Evaluation of Agronomic Practices for Striga Controlling Management on Sorghum (Sorghum Bicolor L.) Crop Yield in Raya valley, Northern Ethiopia

Berhane Sibhatu[1*] Gebremeskel Gebrekorkos[1] Hayelom Berhe[2] Kasaye Abera[1]
1.Department of Field crops, Ethiopian Institute of Agricultural Research, Mekoni Agricultural Research Center, P.O.Box, 71Maichew, Ethiopia
2.Natural Resources Management Research Process, Ethiopian Institute of Agricultural Research, Mekoni Agricultural Research Center, P.O. Box,71 Maichew, Ethiopia

Abstract
Striga hermonthica (Del.) Benth (*Scrophulariacae*), which is aggravated by the inherent low soil fertility, recurrent drought and continuous cereal monoculture, is one of the major production constraints in the sorghum growing regions of Ethiopia. Thus, an experiment on evaluation of agronomic practices for *Striga* controlling management on sorghum was conducted in 2016 and 2017 cropping seasons to determine the appropriate *Striga* controlling management practice under rain fed conditions. Treatments (T) comprised (T1) farmers' practice (no fertilizer and intercropping) as a control; (T2) compost (at10 ton ha^{-1}); (T3) intercropping with Mungbean variety (N-26); (T4) inorganic fertilizer (at 41kg N ha^{-1} and 46 kg P_2O_5 ha-^{1}); (T5) 50% compost + 50% inorganic fertilizer; (T6) 50% compost + intercropping; (T7) 50% inorganic fertilizer + intercropping; (T8) 50% compost + intercropping + 50% inorganic fertilizer rate; (T9) *Striga* resistant sorghum. These treatments were laid out in Randomized Complete Block Design (RCBD) with three replications. According to the current results, the maximum average grain yield (4640.40 kg ha^{-1}) and total biomass (10879.60 kg ha^{-1}), head weight (93.54 g), and plant height (164.16 cm) were recorded prominently in plots treated with inorganic fertilizer. The combination of compost and inorganic fertilizer also gave remarkable grain (4537.80 kg ha^{-1}) and biomass yields (10592.60 kg ha^{-1}). Moreover, *Striga* population reduced due to application of inorganic fertilizers (0.95 *Striga* m^{-2}). A significant reduction was also observed when plots were treated with the combination of compost and inorganic fertilizer (1.17*Striga* m^{-2}). Similarly, as compared to farmers' practice (2.37 *Striga* m^{-2}), low number of *Striga* m^{-2}(1.24) was recorded from resistant sorghum variety (Gubiye). Based on economic analysis, application of 50% compost + 50% inorganic fertilizers gave optimum marginal rate of return (MRR) (165.66%), which was above the minimum rate of return (100%). Generally, this experiment showed that productivity of sorghum is considerably higher when farmers use integrated soil fertility management options. This is, therefore, integrated use of 50% compost and 50% inorganic fertilizers should be recommended for farmers as they were affordable options for increasing sorghum yields with improving soil fertility in the small-scale farming systems of the study area. Furthermore, integrated use of organic and inorganic fertilizers proved to be highly effective in terms of reducing *Striga* incidence both in terms of reduced seed density in the soil and decreased infection in sorghum.
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INTRODUCTION

In Ethiopia, the genus *Striga* (*Orobanchaceae*) is the most important biotic constraint affecting sorghum production**.** *Striga hermonthica* (Del.) Benth (*Scrophulariacae*), which is among *Striga* weed spp. competes for water and nutrients as a root parasite, is one of the major production constraints in the subsistence agriculture regions of Ethiopia. The problem in those areas is aggravated by the inherent low soil fertility, recurrent drought and overall natural resource degradation because of decades of continuous cereal monoculture and deforestation (Fasil, 2002). The *Striga* problem in sub-sharan Africa is exasperated by its exquisite adaptation to the climatic conditions of the Semi-Arid tropics, its high fecundity, and longevity of its seed reserves in tropical soils (Kudra *et al*., 2012). This is, therefore, reducing the seed bank from the infested field must be considered as one strategy for effective control.

