

Agrotechniques in teff: A miracle millet crop

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Introduction

Teff (*Eragrostis tef* (Zucc.) Trotter) commonly known as “Williams love grass, teffa and annual bunch grass” in different parts of the world. It is a major indigenous cereal crop of Ethiopia, where it originated and diversified. Being minor millet, it belongs to the Poaceae family, sub-family Eragrostoidae, tribe Eragrosteae and genus Eragrostis, with diploid chromosome number, $2n = 40$. Among the 300 species known in the genus Eragrostis, teff is the only cultivated species. It is a highly demanded cereal and a staple food grain for more than 85 per cent of the 85 million people of Ethiopia. In Ethiopia, it is being cultivated to an extent of 3.01 m ha, with a production of 5.01 m t and a productivity of 1664 kg ha^{-1} (Lee, 2018). The Central Food and Technological Research Institute (CFTRI), Mysore introduced teff crop to India in an effort to promote it as a “super food” as well as a means of easy earnings for farmers and make it more accessible and less expensive to the consumers. Presently teff is cultivated on a few hundred hectares in Karnataka around Mysore, Sirsi (Uttar Kannada), Haveri, Gadag and Raichur districts. CFTRI, Mysore and Kadamba Foundation, Sirsi are the premier organizations for promoting the cultivation of teff in South and North Karnataka, respectively.

It can be grown under varied climatic conditions and during both *kharif* (June-July) and *rabi* (October-November) seasons. It is highly tolerant to drought and resistant to diseases, which makes it easier to grow than other millet. Teff grain is not attacked by weevils; hence, it has a reduced post-harvest loss in storage and reduced cost of using storage chemicals for pest-control. It has the potential to yield 200-250 kg per acre. Being an export-oriented crop, it fetches premium price in the market compared to other small millets, and with high nutrient supply helps in improving socio-economic status of the small farmers under dryland conditions and helps to attain national food security.

Teff is a boon to Indian farmers, little is known about its cultivation, production and value addition in India. The limitations for cultivation of the crop lies in the name itself *i.e.*, teff derived from the Amharic word “teffa” meaning “loss”, due to small size of grains that causes its easy loss during the production. Small size of the grains poses problems during sowing (leads to uneven plant stand) and indirectly during weeding and threshing. Other limitations include: lack of improved varieties, lodging of the crop at later stages of crop growth, lack of mechanization (leading to labour intensive cultivation), lack of awareness and standard package of practice (Agrotechniques) suitability to Indian agriculture scenario. These are the premier areas of research needed to promote this crop at global level. The standard agrotechniques *viz.*, planting method, spacing, nutrient management, weed management, pest management and reduction in post-harvest losses must be aimed at reducing the loss in the output. Among these, row spacing and nutrient management play a vital role in increasing yield levels of teff crop as they ensure optimum plant population and adequate supply of nutrition to the plants.

Need for teff in India...!

- Contain very little gluten (hence, can substitute wheat against celiac disease).
- Acceptance in the national diet.
- Export oriented crop, high market value and hence enables farmers to earn more than that compared to other crops.
- Tasty and slow energy releasing food.
- A new opportunity crop for innovative farmers in dryland agriculture.

Plant biology

- Inflorescence is an open **panicle**; single inflorescence can produce up to 1000 seeds and one plant up to 10,000.
- **Smallest grain** in the world (weight of 150 teff grains = 1 wheat grain), 1–1.7 mm long and 0.6 – 1 mm diameter with 1000 seed weight averaging 0.3–0.4 grams.
- Colour of grains: Ivory, light tan to deep brown or dark reddishbrown purple, depending on the variety (upper class consumed the lighter grains, the dark grain was the food of soldiers and servants).
- The grain is somewhat **mucilaginous**.

- Only white and reddish-brown seeded types are best suited to Indian conditions.



