Maize-lablab intercropping date improves yield and suppress parthenium weed

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Maize-lablab intercropping date improves yield and suppress parthenium weed

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Abstract: Intercropping improves total productivity of food and feed crops through efficient utilization of land resource and farming inputs. The objective of sowing lablab (Lablab purpureus L.) in maize (Zea mays L.) field was to evaluate biological yield and parthenium (Parthenium hysterophorus L.) control during 2018–2020 at research substation of ArbaMinch on a sandy-loam soil and rainfall of 1103 mm. The treatments: sole-maize(M0), sole-lablab(L0), similar day planting (ML0), planting lablab ten days after maize(ML10), twenty days(ML20), thirty days (ML30) and forty days(ML40) were laid out in randomized complete block design with three replications. Growth, yield and yield components, biological competition of intercrops and weed invasion of the plots were assessed for intercrop combinations of maize and lablab. Higher(P < 0.01) plant height and branch number of lablab were recorded at ML10, leaf to stem ratio of lablab was higher at L0 while all parameters value was lower at ML0. Higher biomass yield (46.89 t/ha) was recorded at ML10, grain yield (7.73 t/ha) at M0 and dry matter yield (14.56 t/ha) at L0. Land equivalent ratio (LER) showed 80.1% efficient at ML10 followed by ML20 (79.2%) while lower at ML40 (35.7%) and the highest monetary advantage value (MVI) was 12,084.00ETB at ML10 followed by ML20. Lablab demonstrated the highest suppressing ability over weed density at ML0. Planting lablab 10–20 days after maize proves efficient land use and profitability. Forage quality analysis of intercrops has to be considered in the future studies.

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PUBLIC INTEREST STATEMENT

Maize crop is one of the major cereal food crops in Ethiopia. Lablab is also very important for feed quality improvement, soil cover, and soil fertility management by fixing atmospheric nitrogen and improving feed supply in quantity. Intercropping cereals with legume especially maize with lablab has been an ideal solution for parthenium weed control by suppressing the weed. Thus, this maize-lablab intercropping date improves crop grain yield, forage biomass yield, efficiency of land use, economic benefit of farming community, suppressing and reducing the invasion of partheninu weed so that the human health and the environmental safeness assured. Creating safe environment for the community is already the agenda of global community (UN SDG) and this project contributes a lot for the community of crop livestock farming system in Ethiopia and elsewhere.
Subjects: Agriculture & Environmental Sciences; Botany; Plant & Animal Ecology

Keywords: biological yield; land equivalent ratio; lablab purpurus; monetary value index; Zea mays

1. Introduction

Intercropping is a type of multiple cropping and practicing cultivation of two or more crops in the same land at the same time to increase the productivity per unit of land for sustainable food production (Adesogan et al., 2000). Intercropping system maximizes use of environmental resources such as space, moisture, nutrients, and solar radiation for improvement of crop production per unit area per unit time and minimizes risk (Layek et al., 2018). Legume-cereal intercropping improves forage yield, quality and degradability for alfalfa corn-rye intercropping mixture in terms of DM yield 9.52% and 34.81%, crude protein (CP) yield 42.13% and 16.74%, degradable DM yield 25.94% and 69.99%, and degradable CP yield 16.96% and 5.50% than sole cropping (Zhang et al., 2015). Maize-legume intercrop could reduce pest attack (Halilu et al., 2018). The cropping system substantially increases forage quantity and quality and lessening condition for protein supplement (Mthembu et al., 2018). Maize-lablab intercropping improves maize yield and yield components considerably that it had a yield advantage of 39.50% to 59.03% in South Africa (Mthembu et al., 2018) and 17.68% in Ethiopia (Redae & Tekle, 2020) over sole cropping.

Broad-leaved legumes suppress weed and conserve soil moisture in dry land agriculture (Eskandari & Ghanbari, 2011). In this regard, lablab (Lablab purpureus) plays an important role in suppressing Parthenium (Parthenium hysterophorus) weed in maize-based low land mono-cropping system that it has an advantage of 77.6% ground cover in arid (Savanna) agro-climatic zone (Birteeb et al., 2013). Lablab is used as a nitrogen-fixing green manure to improve soil quality and often produces more dry matter than cowpea (Vigna unguiculata), especially during drought, and can produce roughly 2.13 tons of leaf dry matter (Cook et al., 2012) and 6.25 tons of total biomass per hectare and each ton of biomass produced 0.0625 ton of nitrogen (Valenzuela & Smith, 2002).

