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Effect of Sorghum and Cowpea of Intercropping Systems at Mechara on Station, West Hararghe, Eastern Oromia, Ethiopia

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Abstract
The experiment was conducted at Mechara Agricultural Research Center (McARC) on experimental station with the objectives to evaluate the effect sorghum and cowpea intercropping on grain and forage dry matter yield and to recommend appropriate intercropping strategy for the study area. A total of ten treatments; Abshir + cow pea + fertilizer, Abshir + cow pea without fertilizer, Abshir sole with fertilizer, cow pea sole without fertilizer, IS-9302 + cow pea + fertilizer, IS-9302 + cow pea without fertilizer, IS-9302 sole with fertilizer, Seredo + cow pea + fertilizer, Seredo + cow pea without fertilizer and Seredo sole with fertilizer were used. The experiment was arranged using randomized complete block design (RCBD) with three replications. The experiment was conducted on the plot size of 4m*6m. The sorghum varieties were sown at the spacing of 75cm between rows and 20cm between plants. Cowpea also planted with spacing of two rows between sorghum spaced at 25cm away from the rows of the sorghum at the time of the first weeding of sorghum to minimize any competition. The grain yield of the sorghum, IS-9302 and cowpea with fertilizer (37.54 Qt/ha) showed was significantly higher than the rest of the other sorghums (Abshir and Seredo) ($P<0.05$). The mean grain yield of Abshir and cowpea intercropping without fertilizer (5.59 Qt/ha) was significantly lower than those of the sorghums-cowpea intercrops (8.86-37.54 Qt/ha) ($P>0.05$). The mean grain yield of sole cowpea (6.01 t/ha) was significantly higher than those of the IS-9302-cowpea intercrop with fertilize (2.86t/ha), IS-9302-cowpea intercrop without fertilize (3.13t/ha) and Seredo-cowpea intercrop without fertilize (3.59t/ha) ($P<0.05$). The biomass yield of the individual sorghums and cowpea showed were not significantly difference to each other ($P>0.05$). The results suggest that sorghums and cowpea grain yields and biomass yields of intercrops can be maximized for both human and livestock feeding by integrating IS-9302 and cowpea with fertilizer (37.54 Qt/ha). Hence, from the overall performances IS-9302 IS-9302 and cowpea intercropping with fertilizer was selected for demonstration and promotion in the study area.
Keywords: Abshir, Cowpea, Seredo, Sorghum, Intercropping and IS-9302

1. Introduction

Many indigenous forage species of our country have low productivity, low nutritive value and low digestibility which reduce their usefulness for livestock nutrition. Improved forage species was selected for their high productivity, high palatability and better nutritive value and it was for their capacity in increasing livestock production and productivity. These high characteristics favored to concentrate on production of improved and ecologically adapted forage crops, hence production of these forages and feeding to the animal on requirement with concentrate increase livestock and livestock product quantity and quality. These high yielding forage crops enhance soil fertility by adding N in to soil and this biological N fixing potential of the legumes help to maintain N balance in the nature (Gutteridge and Shelton 1994, Mohammad-Saleem, 1985).

The production system in the West Hararghe Zone is predominantly mixed crop-livestock farming. The West Hararghe Zone particularly known for elaborated culture of smallholder beef fattening schemes. This intensive traditional livestock management system capitalizes on sorghum crop residues and sweet potato vines.

The population pressure and the fixed availability of land resource as well as low attention of farmers to ward forage cultivation as compared to food crop cultivation and field forage cropping is not feasibly attachable. Intercropping of forage legumes with cereals offers a potential for increasing forage and livestock production. In addition, forage legumes fertilizes soil, control water evaporation and soil erosion by covering the surface soil and reducing the speed of rainfall and flood and hence facilitate precipitation and appreciates the use of land resource. Moreover, integration of crop and forage production systems of could be the solution in the areas of land shortage to minimize feed shortage and facilitate adoption of forage-crop production strategy. With this case, this experiment was initiated to evaluate the effect of cowpea intercropping on sorghum grain and forage dry matter yield and to recommend appropriate intercropping strategy for the study area.

2. Materials & Methods

The experiment conducted at Mechara Agricultural Research Center (McARC) on experimental station. The experiment was arranged in RCBD with three replications. A plot size of 4m * 6m were used. The sorghum varieties were sown with the spacing of 75cm between rows and 25cm between plants. Forage (cowpea) was planted with spacing of two rows between sorghum spaced at 25cm away from the rows of the sorghum. DAP and UREA fertilizers were applied in rate of 100 and 50kg/ha respectively. DAP was applied at the time of planting

while UREA was applied at the time of first weeding sorghum. The forages were sown at the time of the first weeding of sorghum to minimize any competition. The experiment was consists of the following treatments.

