Response of tef row planting to sowing dates on the highland heavy clay soils

Reducing Land Degradation and Farmers' Vulnerability to Climate Change in the Highland Dry Areas of North-Western Ethiopia

TECHNICAL REPORT OF EXPERIMENTAL ACTIVITIES

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Implemented by

ICARDA
Science for Better Livelihoods in Dry Areas

In collaboration with

ARARI

BOKU

Funded by

AUSTRIAN DEVELOPMENT COOPERATION

Contributes to

CGIAR RESEARCH PROGRAM ON Dryland Systems

About the Project

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Dr. Claudio Zucca

Partners

Dept. of Water, Atmosphere and Environment, Institute of Hydraulics and Rural Water Management, BOKU - University of Natural Resources and Applied Life Sciences, Vienna Austria

Amhara Region Agricultural Research Institute (ARARI), Bahir Dar, Ethiopia

Ethiopia Institute of Agriculture Research (EIAR), Ministry of Agriculture and Rural Development, Addis Ababa, Ethiopia

About ICARDA

The International Center for Agricultural Research in the Dry Areas (ICARDA) is the global agricultural research Center working with countries in the world's dry and marginal areas, supporting them for sustainable agriculture development to help increase their productivity, raise incomes for smallholder farmer families, improve rural nutrition and strengthen national food security. With partners in more than 40 countries, ICARDA produces science based-solutions that include new crop varieties (barley, wheat, durum wheat, lentil, faba bean, kabuli chickpea, pasture and forage legumes); improved practices for farming and natural resources management; and socio-economic and policy options to enable and empower countries to improve their food security. ICARDA works closely with national agricultural research programs and other partners worldwide in Central Asia, South Asia, West Asia, North Africa, and Sub-Saharan Africa.

International Center for Agricultural Research in the Dry Areas (ICARDA)
PO Box 950764,
Amman 11195, JORDAN
www.icarda.org

Synthesis

Activity type: Technology generation

Report submitted by: Tsedalu Jambere

Schematic summary of information

Location (locality, town, province….):	Gumara-Maksegnit watershed, Gondar
Easting:	0346223
Northing:	1373200
Elevation:	1982m a.s.l.
Period of implementation:	June, 2013 to January, 2014
Duration of trials:	Two years
Activity leader(s):	Nigus D. and Meron L.
Other researchers involved:	Baye A., Ayalew A., Tamrat W and Melkamu A

1 Background and rationale

Tef, *Eragrostis Tef* /zucc./ Trotter is one of the most important cereal crops in Ethiopia that occupies (32%), the largest cultivated area under cereals and 26% of the whole area cultivated to annual field crops by covering about two million hectares of land annually. Tef is adapted to environments ranging from drought stress to water logged soil conditions. It can be grown at altitude ranging from sea level to 3000m above sea level, with the maximum production occurs between 1700 and 2400m. Tef has its own unique qualities and advantages such as its tolerance to reasonable levels of both drought and water logging.

Tef is the principal crop of Ethiopia and stands first both in area coverage and production among cereals. However, the productivity of the current cultivars in the region is below the national average yield of Tef under traditional practices (9.1 q/ha) and improved technologies (17-22 q/ha) on farmer fields. Even though research efforts in the last few decades developed important technologies to overcome production constraints and increase productivity, the productivity has not yet been raised to satisfactory level as compared to the potential. Factors contributing to low yields are practicing of improper agronomic practices, drought, low soil fertility, soil erosion, poor crop management practices, insect pests and weeds. Among insect pests grasshopper, wollo bush cricket; Tef shoot fly, locust and armyworm are some of the major once. Tef shoot fly attacks Tef throughout the crop's active growing period. However, the seedling stage is the most critical. Tef production constraints such as lodging, drought, water logging, insect pest heat and frost might be overcome through a comprehensive agronomic practice program.

Development of improved and appropriate agronomic practices (seed rate, sowing dates, seedbed preparation, fertilizer type, rate and time of application), and cropping systems (crop sequence, relay cropping, intercropping, etc.) would greatly contribute to overcoming production constraints and improving productivity of tef.

2 Objective

The main objective of this research activity was to identify best sowing dates for tef.

3 Experimental Methods

The experiment was conducted on heavy clay soils of tef producing areas on the North Gondar Zone of Amhara Region. One site was selected for testing sowing dates with replication per site. Timely land preparation, weed, insect pest and disease management done as per recommendation for the location. Soil compaction is an important practice that should not be forgotten in tef planting. Preparation of filler soil to be mixed with tef to facilitate drilling is required.

Factors and treatments

Factor I: Sowing methods:

1. Broadcast sowing
2. Row sowing

Factor II: Sowing dates

1. Sowing soon after the onset of rainfall when the soil is moist enough
2. Sowing after seven days of the first sowing date
3. Sowing seven days after the second sowing date
4. Sowing seven days after the third sowing date
5. sowing seven days after the fourth sowing date

Treatments

1. Broadcast + sowing soon after the onset of rainfall when the soil is moist enough so as to make soil compaction and row planting of tef seeds through drilling
2. Row sowing + Sowing soon after the onset of rainfall when the soil is moist enough so as to make soil compaction and row planting of tef seeds through drilling
3. Row sowing + Sowing after seven days of the 1st sowing date
4. broadcast+ Sowing after seven days of the 1 st sowing date
5. Row sowing+ Sowing after seven days of the 2nd sowing date
6. Broadcast + Sowing after seven days of the 2nd sowing date
7. Row sowing+ Sowing after seven days of the 3rd sowing date
8. Broadcast + Sowing after seven days of the 3rd sowing date
9. Row sowing+ Sowing after seven days of the 4th sowing date
10. Broadcast + Sowing after seven days of the 4th sowing date

Design: RCBD with three replications. Plot size: 3 m*2 m (row length is 2 m with row spacing of 20cm). Alley space: between plots = 1 m and 1.5 m between blocks.

