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# Tef (*Eragrostis tef*) Variety "Dagim"

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## አህፅሮት

*ጤፍ የአገሪቱ ዋነኛ ሰብል ሲሆን በዓመት ከ 3.02 ሚሊዮን ሄክታር በላይ መሬት ለጤፍ ምርት ይውላል :: ለ 70 ሚሊዮን በላይ ሰዎችም እንደ ዋና ምግብነት ሆኖ ያገለግላል:: ነገር ግን አማካይ የአገሪቱ የጤፍ ምርታማነት አነስተኛ ነው (1.6 ቶን/ ሄክታር) :: ይኸም የሆነበት ምክንያት በከፊል አርሶ አደሩ ያልተሻሻሉ የአካባቢ ዝርያዎችን በመጠቀሙ፣ እንዲሁም የተለያዩ የጤፍ ምርታማነትን የሚቀንሱ እንደ በሽታ፣ ተባይ፣ አረም፣ የሰብል መጋሸብ፣ የርጥበት ማነስና የመሳሰሉ ችግሮች ሲሆኑ የጥናቱም ዓላማ ከፍተኛ ምርት እና ጥራት ያለቸውን ለተለያዩ አካባቢዎች ተስማሚ የሆኑ ዝርያዎችን ማፍለቅ ነበር:: ለዘህም 14 የተለያዩ የጤፍ ዝርያዎች ( ሁለት ማወዳደሪያ ዝርያዎችን በማካተት) ለሁለት ዓመት (2012-2013) በስምንት የተለያዩ ወኪይ ቦታወች ላይ ከተፈተሸ በኋላ ዳግም የተባለው ዝርያ ከማወዳደሪያ ዝርያዎች የተሻለ ውጤት በማሳየቱ ለምርት አንዲውል ተለቋል::*

## Abstract

*Tef is the major Ethiopian cereal grown on 3.02 million hectares annually and serving as staple food grain for over 70 million people. However, the national average yield of tef is low 1.6 t ha$^{-1}$. This is partially due to the use of unimproved local cultivars, and biotic and abiotic stresses. Therefore the experiment was designed to develop high yielding and desirable quality improved varieties suitable for diverse agro-ecologies, farming systems and purposes. Fourteen tef genotypes including two checks were laid out in randomized complete block design using four replications for two years (2012 and 2013) at eight locations. Results of combined data analysis across locations and over the years showed that candidate variety Dagem [DZ-Cr-387 X Kay Murri (DZ-Cr-438 (RIL No 91A))] performed better than the two check and other test genotypes. Thus, Dagim was identified and released as best promising tef variety for production in the country.*

## Introduction

*Tef* (*Eragrostis tef* (Zucc.)*Trotter*) belongs to the family Poacea, subfamily Eragrostoideae, tribe Eragrosteae and genus *Eragrostis*. It is a C4, self-pollinated, chasmogamous annual cereal. It has a fibrous root system with mostly erect stems, although, some cultivars are bending or elbowing types (Ayele, 1999). The genus contains about 350 species of which tef is the only cultivated species. Fifty four *Eragrostis species* are found in Ethiopia, out of which fourteen are known to be endemic.

Tef is the major Ethiopian cereal grown on 3.02 million hectares annually (CSA, 2015), and serving as staple food grain for over 70 million people. The crop constitutes 30% of the total area allocated to cereals and contributes more than 20% of the total cereals production (CSA. 2015). The major constraints in Ethiopia's tef husbandry are low productivity (national average 1.6 t $ha^{-1}$) and susceptibility to lodging. The straw *(chid)* is an important source of feed for animals. Tef is also a resilient crop adapted to diverse agro-ecologies with reasonable tolerance to both low (especially terminal drought) and high (waterlogging) moisture stresses. Tef, therefore, is useful as a low-risk crop to farmers due to its high potential of adaption to climate change and fluctuating environmental conditions.

Scientific research on tef was started in the late 1950s.Since then tremendous commendable achievements have been made through both basic and applied research endeavors. Of these, the major ones include: the release of more than 36 improved varieties (MoA, 2015); development of the artificial cross- breeding technique; generation of basic knowledge on inheritance of agronomic traits, yield components and yield-related traits, selection methods, and molecular genetics; characterization and development of a working "core-collection" of germplasm; development of appropriate cultural practices (seed rate, planting time, harvesting stage, fertilizer rate) for major tef growing areas; and identification and cataloguing of major diseases, pests and weeds, and control measures. However, tef hybridization began following the discovery of tef flower opening time and consequent to that the artificial surgical binocular-aided hand emasculation and pollination technique by Tareke Berhe in 1974 (Tareke, 1975). Nevertheless, the national yield per unit area (1.6 t $ha^{-1}$) still remains low, quite large proportions of tef producing farmers still use unimproved local cultivars, bottleneck problems like lodging have not been alleviated, and the demand for high-quality tef planting seed has become increasingly high.

Over the years of tef breeding, the average annual genetic gain in grain yield was estimated as 0.8% under lodging controlled conditions from 1970 until 1995 (Yifru and Hailu, 2005) and 0.58% under lodging uncontrolled condition from 1970 until 2012 (Fano, 2013). The former workers also reported that from 1970 until 1995, grain yield increased from 3.4-4.6 t $ha^{-1}$(i.e. 27 kg/ha/year), and varieties developed through

hybridization showed a yield advantage of 9.5% over those developed through direct selection from farmers' varieties.

