Evaluation of under-sowing Vetch in sorghum for intensifying existing production systems

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
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In collaboration with

ARARI

BOKU

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About the Project

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Cover photo: Vetch performing under Sorghum | September 2015 | Muuz Gebretsadik

About ICARDA

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Synthesis

Activity type: Technology generation

Report submitted by: Alemu Tarekegn

Summary report

The objectives of the research were i) to explore the production potential of diversified sorghum- forage legumes intercropping systems under different planting patterns, and ii) to evaluate the possible amount of forage produced from a place which will not be utilized by the crop.

A food shortage interim of quality and quantity is the major livestock production problem in the Gumara-Maksegnit watershed as well as in many parts of the country. The Vetch forage crop adaptation trail was conducted in Gumara-Maksegnit watershed in previous years and the best adapted and high yielder Vetch species were identified. However, there is a serious adoption of forage crops because they compute the food crop for land. Vetch intercropping with the major food crop in the study area (sorghum) was conducted to find the entry point of forage crop adoption. Vetch intercropping with sorghums with 7 different treatments (with different spacing and time of Vetch sawing) was conducted in Gumara-Maksegnit watershed in RCBD design for two consecutive years (2014 and 2015). The introductions of Vetch forage in sorghum had an effect in sorghum yield and yield parameters however this study confirmed that the possibilities of introduction of Vetch forage species without adverse effect on sorghum productivity.

Schematic summary of information

Location:	Degola-chinchaye Village. Gumara Maksegnit watershed, Gondar
Easting:	0346190
Northing:	1373265
Elevation	1976m a.s.l.
Period of implementation:	April, 2014 to January, 2016
Duration of trials:	2years
Activity leader(s):	Alemu Tarekegn, Belete Shimelash and Tikunesh Zelalem

1 Objective

The main objective of this research activity was to explore the production potential of diversified sorghum- forage legumes intercropping systems under different planting patterns and to evaluate the possible amount of forage produced from a place which will not be utilized by the crop.

2 Experimental Methods

The experiment was conducting in a randomized complete block design (RCBD) in three replications. The field was divided in to three blocks and the seven treatments randomly assigned to the plots in each block. The treatments included: Sole sorghum (V0), Sorghum in 75 cm row spacing plus Vetch with simultaneous planting (V1), Sorghum in 75 cm row spacing plus Vetch planted 2 weeks after sorghum planting (V2), Sorghum in 75 cm row spacing plus Vetch planted 3 weeks after sorghum planting (V3), Sorghum in 150 cm row spacing plus Vetch with simultaneous planting (V4), Sorghum in 150 cm row spacing plus Vetch planted 2 weeks after sorghum planting (V5) and Sorghum in 150 cm row spacing plus Vetch planted 3 weeks after sorghum planting (V6). Sorghum was planted with a spacing of 75cm and 30cm between rows and plants, respectively on a plot size of 5m * 4.5m. Spacing between blocks and plots was 1.5m and 1m, respectively. In treatments 1-4 sorghum were planted at one plant per hill, while in treatments 5 to 7 sorghum were planted at two plants per hill. Vetch was planted at 30cm plant spacing in between sorghum rows at the seed rate of 12 kg per hectare. The local sorghum variety Kucho and the Vetch var. Vicia villosa were used. Fertilizer at the rate of 50 kg urea and 100 kg DAP per hectare were applied for sorghum. The whole DAP was applied at planting, while urea was applied at knee height stage of the sorghum.

Sorghum and forage legume were harvested from all the treatments excluding guard rows from all the plots at full maturity and at 50% blooming stage, respectively. Grain yield was determined at 12.5% moisture content of sorghum and individual samples of the sorghum, sorghum Stover components and under sown forage legume will be taken for DM% analysis, which will be oven drying at 65oc for 72 hours until constant weight will be obtained.

Data collected for sorghum were: emergence, heading, and maturity dates when 50% of the population per plot reach each stage; stand count at harvest, plant height from average of 20 plants per plot, leaf area from 10 plants per plot at heading, panicle weight

per plant from 10 plants per plot, panicle length from 10 plants per plot, seed weight per panicle from 10 plants per plot, Stover and grain yields at harvest, 1000 seed weight.