In southern Ethiopia, low land farming system has been dominated by mono cropping of maize. Farmers let growing voluntary weeds in maize field and practice cattle grazing in the field after harvesting prior to next season cultivation. The farm land usually invaded by Parthenium weed, which is unpalatable to livestock (Huy & Seghal, 2004), reduce the productivity of pastures, affect livestock health and if it is mixed with fodder, it defects quality of meat and milk (McFadyen, 1992) and causes significant yield loss of crops (Tana et al., 2002). Parthenium weed affected plant species diversity as highly as mean importance value index of 76.15% and urgent intervention needed to take appropriate measures in the study area, especially, in Arba Minch, to stop its further spread to Nech Sar National Park (Gebrehiwot & Berhanu, 2015).

Figure 1. Map of study area and climatic data.
Therefore, this project aimed to determine date of under-sowing lablab in maize field for efficient ground cover to suppress weed and improve biological and economical yield of maize lablab intercrops in crop livestock farming system of southern Ethiopia.

2. Materials and methods
Temporal arrangement of maize lablab intercropping was conducted from April 2018 to July 2020 at the Arba Minch Agricultural Research Center sub-station (6°06’ N, 37°35’ E; 1,206 meters above sea level) Figure 1, where mean annual rainfall is 1103 mm.

Weather data including mean monthly rainfall and maximum and minimum temperatures during the course of the trial and forty years average are presented in Figure 1. Laboratory analysis of a composite (0–30 cm) soil sample collected from the experimental site (Chano Mille) before the trial was presented in Table 1

| Description                  | Amount  | Class of soil consideration | References          |
|------------------------------|---------|------------------------------|---------------------|
| Soil pH                      | 6.2     | Within range of productive soils | (UNDP, 2011)        |
| Available Phosphorus (cmolc/kg) | 14.5   | Very low                    | (ATA, 2016)         |
| Total Nitrogen (%)           | 0.29    | Optimum                     | (ATA, 2016)         |
| Organic Carbon (%)           | 1.19    | Medium                      | (Herrera, 2005)     |
| Organic matter (%)           | 1.63    | Low                         | (ATA, 2016)         |
| Potassium (cmolc/kg)         | 1.12    | High                        | (Landon, 1991)      |
| Textural class               |         | Sandy loam                  |                     |

Growth, yield and yield component parameters of maize such as plant height (PH cm), grain yield (GY t/ha), biomass yield (BMY t/ha), cob length (CL cm), seed number per cob (SNPC), hundred seed weight (100SW) and harvest index (HI) were computed for three consecutive years. Vine length (PH cm), branch number per plant (BNPP), leaf to stem ratio (LSR), and dry matter yield (DMY t/ha) were the parameters computed for lablab in three experimental years. Plant height was measured for five maize and lablab plants for each randomly selected from central net rows of the plot using tape meter from ground to top at forage harvesting for lablab and harvest maturity for maize. Grain yield of maize was weighed per plot in spring balance after moisture test of 13% using
graduated moisture tester expressed in ton per hectare. Biomass yield of maize weighed for randomly selected five plants and converted to hectare base. The cob length was measured using linen meter from attachment to the stem to its tip and seed number count for five plants to calculate average number of seed per each cob. Hundred seed weight from each plot counted and weighed using sensitive electronic balance.

Lablab forage on the plot (1 m² quadrant) were cut close to the ground level at 50% flowering stage by using the manual sickle and collected to one composite sample to measure forage yield at fresh per plot. Sample of 400 gram was taken for leaf and stem independently for computing leaf to stem ratio (LSR) after the plot green forage measured by spring balance to figure fresh matter yield per hectare. The sample was taken to laboratory and exposed to oven at 65°C for 24 hours to get constant dry weight and calculate dry matter yield (DMY t/ha) by using the formula:

\[ DM\% = \frac{ODW}{FW} \times 100 \]  

Where: DM% is dry matter percent; ODW is oven dry weight, dried in to the constant weight through 65°C for 24 hrs. FW is fresh weight of the sample from the field.

\[ DMY(t/ha) = FMY(t/ha) \times DM\% \]  

Where: DMY is dry matter yield in ton per hectare, FMY is fresh matter yield in ton per hectare converted from a plot yield, and fresh matter yield was computed from the whole plots.

