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Reviews

Significance of teff (*Eragrostis tef* (Zucc.) Trotter) as a new fodder crop for Bulgaria

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Abstract. *This review article aims to summarize global studies relating to the distribution, biological characteristics, productivity and cultivation technology for grain and green mass from teff (Eragrostis tef). Teff has the shortest vegetation period among cereals, good adaptability to varied environmental conditions and high drought resistance. In the world, it is gaining popularity as a healthy grain food, especially suitable for people suffering from celiac disease, due to the lack of gluten in the grain and a good source of omega fatty acids, vitamins and minerals. Teff is the crop with the shortest vegetation among the cereals – it ripens for 50 to 90 days. It can successfully be sown as a second crop following early cereals. As fodder, it has good nutritional value compared to some basic fodder crops. It is used as food for ruminants and horses, compared to the quality of well-maintained natural grasslands. Straw is preferred more than that of the basic annual cereal crops in ratios as coarse fodder. Its application in industry is also feasible. Resistance against diseases and enemies, as well as the ability to choke weeds, makes it an economically efficient and ecological crop. While studies on teff in Bulgaria are limited, they indicate successful cultivation in the arid conditions of Southern Dobrudzha. This crop, unknown to our producers, could be included in the structure of field crops and take up areas that are not suitable for the traditionally grown cereal plants – wheat, barley, maize. For this purpose, it is necessary to study the impact of the climate at a local level on the development and productivity of teff. It is necessary to pay serious attention when choosing the production technology, in order to use the potential for the production of green mass and grain, and a possible choice for impact is the optimization of the seeding rate and fertilization.*

Keywords: *Eragrostis tef (Zucc.)* Trotter, productivity, technology for growing, quality

Introduction

Currently, climate and resource challenges are particularly important for the development of agriculture and, in particular, the cultivation of fodder crops. Sustainable feed production aims to provide feed with high nutritional value. Local droughts, heavy rains for short periods, increase in average daily temperatures lead to improper development of crops and obtaining. low yields. A crucial aspect of developing fodder production is the selection of appropriate crops, adaptable to different climatic conditions of the environment, meeting requirements for soil and biodiversity protection (Miller, 2009; Kakabouki et al., 2021; Wagali et al., 2023). More frequent and intense droughts are likely to reduce water supplies, which combined with hot winds, will increase the risk of wind erosion and soil degradation. In certain areas, this is a limiting factor for the cultivation of main fodder crops requiring fertile structural soils. To reduce the negative impact of climate anomalies on agriculture, adapting alternative ecologically plastic crops is a suitable approach (Kakabouki et al., 2021). A critical step in introducing new crop plants for a specific region is to make in-depth studies of the morphological

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features, biological requirements and agrotechnics of crop production with the aim of establishing an appropriate cultivation technology. In Africa, teff is considered a potential fodder crop during the summer months, especially for the USA (Twidwell et al., 2002; Roseberg et al., 2005; Norberg et al., 2008; Miller, 2009; Saylor, 2017). At the moment, there are limited studies on teff in Bulgaria, and their main focus is the production of grain and its nutritional potential. A number of authors point to teff as an ancient and forgotten crop with the prospect of producing food for humans and animals, due to its valuable qualities: drought resistance, ecological plasticity, short growing season, higher nutritional value than some cereals and indispensable nutritional qualities of the grain with the possibility for production of gluten-free bakery products (Ketema, 1997; Mengistu and Mekonnen, 2011; Stoyanov, 2014; Sang-Hoon et al., 2015; Ivanova, 2018; Barretto et al., 2021; Kakabouki et al., 2021; Chochkov et al., 2022).

Teff (*Eragrostis tef* (Zucc.) Trotter) is a cereal plant native to West Africa (Ketema, 1993; Assefa and Chanyalew, 2018; Cannarozzi and Tadele, 2022). At certain stages of animal growth and development, teff feed can supplement or replace the feeding of other staple feeds (Miller, 2009;Wagali et al., 2023). According to Saylor (2017), feeding cattle with teff hay did not decrease milk yield and fat content, while increasing milk protein content. Due to the great drought tolerance of the crop and its cultivation without irrigation, a reduction in water consumption is also achieved in the livestock farm, which increases the profitability of production. Teff is versatile and can be cultivated for green mass, hay, silage, straw, and grazing purposes (Miller, 2009; Saylor, 2017; Vinyard et al., 2018; Laca, 2021).

