

**The effect of different *In-situ* conservation methods on yield of Teff in Tigray, Northern Ethiopia**

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**Abstract**

The imbalance in food supply and demand urgently calls for more efficient use of water to enhance food security and promote sustainable agricultural production. Teff is one of the economical and staple food crops grown in northern Ethiopia which is severely affected by drought stress. However, the frequent occurrences of drought and consequently decreasing seasonal quality, which have been common over the past two decades in the eastern Africa region, are negatively affecting teff production. However, there is limited information as to what extent the water stresses that result from climate variability could be reduced by improving rain water use efficiency and the misunderstanding of rainfall and other associated factors that affect soil water availability in the study area. Given its economic importance, understanding the efficient use of water for growing teff could contribute to the livelihood food security in the region. So, this research focuses on developing suitable soil water conservation techniques for adaptation and mitigation of climate change on yield of teff. The effects of treatments like tie-ridge, mulching and control techniques on days to emergence, grain yield, height of tillers, and number of tillers, biomass, and soil moisture content will be compared. As a result of this, a water conservation package for use in northern Ethiopia to counteract the effect of climate change on teff production will be suggested.

Key words: Climate change, northern Ethiopia, soil water conservation techniques, teff

**Résumé**

Le déséquilibre entre l'offre et la demande alimentaire lance un appel urgent pour une utilisation plus efficace de l'eau afin d'améliorer la sécurité alimentaire et promouvoir une production agricole durable. Le teff est l'une des cultures vivrières de base et économique, cultivé dans le nord de l'Ethiopie, qui est gravement touché par le stress dû à la sécheresse. Toutefois,

les fréquents épisodes de sécheresse et par conséquent diminuant la qualité saisonnière, qui ont été communs au cours de deux dernières décennies dans la région de l'Afrique orientale, affectent négativement la production du teff. Cependant, il existe peu d'informations s'agissant dans quelle mesure les stress hydriques qui résultent de la variabilité climatique, pourraient être réduits en améliorant l'efficacité d'utilisation de l'eau de pluie et l'incompréhension des précipitations et d'autres facteurs associés qui affectent la disponibilité en eau dans le sol du milieu d'étude. Compte tenu de son importance économique, la compréhension de l'utilisation efficace de l'eau pour la culture du teff pourrait contribuer à la sécurité alimentaire des moyens de subsistance dans la région. Ainsi, cette recherche se concentre sur le développement de techniques appropriées de conservation de l'eau dans le sol pour l'adaptation et l'atténuation du changement climatique sur le rendement du teff. Les effets des traitements tels que le billon-traverse, le paillage et les techniques de contrôle sur les jours pour l'émergence, le rendement en grains, la hauteur des tiges et le nombre de tiges, la biomasse et la teneur en humidité du sol seront comparés. À la suite de cela, un ensemble de techniques de conservation de l'eau destinées à être utilisées dans le Nord de l'Éthiopie pour lutter contre les effets du changement climatique sur la production du teff sera proposé.

Mots clés: Changement climatique, Nord de l'Éthiopie, techniques de conservation de l'eau du sol, teff

## Background

Agriculture is the basis of Ethiopian economy. It is the source of income for about 80% of the labor force in Ethiopia (Bewket and Conway, 2007). Most agriculture in Ethiopia is rain fed and therefore very prone to droughts. Assessing seasonal or decadal rainfall characteristics based on past records is essential to evaluate drought risk and to contribute to the drought mitigation strategies (Araya *et al.*, 2010). In northern Ethiopia, the uneven distribution of rainfall over the rainy seasons and the shortening of growing periods due to late start or early cessation of rains have been causing crop failure over the past three decades. Mismatches of crop growing period with the seasonal rainy period was reported to cause crop water stress and crop failure (Tesfay and Walker, 2004; Araya *et al.*, 2010). The objectives of this study are to: (1) study the effect of tied-ridge, mulching and control techniques on soil water and nutrient availability and its viability under smallholder farmers' teff yield in the semi-arid regions of Ethiopia; (2) compare the soil water, soil and soil

nutrient status as influenced by tie -ridge and mulching with farmers' practices; and (3) evaluate the spread of weeds with tied ridge and without tied ridge condition.

