

# Determination of Weeding Frequency to Increase Production and Productivity of Sorghum

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



## TECHNICAL REPORT OF EXPERIMENTAL ACTIVITIES JUNE 2016

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RESEARCH  
PROGRAM ON  
Dryland Systems

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## About the Project

### Implemented By

International Center for Agricultural Research in the Dry Areas (ICARDA)  
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### Funded by

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### Duration

01 April 2013 to 30 June 2016

### Project coordinator

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

*Cover photo: Un-weeded sorghum field in the Degola Chinchaye, Gumara Maksegnit watershed | 15 August 2015 | Picture by Claudio Zucca*

## 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.

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## Synthesis

**Activity type:** Technology generation

**Report submitted by:** Tsedalu Jemberu

### Schematic summary of information

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Location (locality, town, province.....)	Degola Chinchaye, Gumara maksegnit watershed
Easting:	0345719
Northing:	1373226
Elevation:	1976m a.s.l.
Period of implementation	January 2014 to march 2016
Duration of trials	two year
Activity leader(s) with email address	Tsedalu jemberu (tsedalu2009gmail.com)
Other researchers involved	
Technical staff involved	Tsedalu Jemberu, Yimer Abje an Melaku Azanaw

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## 1 Background and rationale

Sorghum (*sorghum bicolor*) is primarily a rain fed crop with low input management. Sorghum production has so many constraints, insect pest, disease and weed infestation are the most known among of them. Farmers in Ethiopia commonly lose up to 40% of their crops due to weed infestations. Because it is not normally planted in rows, weeding is a time-consuming task, taking up to 140 hr./ha. Most farmers in Ethiopia as well as in Amhara Region do not weed their fields at the right time because of labor bottlenecks. Weeds are therefore one of the most important crop production constraints in the country and the region. Heavy infestations of grassy weeds may cause up to a 20 percent yield reduction in the first two weeks after sorghum germination (International Journal of Agronomy Volume 2012)). The most troublesome weeds in sorghum include Striga (*Striga hermonthica*), Nut-grass (*Cyperus rotundus*), and other common narrow and broad leaved weeds. Farmers in the watershed have no a weeding habit of their sorghum at the right time and frequency, because they believe that weed free crops at the early stage of the crop will got stalk borer damage. And after at the beginning of September they start to weed their land and used the weed as a feed for their animal. Therefore, the objective of this study is to determine better weeding frequency of sorghum in Gumara-Maksegnit watershed.

## 2 Objective

The main objective of this research activity was to determine better weeding frequency of sorghum in Gumara-Maksegnit watershed.

## 3 Experimental Methods

The experiment was conducted in the Gumara- Maksegnit watershed for two cropping seasons (2014-2015) in the main season at two sites (one at heavy soil and the remaining at light soil). The experimental design was arranged in randomized complete block design with three replications. The plot size was 4.5m ×5m (22.5m<sup>2</sup>) with six rows, Ridge and furrow planting method was used on black soil. Local sorghum variety used and planted in rows. The spacing between replications, plots, rows and plants was 1.5m, 1m, 75cm and 15cm respectively. 41kg N/ha in two splits and 46kg p<sub>2</sub>O<sub>5</sub>/ha at planting was applied. Other agronomic practices were done as per recommendations. The weeds in every plot of 3 quadrants per plot (1mX1m quadrant) was counted and recorded at each weeding time.

### Treatments

1. HW1 -Hand weeding once (25 days after emergence/DAE/)
2. HW2-Two times hand weeding (25 and 55 days after emergence/DAE/)
3. HW3- Three times Hand weeding (25, 55 and 90 days after emergence/DAE/)
4. HW4- Farmers practice (weeding once at 80 days after emergence/DAE/)
5. HW5- Weed free plot
6. HW6- Control (Un weeded plot)
7. Shelshalo

## 4 Results & Discussion

The soil status of the experimental area showed that the PH value of both sites laid on neutral soil conditions. The available Phosphorus content of the experimental site-1 indicated that, it has very low Available soil phosphorus content when compared to site 2, which have relatively high soil phosphorus. But both experimental sites have low available phosphorus content when compared to the critical P content for crop growth which is characterized as low < 23, medium 23-56 and high > 56ppm (Tandon, 2004).

**Table 1: Soil properties of the experimental site**

No.	Site	PH	E.C	TN%	Available	O.C%	Texture
1	Tilahun-Site 1	7.1	0.03		7.68	0.71	Clay loam
2	Mande-Site 2	6.94	0.1		14.54	0.88	Clay

The experiment was conducted on the Vertisols of Gumara Maksegnit watershed, North Gondar zone, Ethiopia. The result revealed that, there were significance difference on heading days, plant height, thousand seed weight, grain yield and fresh biomass in 2014. Farmers practice and unweeded treatment took longest days to heading which was 104 and 102 days respectively. in this experiment the highest grain yield was recorded on two times hand weeding (2916kg/ha) and weed free treatments (2666 kg/ha). Whereas the lowest grain yield was recorded on unweeded treatments, farmers practice and one times weeding which was 1778, 1836 and 2003 kg/ha respectively (Table 1). This revealed that, weeding in sorghum production at Gondar Zuria woreda ha significance effect on grain yield.