Cultivation of teff as a forage crop has been studied in recent years in the USA, Italy, and Israel. In Bulgaria, research is limited. Productive tillering of teff samples and grain productivity were tested by Stoyanov (2013, 2014), who summarized that further studies were needed on the biological and technological requirements of the crop in the conditions of the country and considered that it could be grown in South Dobrudzha due to the arid nature of the climate in the area.

Teff could be cultivated in areas unsuitable for traditional cereal crops in our country. For this purpose, it is necessary to study the impact of the climate on the development and productivity of this crop in the conditions of the country. The various stages of cultivation technology, including tillage, fertilization, sowing, etc., should also be studied in order to obtain its potential for green mass and grain yield (Dereje et al., 2018; Reda et al., 2018; Roussis et al., 2019; Arefaine et al., 2020; Mihretie et al., 2020).

The objective of the article is to summarize the studies related to the distribution, productive possibilities, biological, selection, ecological and technological features in the production of seeds and bulk fodder from teff.

Significance, origin and distribution

Teff (*Eragrostis tef* (Zucc.) Trotter), an annual cereal crop (Assefa et al., 2015; Bultosa, 2016), is a staple in Ethiopia, where it is grown on more than three million hectares annually, equal to 30% of the country's cereal area (CSA, 2020; Cannarozzi and Tadele, 2022). Its grain is a crucial part of the diet in Ethiopia, Eritrea, and South Africa, where it is used to make traditional foods and beverages (Gebremariam et al., 2014; Bultosa, 2016). In addition to being easily digestible, teff grain does not contain gluten, which is why bread made from it is a staple food for people with gluten intolerance (Gebremariam et al., 2014; Nascimento et al., 2018; Gebru et al., 2020; Chochkov et al., 2022). Owing to its numerous dietary benefits and tolerance to extreme environmental conditions, teff is a promising cereal crop for cultivation (Gregory et al., 2019). Teff has many valuable morphological, physiological and biological properties. Its drought tolerance allows it to be used for reseeding frozen or damaged winter crops and also as a component in the green conveyor (Stallknecht et al., 1993; Miller, 2009; Gebremariam et al., 2014; Habte et al., 2019). Its rapid growth rate and short growing season enable high yields under specific soil and climatic conditions (Miller, 2009; Dereje et al., 2018; Habte et al., 2019). Teff has the shortest growing season among cereal crops, maturing in 50 to 120 days (Kodama, 2009; Tesema et al., 2013). It can be successfully sown as a second crop on non-irrigated areas (Habte et al., 2019). Its rapid germination, emergence, and bearded root system make teff an ideal crop for erosion control (Miller, 2009; Assefa and Chanyalew, 2018; Chanyalew et al., 2019). Compared to other cereals, teff is less attacked by diseases and enemies (Gebremariam et al., 2014). It can also be used as an ornamental plant (Belay et al., 2006). The warming and drying of the planet's climate requires the cultivation of drought-tolerant crops with a shorter growing season (Assefa et al., 2015). Teff is suitable for these conditions. Teff's valuable biological qualities and favorable chemical composition make it important for addressing both the food needs of the population and fodder production (Mengistu, 2003; McCown et al., 2012; Ream et al., 2020).

Morphological characteristics

Teff (*Eragrostis tef* (Zucc.) Trotter) belongs to the Poaceae family. Together with finger millet (*Eleusine coracana* (L.) Gaertn.) they belong to the subfamily Chloridoideae, which points to their similar morphological and physiological structure. Of the approximately 350 species within the *Eragrostis* genus, only teff is cultivated. Because no systematic studies have been conducted, this crop is labeled as forgotten (Ketema, 1997; Tesema et al., 2013; Tadele, 2018). Teff has a tiller type of root system (Stallknecht et al., 1993; Bultosa, 2016; Assefa and Chanyalew, 2018). The stems are straight, cylindrical and hollow, heavily leafy and prone to lodging with a good nutritional regime and good moisture supply. This makes it suitable for cultivation on infertile soils, including mountainous and semi-mountainous regions, with a light mechanical composition and low soil pH (Ketema, 1993). The leaves are linear, lanceolate up to 45 cm long, 2-6 per stem. The inflorescence is a panicle, which can be loosely to compactly branched with a large number of spikelets – from 30 to 100. The spikelet is multi-floret, narrowly oblong, 4-9 mm long and 1-3 mm wide. Anthers are 3, stamens are up to 0.5 mm long, bilobed, and the ovary is superior with two stigmas (Cannarozzi and Tadele, 2022). The fruit is a grain, small, ovoid to elliptical in shape, 1-1.5 mm long and 0.5-1 mm wide. The grain in different varieties is colored from yellowish-white to dark brown (Ketema, 1993; Ketema, 1997; Miller, 2009). Like other cereals, the teff grain comprises a germ, pericarp (cuticle, mesocarp, and endocarp), and endosperm layers. The germ is rich in lipid and protein compounds. The pigmented teff spikes are rich in polyphenols and tannins, which have antioxidant activity (Serna-Saldivar and Espinosa-Ramires, 2019; Barretto et al., 2021).