The crop plants which stimulate germination and do not support the seedling further for establishment are known as false hosts (trap crops). Crop rotation and intercropping with these false hosts are of practical importance in reducing the *Striga* seed reserves from the soil. Thus conducting simultaneous experiments to determine effective inter crop or tap crop with proper dose determination of N and compost rates seems to be a reasonable idea for better controlling measure, as fertility improvement is considered as a control (Chikoye *et al*., 2006; Mumera and Below, 1993; Kim *et al*., 1997). A work of Chikoye *et al*. (2006), conducted in Kenya, indicated that maize vigor and grain yield were lowest where no N was applied and increased with higher N rates. On the other hand, *Striga* incidence and crop damage were higher where no N was applied and decreased with higher N rates.

From the point of economic analysis, these authors generalized that the use of *Striga* tolerant maize and legume trap crops grown in rotation with maize can provide better returns than continuous maize.

In general, to alleviate yield loss due to *Striga* infestation and to have optimum crop productivity and to ensure food self sufficiency in the study area, agricultural research activities should focus on integrated agronomic *Striga* control as sustainable control of *Striga* through single control options is unlikely (Schulz *et al.*, 2003). Therefore, this research studywas initiated to evaluate each agronomic practices on *Striga* controlling management and to determine the most effective agronomic practices on sorghum crop yield

MATERIALS AND METHODS

The experiment was carried out under rain fed conditions in 2015 and 2016 cropping seasons in Alamata woreda which is situated at 12°15'N latitude and 39°35'E longitude. The area is found at an altitude of 1450 to 1750 meter above sea level (m.a.s.l) with average annual rain fall of 663 mm and mean annual temperature of 14.6^0c to 29.7^0c (Abay, 2013).The treatments were laid out under RCB design with three replications. Improved sorghum variety (Meko-I) adapted to the area was used. The treatments (T) were (T1) farmers' practice (no fertilizer and intercropping) as a control; (T2) compost (at 10 ton ha^{-1}); (T3) intercropping with Mungbean variety (N-26) at seed rate of 20 kg ha^{-1}; (T4) inorganic fertilizer (at 41kg N ha^{-1} and 46 kg P_2O_5 ha-^{1}); (T5) 50% compost + 50% inorganic fertilizer; (T6) 50% compost + intercropping; (T7) 50% inorganic fertilizer + intercropping; (T8) 50% compost + intercropping + 50% inorganic fertilizer rate; (T9) *Striga* resistant sorghum (Gubiye variety). Meko-I sorghum variety was planted in a plot size of 3.75m * 4m (15 m^2) with five rows at spacing of 75 cm between rows and 20 cm between plants within a row. Half dose of Nitrogen in the form of urea was applied during planting while the remained 50% urea was applied at knee height. Full dose of phosphorus was applied as band application method in the form of Di Ammonium Phosphate (DAP) at planting time. Compost was applied to the plots and mixed with the soil two weeks before planting. Intercropping of Mungbean was done simultaneously with sorghum at 1:1 planting pattern. Ridge on all plots to harvest water was made to be of 0.30 m in height and the ties were at a height of 0.25m. All other appropriate agronomic practices such as weeding excluding *Striga* weed and thinning were conducted uniformly to the experimental field.

Agronomic data on days to 90% maturity, plant height (cm), panicle length (cm), grain yield (kg ha^{-1}), dry biomass yield (kg ha^{-1}) and number of *Striga* m^{-2} were collected. The collected agronomic data were subjected to the analysis of variance (ANOVA) using the SAS software computer package version 9.0 (SAS Institute, 2002) and least significant difference (LSD) at 5% probability level was employed to compute significance difference among the treatment means (Gomez and Gomez, 1984).