Biological competition of intercropping was described by using relative yield of a particular species which is imposed by another species in a mixed stand and expressed by the sum of the relative yields as a relative yield total (RYT) and land equivalent ratio (LER; Mthembu et al., 2018). RYT describes the resource complementarities between species in a binary mixture which indicates whether the species are performing better in a mixture than in monoculture. The value of relative yield was expressed as RYT = 1 the absence of biological yield advantage, RYT>1 complementarities in resource use between the two species and RYT<1 the highly aggressive nature of one of the components to the extent that one species exterminates the other. LER was calculated as follows:

\[ LER(\text{Maize}) = \frac{Yml}{Ym} \]  

where: Yml = yield of maize intercropped with lablab; Ym = yield of sole maize.

\[ LER(\text{Lablab}) = \frac{Ylm}{Yl} \]  

where: Ylm = yield of lablab intercropped with maize; Yl = yield of sole lablab.

\[ LER = (\frac{Yml}{Ym}) + (\frac{Ylm}{Yl}) \]  

Therefore, the results will indicate the percent amount of land that would be required by sole cropped maize to yield the same amount of yield as that yielded from the intercropped maize. Economic benefit of maize lablab intercropping was determined by calculating monetary advantage index (MAI; Girma, 2015) using the formula:

\[ MAI = \frac{(\text{Valueofcombinedintercrops})(LER - 1)}{LER} \]  

Where MAI = Monetary advantage index LER = Land equivalent ratio.

Counting parthenium weed per plot at the time of forage harvesting of lablab and grain yield of maize was performed compute weed density in the plot. Weed density was calculated in hectare basis. Weed density was calculated by using the formula total number of parthenium weed in a plot divided by the plot area (12 m²) multiplied by 100 (Maszura et al., 2018).
Table 2. Mean values of lablab growth parameters and Leaf to stem ratio (LSR) in 2018, 2019, and 2020 cropping seasons under maize lablab intercropping system

| Maize Lablab Intercrop | NBPP  | LSR  | VL cm |
|------------------------|-------|------|-------|
|                        | 2018  | 2019 | 2020  | Mean | 2018  | 2019 | 2020  | Mean | 2018  | 2019 | 2020  | Mean |
| LO                     | 10.67b| 6.3c | 13a   | 10.0 | 0.989abc| 1.247a| 0.847abc| 1.028| 18.8  | 204.1| 207.4 | 143.4b|
| ML0                    | -     | 6.7c | 13a   | 9.8  | -     | 0.779bc| 0.939abc| 0.859| -    | 249.8| 212.9 | 231.35a|
| ML10                   | 12.7ab| 7.5c | 12.13ab| 10.8 | 1.094abc| 0.932abc| 0.847abc| 0.958| 33.3  | 271.2| 214.0 | 172.8ab|
| ML20                   | 10.67b| 6.9c | 12.13ab| 9.9  | 0.944abc| 0.636c| 0.968abc| 0.849| 15.2  | 241.7| 193.1 | 150b  |
| ML30                   | 10.5b | 8.2c | 11.87ab| 10.2 | 0.984abc| 0.925abc| 1.058abc| 0.989| 21.0  | 248.2| 211.3 | 160.2ab|
| ML40                   | 11.67ab| 7.0c | 12.6ab | 10.4 | 1.143abc| 0.879abc| 0.9abc | 0.974| 10.2  | 252.8| 217.9 | 160.3ab|
| Mean                   | 11.2  | 7.1  | 12.5  | 9.6  | 1.031  | 0.900  | 0.927  | 0.952| 19.7  | 244.6| 209.4 | 169.7 |

P-value: <0.001
LSD<sub>0.05</sub>: 2.18
CV%: 13.6

LSD<sub>0.05</sub>: 17.08
CV%: 11.4
Table 3. Mean values of growth parameters and yield components of maize in 2018, 2019, 2020 cropping seasons under maize lablab intercropping system