Biological requirements

In the last decade, the demand for crops adaptable to stress climates, which provide biomass and grain for a short period under adverse environmental conditions, has intensified (Tadele, 2019; CSA, 2020; Cannarozzi and Tadele, 2022). The biological features of the crop make it possible to use it in compacting crop rotations.

Moisture Requirements: Teff is highly resistant to drought. In the literature, it is presented as a crop that can replace or supplement some of the fodder crops – alfalfa, corn, sorghum, barley and wheat in the absence of sufficient moisture supply (Twidwell et al., 2002; Miller, 2009; Barretto et al., 2021). Compared to other cereals, it is more tolerant to extreme environmental conditions – well adapting, especially to shortage or excess of soil moisture (Balcha et al., 2006). Its high resistance to drought ensures good yields even in areas with a deficit of rainfall. Drought-tolerant crops are characterized by C4 photosynthesis – teff, sorghum, millet, corn, while those with higher water needs use C3 photosynthesis. Physiology of C4 species has evolved with adaptation to high light intensity, high temperatures and drought (Ketema, 1993; Bultosa, 2016; Miller, 2021; Cannarozzi and Tadele, 2022). The grain growth period is critical with respect to moisture. This is the reason, according to some authors, for low grain yields (Dereje et al., 2018). In Ethiopia, teff is mainly grown during the wet season of the year. According to some studies, the amount of rainfall during the vegetation period needed for the production of teff grain is between 400-500 mm (Ketema 1993; Bultosa, 2016). Other authors indicate that 25-50 mm of rainfall between sowing and first cutting is sufficient for the development of the crop (Roseberg et al., 2005; Miller, 2009).

Temperature Requirements: Teff is a heat-loving plant. It germinates at a soil temperature of 15-18°C and dies/freezes at temperatures below 5°C (Ketema, 1997). It has very good development at average daily temperatures above 20°C (Ketema, 1993; Assefa et al., 2015; Miller, 2021).

Light Requirements: Teff prefers abundant light. Flowering and ripening of the grain take place under twelve hours of daylight. It occupies an intermediate position among species of tropical and temperate climates, with high sensitivity to light (Ketema, 1997; Bultosa, 2016).

Soil Requirements: Teff contributes to ecological soil compaction and helps protect soils from erosion (Miller, 2009; Kakabouki et al., 2021). It is a crop non-demanding to soil, with very short vegetation period and ecological plasticity. Belay et al. (2006) found that neutral or slightly acidic soil is the most suitable for teff.

Cultivation technology

Place in the crop rotation

The vegetation period for teff varies between March and November, depending on agro-climatic conditions and the developmental phase at harvest (Ketema, 1997). Ketema (1993) indicated as good predecessors of teff legumes (chickpeas, peas, grass pea – especially at high altitudes) and cereals (wheat and barley). It is usually included in a 4-5-year crop rotation. Its monocultural cultivation is characteristic of Africa. Due to its short growing season, it can be used as an intermediate crop (Ketema, 1997; Nakata et al., 2018).

Tillage

Tillage practices for teff are determined by factors such as the preceding crop, type and mechanical composition of the soil, weed presence. Most often, it is recommended that the main treatment is plowing at a depth of 20-30 cm after cereal crops, followed by several discings at a depth of 10-15 cm. Tillages that create a compacted bed are more successful (Ketema, 1997; Ivanova, 2018). Some studies indicate that teff can also be grown with minimal or zero tillage (Miller, 2009; Assefa and Chanyalew, 2018). Bogale et al. (2013) found that reducing tillage increased grain yields by 20-25% and was particularly suitable for mountainous and semi-mountainous regions of Ethiopia.