Economic analysis was also performed to investigate the economic feasibility of the treatments by using partial and marginal analyses. Marginal rate of return (MRR) was calculated as the change in net benefit (NB) divided by the change in total variable cost (TVC) of the successive net benefit and total variable cost levels (CIMMYT, 1988).Total variable cost was calculated from purchasing costs of DAP, urea, and Mungbean seed but not cost of sorghum varieties as it was the same cost. It also included the labor costs. Labor costs to manage the treatments (compost preparation, planting, fertilizer application, weeding, harvesting and threshing) were calculated by using 50 ETB per person per day. The price of DAP, urea, and Mungbean seed was 1563.20 ETB $100kg^{-1}$, 1057.35 ETB $100kg^{-1}$, and 15 ETB kg^{-1}, respectively. The cost of compost was only consider the wage for preparation of compost because compost was prepared by using local available materials in the area. In the economic analysis, the average yields were adjusted down wards by 10%, taking in to consideration those farmers could obtain 10 % less than the experiment yield (CIMMYT, 1998).

RESULTS AND DISCUSSION

Days to maturity

As shown in Table 1, days to maturity was highly significantly ($P<0.01$) influenced in 2015 and also significantly ($P<0.05$) affected in 2016 cropping seasons. According to this current finding, Gubiye sorghum variety was late mature crop, which took 101.83 to 110 days, as compared to Meko-I. It matured in a range of 98.17 to 107.33 days. Earliness or lateness in the days to maturity might have been due to their inherited characters, early acclimatization to the growing area to enhance their growth and developments. Unlike to Gubiye and intercropping + 50% inorganic fertilizer, the other treatments were significantly at par with control in the year 2015. Similarly, without Gubiye, compost and 50% compost + 50% inorganic fertilizer treatments, the other agronomic practices were similarly affecting days to maturity of Meko-I variety in 2016 cropping season.This present finding was in agreement with the work of Zerihun (2016) who reported that days to 90% physiological maturity was significantly different due to nitrogen and variety. He noted that high level of N delays maturity as it increases vegetative growth and difference in days to maturity of the varieties ascribed to their genetic characteristics.

Table 1. Effect of *Striga* controlling management practices on days to maturity of sorghum

Treatments	Days to maturity		
	Year_1	**Year_2**	**Mean**
Control /no fertilizer/	98.17c	105.00c	101.59
Compost	98.50bc	107.33b	102.92
Intercropping	99.00bc	106.67bc	102.84
Inorganic fertilizer	98.50bc	107.00bc	102.75
50% compost+50% inorganic fertilizer	99.00bc	107.33b	103.16
50% compost + intercropping	99.00bc	106.00bc	102.5
Intercropping + 50% inorganic fertilizer	99.33b	107.00bc	103.16
50%compost + intercropping+50% inorganic fertilizer rate	98.83bc	106.67bc	102.75
Resistant sorghum crop (Gubiye)	101.83a	110.00a	105.92
CV (%)	0.61	1.25	
LSD (0.05)	1.05	2.32	

Means with the same letter (s) in the same column are not significantly different at P<0.05 and P<0.01; LSD= least significant difference; CV= coefficient of variance; Year_1= 2015; Year_2= 2016

Panicle length

Panicle length was differed significantly (P<0.01) due to the effect of integrated agronomic practices in 2015 cropping season (Table 2). The maximum value (24.17 cm) was recorded from Gubiye while the minimum panicle length (19.17 cm) was from the control. As revealed in this table, similar trend was happened in 2016. Accordingly, Gubiye registered significantly (P<0.05) higher panicle length (26.60 cm) in contrast to the other treatments. It was generally noted that Gubiye gave high panicle length while Meko-I produced smaller value. Gubiye variety had 19.66% to 26.08% taller panicle length than Meko-I. This difference could be most probably due to their inherited traits and adaptability to the environmental condition of the study area. This current result was supported by the findings of Zerihun (2016) who explained that the effect of variety on panicle length of sorghum was significant, where the longest panicle length (25.74 cm) was recorded from Gubiye among Hormat and Teshale varieties.

