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Full Length Research Paper

Determination of optimal sowing date for cowpea (*Vignaunguiculata*) intercropped with maize (*Zea mays* L.) in Western Gojam, Ethiopia

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Abstract

The experiment was laid using four cowpea sowing date to determine optimum intercropping date of cowpea with maize and its effect on maize grain yield and forage biomass yield in South Achefer and Jabitehnan districts of west Gojjam zone, Ethiopia. Each experimental plot had an area of (36m ^{2}).One cowpea (9333) and maize (BH-660) for both districts using fourreplication in randomized complete block design was used. During planting 200 kg/ha diammonium phosphate (DAP) and after 45 days 200kg urea was applied. Cowpea intercropped simultaneous with maize gave significantly (P<0.01) higher dry matter yield 1.06 and 1.78t/ha as compared to the three intercropping dates 0.84, 0.66, 0.43 and 0.77, 0.45, 0.31 in South Achefer and Jabitehnan districts respectively. Maize grain yield, cob per plant and maize stover yield were not affected by cowpea intercropping date in both districts. This study showed that cowpea intercropped simultaneously with maize could be optimum sowing date for better dry matter yield of cowpea without affecting maize grain yield devoid of experience of shilshalo (cultural practice by farmers) in the study areas.

Keywords: Cowpea, dry matter yield, intercropping date, maize grain yield

INTRODUCTION

Feed scarcity in qualitative and quantitative dimensions is one of the major impediments to livestock production in Ethiopia. Much of the available feed resources are derived from fragmented native pastures, transient pastures between cropping cycles, crop residues and crop aftermath. Feed supplies are constrained mainly by shrinkage of grazing land, soil fertility and by the unreliable seasonal rainfall pattern in most areas. In general, the available feed resources are characterized by marked seasonal fluctuations in both quantity and quality (digestibility and protein content) including deficiencies of some minerals like phosphorus, copper and zinc. Reasonable levels of increases in body weight of animals gained during the wet season are lost dramatically during the long dry season.

Intercropping is the simultaneous cultivation of more than one crop species on the same plot of land and is regarded as the practical application of basic ecological principles such as diversity, competition and facilitation. Intercropping annual forage legumes with row crops has been proposed as a strategy to control erosion, suppress weeds, and contribute biological N to companion or subsequent crops (Jeranyman *et al.,* 1998). Moreover, the under sown forage legumes can also help in suppressing weed growth (Tessema *et al*., 1995) and control the rate of available moisture evaporation on the cropland by their canopying effect.

Cowpea (*Vigna unguiculata*) is one among the most important grain legumes grown in the tropics and sub-tropics. Growing of forage legumes which has less impact on the grain production of the main crop through under sowing / intercropping is useful for the introduction of these forage crops and to use the available small farm land for both crop and feed production. The system offers a potential for increasing fodder production without appreciable reduction of grain production. One of the conspicuous advantages of under sowing is to get a variety of returns from land

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and labor to increase efficiency of resource use and to reduce risks which may be caused by bad weather, disease and pests (Tessema *et al.,* 1995).

In addition to its suitability for inter-cropping, crop residue (hay and haulm) from cowpea is a very important fodder resource, which contains higher crude protein content which is about 21% in the dry haulm (Singh and Tarawali, 1997).Although intercropping is being adopted by most growers, it is however non-favorable to growers as far as growth and crop yields are concerned due to high pod losses under the shadow of competitive leaves, spoilage of seeds when maturity occurs in the rainy season. This is due to scanty of information about the optimal time of planting/introducing cow pea into maize crops. Evidence from other cropping systems however suggest that improved resources utilization and hence, increased yield can be achieved with proper manipulation of time of planting. Therefore, this experiment was designed to determine optimal sowing date for selected cowpea variety in association with maize

MATERIALS AND METHODS

Study Area

The study was conducted at South Achefer and Jabitehnan districts of West Gojam zone, Amhara Region. South Achefer district; is located at an altitude of 1500-2600 meters above sea level. It lies between 9^0 23' to 9^0 26' latitude and 41^0 59' to 42^0 02'E longitude. The study area is characterized by a mono-modal rainfall pattern, and receives an annual rainfall of 1365-1623mm with irregular and heavy rainfall in some months. The daily temperature ranges from 18 to 27^0C, with mean minimum and maximum temperatures respectively. On the other hand, Jabitehnan district located at an altitude of 1500-2300 meters above sea level is characterized by a mono-modal rainfall pattern; and receives a mean annual rainfall of 1250 mm. The daily temperature ranges from 14 to 32^0C, with mean minimum and maximum temperatures respectively.