**Table 2:List of weeds observed in the experimental area**

NO.	Weed Type in heavy clay soil (Amharic)	Weed Type in heavy clay soil (English)	Weed type in light soil (Amharic)	Weed Type in heavy clay soil (English)
1	Gicha	-	Lolia	-
2	Enat kurit	-	Gicha	-
3	Chilika	-	Enat kurit	-
4	Yewusha milas	-	Mech	-
5	Nech abeba	-	Akakma	-
6			Maget	-
7			Meskel ferche	-
			Nech abeba	-

**Table 3: Mean Value of HD, MD, PH, TSW, Yield and Fresh Biomass of sorghum in G/Maksegnit watershed on 2014**

Treatment	HD	MD	PH	TSW	Yield kg/ha	Fresh biomass
HW1	99.0b-d	184.0	172.8b	35.2ab	2003b	9.6cde
HW2	96.0b	180.6	180.0ab	35.5a	2916a	12.1ab
HW3	98.0cd	185.6	176.6b	36.0a	2663ab	12.0abc
FP	104.0a	185.3	175.0ab	34.2a-c	1836b	9.2de
WF	97.6cd	182.0	183.2a	33.2bc	2666ab	13.4a
Control	102.3ab	183.3	171.6b	35.2ab	1778b	8.3e
Shelshalo	101.3a-c	181.6	176.0ab	32.3c	2256ab	11.0bcd
LSD%	4.21	9.33	9.37	1.97	888	2.43
CV%	2.37	2.86	2.98	3.21	21.6	12.6

**Table 4: Combined Mean Value of HD, MD, PH, TSW, yield and Fresh Biomass of sites sorghum in G/Maksegnit watershed on 2014 and 2015**

Treatment	MD	PH	TSW	Yield kg/ha	Fresh biomass t/ha
HW1	146.3	179.8	31.9b	2729c	7.97ab
HW2	145.3	188.2	32.5ab	3254ab	7.51b
HW3	147	185.3	32.0b	3250ab	7.76b
FP	146	183.4	34.3a	2820bc	7.42b
WF	146.7	189.3	33.7a	3638a	7.23b
Control	145.7	182.2	32.9ab	2433c	9a
Shelshalo	146.2	178.8	32.1b	2812bc	7.56b
LSD%	3.75	13.8	2.02	505	1.2
	ns	ns	ns	**	ns
Trt* Site	ns	ns	ns	ns	ns
CV%	2.16	6.3	5.2	14.2	13.1

In 2015 different weeding frequency has shown difference in thousand seed weight, grain yield and fresh biomass, however, maturity days and plant height didn't showed significance difference over the treatments. In the year 2015, the highest grain yield was observed on weed free treatments (3638kg/ha), followed by two times an three times hand weeding respectively. The lowest grain yield was observed on un weeded and farmer practice treatments which was 2433kg/ha and 2820kg/ha respectively. In contrast, the highest biomass was recorded on non-weeded treatment (Table-4)

The two years combined analysis of variance showed that, thousand seed weight, grain yield and fresh biomass showed significance difference, whereas, maturity days and plant height didn't showed significance difference. In the combined analysis the highest grain yield was recorded from weed free, two times hand weeding and three times hand weeding treatments, 3314 kg/ha, 3141kg/ha and 3054 kg/ha respectively. Whereas, the lowest yield was recorded from the un-weeded experimental plots which was 2215kg/ha, followed by farmers practice (2492 kg/ha). Two times hand weeding has yield advantage of 649 and 822kg/ha over farmers weeding practice and weed free experimental plots.

Almost all treatments gave the highest fresh biomass yield except farmers practice which gave the lowest biomass yield of sorghum, 8.04 t/ha. The highest were recorded from weed free experimental plots and followed by three times hand weeding (Table 5).

## 5 Conclusions & Recommendation

The results of the experiment showed that the grain yield of sorghum crop is highly affected by weed. There is a yield loss from 822kg/ha in the un-weeded field. Hence, weeds are found now a serious threat in sorghum production in the area, but relatively little attention has so far been paid to research on weed management.

According to the combined results of the two-year data weed free treatments gave the highest yield (3314 kg/ha) followed by two times and three times hand weeding. In general, there was no significance difference between weed free and two times hand weeding. Therefore, two times hand weeding is recommended for areas like G/Zuria and Dembia.

***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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