Seed rate: 5 kg/ha. Variety: Quncho. Fertilizer application rate and timing: 41/46 N-P2O5Recommended rate for tef in each location was applied in such a way that all DAP and half of Urea at planting and the remaining half of urea at tillering stage of tef, soon after the first weeding.

Lay out

30 **5**	29 **3**	28 **9**	27 **8**	26 **2**
21 **6**	22 **4**	23 **1**	24 **10**	25 **7**
20 **3**	19 **7**	18 **8**	17 **9**	16 **10**
11 **5**	12 **4**	13 **6**	14 **2**	15 **1**
10 **10**	9 **9**	8 **8**	7 **7**	6 **6**
1 **1**	2 **2**	3 **3**	4 **4**	5 **5**

4 Results & Discussion

Tef has high share of land in Gumara Maksegnit watershed. However, its productivity is low when compared to the crop potential if we give optimum management practices. Therefore, identifying of the best sowing date was the main objective of this experiment. The ANOVA table showed that, sowing date showed significance difference on days to heading, days to maturity, plant height, number of effective tillers per plant, grain yield and other recorded parameter. However only plant height and grain yield showed significance difference on sowing methods.

The shortest day to heading obtained from the fourth sowing date which was sowing on July 23, 2013, whereas the longest heading days obtained from the early sowing days at July. When we see the performance of sowing date treatments on the plant height, the earlier planted treatments gave the tallest plant highest and the shortest plant height recorded from the late sowing treatments (Table 2).

The highest grain yield was recorded on the first sowing date (1728kg/ha) and the lowest grain yield was recorded from the last sowing date (1187 kg/ha). When the sowing date goes from 2 of July to 30 of July the grain yield decreases dramatically. This is attributed to the terminal moisture stress of the area. But when we compared to early sowing to the farmers practice it gave nearly 400 kg/ha yield advantage. But if we see the sowing method effect on the grain yield, broadcast method gave highest grain yield when compared to the row planting methods. But there was high shoot fly incidence on row planting treatments than broadcast method (researcher observation).

Table 1: Analysis of Variance of HD, MD, PH, No. of tillers /Plant, No. of eff. tillers /Plant, grain yield and panicle length 2013 /Mean Square/

Source Of Variation	Df	Days To Heading	Days to Maturity	Plant Height	No. of Tillers /Plant	No. of Eff. Tillers/Plant	Grain Yield Kg/Ha	Panicle Length
Replication	2	7.6*	3.70NS	41.69NS	1.47NS	0.16NS	29734NS	13.9NS
Sowing date (SD)	4	112.1**	215.2**	1254**	11.45**	5.79**	356532**	143.5**
Sowing methods (SM)	1	1.2NS	1.63NS	302**	0.91NS	0.3NS	1013457**	1.4NS
SD*SM	4	1.28NS	6.13NS	16.17NS	2.31NS	0.25NS	77088NS	9.24NS
Error	18	2.08	73.9	29.84	0.96	0.45	38684	12.89
CV		2.59	2.45	7.12	21.6	24.4	13.9	11.2

Table 2: Main effect of Heading Days, Maturity Days, Plant height, No. of tillers /Plant, No. of eff. tillers /Plant, grain yield and panicle length 2013

Sowing date	Heading Days	Maturity Days	Plant Height (cm)	No. of Tillers /Plant	No. of Eff. Tillers/Plant	Grain Yield (Kg/ha)	Panicle Length (cm)
SD1/2/07/2013/	61.3^{a}	90.7^{a}	95.22^{a}	3.8^{b}	2.3^{b}	1728^{a}	36.8^{a}
SD2 /9/07/	56.3^{b}	85.2^{b}	87.9^{b}	4.0^{b}	2.5^{b}	1608^{a}	35.2^{ab}
SD3 /16/07/	54.5^{c}	83.7^{b}	73.2^{c}	4.5^{b}	2.5^{b}	1344^{b}	32.1^{b}
SD4 /23/07/	49.3^{d}	79.0^{c}	63.3^{d}	3.6^{b}	2.1^{b}	1202^{b}	31.8^{b}
SD5 /30/07/	56.5^{b}	75.0^{d}	63.4^{d}	6.9^{a}	4.5^{a}	1187^{b}	24.1^{c}
LSD	1.75	2.45	6.63	1.2	0.82	239	4.4
SOWING METHODS							
Row	55.8	82.5	79.8^{a}	4.7	2.9	1230^{b}	32.0
Broadcast	55.4	83.0	73.5^{b}	4.3	2.7	1597^{a}	32.2
LSD	1.1	1.6	4.2	0.75	0.52	151	2.8

***NOTE**: The data presented in this report are currently being elaborated for scientific publication, thus some of them are not final. The aim of this report is to summarize the nature and quality of the activities conducted and of the dataset generated, and to illustrate the main results obtained.*

Project Manager

Claudio Zucca
Soil Conservation/Land Management Specialist
CGIAR Research Program on Dryland Systems
ICARDA
Marrakesh, Morocco
C.Zucca@cgiar.org

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