Computational Biology and Bioinformatics
2022; 10(1): 20-26
http://www.sciencepublishinggroup.com/j/cbb
doi: 10.11648/j.cbb.20221001.14
ISSN: 2330-8265 (Print); ISSN: 2330-8281 (Online)

Determination of Optimum Sowing Dates of Dolichos Lablab Intercropping with Sorghum in West Hararghe, Oromia, Ethiopia

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To cite this article:
Tamrat Dinkale, Muleta Debela, Birmaduma Gadisa. Determination of Optimum Sowing Dates of Dolichos Lablab Intercropping with Sorghum in West Hararghe, Oromia, Ethiopia. *Computational Biology and Bioinformatics*. Vol. 10, No. 1, 2022, pp. 20-26.
doi: 10.11648/j.cbb.20221001.14

Received: March 14, 2022; **Accepted**: April 12, 2022; **Published**: April 25, 2022

Abstract: In Hararghe as whole, intercropping is the main and indigenous activity of the farmers due to land shortage that most farmers are practicing intercropping of different crops for different reasons like to minimize total crop failure and efficient land utilization. An experiment was conducted to evaluate the influence of sowing dates of Dolichos lablab intercropping with sorghum on sorghum yield and yield related and to identify the optimum sowing date of Dolichos lablab intercropping with sorghum in West Hararghe Zone, Oromia, Ethiopia. Six treatments, namely: sole lablab, sole sorghum, Sorghum + lablab simultaneous, Sorghum + lablab after two weeks, Sorghum + lablab after four weeks and Sorghum + lablab after six weeks were used with 3 replications in a randomized complete block design. Significant ($p<0.05$) variation were observed between 50% flowering, plant height, stand count at harvest, sorghum yield, and plot cover but has no significant ($p>0.05$) in terms of sorghum maturity and diseases incidence. The highest mean sorghum seed yield (20.61qt/ha) was obtained from sole sorghum followed by sorghum + lablab after four weeks intercropped while the lowest seed yield (10.82qt/ha) was recorded from Sorghum + lablab simultaneous intercropped. The study showed that sorghum-lablab intercropped at different sowing date has influence on grain yield of sorghum that grain yield of sorghum increases as sowing date of lablab increases. The ideal acceptable LER was produced from sorghum + lablab intercropped after four weeks. The highest mean grain yield of lablab yield (19.9 qt/ha) were recorded from sorghum + lablab simultaneous intercropping whereas the lowest mean grain yield (4.2 qt/ha) was recorded from sorghum + lablab after six weeks intercropped. The largest lablab dry matter yield (2.31 t/ha) was recorded from sorghum + lablab after four weeks whereas the lowest (2.15 t/ha) was recorded from sorghum + lablab after six weeks intercropped. Therefore, it recommended that four weak after sown of sorghum is the appropriate date of sorghum-lablab intercropping.

Keywords: Grain Yield, Influence, Intercropping, Lablab, Sowing Date and Sorghum

1. Introduction

In Ethiopia, the dominant farming system is a crop-livestock system [9] in which both crop and livestock production are economically important. In the country, natural pasture is the primary feed source, which has low biomass yield and nutritional value because of mismanagement [5].

Intercropping legumes into grass pastures have proven to be a viable means to mitigate the decline in quantity and quality of grass forages [11]. It has been reported that intercropping of grasses with legumes increased yield, improved growth, enhanced palatability and nutritive quality feeds for animals [12]. The advantages of intercropping forage legumes into farming system include the transfer of nitrogen to the component cereal crops thereby, increasing the crude protein content of the grasses [20]. Lablab (Lablab purpureus) is a creeping legume which produces high nutritive quality of conserved feed in form of hay or silage [2].