Experimental design, Treatments and Planting

Field experiment was done in 2013/14 and 2014/15 cropping season. One cow pea and one maize variety which are known in the area were used for the study. Each experimental plot had a size of 6x6 m^2 for both districts, Cowpea (9333) and Maize (BH-660) were used in four replication in randomized complete block design. The spacing for maize was 75cm between rows and 30cm between plants, while cowpea was intercropped between two maize rows with 10cm between plants. The seeding rate of the maize varieties was as per the recommendations. 200 kg of DAP during maize sowing and 200 Kg of urea after 40-45 days of maize sown was applied. All agronomic requirements were applied for both maize and cowpea as per the recommendation. Thinning was done for both maize and cowpea to retain one healthy seedling per hole after 15 days of sowing. Treatments used were as follows.

Treatments

$T_{1=}$ cowpea simultaneously with maize
T_2=cowpea intercropped 10 days after maize sowing
T_3=cowpea intercropped 20 days after maize sowing
T_4= cowpea intercropped 30 days after maize sowing

Data collection and Statistical Analysis

Cowpea biomass was taken from middle two rows during 50% flowering and dried until constant weight for dry matter percentage measurement then after to calculate dry matter yield from hectare of land. Maize was harvested from middle two rows when the leaves and tassel became dry and cob was separated from maize manually. The seed was separated from the cob manually after drying and weighed. The Stover was weighed during harvesting and sample was taken for dry matter yield determination.

Cowpea biomass, maize grain yield and Stover yield data generated from on-farm experiment were analyzed using the General Linear Models (GLM) procedure of SAS (SAS, 2002). Significant treatment means were separated using least significance difference test.

RESULTS AND DISCUSSION

Herbage yield

Dry matter yield of cowpea is presented in table1. Cowpea intercropped simultaneous with maize variety BH-660 gave significantly ($P<0.01$) higher dry matter yield 1.06 and 1.78t/ha as compared to three intercropping dates 0.84, 0.66, 0.43 and 0.77, 0.45, 0.31in South Achefer and Jabitehnan districts respectively. In South Achefer district four intercropping date showed highly significant ($P<0.001$) difference from each other but in Jabitehnan intercropping date of 10 days and 20 days after maize sowing showed no significance ($P>0.05$) difference. The case with Jabitehnan might be during 10 days of intercropping there was moisture problem for more than a week which could have greater impact for

Table 1: Dry matter yield of cowpea in different intercropping date with maize in South Achefer and Jabitehnan districts of Ethiopia

Treatments	South Achefer DMYt/ha	Jabitehnan DMY t/ha
Cowpea simultaneously with maize	1.06a	1.78a
Cowpea 10 days after maize sowing	0.84b	0.77b
Cowpea 20 days after maize sowing	0.66c	0.45bc
Cowpea 30 days after maize sowing	0.43d	0.31c
Overall	0.75	0.83
SE	0.03	0.12
CV	8.6	8.3
SL	***	**

DMY t/ha = dry matter yield ton per hectare, SE= standard error, CV= coefficient of variation and SL= significance level.