Fertilization

Phosphorus and Potassium: The application of phosphorus and potassium fertilizers should align with soil availability indices and be applied as needed. The investigated effective rates of phosphorus in some literature sources are from 10 to 40 kg. ha^{-1} P_2O (Gebretsadik et al., 2009; Abay et al., 2011; Girma et al., 2012; Getahun et al., 2018; Mihretie et al., 2020). Potassium fertilization is applied in grain production (Girma et al., 2012).

Nitrogen: A number of authors established as effective rates of nitrogen fertilization from 20 to 90 kg. ha^{-1} active substance, in the production of green mass and grain (Gebretsadik et al., 2009; Abay et al., 2011; Girma et al., 2012; Getahun et al. et al., 2018). According to Habtegebrial et al. (2007), grain yield and dry matter increased linearly with fertilization application from 0 to 60 kg. ha^{-1} N. At higher fertilizer rates (90 kg. ha), no increase in yield has been observed due to leaching. losses in the lower soil layers. Hunter et al. (2009) and Miller (2009) found that 30 to 90 kg. ha^{-1} N fertilization was required before sowing and for each subsequent swath. Pre-seeding nitrogen fertilization is recommended before supplemental feeding during vegetation, due to the absence of losses from nitrogen escape at high temperatures or nitrate leaching in light soils. Some authors recommend fertilizing with ammonium nitrate after harvesting each biomass swath. According to Gebretsadik et al. (2009), the highest grain and green mass yields were obtained when fertilized with 92 kg. ha^{-1} N. High nitrogen fertilizer rates and irrigation can result in lodging (Saylor, 2017; Barretto et al., 2021).

Seeding

When growing teff for green mass, seeding rates of 5 to 20 kg. ha^{-1} are recommended for different regions of the USA. Tillage prior to seeding teff should ensure a firm bed and seed should not be sown below 1 cm depth (Ketema, 1997; Miller, 2009). The preferred seeding method is broadcasting, with better results observed at 15 cm between rows (Mihretie, 2020).

Teff can be sown from late spring to mid-summer in the Northern hemisphere, so it can be grown as a second crop after winter cereals, e.g. barley, wheat. Under optimal conditions, teff typically germinates and sprouts within 3-5 days (Ketema, 1997; Miller, 2009; Assefa and Chanyalew, 2018). In cereal stubble, direct seeding can be applied (Miller, 2009; Bogale et al., 2013).

For Ethiopian conditions, many authors recommend a seeding rate of 10 to 25 kg. ha^{-1} (Asargew et al., 2014; Abraham et al., 2014; Abraha et al., 2016; Bultosa, 2016; Arefaine et al., 2020; Mihretie et al., 2020). For green mass production, Miller (2009) indicates seeding rates of 6 to 8 kg. ha^{-1} as suitable ones. Other studies suggest a seeding rate of 5 to 20 kg. ha^{-1}, adaptable to a range of climatic conditions (Roseberg et al., 2005). According to Arefaine et al. (2020), the highest yield of grain, biomass and straw was obtained at a seeding rate of 10 kg. ha^{-1} combined with seeding behind country plough.

Ivanova (2018), in the conditions of Western Bulgaria, found that to increase yields in teff production, a higher seeding rate of 8 kg. ha^{-1} combined with soil and foliar fertilization is needed.

Care during vegetation

Weed control: Teff is sensitive to temperatures and moisture at the beginning of its vegetation, and if it does not germinate jointly, it may be suppressed by weeds. Competition with weeds can result in 50% yield loss (Ketema, 1997). Studies in recent years have shown that teff is not sufficiently competitive with weeds, especially if it develops more slowly in the initial phases due to lack of heat and light (Billman et al., 2022). Literature reports effective use of active substances like 2,4-diamine salt against weeds, applied from the tillering to the flag. leaf phase of the crop (Ketema, 1993). "Musket Power OD 375" (2.4-D 2-ethylhexyl ester 430 g. l^{-1} + Iodosulfuron-methyl-sodium 5 g. l^{-1}) is a registered herbicide in Ethiopia for the control of narrow- and broadleaf weeds in teff, wheat and barley cultivation. It is applied from the tillering phase to heading of the crop (Feleke et al., 2022). Other effective herbicides are: Flurasulam (75 g. l^{-1}) + Flumelsulam (100 g. l^{-1}); Derby 175 SC; (at a dose of 0.06 l. ha^{-1}); Pyroxsulam (Pallas 45 OD) at a dose of 0.45 l. ha^{-1}, applied 35 days after emergence; 2.4-D at a dose of 1.0 l. ha^{-1}; Derby + Pallas and 2.4-D + Pallas. The indicated herbicide substances are applied effectively and are considered important in conditions of high weed risk (Addisu, 2016).