## Methodology

Hybridization or crossing between DZ-Cr-387 X Kaye Murri was made in 2006. The purpose was to develop stable, high yielding; and farmers and consumers preferred tef varieties for the high rainfall and optimum moisture (high potential) areas of the country. In other words, it was targeted at developing varieties with high yielding potential and better quality than the improved contemporary standard check varieties ***Quncho*** and **Kora**. DZ-Cr-387 RIL 355 (Quncho) was selected as maternal parent for its high yielding ability and wide adaptability. Likewise, Kaye Murri was selected as a parent for its extra white seed color, relatively large kernel size, thick culm and vigorous growth habit. After a successful crossing rapid generation advancement up to two to three generations per year was made using off-season irrigation facilities. Finally, Dagem was developed as a recombinant inbred line through an $F_2$ derived single-seed descent method; and following series of multi-environment yield tests in various major tef growing regions of the country.

This variety designated as; [DZ-Cr-387 X Kay Murri (DZ-Cr-438 (RIL No. 91A))] can be explained as follows: Genotype DZ-Cr-387 (Quncho) was the female (ovule) parent and Kay Murri was the male (pollen) parent. And the cross was numbered as “438”. RIL No.91A (Recombinant Inbred Line 91A) is a designation of the homozygous line among the tested at F7.

### Description of "Dagim" tef variety

DZ-Cr-438 (RIL No. 91A) christened as "Dagim" was released in 2015 (MoA, 2015). Dagim is white seeded, high yielding tef variety with grain yield advantage of 7.31% and 8.14% over the standard check (Quncho) and local check, respectively. Dagim takes 59 days to head and 114 days to mature (Table 1). It is 95.6 cm tall in height with 35.5 cm panicle length (Tables 1). It has got variegated (yellow+ red) lemma color, red anther color, loose panicle form and very white seed color. Dagim has gained immense farmers' attention due to its yielding potential and stable performance, very white caryopsis color and good straw yield (straw yield is no less important than grain yield) at participatory variety selection trials.

Table 1: Mean agronomic performance of Tef genotypes evaluated in National variety Trial across locations and over years

| Genotypes | DTH | DTM | GFP | PH | PL | LI* | SBM | GY |
|---|---|---|---|---|---|---|---|---|
| DZ-Cr-387 (Quncho) | 59.5 | 114.8 | 55.3 | 102.7 | 40.6 | 77.8 | 10328.1 | 2355.5 |
| DZ-01-354 X DZ-01-196 (RIL No 65) | 55.9 | 114.3 | 58.4 | 95.8 | 37.7 | 80.0 | 10226.6 | 2464.3 |
| DZ-01-354 X DZ-01-196 (RIL No 86) | 58.8 | 115.4 | 56.7 | 93.8 | 38.0 | 78.5 | 10029.3 | 2344.7 |
| DZ-01-354 X DZ-01-196 (RIL No 190) | 56.3 | 116.5 | 60.1 | 93.1 | 38.5 | 77.7 | 9482.4 | 2173.0 |
| Alba X DZ-01-196 (RIL No 96) | 59.6 | 116.0 | 56.4 | 98.7 | 39.6 | 76.3 | 10632.8 | 2471.5 |
| DZ-Cr-387 X Kay Murri (RIL No 109A) | 59.1 | 113.6 | 54.6 | 103.0 | 39.5 | 75.6 | 10060.5 | 2331.2 |
| DZ-Cr-387 X Kay Murri (RIL No 15A) | 61.0 | 115.0 | 54.0 | 102.2 | 39.6 | 75.9 | 10068.4 | 2430.0 |
| DZ-Cr-387 X Kay Murri (RIL No 52) | 60.9 | 113.9 | 53.0 | 98.9 | 36.8 | 76.8 | 10056.6 | 2237.3 |
| DZ-Cr-387 X Kay Murri (RIL No 129A) | 58.8 | 111.5 | 52.7 | 98.0 | 37.3 | 78.9 | 9748.0 | 2487.8 |
| DZ-Cr-387 X Kay Murri (RIL No 91A) | 59.1 | 113.8 | 54.7 | 95.6 | 35.5 | 78.0 | 10068.4 | 2527.7 |
| DZ-Cr-387 X Kay Murri (RIL No 101C) | 60.2 | 114.1 | 53.9 | 98.5 | 38.5 | 75.3 | 10003.9 | 2493.3 |
| DZ-Cr-387 X Kay Murri (RILNo 107) | 60.2 | 114.7 | 54.5 | 97.0 | 38.3 | 77.1 | 9915.4 | 2267.3 |
| DZ-01-354 X DZ-01-196 (RIL No 157) | 57.9 | 118.3 | 60.5 | 95.2 | 36.5 | 78.0 | 10171.9 | 2319.0 |
| Local check | 54.1 | 112.2 | 58.1 | 87.2 | 33.8 | 82.6 | 9332.0 | 2337.4 |
| Mean | 58.7 | 114.6 | 55.9 | 97.1 | 37.9 | 77.9 | 10008.9 | 2374.3 |
| LSD (5%) | 0.6 | 2.0 | 2.0 | 2.5 | 1.2 | 3.1 | 652.6 | 169.6 |
| CV | 2.74 | 5.02 | 10.35 | 7.54 | 8.78 | 9.84 | 18.78 | 20.6 |
| $R^2$ | 0.98 | 0.91 | 0.80 | 0.91 | 0.85 | 0.75 | 0.68 | 0.61 |

N.B: DTH=number of days to heading; DTM=number of days to maturity; GFP=grain filling period; PH=plant height (cm); PL=panicle length (cm); LI=Lodging index; SBM=Shoot biomass (Kg/ha); GY=Grain yield (Kg/ha)

*=lodging index is computed from only six out of eight locations (Debre Zeit light soil, Debre zeit black soil, Minjar, Adet, Bichena, Holeta, Addadi Mariam and Ginchi) over years.

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