Table 1. Treatments used in the experiment

T1	Abshir + Cow pea + fertilizer
T2	Abshir + Cow pea without fertilizer
T3	Abshir + fertilizer
T4	Cow pea without fertilizer
T5	IS-9302 + Cow pea + fertilizer
T6	IS-9302 + Cow pea without fertilizer
T7	IS-9302 + fertilizer
T8	Seredo + Cow pea + fertilizer
T9	Seredo + Cow pea without fertilizer
T10	Seredo + fertilizer

All necessary data including grain yield of sorghum and forage, biomass yield of sorghum and forage were collected. Finally the data was analyzed using SAS ver 9.1

3. Result and Discussion

3.1. Grain yield of cowpea and sorghum

The mean grain yield of sole cowpea (6.01 t/ha) was significantly higher than those of the IS-9302-cowpea intercrop with fertilize (2.86t/ha), IS-9302-cowpea intercrop without fertilize (3.13t/ha) and Seredo-cowpea intercrop without fertilize (3.59t/ha) ($P<0.05$). The mean grain yield of sole cowpea (6.01 t/ha) was also the highest but not significantly higher than those of the Abshir-cowpea intercrop with fertilize (3.91t/ha), Abshir-cowpea intercrop without fertilize (4.63t/ha) and Seredo-cowpea intercrop with fertilize (4.02t/ha) ($P>0.05$).

The findings of this study was similar with the findings of Oseni and Aliyu (2010) who reported that the grain yield of cowpea was higher in sole cropping than in intercropping mixtures. When comparing the sole and intercropped cowpea yield in this study, it was observed that sole cropping system gave 6.01Qt/ha cowpea yield that was almost 2Qt/ha higher than the intercropped cowpea yield with all sorghum varieties. Cowpea yield was reduced due to sorghum/ cowpea intercropping system. The grain yield of cowpea was depressed by sorghum-cowpea intercropping systems that agreed with the findings of Egbe *et al*. (2010) who found that cowpea grain yield was depressed by sorghum-cowpea intercropping systems. The grain yield of Abshir and Seredo were also depressed by sorghum-cowpea intercropping systems in this findings

The mean grain yields were recorded for IS-9302+ cow pea with fertilizer (37.54Qt/ha), IS-9302+cow pea without fertilizer (27.41Qt/ha) and IS-9302 sole with fertilizer (34.89Qt/ha). The result also confirmed that there is significant variation in grain yield between sorghum varieties. The highest mean grain yields were recorded for IS-9302+ cow pea+ fertilizer (37.54Qt/ha) and the result suggest that forage legumes, when intercropped with IS-9302, improve the grain yield of the IS-9302. There was significantly difference grain yield between Abshir and IS-9302 and between Abshir and Seredo but there is no yield difference between IS-9302 and Seredo as both were high yielding varieties under different intercropping system (Table 2).

3.2. Stover (stalks) biomass yield of cowpea and sorghum

The stover yields in all the treatments were statistically similar ($P>0.05$). The result showed that there was no significant difference among treatment mean of biomass yield of cowpea DM and sorghum stalk (Abshir, Seredo and IS-9302) yields under different intercropping system. Mean dry matter yield of cowpea was not affected by intercropping systems. Cowpea sole without fertilizer provide higher DM yield (1.85t/ha) and followed by Abshir + cowpea without fertilizer (1.84t/ha).

Table 2. Grain yield and stover (stalks) biomass yield of cowpea and sorghum intercropping at Mechara on station

Treatments	Grain Components (qt/ha)		LER for Grain	Non Grain components (t/ha)		LER for non- grain (DM)
	Sorghum	Cow Pea		Sorghum	Cow Pea	
Abshir + Cow pea + fertilizer	8.85	3.91	1.41	0.12	1.76	2.2
Abshir + Cow pea without fertilizer	5.59	4.63	1.25	0.12	1.84	2.3
Abshir alone +with fertilizer	11.66	-	-	0.10	-	-
Cow pea without fertilizer	-	6.01	-	-	1.85	-
IS-9302 + Cow pea + fertilizer	37.54	2.86	1.54	0.16	1.43	2
IS-9302 + Cow pea without fertilizer	27.41	3.13	1.31	0.14	1.19	1.72
IS-9302 alone + with fertilizer	34.89	-	-	0.13	-	-
Seredo + Cow pea + fertilizer	27.96	4.02	1.59	0.12	1.16	1.51
Seredo + Cow pea without fertilizer	19.00	3.59	1.22	0.11	1.78	1.7
Seredo alone + fertilizer	30.35		-	0.14	-	-
Mean	22.58	4.02	-	0.13	1.57	-
CV	16.2	31.2	-	18.6	27.5	-
LSD	6.33	2.23		0.04	0.77	
P-value	0.001	0.126	-	0.126	0.252	-

4. Conclusion and Recommendation

The effect of intercropping some sorghums with cowpea on grain and forage dry matter yield, and the grain yield of sorghum was determined at Mechara on station, West Hararghe zone. Intercropping cereals with legumes and introducing forage legumes into the mixed cropping systems to provide not only better grain yields for human consumption but also fodder with an improved biological value for livestock. Such double gains (sorghum grain and livestock feed) advantageous compared to those practicing mono cropping.

IS-9302 and cow pea intercropping with fertilizer was recommended for the target of intercropping forage legume-crop production strategy. IS-9302 sorghum variety relatively has potential to fix nitrogen from the soil to give high yield when compared to the other varieties (Abshir and Seredo). Moreover, intercropping of IS-9302 with cowpea was also economically profitable in the area of land shortage. Therefore, in the area like Western Hararghe where there is land shortage, IS-9302 could be recommended and promoted for forage-crop intercropping in the area to minimize feed shortage and farmers practicing cereal-legume intercropping could gain more in terms of food and animal feed than those practicing mono cropping.

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