Disease and pest control: Major diseases affecting teff include rust (*Uromyces eragrostidis* Tracy), panicle spot (*Heminthosporium miyakei* Nisikado), and leaf blight caused by *Drechslera* spp. and *Epicoccum nigrum* Link (Assefa and Chanyalew, 2018). Studies indicate that there are few diseases of economic importance under Ethiopian conditions, with the possibility of fungicide protection in attacks (Degete, 2021).

Productivity

Under optimal growing conditions, teff can provide 1020-8250 kg. ha^{-1} biomass (Table 2) and 500-1650 kg. ha^{-1} grain from 45 to 120 days after seeding depending on the climatic conditions of the area (Twidwell et al., 2002; Norberg et al., 2008; Miller, 2009; Stoyanov, 2014; Sang-Hoon et al., 2015; Saylor, 2017; Getahun et al., 2018). Teff biomass can be harvested and used for hay, haylage, silage, and straw or for grazing (Ketema, 1993; Saylor, 2017; Vinyard et al., 2018; Laca, 2021).

Harvesting grain and green mass

Grain crops are harvested using a single-phase grain harvester. According to Ivanova (2018), the harvester should be set to minimum fan speed and compacted or closed from all sides due to the relatively low weight of the grains, in its production in Western Bulgaria. The sieves of the harvester are also closed. Drum RPM are high. The author also points out that immediately after harvest, the grain must be weeded to avoid waterlogging and contamination with mycotoxins.

Harvesting for forage purposes can be done at different stages of crop development, from flag. leaf to wax maturity (Roseberg et al., 2005; Saylor, 2017; Ben-Zeev et al., 2018; Ream et al., 2020; Laca, 2021). In a number of sources, the time of harvest is noted as days after seeding the crop - 45 to 120 days after seeding (DAS), early or late heading (EH or LH), or 50-90% occurrence of the flag. leaf, heading and maturity stages.

Quality of teff grain and biomass

Grain: Teff's application as a 'healthy food' stems from its unique taste as a gluten-free grain and its distinct biochemical composition (refer to Table 1). The amylase content of 20-26% in the grain is comparable to other cereals (Bultosa, 2016), and the fiber is in a higher percentage – 9.8% for teff (Gebru et al., 2020). 100 g of grain contains 73 g of carbohydrates, 8 g of fiber, 14 g of protein, 2-3 g of fat, of which 923 mg of Omega 6 and 135 mg of Omega 3 fatty acids; a number of minerals such as calcium (180 mg), magnesium (184 mg), manganese (9 mg), phosphorus (429 mg), and also vitamins - thiamin (0.4 mg), riboflavin-niacin (0.3 mg) and vitamin B6 (0.5 mg) (Ivanova, 2018; Barretto et al., 2021).

Table 1. Biochemical composition of teff grain

Author	Bultosa, 2016	Baye, 2014	Barretto et al., 2021	Ketema, 1997
Yield, kg ha^{-1}	-	-	1400	700
Fiber, %	3.5	4.5	3	-
Fat, %	2.4	2.5	2	2
Ash, %	2.5	2.8	2.9	-
Crude protein, %	13.3	11	9.6	8-11
Food energy, kcal.100 g^{-1}	367	357	336	-
Calcium, %	0.156-0.18	0.17	0.159	0.17-0.18
Iron, ppm	76-589	95-377	58	115-196
Magnesium, %	0.184	-	0.17	0.18-0.19
Phosphorus, %	0.429	-	0.378	0.44-0.46
Potassium, %	0.427	-	0.401	0.2-0.36
Manganese, ppm	92	-	64	21.2-30
Zinc, ppm	36	24-68	20	67-67.5
Copper, ppm	53	11-36	70	36-53
Vitamin A, RE	8	-	8	-
Thiamin, mg	0.39	-	0.3	-
Niacin, mg	3.4	-	2.5	-

