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Pre-extension Demonstration of Dolichos lablab (Lablab purpureus) under sown in Maize at Dugda and Lume Districts of East Shoa Zone, Oromia, Ethiopia

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Abstract

The activity was conducted in Bekele-Girisa of Dugda district. The objectives were to demonstrate forage production from lablab under sown in maize and to evaluate the lablab-maize intercropping practices with farmers participation. Accordingly, Farmers' Research and Extension Groups (FREGs) with 18 members were established at Bekele Girisa kebele. Four trial farmers were selected from each FREGs for forage production based on the criteria including interest of the farmers in producing forage on their land, farmer having enough land for forage production and who have milking cows. BH-540 maize variety was intercropped with Lablab purpureus on plot a size of 32*32m2. Pure- stands of maize with similar plot size was also established for comparison. Lablab purpureus was intercropped in maize at two weeks period after maize planting. Farmers were used as replication with participatory approach. The results revealed that the total biomass (Stover + lablab) and maize grain yields were significantly different ($P<0.05$) among the practices at Dugda site. Even though statistically not significant ($P>0.05$) between the two practices, there was total biomass and maize grain yield increment in lablab under-sown in maize than pure stand of maize. Similarly, crude protein content of the maize Stover under sown with lablab was improved. Farmers were also very interested for forage production from lablab intercropping in maize as compared to sole maize production practice. Therefore, it is recommended to extend the forage production strategy such as lablab intercropping in maize to enhance the production of high biomass of forage with good quality.

Keywords: Biomass yield, FREG, intercropping, Lablab.

INTRODUCTION

In mixed crop-livestock systems, livestock feed supply is mainly dependent on crop residues, natural pastures, and other agricultural by-products. However, the quantity and quality of the available feed resources is declining [1].

Legumes integrated with food crops and livestock is often advocated to minimize inputs as well as to improve the productivity and sustainability of crop-livestock production in developing countries [2, 3]. Forage legumes provide food, feed and facilitate soil nutrient management.

Intercropping is a type of mixed cropping agricultural practice of cultivating two or more crops in the same space at the same time. Intercropping of cereals with legumes has been popular in tropics [4, 5] and rain-fed areas of the world [6, 7, 8, 9] due to its advantages for soil Conservation [10], weed control [11, 12], lodging resistance, yield increase [10, 13], and legume root parasite infections control [14]. Different studies also indicated that forage legumes integration through intercropping did not have a significant effect on maize grain and biomass yield [15]. The feasibility of intercropping lablab in maize for additional feed source was investigated and promising results were obtained and recommended for the end users [16].

However, this intercropping practice was not demonstrated to small scale farmers and evaluated at on-farm condition with farmers' participation. Therefore, this study was designed to evaluate and demonstrate the practice of lablab intercropping in maize to improve production.

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MATERIALS AND METHODS

Description of the study area

The study was carried out at Dugda districts of East Shoa zone. One kebele; Bekele-Girisa was selected from the District based on the livestock population potential, severity of feed shortage and cropping system (maize dominant). Geographically Dugda district is located between $8^0$01'N to $8^0$10'North latitude and $38^0$31'E to $38^0$57'E longitude. Meki, the capital city of Dugda district, is located 134 km to the South East of Addis Ababa on the main road to Ziway town. The altitude of the study area ranges from 500 to 2000 (m.a.s.l). The area receives an erratic, unreliable and low rainfall, averaging between 500 and 900 mm per annum. The rain fall is bi-modal with the long rain lasting from June to September [17].

Farmers' selection

The activity was carried out using Farmers' Research and Extension Groups (FREGs) of smallholder farmers. Accordingly, FREGs with 18 members were established at Bekele Girisa kebeles. Detailed analysis of the problem and potential benefits of improved forage production and utilization were discussed with farmers. Four trial farmers were selected from each site for the forage production based on the criteria including interest of the farmers in producing forage on their land, farmer having enough land for forage production and farmers who have milking cows.