Table 2. Mean of plant height and panicle length of sorghum as influenced by *Striga* controlling management practices

Treatments	Plant height (cm)			Panicle length (cm)		
	Year_1	**Year_2**	**Mean**	**Year_1**	**Year_2**	**Mean**
Control /no fertilizer/	135.67b	161.00ab	148.33	19.17c	22.23b	20.70
Compost rate	152.83a	166.27ab	159.55	21.17b	22.87b	22.02
Intercropping	151.17ab	146.93bc	149.05	20.17bc	23.13b	21.65
Inorganic fertilizer	157.00a	171.33a	164.16	22.00b	23.07b	22.54
50%compost+50% inorganic fertilizer	156.67a	173.93a	165.30	21.83b	23.80b	22.82
50%compost +intercropping	152.83a	166.27ab	159.55	20.17bc	23.33b	21.75
Intercropping+50% inorganic fertilizer	154.83a	168.40a	161.62	20.33bc	23.67b	22.00
50%compost+intercropping+50%inorganic fertilizer rate	156.67a	168.93a	162.80	20.50bc	23.13b	21.82
Resistant sorghum crop (Gubiye)	106.00c	128.47c	117.24	24.17a	26.60a	25.39
CV (%)	6.35	7.69		5.08	5.39	
LSD (0.05)	16.16	21.46		1.85	2.20	

Means with the same letter (s) in the same column are not significantly different at P<0.05 and P<0.01; LSD= least significant difference; CV= coefficient of variance; Year_1= 2015; Year_2= 2016

Plant height

Agronomic practices showed highly significant difference (P<0.01) in affecting plant height in both cropping years. In 2015, the smallest plant height (106.00 cm) was recorded from Gubiye (Table 2). The other agronomic treatments were statistically at par, which they produced significantly higher plant height as compared to the control. Similar trend is also observed in 2016 where the minimum value (128.47 m) was obtained from Gubiye while the maximum was due to the other treatments excluding intercropping. Generally, Meko-I was taller than Gubiye variety. It produced a plant height advantage of 25.32% to 48.11% over Gubiye. This was ascribed to the difference in genetic make-up of the varieties, and its efficient utilization of environmental growth resources so as to stimulate and enhance the photosynthetic and metabolic activities of the plant which reflected on the increase in the vegetative growth of Meko-I. This result was in conformity with the findings of Adekayode and Ogunkoya (2010) who reported significantly higher maize plant height (197.6 cm) in 300 kg NPK ha^{-1} and lower value of 167.9 cm in plots without fertilizer (0 kg NPK ha^{-1}).

Grain yield

Yield of sorghum was highly significantly (P<0.01) affected by integrated agronomic practices in 2015. According to Table 4, a prominent grain yield (4669.50 kg ha^{-1}) was produced due to application of inorganic fertilizer though statistically similar with the effect of compost, intercropping and 50%compost+50%inorganic fertilizer. Conversely, the smallest yield was recorded from Gubiye which gave 34.38 % to 45.36% lower yield than Meko-I. Similarly, the treatments showed significant difference (P<0.05) in influencing the grain yield of sorghum in 2016 cropping season (Table 4).

Table 4. Effect of *Striga* controlling management practices on grain yield of sorghum

Treatments	**Grain yield (kg ha^{-1})**		
	Year -1	**Year-2**	**Mean**
Control /no fertilizer/	3917.67bc	4043.20ab	3980.40
Compost rate	4042.83abc	4354.50ab	4198.70
Intercropping (Mungbean)	4029.50abc	4156.80ab	4093.20
Inorganic fertilizer	4669.50a	4611.30a	4640.40
50%compost+50%inorganic fertilizer	4583.17ab	4492.40ab	4537.80
50%compost+intercropping(Mungbean)	3940.17bc	3740.50b	3840.30
Intercropping(Mungbean)+50%inorganic fertilizer	3924.33bc	4000.30ab	3962.30
50%compost+intercropping+50%inorganic fertilizer rate	3887.83c	4355.90ab	4121.80
Resistant sorghum crop /Gubiye/	2551.17d	2882.30c	2716.70
CV (%)	10.04	11.53	
LSD (0.05)	686.12	812.48	