Biomass: Teff feed quality is highly dependent on nitrogen fertilization, stage of development at harvest, and number of swaths (Nakata et al., 2018; Laca, 2021). Currently, there is limited information on the nutritional value of biomass and its potential for use as ruminant feed. Table 2 gives average values for yield of dry matter, crude protein, fiber, and nutritional value, which determine the qualitative potential of biomass. More and more attention is being paid to the digestibility and chemical composition of teff hay or silage, as well as the possibility of its combination with other types. The crude protein content of teff biomass according to literature sources ranges from 8.5 to 21.5% (Roseberg et al., 2005; Norberg et al., 2008; Miller, 2009; Sang-Hoon et al., 2015; Saylor, 2017; Vinyard et al., 2018; Kakabouki et al., 2020; Laca, 2021), the fiber content varies from 53 to 73% (Roseberg et al., 2005; Miller, 2009), depending on the developmental phase at harvest of the crop. According to some authors, teff hay has the potential to replace corn silage in cattle rations and become a major forage source in the nutrition of bulls and dairy heifers (Saylor, 2017; Ream et al., 2020). Developmental stage at harvest is one of the main factors affecting feed quality and digestibility (Saylor, 2017; Vinyard et al., 2018; Kakabouki et al., 2020; Billman et al., 2022). There are many varieties of teff on the market today; some suitable for grain production, others for feed production (Baye, 2014). High nutritional value of teff forage has been reported, comparable to major forage crops – wheat, barley, rice and corn, sorghum (Saylor, 2017; Miller, 2021; Billman et al., 2022). After the heading phase, photosynthetic products are converted into fibrous structural components, fiber increases, and protein decreases its values. Lower temperatures slow the ripening process and the subsequent production of fibrous structural components, thereby improving crude protein concentration and overall forage quality. As the developmental phase progresses, lignin concentration increases, ultimately reducing overall fiber digestibility (Vinyard et al., 2018; Billman et al., 2022). Recent years have seen a significant surge in research focused on the harvesting phase and methods. Sustainable storage methods are silage and hay making, as the nutritional value and rich mineral and chemical composition are preserved (Sang-Hoon et al., 2015; Saylor, 2017; Laca, 2021; Billman et al., 2022).

Table 2. Productivity, protein content, fiber content, and relative feed value of teff biomass

Author	Ream et al., 2020	Twidwell et al., 2002	Sang-Hoon et al., 2015	Vinyard et al., 2018	Miller, 2009	Kakabouki et al., 2020	Roseberg et al., 2005	Saylor, 2017	Norberg et al., 2008
Yield of DM, kg. ha^{-1}	-	8250	5125	4020	6000	5220	4600	-	1020-2680
CP, %	15.4-17.6	14.05	8.87	14.8	11.5	16.68	12.85	12.9	9.1-16.6
NDF, %	58.6-60	-	64.23	62.1	56	56.79	59.85	56.1	57.4-60.8
ADF, %	35.2-35.6	-	34.51	28.15	34	26.12	35.7	29.8	35.2-38.8
RFV, %	-	-	100	-	-	-	95	-	93-100

*Dry matter (DM), Crude protein (CP), Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), Relative Feed Value (RFV)

Conclusion

Cultivating unfamiliar crops globally presents challenges and risks, yet it offers opportunities for enhanced crop diversification and improved economic efficiency on farms. Teff has valuable morphological, physiological, and biological qualities. Due to the high drought resistance and rapid rate of growth and development, the crop can be grown successfully in dry areas and, under certain soil and climatic conditions, can provide high yields. Among cereals, teff has the shortest vegetation period, ripening in just 50 to 90 days. It can be successfully sown as a second crop after early cereals. Teff stands out as one of the few crops suitable for cultivation as a second crop on non-irrigated land Its drought resistance allows it to be used for reseeding frosted or destroyed winter crops, with damage from ground beetles, and also as a component in the green conveyor.

Compared to other cereal crops, teff is less susceptible to diseases and other pests.

As a food crop, it has irreplaceable qualities. In addition to being easily digestible, teff grain does not contain gluten, which is why bread made from it is a staple food for people with gluten intolerance.

Valuable biological qualities and favorable chemical composition rank teff as an important crop not only for solving the food needs of the population but also in animal husbandry.

Although studies on teff in Bulgaria are limited, they indicate successful cultivation in the arid conditions of Southern Dobrudzha. This crop, unknown to our producers, could be included in the structure of field crops and occupy areas that are not suitable for traditionally grown cereal plants – wheat, barley, and corn. For this purpose, it is necessary to study the impact of climate on the development and productivity of this crop on a local level. Serious attention should also be paid to the selection of production technology in order to exploit its potential for grain and green mass yield, optimization of seeding rate, and fertilization being a possible choice for impact.

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