Trial establishment and management

BH-540 maize variety was planted as intercrop with *Lablab purpureus* on plot size of 32*32m^2. With farmers practice, pure stands of maize crop of the same variety with similar plot size was also established as comparison. Seed rate of 25 kg/ha with 75cm of spacing between the rows, and 25 cm among the plants were used for maize crop. *Lablab purpureus* was intercropped between the maize rows at seed rate of 15kg/ha (half of the recommended seed rate for sole production) two weeks after maize planting. Trial farmers were used as replication with participatory approach. NPS fertilizer at rate of 100kg/ha was applied at planting. All other recommended agronomic practices were done for all plots uniformly.

Farmer's training and evaluation of forage development technologies

Theoretical training was given for group members on forage production and utilization before planting. Then practical training was given for the group at each farm; where the trial was conducted to address the crop establishment, general management, harvesting and feeding system. Neighbors were encouraged to attain the training. Farmers carried out qualitative evaluation of the forage intercropping system through matrix ranking. They critically evaluated forage production strategy based on their criteria. Farmers of the two districts used almost similar criteria for evaluation of the forage production strategy. The major criteria considered in the evaluation includes; herbage biomass yield, multipurpose use of the technology, protection of soil erosion, ability of drought tolerance, improvement of soil fertility and compatibility of the technology with the existing production system, finally they selected forage production strategies suitable to their farming condition.

Biomass yield advantage determination

Biomass yield advantages of the forages were determined by comparing the biomass yield obtained from forage intercropped (maize-lablab) and sole maize farming practices using the following formula:

$$\text{Biomass yield advantage \%} = \frac{\text{Yield of intercrop (t/ha)} - \text{Yield of sole (t/ha)} \times 100}{\text{Yield of sole (t/ha)}}$$

Data collection and analysis

Relevant agronomic and yield including plant height, biomass yield of lablab, maize Stover and seed yield were collected. The data was organized and analyzed to describe various variables using Microsoft Excel and Statistical Package for Social Sciences (SPSS 20). The student t-test was used for mean separation.

RESULTS AND DISCUSSIONS

Agronomic and yield performances of Lablab under-sown in maize

Agronomic and yield performances of lablab under-sown in maize at Bekele Girisa site of Dugda district is presented in table 1. At Dugda site the total biomass yield and seed yield differ significantly ($p<0.05$). Other tested parameters like plant height (cm) and crude protein (cp) were not significantly ($p>0.05$) different among the two practices. The total biomass yield (7.20 t/ha) and maize grain yield (52.7quintal/ ha) were recorded for maize-lablab intercropping practice. Due to the lablab intercropping the total biomass was increased by 9.1% at study area site.

The higher maize grain yield recorded for the intercropping could be due to the better maize crop management since the recommended seeding rate and spacing were used for the intercropping practice. In farmers practice (sole maize production), farmers used lower spacing between rows and plants that could be a cause for lower maize grain yield recorded. In addition, the under sown forage legumes help in suppressing the growth of unwanted weeds and conserve moisture in the soil. This result is in agreement with [15], where inclusion of vetch, cowpea and lablab increased grain yield of maize by 7.4%, 5.9%, and 5%, respectively. However, the results of this study is contrary to those reported by [18,19] where the inclusion of forage legumes depressed grain yield of companion cereals by 3.6 to 9%. [20] also reported that simultaneous planting of lablab significantly ($P < 0.05$) reduced grain and stover yield but increased forage dry matter (DM) yield. However, delayed planting, did not affect ($P > 0.05$) grain, Stover, forage dry matter (DM) or total fodder yields.

Even though it is not significantly ($p>0.05$) different, the crude protein content of maize stover under sown with lablab was greater than that of maize Stover from pure stands (sole maize). Similarly, [15] also stating that crude protein content was not significantly different ($p>0.05$) among the maize Stovers samples taken from maize-lablab intercropped and sole maize treatments. Crude protein content of most cereal crop residues is lower than 7 % which is the critical level of microbial protein synthesis of feed intake [21]. However, due to lablab-intercropping in maize the crude protein content of maize stover was above the critical level. This indicates that maize under-sown with forage legumes improve the crude protein quality of stover than pure stand (sole) maize sown.