Table 1: Comparison between types of teft grains

Minerals (mg/100 g)	White teft	Red teft	Mixed teft
Iron	9.5-37.7	11.6 – 150	11.5 – 150
Zinc	2.4-6.8	2.3-6.7	3.8-3.9
Calcium	17-124	18-178	78.8-147
Copper	2.5-5.3	1.1-3.6	1.6

(Akanksha *et al.*, 2008)

Nutritional composition of Teft

Table 2: Teft grains composition		Table 3: Teft hay composition	
Component	100 g ⁻¹	Quality Parameters	Composition (%)
Water (g)	10.0	Crude Protein	9-14
Energy (kJ)	1468	Acid Detergent Fiber (ADF)	32 – 38
Protein (g)	12.3	Neutral Detergent Fiber (NDF)	53 – 65
Fat (g)	2.1	Total Digestible Nutrients (TDN)	55 - 64
Starch (g)	59.8	Relative Feed Value (RFV)	80-120
Fibers (g)	7.9		
Calcium (mg)	167		
Iron (mg)	5.7		
Magnesium (mg)	194		
Potassium (mg)	477		
Akanksha <i>et al.</i> (2008)		(Miller, 2007)	

Uses of teft

- Teft flour is primarily used to make a fermented, sourdough type, flat bread called *Injera*.
- Teft is also eaten as porridge and also used for making traditional alcoholic drinks like *tella* (local opaque beer) and *katikalla* (local spirit), *kitta* (sweet dry unleavened bread) and *muk* (gruel).

- Cooked teff can be mixed with herbs, seeds, beans or tofu, garlic, and onions to make grain burgers.
- The seeds can also be sprouted and the sprouts used in salads and on sandwiches.
- Good thickener for soups, stews, gravies, and puddings and can also be used in stir-fry dishes, and casserole dishes.
- Used as a livestock forage or pasture crop.
- Straw can also be used as building material along with mud.

Teff products: Teff flour can be used as a substitute for part of the flour in baked goods, or the grains added uncooked or substituted for part of the seeds.

- Appetizers Baked goods
- Biscuits and scones Breads
- Breakfast and desserts bars
- Breakfast dishes (to be eaten with fruits and milk, hot or cold)
- Brownies
- Cakes and cupcakes casserole dishes cookies
- Crackers desserts
- Dips, sauces and gravy Granolas (muesli) Muffins
- Pancakes & waffles Pastas
- Pie crusts pizza crusts rolls & buns soups & stews
- Tortillas and flat breads
- Weaning food



Agonomic importance of teff

- Short duration; suitable for multiple cropping
- Seeds can be stored up to more than 2 years
- Wider adaptability; grows well under moisture stress conditions where other crops fail.
- Good hay or pasture crop when late season plantings are required due to a crop failure (emergency crop)
- Low input annual forage grass

- Very few disease and pest problems have been observed
- High quality hay, palatability and animal acceptance has been reported.
- Versatility of harvest - Although in most instances teff forage is baled as dry hay, sometimes be grazed directly or ensiled.

Limitations in teff cultivation

- Small size of teff seeds poses problems during sowing and indirectly during weeding and threshing.
- Uneven plant stand (reduces fertilizer and water use efficiencies)
- Landraces and cultivars are low yielding.
- Lodging is common if harvest is delayed.
- Labour intensive.
- Lack of market facilities.
- Lack of awareness and standard agrotechniques.



Agrotechniques of teff production

- Seedbed preparation
- Seed selection (variety, seed rate and seed treatment)
- Planting (time, method and depth)
- Nutrient management
- Irrigation management
- Weed management
- Teff based cropping systems

Conclusion

Seed rate of 5 kg ha⁻¹ is sufficient to obtain maximum yield under direct seeding for rainfed conditions. Row planting at shallow depth (< 1 cm) to ensure faster germination and quicker establishment of crop and band application of fertilizers along row planting resulted in 2-3 times higher grain yield. Stress at



the mid-season stage (most sensitive, at 75 % D, 50 % D and 25 % D, respectively) resulted in yield reduction (30 %, 23 % and 23 %, respectively) against no water stress. Teff crop fits well into multiple cropping systems such as mixed and relay cropping systems.

References

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