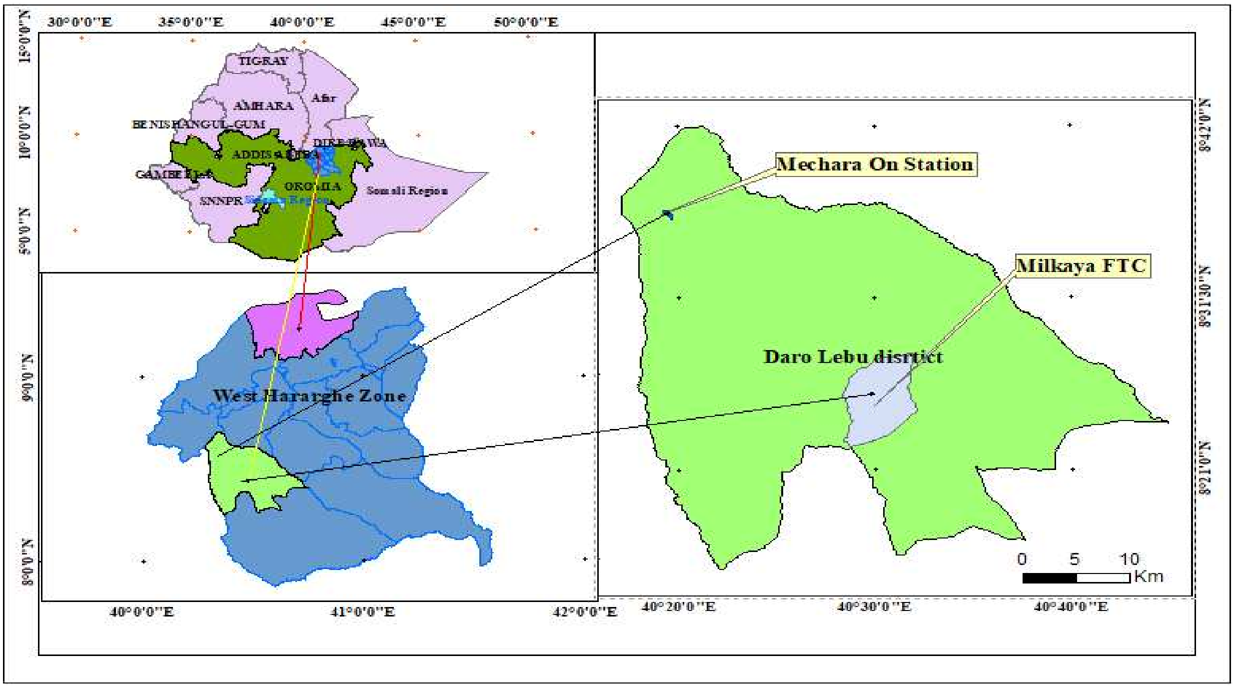
Cereals –legumes cropping system is the most used by small scale farmers in Sub Saharan Africa because of their compatibility. Intercropping systems help farmers to exploit the principle of diversity, they are helpful to avoid reliance on a single crop and result in a variety of products of a different nature such as forages, oil and pulses. Another key advantage associated with intercropping is its potential to increase the land productivity per unit area and the efficient utilization of farm resources [16].

In Hararghe as whole, intercropping is the main and indigenous activity of the farmers due to land shortage. Most of the farmers are practicing intercropping of different crops for different reasons like to minimize total crop failure and efficient land utilization [4]. Therefore, this experiment was initiated with to evaluate the influence of sowing dates of *Dolichos lablab* intercropping with sorghum on sorghum yield and yield related and to identify the optimum sowing date of *Dolichos lablab* intercropping with sorghum in West Hararghe Zone.

2. Materials and Methods

2.1. Description of Study Area

The study was conduct at Mecahara Agriculture Research Center on station and Milkaye FTC, Daro labu district, West Hararghe Zone during 2019/2020 to 2020/2021. Experimental sites are located at a distance of 434 km and 474 km to the east of capital city, Addis Ababa and from Chiro (Zonal Capital city) is 111km and 151km respectively. Daro Labu district is located at latitude of 40°19.114 north and longitude of 08°35.589 east. The district has altitude ranges from 1350 to 2450 m.a.s.l. The nature of rainfall is very erratic and unpredictable causing dangerous erosion. The area has a bimodal rain fall type ranging from 900 to 1300mm average of 1094mm. The ambient average temperature was 20°C and the major soil type of the area is sandy clay loam which is reddish in color. The predominant production system in the district is mixed livestock-crop production system. The crops that growths in study area are cereals such as maize, sorghum, haricot bean, *teff* to large tree fruits like mango, banana, and Avocado especially coffee is the brand crop of the study area known as Hararghe coffee spatiality.



Source of the map: Ethio-GIS shape file, 2016

Figure 1. *Map of the study area.*

2.2. Treatments and Experimental Design

The experiment was conducted for two consecutive years with six treatments using a randomized complete block design (RCBD) with three replications. The treatments arrangements were sole lablab, sole sorghum, Sorghum + lablab simultaneous, Sorghum + lablab after two weeks, Sorghum + lablab after four weeks and Sorghum + lablab after six weeks. One sorghum variety (Dagim) and one Dolichus lablab (Dole-1) variety were used with plot size of 3m*2.75m and the space between block, plot and rows were 1m, 1m and 0.55m respectively for sorghum. Dolichus lablab was sown between the rows of sorghum with 22.50cm distance from the sorghum for all sowing times and each plot has five rows for sorghum and four rows for lablab. All sorghum treatments were sown on the same date of sowing and on the other hand, sole lablab was sown on the second weeks of the treatments. Sorghum was sown at the seed rate of 15kg/ha whereas lablab was sown at the seed rate 10kg/ha through drilling techniques and thinned to 25cm and 10cm space between plants for sorghum and lablab respectively. Fertilizer application was done at the time of sowing for all treatments with the rate of 100kg/ha and 50kg/ha NBS and UREA respectively. Land preparation was done manually and every management was applied for all treatments uniformly.

