amino acids, is high in iron and calcium and is low in gluten (suitable for people with allergies to wheat flour)
- Teff has the potential for incorporation into other products such as thickeners for soups, stews and gravies and baby foods. With its slightly molasses like sweetness Teff is also included in porridge, pancakes, muffins and biscuits, cakes, stir fry dishes, casseroles, soups, stews and puddings.



Irrigated Teff growing in plots at Medina Research station.

Species Information

Botanical name: *Eragrostis tef* (Zucc.) Trotter

Common names:

Afrikaans - tef, gewone bruin tef (ou bruin)

Amharic - Tyeff

Arabic - taht

Danish - Abessinsk Rapgræs

English - tef, teff, Williams lovegrass

Ethiopia - tafi (Oromo/Afar/Sodo), tafe-e (Had); t'ef, teff, taf (Amarinya, Tigrinya languages)

Finnish - Tefheinä

French - mil éthiopien

German - Äthiopisches Liebesgras

Malawi - chimanganga, ndzungula (Ch), chidzanjala (Lo)

Teff grain is nutritious enough to be a "health" food and tasty enough to be a gourmet food.

Domestic demand for Teff will be limited by the size of Australia's Ethiopian, Eritrean and Somali population. This market may have the potential to expand with product development but is not guaranteed. Teff is not commonly traded on world grain markets and little information on the potential size of the export market is available. Initial markets may come from countries with

Important Disclaimer

The Chief Executive Officer of the Department of Agriculture and the State of Western Australia accept no liability whatsoever by reason of negligence or otherwise arising from the use or release of this information or any part of it.

high populations of Ethiopians, Eritreans and Somalis (contacts in Israel have indicated the potential for Israel to import certain varieties of Teff). In 2000 the demand for Teff in the US was estimated to be in the order of 1000 to 1400 t/year.

Characteristics

Teff is a fine stemmed, tufted annual grass characterised by a large crown, many shoots and a shallow, diverse root system. Its inflorescence is a loose or compact panicle. The extremely small grains are 1 - 1.5 mm long, and there are 2,500 - 3,000 seeds to the gram. The plant employs the C4 photosynthetic pathway, which indicates that it uses light efficiently while having low moisture demands. The plants germinate quickly and are adapted to environments ranging from drought stressed to water-logged. In Ethiopia it is considered a reliable, low-risk crop.

The word Teff is thought to have been derived from the Amharic word *teffa* which means "lost", due to the small size of the grain. Teff is the smallest grain in the world, taking 150 grains to weigh as much as one grain of wheat. Because the grains are so small, the bulk of the flour consists of the bran and germ. The bran and germ are the most nutritious parts of any grain. This grain also has very high calcium content, and contains high levels of phosphorous, iron, copper, aluminium barium, and thiamin. It is considered to have an excellent amino acid composition, with lysine levels higher than wheat or barley (some research indicates that at least in part some of the high levels of minerals may be due to contamination of samples with fine soil particles). Teff is high in protein, carbohydrates and fibre. It contains no gluten so it is appropriate for those with gluten intolerance.

Attributes

Some attributes of Teff as reported in the literature are;

- It will grow on a wide range of soil types with maturities from 45 - 160 days,
- Is tolerant of waterlogging (quoted as second only to rice amongst the cereals), and annual rainfall up to 2,500 mm/year
- Tolerates soils with low pH,
- Tolerates moisture stress (rainfall as low as 250 mm/year),
- May be sown following the failure of other crops,
- Is relatively free of diseases and pests,
- Produces rapid cover/protection from erosion.

Teff can be used as stock feed (paddock feed, hay, silage or chaff production) or sold as a high value grain yielding 1.5 - 2.5 tonnes per hectare. Small-scale field plots at Northam in the Western Australian wheatbelt in 1999 have yielded from 2.4 to 2.8 tonnes per hectare.

Cropping options

Teff may add to the range of cropping options (particularly for marginal soils), extending the farmer's flexibility, sustainability and profitability. Other benefits would include the availability of Teff to the Australian communities with Ethiopian, Eritrean and Somali heritage for whom Teff traditionally forms an integral component of their daily diet - Teff is currently unavailable locally.

Teff may also extend farmers flexibility by assisting with the management of herbicide resistance, disease risk and variable seasonal conditions (drought, waterlogging). Based on Teff's adaptations and possible role of using water in early summer, it may provide an additional option for managing watertables.

However, there have not been any local trials to confirm how Teff will perform in the Western Australian wheat belt. There may also be some potential for Teff grown under irrigation in WA. Teff grew well in seed bulk up plots at Medina Research Station but no yield information is available.

Agronomy

With Teff's small seed it needs to be sown within the top few millimetres of soil. As with other C4 grasses it is likely to germinate best as soil temperatures are increasing in spring (but requirements for best results have not been established).

Teff's small seed size also makes it vulnerable to insect attack at emergence. Control of RLEM, Lucerne flea and other insect pests will be important for successful establishment.

Good weed control prior to sowing is a priority given the lack of registered or tested chemicals for in-crop weed control. Sowing in spring as soil temperatures start to increase should provide an opportunity for weed control prior to sowing. Little information is available on Teff's tolerance to a range of herbicides. Its tolerance of chemicals for broadleaf weeds is likely to be similar to other cereals and grasses. Options for grass weed control in Teff are more limited. Some initial herbicide tolerance trials have indicated limited tolerance of Glean, Ally and Eclipse but varietal variations would suggest the need for more detailed testing to determine safe rates. There are virtually no registered herbicides for use in Teff in Australia.



Photo shows the extremely small size of Teff seed and the colour variation between varieties.

Harvesting and Handling

Teff threshes well with standard methods and equipment. Very early maturing types are ready to harvest in 45 - 60 days; early types in 60 - 120 days; and late types in 120 - 160 days. Yields range from 300 to 3,000 kg per hectare, or even more. Although the national average in Ethiopia is 910 kg per hectare, yields of 2,000 - 2,200 kg per hectare are considered routinely attainable if good agronomic practices are carefully followed. Yields of 2,000 kg per hectare have been achieved on South African farms also. The grain is easy to store and will survive for many years in traditional storehouses without damage by insects. This has made Teff a valuable safeguard against famine. The main problems that might be encountered at harvest relate to the small seed size of Teff.

Uses

Teff grain comes in a range of colours from milky white to almost black, but its most popular colours are white, red and brown. The darker the colour, the richer the flavour. Although blander in taste, the white seeds command the highest prices. However, the red and brown seeds come from plants that are hardier, faster maturing and easier to grow. In addition, Teff enthusiasts prefer their more robust flavour. Quality attributes required in Teff appear to be poorly understood with little documentation of quality requirements for end products.

As a fodder, the Teff plant is reported to be cheap to raise and quick to produce. Its straw is soft and fast drying. It is both nutritious and extremely palatable to livestock. Its

leaf to stem ratio (average 73:27) is high, its digestibility (65 percent) relatively high, and its forage protein content (1.9 - 5.2 percent) low but nonetheless valuable.

On Western Australian soils it is likely to require similar levels of inputs as other grass or cereal crops if it is to perform well.

Further Reading

Stallknecht, G.F., Gilbertson, K.M. and Eckhoff, J.L. (1993) Teff; Food Crop for Humans and Animals. P231-234 in J. Janick and JE Simon (eds.) New Crops.

National Academy of Sciences, (1996) Teff. pp. 215-235. Lost Crops of African. Vol 1. Grains.



Teff varieties displays a range of inflorescence types from loose to compact panicles.