Table 2. Grain yield and maize Stover in different intercropping date of cowpea with maize

Treatments	**South Achefer**			**Jabitehnan**		
	MDMY t/ha	MGY (kg/ha)	Cob/plant	MDMY t/ha	MGY (kg/ha)	Cob/plant
Cowpea simultaneously with maize	11.05	8333	1.04	10.88	8750.3	1.68
Cowpea 10 days after maize sowing	12.28	8667	1.05	13.13	9398.6	1.48
Cowpea 20 days after maize sowing	11.0	8444	1.04	13.11	9468.9	1.63
Cowpea 30 days after maize sowing	11.29	6889	1.05	11.59	8305.6	1.78
Overall	11.40	8083.3	1.05	12.18	8980.8	1.64
SE	0.65	1052.9	0.03	0.77	409.1	0.18
CV	11.4	16.1	5.7	12.6	9.1	12.6
SL	ns	ns	ns	ns	ns	ns

MDMY= Maize Stover dry matter yield ton per hectare, MGY= maize grain yield kilogram per hectare, ns= non significance difference, SE= standard error of mean, CV= coefficient of variation and SL= significance level.

emergence. From the result of this study it can be concluded as sowing date of cowpea delays dry matter yield of cowpea decreased. This might be attributed to competition to resources especially light as maize variety is long in its shading effect reduces cowpea growth. Samuel and Mesfin (2003) obtained mean dry matter forage yield among tested forage species were significant for both locations with highest mean dry matter forage yield of 2.098t/ha was harvested from *Lablab purpureus*, followed by *Vigna unguiculata* with mean dry matter forage yield of 0.82t/ha which is higher than the present result. This might be difference in forage legumes and date of intercropping.

Maize grain yield, cob per plant and Stover yield

Maize grain yield, cob per plant and Stover yield are presented in table 2. Results showed that maize grain yield, cob per plant and maize Stover yield were not affected by cowpea intercropping date in both districts. In agreement with the present study Gabatshele *et al.* (2012) reported maize dry matter weight was not affected by planting patterns used in the two intercropping systems. Unlike to the present study, Samuel and Mesfin (2003) reported grain yield reduction of 22.6 and 22.9% at Sirinka and Chefa respectively, and for dry matter stalk maximum yield reduction of 17.0% was obtained at Chefa as compared with sole sorghum mean grain and dry matter stalk yield in north western Ethiopia. The difference with the present study could be attributed to difference in growth nature of cereals used in the experiment (sorghum and maize) and difference in climatic condition specially rainfall and annual temperature variation.

The time of sowing of cereal and forage legume is critical for the yield of each crop (Nnadil and Haque, 1986). In addition Lulseged *et al.* (1987) also showed that the right choice of both food and forage crop and the right time of planting also important factors. In the present study simultaneous intercropping of cowpea with maize had no effect on maize yield parameters. This could be an opportunity for farmers using simultaneous intercropping of cowpea with maize for better herbage dry matter yield without the practice of *shilshalo* (Agricultural practice by farmers approximately 45 days after maize sowing in which a farmer ridge in between two maize rows by ox as weed control and minimization of labor in cultural maize agronomic practice). The high maize grain yield observed in the two districts could be attributed to optimum plant density and favorable environmental conditions specially rainfall and temperature. However, differences in the depth of roots, lateral root spread and root densities are some of the factors that affect competition between the component crops in an intercropping system for nutrients Eskandari and Ghanbari, (2009). Unlike to the present study, previous researches reported yield reduction in cowpea and maize in maize-cowpea intercrops Willey and Osiru, (1972) due lower plant densities.

Incidence of disease

The disease observed in the present study might be Fusarium wilt or Cowpea wilt (*Fusariumoxysporum)*. Its occurrence first observed during middle of August when there was high rainfall and relatively moderate temperature. At this particular time cowpea was in its flowering stage. As the intensity of rainfall declines and temperature rises the stems starts new shoots and moderately recover. The symptoms observed was yellowing and leaf drooping in the leaves, shoots dry and stem became wilt. The incidence was slightly higher in Jabitehnan as compared to South Achefer districts.

CONCLUSION AND RECOMMENDATION

Cowpea intercropped simultaneously with maize had no significant effect on the yield of maize in terms of maize grain yield, number of cobs per plant and maize Stover yield. From the result as intercropping date of cowpea with maize variety like BH-660 delays dry matter yield of cowpea decreased. This study showed that cowpea intercropped simultaneously with maize could be optimum sowing date for better dry matter yield of cowpea without affecting maize grain yield devoid of experience of shilshalo (cultural practice by farmers) in the study areas. Future study should focuses on identification of cause of disease and preventive measure of the diseases for wider adoption in the study districts and other similar agro ecologies.

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