2.3. Data Collection Methods

2.3.1. Sorghum Data

Data of 50% flowering and number of days to maturity were collected as days after emergency and data of plot cover, stand vigor, plant height, stand count at harvesting and grain yield was collected for all plots. The yield was adjusted and weighted at 12.5% of moisture content to calculate actual seed yield per hectare.

2.3.2. Legumes Data Collection

Major data like days to 50% flowering, maturity date, green biomass yield, leaf stem ratio, plot cover, stand vigor, plant height, disease incidence, grain yield and land equivalent ratio was collected.

2.4. Land Equivalent Ratio (LER)

Yield advantages was calculated though land equivalent ratio. Intercropping determined by advantage that indicated the amount of interspecific competition or facilitation in an intercropping system (Fetene 2003)

$$\text{LER} = \frac{yis}{yss} + \frac{yil}{ysl}$$

Where yis and yss are the yields of intercrop and sole crop of sorghum and yil and ysl are the yields of intercrop and sole crop of legumes. A LER more than 1.0 reveals an intercropping has an advantage or a demonstration that interspecific facilitation is higher than interspecific competition so that intercropping results in greater land-use efficiency. LER less than 1.0 reveals mutual antagonism in the intercropping system. As a result, a LER less than 1.0 has no intercropping advantage [21].

2.5. Statistical Analysis

Data were subjected to analysis of variance (ANOVA) using (SAS version 9.1.3). Significance differences between treatments means were separated using Least Significance Difference (LSD) test at 5% probability level.

3. Results and Discussions

3.1. Influence of Lablab on Sorghum Yield and Yield Components

3.1.1. Days of 50% Flowering and Maturity

The combined analysis of 50% heading and maturity date of sorghum were presented in (Table 3). There were statistical ($p<0.05$) variation between sorghum in 50% heading date but has not variation in terms of maturity due to intercropping date of lablab. The longest date to 50% heading and maturity was recorded from (86.2 day). Sorghum intercropping with lablab in different sowing date does not influence maturity date of sorghum (Dagim variety).

3.1.2. Plant Height and Stand Count at Harvest

The combined analysis of sorghum plant height and stand count at harvest were presented in (Table 3). There were statistical ($p<0.05$) variation between sorghum plant height and stand count at harvest due to intercropping date of lablab. The longest plant height of 160.3 cm was recorded from sorghum + lablab simultaneous whereas the shortest plant height 152.3 cm was recorded from sorghum + lablab after four weeks. The longest plant height for sorghum + lablab simultaneous may be due to growth competition of sorghum rather than gave grain yield. [1] reported that plant height for dagim variety 118cm which was shorter than the present results and similar results reported by [14] from 162 to 167cm. This variation may be due to intercropping of lablab helps plant height increment.

Plant population count at harvest has direct effect on grain yield and yield components of most crops. The highest plant count at harvest was recorded from sorghum + lablab after four weeks (73.2) followed by sole sorghum (67.5). The list plant population count at harvest was recorded from sorghum + lablab simultaneous (41.5). Intercropping sorghum-lablab simultaneous causes reduction of plant population that leads grain and grain yield related reduction.

3.1.3. Sorghum Grain Yield and Yield Components

The combined result of grain yield of sorghum intercropped with lablab in different sowing date for two years were presented (table 3). Sorghum yield was showed significance ($p<0.05$) variation among the treatments. The highest mean grain yield of sorghum was recorded from sole sorghum (20.61 qt/ha) followed by sorghum + lablab after four weeks (20.32 qt/ha) that indicated the higher yield under sole cropped condition is directly related with lack of competition for nutrient and moisture [8] whereas the lowest grain yield (10.82 qt/ha) was recorded from Sorghum + lablab simultaneous. The mean of sorghum grain yield variation was due to main effect of planting date that similar result reported by [10] there was a significantly difference on grain yield of sorghum due to intercropping legumes in different planting pattern. [19] also reported that inter-cropping of lablab with sorghum caused a marked reduction in yields of sorghum stem, leaves and grain, while [13] found a reduction in height of maize following inter-cropping with lablab. The present findings for sorghum grain yield (Dagim variety) is higher than the findings of [1] that 13qt/ha who reported that without intercropping. In the current study, the grain yield difference might be due to legumes can fix nitrogen that similar result reported by [15] Dolichos can fix about 20 kg N/ha under drought conditions. Different scholars reported different sorghum varieties intercropping with lablab on grain yield of sorghum that [17] 52.5 to 59.5 qt/ha), [10] from 31.19 to 36.99) qt/ha.