Biomass yield advantages

The biomass yield advantage of maize lablab intercropping practices were 9.1% at Dugda site. This indicates that the intercropping practice was more advantageous than sole maize cropping.

Training

Theoretical and practical training was given for FREGs and neighbors farmers on forage production and utilization before forage technology establishment and during forage harvesting. A total of 50 farmers (32 males and 12 females) participated in training on forage production and utilization practices. The training was mainly focused on forage crop establishment, general management, harvesting, storage and feeding system.

The reaction of participating farmers in terms of the advantages and drawbacks of the forage production by under-sowing forage legumes in maize crop as compared to pure maize production practice (monoculture) were indicated in table 2. According to the participant farmers, district animal feed experts and development agent's maize-lablab intercropping was found as better strategy for forage and maize production as compared to sole maize cropping. This is mainly due to the benefits of under-sowing forage legumes in maize crop including additional quality feed production from lablab, soil fertility improvement, protection of soil erosion, ability of drought tolerance and compatibility of the technology to the existing production system.

All participant farmers were very much impressed and interested to grow lablab forage in maize crop after they have realized the benefits of the intercropping practice. They also understood that one can produce forage crops by under-sowing without competing land for crop production. Farmers also had obtained good awareness regarding improved forage production and utilization practices. They were encouraged in participation of the forage production and promotes the adoption of improved forage technologies in the study area. On the other side, there was increased realization on the part of researcher and extension workers that the technology became effective and acceptable by the farmers when the farmers themselves are involved in the research and extension program. It also benefited the researchers and extension workers in gaining and understanding of farmer's evaluation criteria and created good opportunity to communication with farmers.

Table 1: Agronomic and yield performance of maize-lablab intercropping at Bekele Girisa site of Dugda district

Practices	**PH (cm)**	**DMY (tone/ha)**			**MSY (quintal /ha)**	**CPMS (%)**
		Stover	**Lablab**	**Total**		
Sole maize	226.50	6.60	-	6.60	51.40	7.47
Maize –lablab intercropping	227.70	6.15	1.05	7.20	52.7	7.67
Mean	**227.10**	**6.38**	**-**	**7.18**	**52.05**	**7.57**
Standard Error	**5.22**	**0.36**	**-**	**0.35**	**0.41**	**0.21**
Sig. level	**Ns**	**Ns**	**-**	*****	*****	**Ns**

PH=plant height of Maize; DMY= Dry matter yield; MSY= Maize seed yield; CPMS= Crude protein of maize Stover

Figure 1: During the training was given at Dugda district

Table 2: Farmer's criteria for evaluation of lablab legumes under sown in maize and pure stand maize production practices (High score = 5 and least score = 1) and number of evaluating farmers =50

Evaluation parameters	**Sole maize**	**Maize + lablab**
Biomass yield.	4	5
Multi-purpose use as food & feed.	3	5
Protection of soil (water runoff protection)	3	5
Drought tolerance.	4	5
Moisture conservation and soil fertility improvement	3	5
Maize grain yield improvement	3	4
Total score	**20**	**29**
Rank	**2nd**	**1st**

CONCLUSION

The result of the current study indicated that the total biomass (maize + lablab) and maize seed yields of lablab forage legume under-sown in maize were performed better than the pure stand of maize production. Similarly, the changes in crude protein of forage were more pronounced in maize-legume intercrops than in pure cropped maize. Even though, the amount of biomass yield obtained from lablab legumes was low, the fact that yield obtained was without affecting maize grain yield makes the technology of lablab under-sowing in maize strategy attractive. Hence, those farmers practicing maize-legume intercropping could obtain more benefits in terms of food and animal feed than those practicing mono cropping.

Farmer's evaluation result showed that the participating farmers were also very much interested in lablab under-sowing in maize crop as forage development strategy to solve animal feed shortages of the study area. Hence, smallholder farmers are encouraged to produce lablab by under sowing in maize to enhance dry season feed availability and quality. Moreover, further studies on other forage legume species should be evaluated for their compatibility when under-sown/intercropped in food crops.

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Conflict of interest

Authors declare no conflict of interest.

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