Data collected for Vetch were: emergence date, blooming date, plot cover, plant height from average of 20 plants per plot, forage dry matter yield, disease and pest score, farmers' perception.

3 Statistical aspects

The data collected were subjected to analysis of variance by using the general linear model (GLM) procedure in SAS (2003)

4 Results and discussion

Year one

Sorghum performance

There is a significant ($P<0.05$) difference in head weight, grain yield and 1000 seed weight between the treatments. However, there is no significant difference in plant height head length and Stover yield. Among treatments tested, Sorghum in 75 cm row spacing plus Vetch planted 3 weeks after sorghum planting was gave the highest grain yield of Sorghum (2241 kg/ha) and Sorghum in 150 cm row spacing plus Vetch with simultaneous planting was the least (1401 kg/ha).

Among different treatments tested sole sorghum gave the significantly highest 1000 seed weight (31.7 gm) and Sorghum in 150 cm row spacing plus Vetch with simultaneous planting was the least (29.6 gm).

Vetch performance

The mean values of vetch performance at different parameters are presented in Table 2. Analysis of variance showed that there is a significant difference between the treatments for all parameters tested. Sorghum in 75cm rows plus Vetch with simultaneous planting and Sorghum in 150 cm plus Vetch with simultaneous planting gave significantly higher Vetch height 127 cm and 124 cm, respectively. Similarly, those two treatments, Vetch simultaneous planting with sorghum at 75 cm and 150 cm spacing, gave the highest Vetch dry mater yield.

Table 1: Mean of yield and yield components of under-sowing Vetch in sorghum trail conducted in 201the Gumara-Maksegnit watershed in the year 2014

Treatments	Sorghum						Vetch		
	PH (cm)	HL (cm)	HWt (gm)	SY (t/ha)	GYD (Kg/ha)	1000s Wt(g)	PH (cm)	DM%	DMY t/ha
Sole sorghum	163	29.6	80^{a}	10.04	2093^{a}	31.7^{a}			
Sor in 75cm RS+Vetch with sim.pl	160	26.6	70b^{c}	7.55	1488^{b}	30.3^{ab}	123^{a}	24.5^{b}	3.64^{a}
Sorg in 75cm RS +Vetch plted 2 wks after sorg pl	168	29.6	81^{a}	10.19	1925^{a}	30.5^{ab}	94.6^{c}	29^{a}	0.82^{cd}
Sorg in 75cm RS +Vetch plted 3 wks after sorg pl	161	29.3	80^{ab}	10.22	2241^{a}	30.0^{ab}	65^{e}	32^{a}	0.27^{d}
Sor in 150cm RS+Vetch with sim.pl	170	29	73^{abc}	7.85	1401^{b}	29.6^{b}	126^{a}	24^{b}	3.06^{b}
Sorg in 150cm RS +Vetch plted 2 wks after sorg pl	166	27.6	69^{c}	8.65	1427^{b}	29.7^{ab}	108^{b}	28.8^{a}	1.02^{c}
Sorg in 150cm RS +Vetch plted 3 wks after sorg pl	166	30	79^{ab}	8.83	2042^{a}	29.8^{ab}	81^{d}	32^{a}	0.47^{cd}
Mean	165	28.8	76	9.01	1803	30	99.6	28.5	1.55
CV%	3.95	6.58	7.3	18.58	13.04	3.78	6.13	7.15	20.1
LSD(5%)	11.6	3.38	9.88	2.99	418	2.03	11.1	3.7	0.56

PH: Plant height, HL: Head length, HWt: Head Weight, SY: Stover yield, GYl: Grain yield, DM%: Dry mater percentage, DMY: Dry mater yield

Year two

Sorghum performance

The introduction of Vetch in sorghum plantation had significant (P>0.05) influence on the head length, head weight, Stover yield and grain yield of sorghum. However, it has no effect on plant height and 1000 seed weight. Sorghum in 75 cm spacing plus Vetch planted after 3 weeks of sorghum plantation gave significantly lower Stover yield (6.85 ton/hectare). While sole sorghum, sorghum in 75 cm plus Vetch planted after two weeks, and sorghum in 75 cm spacing plus Vetch planted after three weeks gave 8.81, 10.19 and 10.22 ton per hectare Stover yield, respectively. There is no statistical difference in the grain yield of sorghum between Sole sorghum (1878 kg), sorghum in 75 cm plus Vetch planted after two weeks (1807kg), sorghum in 75 cm spacing plus Vetch planted after three weeks (2048kg) and sorghum in 150 cm spacing plus Vetch planted after three week (1934kg).

