Effect of soil drainage and fertilizer on the productivity of sorghum on Vertisols

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

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About the Project

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Partners

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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.

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Synthesis

Activity type: Technology generation

Report submitted by: Tsedalu Jemberu

Schematic summary of information

Location:	Gumara- Maksegnit watershed, Gondar
Easting:	0345456
Northing:	1373270
Elevation:	1981m a.s.l.
Period of implementation:	January, 2013 to July, 2014
Duration of trials:	One year and a half
Activity leader(s):	Tsedalu Jemberu (tsedalu2009@gmail.com)
Other researchers:	
Technical staff involved:	Tesfaay Jorgi

1 Background and rationale

Sorghum (*Sorghum bicolor*) is a multipurpose crop grown for food, animal feed and industrial purposes. It is considered more tolerant to many stresses, including heat, drought, and salinity and flooding. Sorghum (Sorghum bicolor) is one of the most widely grown cereal crops in Ethiopia. It is the fourth important crop in area coverage and volume of production (CSA, 2o11).A staple food crop on which the lives of millions of poor Ethiopians depend. It has tremendous uses for the Ethiopian farmer and no part of this plant is ignored. Sorghum grows in a wide range of agro ecologies most importantly in the moisture stressed parts where other crops can least survive and food insecurity is rampant. North Gondar has districts in which sorghum grown widely. The sorghum belt in the zone is classified in two agro-ecologies. One is the low land areas with relatively high yielder and the second is in the mid altitude which is characterized by low yielder and late maturing with heavy Vertisols. Thus, the aim of making management techniques to improve its productivity and make its maturity date relatively earlier.

2 Objective

The main objective of this research activity was to evaluate the effect of fertilizer combined with soil drainage on the growth and yield of sorghum.

3 Experimental Methods

Two management techniques, ridge and furrow and flat bed, were used as a treatment including the local practice. Each management technique was tested with and without fertilizer. Local variety was used as a test variety. Randomized complete block design was used in three replications. The plot size was 6m x4.5m (27m2).

Treatment

1. Flat bed with fertilizer
2. Flat bed without fertilizer
3. Ridge and furrow with fertilizer
4. Ridge and furrow without fertilizer
5. Farmers practice with fertilizer
6. Farmers practice without fertilizer

For the two improved management techniques, Planting will be done on rows with a seed rate of 10 kg/ha. Spacing will be 75cm and 30 between rows and between plants respectively. For the Farmers practice, planting will be done in broadcast with their seed rate. Fertilizer (Urea and DAP) will be applied at the rate of 50 and 100 kg/ha respectively.

4 Results & Discussion

The soil characteristics of the testing site at Gumara Maksegnit watershed in Gondar Zuria woreda indicates that total nitrogen level is very much low when compared to the critical level. The texture class of the testing site is dominated by clay soil and which have a high water holding capacity (Table 1).

The analysis of variance showed that, there were significance different between treatments on days to maturity, plant height, gain yield and biomass yield (Table 2).

Table 1: Soil characteristics of the testing site

PH	Total N	Available P/PPm	Textural class
6.8	0.117	3.05	Clay

Table 2: Days to maturity, plant height, yield and fresh biomass of sorghum crop at Gumara Maksegnit site on year 2013

Source of Variation	Df	Days to maturity	Plant height	Yield kg/ha	Fresh biomass tone/ha
Treatment	5	15.8**	159.54*	791888*	27.39**
Replication	2	3.63NS	121.54NS	125299NS	2.16NS
CV		1.06	7.53	15.3	11.6

Table 3: Days to maturity, plant height, yield and fresh biomass of sorghum crop at Gumara Maksegnit site on year 2013

No.	List of treatments	Days to maturity	Plant height	Yield kg/ha	Fresh biomass tone/ha
1	Flat bed with fertilizer	172c	170.5a	4061a	9.1b
2	Flat bed without fertilizer	172c	162.2ab	3121bc	8.9b
3	Ridge and furrow with fertilizer	175.3ab	167.9a	3796ab	8.1
4	Ridge and furrow without fertilizer	173.6bc	160.1ab	2849c	7.2b
5	Farmers practice with fertilizer	177a	169.2a	3102bc	14.6a
6	Farmers practice without fertilizer	177.3a	151.9b	2830c	13.4a
	LSD	3.3	13.7	917	2.2

From the listed treatments on table 3, treatments with flat bed (both fertilized and non-fertilizer treatment) took shortest days to mature particularly relative to farmers practice. Except farmers practice without fertilizer treatment, the other treatments gave relatively high plant heights which ranges from 160.1 cm to 170.5cm.

The analysis of variance showed that treatments were express differently on grain yield parameter. The highest grain yield was observed on flat bed with fertilizer and ridge and furrow with fertilizer treatments, which is 4061 and 3796 kg/ha respectively; whereas the lowest grain yield was recorded from farmers practice without fertilizer treatment, which is 2830 kg/ha (Table 3).

In 2014, the experiment have got damaged because of insect pest incidence and showed very poor emergency performance. As well in this year one experiment from soil and water directorate (that is sorghum fertilizer rate determination trial) which incorporates more or less this experiment treatments was executed well. Therefore, the centre monitoring and evaluation team decided to discontinue this experiment.

***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.*

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