| Maize Lablab Intercrop | PH cm | CL cm | 100SW (g) |
|------------------------|-------|-------|-----------|
|                        | 2018  | 2019  | 2020 Mean | 2018  | 2019  | 2020 Mean | 2018  | 2019  | 2020 Mean | 2018  | 2019  | 2020 Mean |
| M0                     | 238a  | 203.1bc | 161.3e | 200.8 | 18.1c | 18.13c | 20.33a | 18.9 | 36.6 | 39.7 | 36.7 | 37.7 |
| ML0                    | -     | 185.7cd | 161.3e | 173.5 | -     | 17.73c | 20.27ab | 19.0 | -   | 37.2 | 39.7 | 38.4 |
| ML10                   | 220.7ab | 186.8cd | 145.3e | 184.3 | 18.13c | 18.47bc | 19.2abc | 18.6 | 38.1 | 34.0 | 37.1 | 36.4 |
| ML20                   | 235.3a | 189.9c  | 153.6e | 192.9 | 19.1abc | 18.27c  | 20.2ab  | 19.2 | 37.4 | 34.8 | 35.9 | 36.0 |
| ML30                   | 230.3a | 200.8bc | 164.5de | 198.5 | 18.77abc | 18.3c   | 20.27ab | 19.1 | 36.9 | 38.9 | 35.4 | 37.1 |
| ML40                   | 229.5a | 197.4bc | 156.7e | 194.5 | 18.67abc | 19.03abc | 20.4a   | 19.4 | 38.3 | 36.2 | 38.3 | 37.6 |
| Mean                   | 230.8 | 194.0   | 157.1  | 190.8 | 18.6 | 18.3  | 20.1    | 19.0 | 37.4 | 36.8 | 37.2 | 37.1 |
| P-value                | <0.001 | <0.001  | <0.001 |
| LSD0.05                | 23.91  | 1.82   | 5.7    |
| CV%                    | 8      | 6.1    | 9.8    |
### Table 4. Mean values of grain yield (GY t/ha), biomass yield (BMY t/ha) and harvest index (HI) of maize in 2018, 2019, 2020 cropping seasons under maize lablab intercropping system

| Trt  | GY t/ha   | BMY t/ha | HI     | 2018 | 2019 | 2020 | Mean | 2018 | 2019 | 2020 | Mean | 2018 | 2019 | 2020 | Mean | 2018 | 2019 | 2020 | Mean |
|------|-----------|----------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| M0   | 9.9<sup>ab</sup> | 5.37<sup>ab</sup> | 7.91<sup>abc</sup> | 7.73 | 60.2<sup>ab</sup> | 27<sup>de</sup> | 50.6<sup>bc</sup> | 45.9 | 0.165<sup>b</sup> | 0.199<sup>b</sup> | 0.165<sup>b</sup> | 0.177 |
| ML0  | -         | 7.16<sup>abc</sup> | 6.28<sup>abc</sup> | 6.72 | -    | 22.5<sup>e</sup> | 41<sup>c</sup> | 31.8 | -   | 0.369<sup>a</sup> | 0.155<sup>b</sup> | 0.262 |
| ML10 | 10<sup>ab</sup> | 5.78<sup>abc</sup> | 6.09<sup>abc</sup> | 7.29 | 67.7<sup>a</sup> | 26.1<sup>e</sup> | 51<sup>b</sup> | 48.3 | 0.148<sup>b</sup> | 0.224<sup>b</sup> | 0.129<sup>b</sup> | 0.167 |
| ML20 | 9.71<sup>ab</sup> | 6.39<sup>abc</sup> | 6.56<sup>abc</sup> | 7.55 | 56.5<sup>ab</sup> | 27.3<sup>de</sup> | 39.2<sup>c</sup> | 41.0 | 0.172<sup>b</sup> | 0.240<sup>b</sup> | 0.171<sup>b</sup> | 0.194 |
| ML30 | 10.61<sup>a</sup> | 5.46<sup>abc</sup> | 6.15<sup>abc</sup> | 7.41 | 64.4<sup>a</sup> | 26.7<sup>d</sup> | 50.5<sup>bc</sup> | 47.2 | 0.167<sup>b</sup> | 0.21<sup>b</sup> | 0.132<sup>b</sup> | 0.170 |
| ML40 | 8.88<sup>abc</sup> | 4.49<sup>cd</sup> | 8.03<sup>abc</sup> | 7.13 | 62.1<sup>ab</sup> | 24.6<sup>e</sup> | 50.3<sup>bc</sup> | 45.7 | 0.147<sup>b</sup> | 0.191<sup>b</sup> | 0.168<sup>b</sup> | 0.169 |
| Mean | 8.18 | 5.86 | 6.33 | 62.2 | 25.7 | 47.1 | 43.3 | 0.160 | 0.239 | 0.153 | 0.190 |

P-value | <0.001 | <0.001 | 0.016 |
LSD<sub>0.05</sub> | 2.51 | 12.9 | 0.12 |
CV% | 25.6 | 18.7 | 40.1 |
Where: WD is weed density, TNPWPP is total number of parthenium weed per plot, plot area of 12 m². This experiment was focussing on parthenium weed than other weeds in maize monoculturing field.

Collected data were analyzed using the analysis of variance procedure and least significance difference (LSD_{0.05}) of Genstat statistical software Version 18, VSN International Ltd, UK (Payne et al., 2015).