Means with the same letter (s) in the same column are not significantly different at P<0.05 and P<0.01; LSD= least significant difference; CV= coefficient of variance; Year_1= 2015; Year_2= 2016

Like to in 2015, the smallest yield (2882.30 kg ha^{-1}) was achieved from resistant (Gubiye) sorghum variety while the maximum yield (4611.30 kg ha^{-1}) was obtained from application of inorganic fertilizer which was significantly at par with the other treatments excluding use of 50%compost + intercropping and resistant sorghum crop. This yield increment could be attributed to the direct response of N on stimulation of plants growth which in turn reflected on grain yield production, and the role of compost in improving cation exchange capacity (CEC), aeration, root penetration, water storage capacity of the soil as well as being host of different microbes. This was supported by the report of Habtamu *et al.* (2015). In addition, other findings confirmed that application of high N fertilizer (120 kg N ha^{-1}) enhanced grain yield, and 1000 grain weight of maize (Miao *et al*., 2007). Moreover, the result of this experiment was coherent with previous research results of Dilshad *et al*. (2010); Nivong *et al.* (2007) noted that combined use of organic and inorganic fertilizers improved grain yield of maize.

Biomass yield

Table 5 revealed that biomass yield was significantly (P<0.05) affected by the treatments in the year of 2015. According to this mean result table (Table 5), the highest value (10722.10 kg ha^{-1}) was obtained due inorganic fertilizers which, however, significantly similar with use of 50%compost+50%inorganic fertilizer. Equally important, biomass yield was highly significantly (P<0.01) influenced by the integrated agronomic practices in 2016. The highest mean numeric value (11037.00 kg ha^{-1}) was also produced from application of inorganic fertilizer.

Table 5. Mean values of biomass yield of sorghum as influenced by agronomic *Striga* management practices

Treatments	**Biomass yield (kg ha^{-1})**		
	Year-1	**Year-2**	**Mean**
Control /no fertilizer/	8291.90c	8444.40d	8368.20
Compost rate	8875.00bc	9543.00bcd	9209.00
Intercropping	8472.30c	8733.30cd	8602.80
Inorganic fertilizer	10722.10a	11037.00a	10879.60
50%compost+50%inorganic fertilizer	10333.40ab	10851.90ab	10592.60
50%compost+intercropping	8597.40c	9518.50bcd	9057.90
Intercropping +50%inorganic fertilizer	8523.80c	10629.60ab	9576.70
50%compost+intercropping+50%inorganic fertilizer rate	8555.50c	10111.10abc	9333.30
Resistant sorghum (Gubiye) crop	8616.80c	8629.60d	8623.20
CV (%)	9.92	8.60	
LSD(0.5)	1544.50	1446.40	

Means with the same letter (s) in the same column are not significantly different at P<0.05 and P<0.01; LSD= least significant difference; CV= coefficient of variance; Year_1= 2015; Year_2= 2016

This might be ascribed to the vital role of N in exciting and enhancing the photosynthetic and metabolic activities of plants which reflected on the increase in the vegetative growth of sorghum. High N fertilizer application could improve the growth and above ground biomass production of sorghum crop. This complemented to the work of Wondimu *et al.* (2006) who reported that farmyard manure and inorganic fertilizers increased stover yield of sorghum by 8% to 21% and 14% to 21%, respectively. Furthermore, the present result was consistent with the findings of Kibunja *et al.* (2010) which showed total dry matter of maize was higher in treatment combinations of inorganic and organic fertilizers.