3.1.4. Plot Cover and Disease Incidence

Significance ($p<0.05$) variation was recorded for plot cover (table 3). The highest plot cover (81.5%) was recorded from sole sorghum followed by sorghum + lablab intercropped after four weeks (80.8%) while the lowest plot cover (69.2%) was from Sorghum + lablab simultaneous intercropped. Intercropping lablab with sorghum can affect plot cover of sorghum when it intercropped inappropriate date of sowing.

The diseases severity was the most important criteria during the data collection. Sole sorghum (1.17) was relatively affected by diseases than the other treatments whereas the lowest (0.92) disease incidence was recorded from sorghum + lablab after six weeks. Disease is the most factor reduce grain yield [18] reported that the most affected by diseases, the lowest in yield but intercropping favors the growth and yield of the crops reducing weed distribution, paste and disease [8] also reported similar findings.

Table 1. *Mean phenology, growth, yield and yield related characters of sorghum as affected by sowing date grown in sole and intercropped with lablab in 2019/20.*

Treatments	50F	MD	PH	DI	SCH	PC	SV	GY (qt/ha)
S+Lb6w	87.7	138.5	176.3^{c}	0.34^{c}	84.4^{a}	88.3^{a}	1.17^{c}	21.08^{b}
S+Lb4w	87.7	138.5	179.1^{bc}	0.67^{ab}	82.8^{a}	89.2^{a}	1.17^{c}	26.71^{a}
S+LbSi	87.7	138.5	181.9^{ab}	0.67^{ab}	50.8^{b}	57.5^{b}	3.5^{a}	15.58c
S+Lb2w	87.7	138.5	182.8^{a}	0.84^{a}	58.5^{b}	66.7^{b}	2.5^{b}	20.34^{b}
Sole sorghum	87.7	138.5	178.8^{bc}	0.5^{bc}	83.0^{a}	91.1^{a}	1.34^{c}	25.71^{a}
Mean	87.7	138.5	179.8	0.6	71.9	78.6	1.93	21.88
CV (%)	0	0	1.57	33.02	19.77	9.78	28.41	11.48
LSD (5%)	0	0	3.39	0.24	17.02	9.21	0.66	3
p-value	NS	NS	***	***	***	**	**	***

NS= Non-significant, * = significant, ** = very significant, *** = highly significant, S+Lb6w= Sorghum + lablab after six weeks, S+Lb4w= Sorghum + lablab after four weeks, S+Lbsi= Sorghum + lablab simultaneous, S+Lb2w= Sorghum + lablab after two weeks, PH =Plant height, MD = maturity date, DI = diseases incidence, PC = plot cover, SV =Stand vigor, SY (qt/ha) = Seed yield quintal per hectare, DMY = dry matter yield, GBth = green biomass yield.

Table 2. *Mean phenology, growth, yield and yield related characters of sorghum as affected by sowing date grown in sole and intercropped with lablab in 2020/21.*

Treatments	50F	MD	PH	DI	SCH	PC	SV	GY (qt/ha)
S+Lb6w	87^{a}	139	136^{a}	1	62^{a}	72^{a}	1.7	16.4^{a}
S+Lb4w	86^{ab}	139	126^{b}	1	51.1^{a}	73^{a}	1.8	13.9^{a}
S+LbSi	86^{a}	139	137^{a}	0.7	32.2^{b}	51^{b}	2.3	6.1^{b}
S+Lb2w	85^{b}	139	138^{a}	1	53.8^{a}	72^{a}	1.7	12.9^{ab}
Sole Sorghum	85^{b}	139	135^{a}	1.3	52^{a}	72^{a}	2	15.5^{a}
Mean	86	139	134	1	50.3	68	1.9	13
CV (%)	1.5	0	4.1	57	20.6	20.3	48.	47.5
LSD (5%)	1.57	0	6.6	0.7	12.6	16.6	1.1	7.5
p-value	**	NS	**	**	***	*	NS	**

NS= Non-significant, * = significant, ** = very significant, *** = highly significant, S+Lb6w= Sorghum + lablab after six weeks, S+Lb4w= Sorghum + lablab after four weeks, S+Lbsi= Sorghum + lablab simultaneous, S+Lb2w= Sorghum + lablab after two weeks, PH =Plant height, MD = maturity date, DI = diseases incidence, PC = plot cover, SV =Stand vigor, SY (qt/ha) = Seed yield quintal per hectare, DMY = dry matter yield, GBth = green biomass yield.