3. Results and discussion

3.1. Growth parameters of maize and lablab
Mean values of maize plant height (Table 3) showed variation of maize plant height due to lablab under planting date difference in maize field was significantly (P < 0.01) ranging from 115.64 to 200.78 cm with average height of 181.1 cm. Intercropping maize with lablab after twenty, thirty and forty days of maize planting had a growth advantage while in similar day (ML0) was disadvantaged the growth of maize plant in this study. That may be due to the spatial competition between the crops in which the vine of lablab climbs earlier over the maize stalk to stress the growth of maize. Lablab vine length (PH cm) and branch number (Table 2) mean values demonstrated that vine length of lablab was varied for lablab under-sowing date variation in maize field that was significantly (P < 0.01) ranging from 143.44 to 172.84 cm with an average length of 156.8 cm. The longest vine was produced at after ten days planting of lablab (ML10) while the shortest was at sole cropping of lablab (L0). This may be due to lablab vine climbing on the stalk of maize in need of solar radiation and sufficient space. Other reports were, however, not observed significant variation of growth parameters among different planting dates of maize lablab intercrops (Redae & Tekle, 2020).

3.2. Yield components of maize and lablab
Intercropping maize with lablab in the same day produced the lowest significant (P < 0.01) value of cob length (12.67 cm) and hundred seed weight (18.58 g) of maize (Table 3) and leaf to stem ratio (0.573) of lablab (Table 2). On the other hand, no significant variation was observed in yield components between sole cropping and under planting lablab after twenty, thirty and forty days, and also non-significant variation among ten days and twenty days. Harvest index was not significantly (P > 0.05) varied among sole and intercropping of maize with lablab in different days of planting. This result indicates planting lablab under maize in different days than sole maize improves production of yield components of maize and lablab. Other scholars report on variation of

Figure 2. Mean values of lablab dry matter yield under maize lablab intercropping in 2018, 2019 and 2020 cropping seasons.

![Figure 2](image_url)
maize and lablab yield components except for harvest index in intercropping system of maize with lablab (Kheroar & Patra, 2013) concurs with the present result.

3.3. Biological yields of maize and lablab
The mean values for biomass yield of maize varied significantly ($P < 0.01$) among different intercropping days and cropping years ranging from 22.5 to 67.7 t/ha with average yield of 43.3 t/ha (Table 4). The highest biomass yield was recorded at ten days of planting lablab after maize while the lowest was in similar day of lablab planting under maize. There was no significant ($P > 0.05$) variation observed for biomass yield between sole cropping and ten, twenty, thirty and forty days of lablab planting after maize. Grain yield value was 8.18 t/ha in 2018, 4.95 in 2019 and 5.86 t/ha in 2020 cropping seasons with its interaction values ranging from 4.49 in 2019 planting lablab at forty days after maize to 10.61 t/ha in 2018 of planting lablab at thirty days after maize with mean value of 6.33 t/ha (Table 4). This indicates that intercropping had an advantage over sole cropping and planting lablab after maize establishment improved maize yield by minimizing spatial competition and adding defoliates of lablab with atmospheric nitrogen fixation. Previous report stated that interaction of cropping seasons with intercropping of maize with lablab in different treatments displayed consistent and stable maize grain yield over sole cropping (Mthembu et al., 2018) which is closely in line with the current study. Dry matter yield of lablab was significantly ($P < 0.01$) varied for intercropping of maize with lablab in different planting dates and it was demonstrated as the higher yield 14.56 t/ha in 2018 while the lowest yield 3.12 t/ha in 2020 cropping year (Figure 2). Sole cropping of lablab showed an advantage over intercropping in dry matter yield of lablab. Previously, it was reported that positive influence of legume-cereal intercropping system might exert on sustainability of fodder production under small holder farming systems (Lithourgidis et al., 2011).

3.4. Competitive values of intercropping
In maize-lablab intercropping maize is treated as base crop without any variation in plant stand. In additive series of intercropping, lablab add plant population per unit area and benefits are achieved as biomass (crop residue) and grain yield of maize and lablab dry matter yields. Land equivalent ratio (LER), relative yield (RY) and monetary value index of intercropping (MVI) were calculated to evaluate the efficiency of intercropping maize with lablab forage. Land equivalent ratio was recorded highest at ML10 as high as 1.801 and resulted in 80.1% improvement of land use efficiency which was followed by ML20 (79.2%) while the lowest was 35.7% for ML40. However, it is not statistically significant, the highest relative yield total (RYT) was recorded at ML10 while the lowest was at ML40 (Table 5). Improvement of monetary advantage value of intercropping systems over mono-cropping indicates certain gain over sole maize (Kheroar & Patra, 2013). The highest monetary advantage value of the current intercropping system was 12,084.00ETB which was obtained from planting lablab with maize after ten days (ML10) of maize establishment followed by twenty days (ML20). Yield advantages occurred due to intercropping was mainly due to the development of both temporal and spatial complementarities (Girma, 2015).