Number of *Striga* m^{-2}

Striga population was significantly (P<0.05) varied by agronomic *Striga* management practices in 2015 cropping season. According to Table 6, more number of *Striga* m^{-2} (1.78) existed in the farmers' practice (control) while the minimum *Striga* population was observed from plots treated with inorganic fertilizer which produced 46.07% less number of *Striga* m^{-2} as compared to the control. This was significantly similar with plots treated with 50%compost+50%inorganic fertilizer, and 50%compost+intercropping+50%inorganic fertilizer. Resistant sorghum variety (Gubiye), like inorganic fertilizer, was also producing significantly similar number of *Striga* m^{-2}. Table 6 also showed that agronomic *Striga* management practices resulted highly significant (P<0.01) effect on number of *Striga* m^{-2} in 2016. Maximum number of *Striga* m^{-2} (2.96) was recorded from the control while minimum mean *Striga* population (0.95) grew on plots treated with inorganic fertilizer. Similar to inorganic fertilizer, plots treated with 50%compost+50%inorganic fertilizer as well as resistant sorghum crop gave significantly similar *Striga* population. This significant variation might be ascribed to the effect of fertilizers in suppressing growth of *Striga* weed and low germination stimulant production by Gubiye which inhibit germination of *Striga* seed in the absence of chemical stimulant.This current result was in lined with the findings of Zerihun (2016) which indicated that number of *S.hermonthica* per plot was significantly influenced by N fertilizer, variety and their interaction. The author specified that low number of *Striga* registered from plots treated with high N level and *Striga* resistant sorghum variety (Gubiye). A report of Hassan *et al*. (2010) illustrated that Nitrogen inhibited to *Striga* growth which reduced *Striga* infestation by 83%. In addition, Hassan *et al*. (2010) and Kudra *et al*. (2014) found thatcombination of chicken manure with nitrogen as urea is an effective weed management practice to control *Striga*. Generally, use of recommended cropping systems and plant populations, *Striga* resistant sorghum varieties, improved soil fertility and soil moisture conservation practices help to maximize crop vigor and minimize effects of *Striga* (Mgonja *et al.,* 2011).

Table 6. Mean number of Strigam^{-2} as influenced by agronomic *Striga* management practices

Treatments	Number of *Striga*m^{-2}		
	Year-1	Year-2	Mean
Control /no fertilizer/	1.78a	2.96a	2.37
Compost rate	1.41abc	2.76ab	2.08
Intercropping(Mungbean)	1.44abc	2.52ab	1.98
Inorganic fertilizer	0.96d	0.95d	0.95
50%compost+50%inorganic fertilizer	1.07cd	1.26cd	1.17
50%compost+intercropping (Mungbean)	1.44abc	2.48ab	1.96
Intercropping(Mungbean)+50%inorganic fertilizer	1.56ab	2.00bc	1.78
50%compost+intercropping+50%inorganic fertilizer	1.21bcd	2.17ab	1.69
Resistant sorghum crop (Gubiye)	1.23bcd	1.26cd	1.24
CV (%)	19.26	23.74	
LSD(0.5)	0.45	0.84	

Means with the same letter (s) in the same column are not significantly different at P<0.05 and P<0.01; LSD= least significant difference; CV= coefficient of variance; Year_1= 2015; Year_2= 2016

Economic analysis

Based on economic analysis, application of 50% compost + 50% inorganic fertilizers gave optimum MRR (165.66%) which was above the minimum rate of return (100%) (Table 6). This economic analysis was decided mainly on sustainability of soil health, and the increasing cost of inorganic fertilizers. Furthermore, poor farmers could not afford the cost for full rate of inorganic fertilizer. Thus, integrated use of organic (compost) and inorganic fertilizers is economically feasible to sustain the productivity of sorghum. According to this analysis, for farmers who use 50% compost + 50% inorganic fertilizer, investing in the higher fertilizer rate would give a marginal rate of return of 165.66%; for every $1 .OO invested in the higher fertilizer rate, they will recover the $1.00 and an additional $1.6566.