Vetch performance

All parameters tested for Vetch performance significantly influenced by the treatments. Vetch planted with sorghum simultaneous at 75 row spacing (127cm) and 150 cm row spacing gave a significantly higher Vetch height, 127 cm and 127 cm, respectively. While vetch planted after three weeks of sorghum plantation at row spacing of 75 cm (66 cm)

and at row spacing of 150 cm (81 cm) gave the shortest Vetch plants. The highest Vetch dry mater yield was obtained at sorghum in 75 cm plus Vetch planted after two weeks (3.34 tons). The lowest Vetch dry mater yield were obtained in the treatments Vetch planted after three weeks of sorghum planting in 75 cm sorghum row spacing (0.23 tons) and 150 cm sorghum row spacing (0.47 tons).

Table 2: Mean of yield and yield components of under sowing Vetch in sorghum trail conducted in the Gumara-Maksegnit watershed in the year 2015

PH: Plant height, HL: Head length, HWt: Head Weight, SY: Stover yield, GYl: Grain yield, DM%: Dry mater.

Treatment	Sorghum						Vetch		
	PLH cm	HL cm	HW gm	S Y t/ha	GYL Kg/ha	1000s Wt(g)	Pht cm	DM%	DMY t/ha
Sole sorghum	164.33	28.00abc	78.667ab	8.81ab	1878a	29.83			
Sor in 75cm RS+Vetch with sim.pl	161.66	26.33^{c}	69.667^{cd}	7.74^{bc}	1373^{b}	30.33	127^{a}	25.2^{bc}	3.34^{a}
Sorg in 75cm RS +Vetch plted 2 wks after sorg pl	168.33	29.66^{a}	81.333^{a}	10.19^{a}	1807^{a}	29.83	92.6^{b}	28^{ab}	0.69^{d}
Sorg in 75cm RS +Vetch plted 3 wks after sorg pl	160.66	29.33^{ab}	80.000^{ab}	10.22^{a}	2048^{a}	30.00	66^{e}	32^{a}	0.23^{e}
Sor in 150cm RS+Vetch with sim.pl	169.66	27.33^{abc}	75.000^{c}	6.85^{c}	1232^{b}	29.86	124^{a}	24.4^{c}	3.06b
Sorg in 150cm RS +Vetch plted 2 wks after sorg pl	165	26.66^{bc}	67.667^{d}	7.74^{bc}	1321^{b}	30.06	108^{b}	28.83^{a}	1.02^{c}
Sorg in 150cm RS +Vetch plted 3 wks after sorg pl	168	30.00^{a}	77.667^{ab}	8.83^{ab}	1934^{a}	29.73	81^{d}	32.1^{a}	0.47^{ed}
Mean	165.38	75.71	28.19	8.628	1656.	29.952	99.76	28.42	1.46
CV%	3.28	5.85	4.38	9.57	8.42	1.85	3.7	6.76	9.56
LSD(5%)	9.67	2.93	5.91	1.47	248	0.98	6.75	3.5	0.25

5 Conclusions and recommendation

The two year intercropping trail showed that there is a possibility of introduction of the Vetch forage species in sorghum plantation without adverse effect on the sorghum yield. Especially, intercropping of Vetch after two weeks of sorghum plantation gave a reasonable sorghum and Vetch yield.

Therefore, it is recommended that intercropping of Vetch in sorghum farming system after two weeks of sorghum plantation could be considered as one of the entry point for improved forage crop (Vetch) popularization and adoption strategies in Gumara-Maksegnit watershed and other similar areas.

***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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