Figure 3.: weed density of parthenium for maize lablab intercropping and association with biological yields.
Table 5. Monetary value index (MVI), land equivalent ratio (LER) and relative yield (RY) value of maize lablab intercropping in 2018, 2019 and 2020 cropping seasons under maize lablab intercropping system

| Treatment | MVI  | 2018 | 2019 | 2020 | Mean | LER  | 2018 | 2019 | 2020 | Mean | RY  | 2018 | 2019 | 2020 | Mean |
|-----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| L0        | 2    | 24.297 | 1    | 8.100ab | 1    | 0.758 | 1    | 0.919c | 0    | 0    | 0    | 0    | 0    | 0    |
| M0        | 6    | 91    | 5    | 30b   | 1    | 0.997 | 1    | 0.999c | 0    | 0    | 0    | 0    | 0    | 0    |
| ML0       | 3898 | 13,868 | 11,561 | 9776a | 1.246 | 2.115 | 1.75 | 1.704a | 0    | 2.936 | 1.75 | 1.562 |
| ML10      | 11,837 | 12,127 | 12,286 | 12,084a | 1.759 | 1.818 | 1.827 | 1.801a | 1.808 | 2.486 | 1.83 | 2.04 |
| ML20      | 11,795 | 11,995 | 11,030 | 11,607a | 1.754 | 1.807 | 1.815 | 1.792a | 1.653 | 2.221 | 1.82 | 1.896 |
| ML30      | 11,117 | 8864  | 11,674 | 10,552a | 1.688 | 1.502 | 1.813 | 1.668a | 1.672 | 1.957 | 1.81 | 1.814 |
| ML40      | 5549 | 4769  | 9904  | 6,741ab | 1.26  | 1.232 | 1.58  | 1.357b | 1.389 | 1.603 | 1.58 | 1.524 |
| Mean      | 6314.3 | 3890.7 | 8064 | 6090  | 1.39  | 1.46  | 1.54  | 1.46   | 0.932 | 1.60  | 1.26 | 1.262 |
| LSD0.05   |      | 15,712.9 |      | 0.2721 |      |      |      |      |      |      |      |      | NS   |
| CV%       |      | 39    |      | 19.5  |      |      |      |      |      |      |      |      | 43.9 |
3.5. Weed density under intercropping system

Mean values of weed density especially *Parthenium* per square meter in the experimental plot counted through the growing period of maize and lablab (figure 3). The highest significant (*P* = 0.000) weed density at regression of R-seq(adjus) = 91.58% was counted in plot of sole maize while the weed growth was more suppressed in similar day planting followed by sole lablab (L0) plot with minimum density. Weed density was more affecting dry matter yield of lablab than maize biomass and grain yields in the present study (figure 3). This was reported previously that cereal-legume intercropping manages weed damage in crop production system (Eskandari et al., 2009). And also another report expressed lablab often used as an intercrop species with maize when sown roughly some days later than maize so as to limit competition and initially its growth is slow, but once established, it competes well with weeds (Sheahan, 2012).

4. Conclusion and recommendation

The current study provides perceptible proofs that maize-lablab intercropping could significantly improve biological yields of maize and lablab in crop livestock farming system of Ethiopia. Maize-lablab intercropping can provide a good control of parthenium weed especially in ten days of lablab planting (ML10) after maize, higher biological yield in terms of feed and food next to lablab monocropping (L0) and similar day planting (ML0). The highest monetary value index, land equivalent ratio and relative yield total obtained at ten days of lablab planting after maize (ML10). Plating lablab in 10 days after maize (ML10) followed by ML20 improved crop growth, grain yield, dry matter yield and biomass yield of maize lablab intercrops. Thus, it was concluded from the experimental findings that all intercropping days proved to be profitable as compared to sole crops in the cropping system. Inclusion of lablab in intercropping system was found to be more lucrative with respect to equivalent yield of maize and forage production in crop livestock farming system of Ethiopia.
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