Table 6. Marginal budget analysis of sorghum as affected by integrated agronomic practices

Treatments	**Adjusted Yield (Kg ha^{-1})**		**Income (ETB ha^{-1})**		**Gross field benefits (ETB ha^{-1})**	**TVC (ETB ha^{-1})**	**Net income (ETB ha^{-1})**	**MRR (%)**
	GY	**BY**	**GY**	**BY**				
Control /no fertilizer/	3638.88	7599.96	32749.92	3419.98	36169.90	3537.77	32632.13	-
Resistant sorghum	2594.07	7766.64	23346.63	3494.99	26841.62	3740.00	23101.62	D
Compost rate	3919.05	8588.70	35271.45	3864.92	39136.37	4726.67	34409.70	197.67
50%compost+50%inorganic fertilizer	4043.16	9766.71	36388.44	4395.02	40783.46	5280.00	35503.46	165.66
Inorganic fertilizer	4150.17	9933.30	37351.53	4469.93	41821.46	5451.11	36370.35	506.63
Intercropping	3741.12	7859.97	39535.74	4217.42	43753.16	7260.00	36493.16	6.79
50%compost+intercropping (Mungbean)	3366.45	8566.65	36213.21	4587.67	40800.88	8320.00	32480.88	D
Intercropping+50%inorganic fertilizer	3600.27	9566.64	39374.91	5076.99	44451.90	8533.33	35918.57	D
50%compost+intercropping+50%inorganic fertilizer	3920.31	9099.99	41321.25	4859.34	46180.59	9440.00	36740.59	5.98

Grain price of sorghum= ETB 9 kg^{-1} ; Biomass yield of sorghum = ETB 0.45 kg^{-1}; Seed price of Mungbean = ETB 18 kg^{-1} ; Biomass yield of Mungbean = ETB 0.45 kg^{-1}; MRR = marginal rate of return; ETB = Ethiopian birr; GY= grain yield, BY= biomass yield; TVC= total variable cost; D= dominated treatment; Average grain yield of Mungbean variety was 362.08 kg ha^{-1}, 365.13 kg ha^{-1} , 430.40 kg ha^{-1} and 372.75 kg ha^{-1} at (T3), (T6), (T7) and (T8), respectively. Similarly, average biomass yield of Mungbean variety was 1680.08 kg ha^{-1}, 1809.07 kg ha^{-1} , 1906.17 kg ha^{-1} and 1887.28 kg ha^{-1} at (T3), (T6), (T7) and (T8), respectively;
Minimum rate of return= 100%

Conclusions

The maximum grain yield and yield components of total biomass, head weight, and plant height were recorded prominently in plots treated with inorganic fertilizer. The combination of compost and inorganic fertilizer also gave remarkable grain and biomass yields. Moreover, *Striga* population reduced due application of inorganic fertilizers. A significant reduction was also observed when plots treated with the combination of compost and inorganic fertilizer. Similarly, low number of *Striga* m^{-2} was recorded from resistant sorghum variety (Gubiye) which characterized by low germination stimulant (LGS) production, low production of the haustorial initiation factor and its incompatible response to parasitic invasion. Based on economic analysis, application of 50% compost + 50% inorganic fertilizers gave optimum MRR, which was above the minimum rate of return (100%). Thus, the use of integrated organic and inorganic fertilizers is economically feasible. Generally, this experiment showed that productivity of sorghum is considerably higher when farmers use integrated soil fertility management options. This is, therefore, the use of integrated compost and inorganic fertilizers should be recommended for farmers as they were affordable options for increasing sorghum yields with improving soil fertility in the small-scale farming systems of the study area. Furthermore, integrated agronomic control practices proved to be highly effective in terms of reducing *Striga* incidence both in terms of reduced seed density in the soil and decreased infection in sorghum.

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