### **Literature Summary**

Regardless whether the cause is due to climate change or climate variability, the rainfall is erratic in nature and in most cases it is the distribution rather than the total amount of rainfall which determines crop production in most semi-arid areas of Africa (Barron *et al.*, 2005). Water is the major crop production limiting factor in semi-arid environments of Africa (Sivakumar, 1992). At present, the rainy seasons in northern Ethiopia are shorter than the length of growing period for the crops grown in the region. Planting short maturing crop varieties that fit into the growing season has not been fully realized. Therefore, optimizing the rain water use is of paramount importance (Araya *et al.*, 2010).

Teff is normally not sown until the peak of the rainy period, which in Tigray is from the third week of July to the first week of August. Wet sowing is preferred to avoid false start, to improve seedling establishment as well as to reduce shoot fly infestation (Araya *et al.*, 2010). Often, the rainy period ends 40 to 50 days after the normal planting time of teff, but the duration of teff's growing period ranges from 80 to 85 days. Considering a normal season, the occurrence of late season (after rainfall cessation) dry spells is more pronounced than intra-seasonal (within the rainy season) dry spells. The occurrence of late season dry spells coincides with the critical crop growth stage, in particular flowering and grain formation stages. Given that rain ceases in the middle of the growing season, supplemental irrigation is necessary for optimum growth (Araya *et al.*, 2010).

### **Study Description**

The study is being conducted in northern Ethiopia, Endamohoni woreda which is found in southern Tigray 121 km from Mekelle city (Tigray regional state) having longitude of 39°32'E and latitude of 12°47'N. The mean annual rainfall is 800 - 923 mm and the mean minimum and maximum seasonal temperature values are 9°C and 22°C.

### **Research Application**

The research that will be carried out will help farmers to know the required amount of water for the growth and yield of teff in the area. Possible water stress and drought mitigation strategies will be established for study site. As a result of this, the



Figure 1. Treatment with tied ridge.

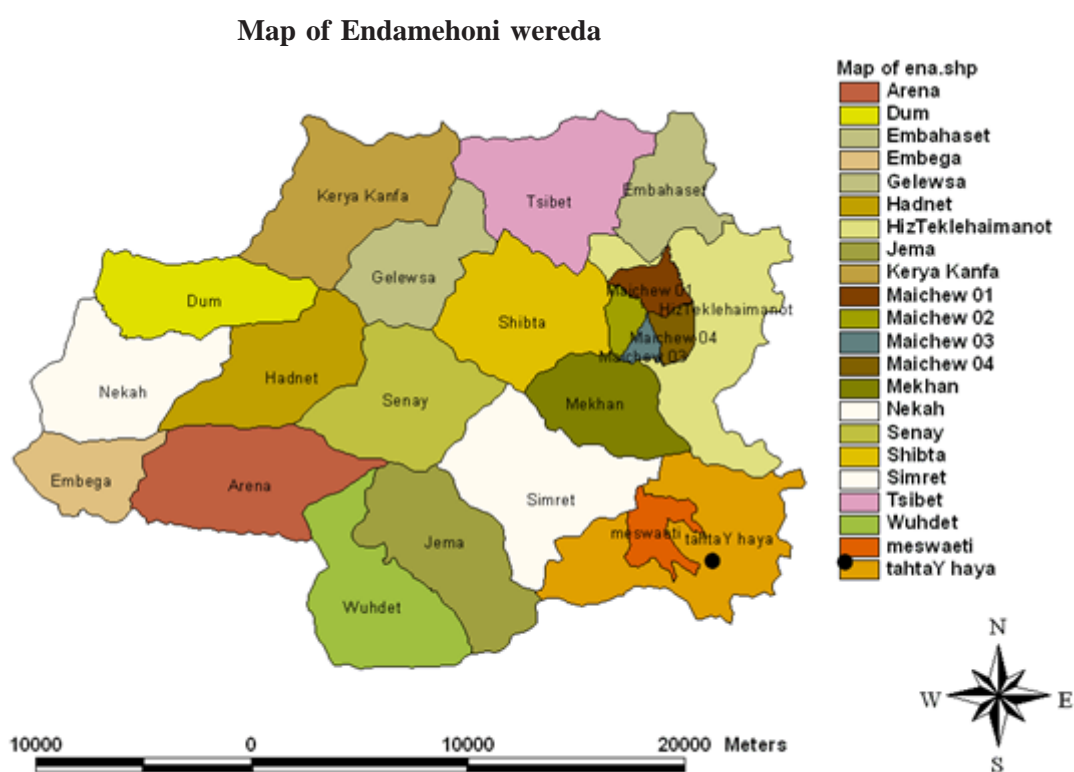


Figure 2. Map of study site.

recommended soil water conservation techniques to minimize water stress for teff production will be promoted.

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