Table 3. *Combined mean of phenology, growth and yield and yield related characters of sorghum as affected by sowing date grown in sole and intercropped with lablab of two years (2019/20 - 2020/21).*

Treatment	50%F	MD	ph	DI	SCH	PC	SV	GY (qt/ha)
S+Lb6w	85.3^{ab}	138.5	156^{b}	0.92	73.2^{a}	80.0^{a}	1.4^{c}	18.74^{a}
S+Lb4w	84^{b}	138.5	152.3^{c}	1.08	67^{a}	80.8^{a}	1.5^{c}	20.32^{a}
S+LbSi	86.2^{a}	138.5	159.8^{a}	1.08	41.5^{c}	54.2^{c}	2.09^{a}	10.82^{b}
S+Lb2w	81.5^{c}	138.5	160.3^{a}	1.0	56.2^{b}	69.2^{b}	2.92^{a}	16.60^{ab}
Sole Sorghum	82.2^{c}	138.5	156.9^{ab}	1.17	67.5^{a}	81.5^{a}	1.67^{bc}	20.61^{a}
Mean	83.8	138.5	157	1.05	61.1	73.1	1.92	17.42
CV (%)	2.61	0	2.83	22.16	18.58	9.7	29.4	40.57
LSD (5%)	1.8	0	3.64	0.91	9.30	5.82	0.46	5.79
p-value	***	NS	***	NS	**	**	**	***

NS= Non-significant, * = significant, ** = very significant, *** = highly significant, S+Lb6w= Sorghum + lablab after six weeks, S+Lb4w= Sorghum + lablab after four weeks, S+Lbsi= Sorghum + lablab simultaneous, S+Lb2w= Sorghum + lablab after two weeks, PH =Plant height, MD = maturity date, DI = diseases incidence, PC = plot cover, SV =Stand vigor, SY (qt/ha) = Seed yield quintal per hectare, DMY = dry matter yield, GBth = green biomass yield.

3.1.5. Land Equivalent Ratio

Land equivalent ratio was used to evaluate the intercrop efficiency in yield relative to the mono cropped condition. The total land equivalent ratios (TLER) were obtained by summing up of the partial land equivalent ration of sorghum and legume crops (Lablab). The combined result of sorghum intercropping lablab total land equivalent ration were significantly (P<0.05) difference due to the main effect of lablab intercropping date. The higher total land equivalent ratio (1.89) was obtained from sorghum + lablab simultaneous followed by sorghum + lablab intercropped after four weeks (1.88), indicating that yield advantage over sole crops (table 4). Even though sorghum + lablab simultaneously intercropped produce the highest total LER, the individual LER of sorghum significantly affected by lablab intercropped. LER for sorghum + lablab intercropped after four weeks was produced the ideal acceptable LER for sorghum. The combatable LER value obtained with sorghum + lablab intercropping after four weeks is further evidence of the benefits of planting sorghum and lablab intercropping system in this environment. The same findings were reported by [17] from 1.54 to 1.87, [16] from 1.88 to 1.98 land equivalent ratio of sorghum lablab intercropped.

Table 4. *Land equivalent ratio (LER) for biomass yield of intercropping sorghum variety with lablab of sorghum yield.*

Treatments	SPLER	LPLER	TLER
S+Lb6w	0.96[a]	0.29[e]	1.25[b]
S+Lb4w	1.01[a]	0.87[c]	1.88[a]
S+LbSi	0.48[c]	1.39[a]	1.87[a]
S+Lb2w	0.78[b]	0.67[d]	1.45[b]
So Lablab	1.0[a]	1[b]	1.00[c]
Mean	0.84	0.84	1.41
CV (%)	21.65	13.49	11.68
LSD (5%)	0.15	0.09	0.13
p-value	***	*	***

* = significant, ** = very significant, *** = highly significant, S+Lb6w= Sorghum + lablab after six weeks, S+Lb4w= Sorghum + lablab after four weeks, S+Lbsi= Sorghum + lablab simultaneous, S+Lb2w= Sorghum + lablab after two weeks, SPLER= Sorghum Partial land equivalent ratio, LPLER= Lablab partial land equivalent ratio, TLER = Total land equivalent ratio.

3.2. Influences of Maize on Forage Legumes

3.2.1. Lablab Yield and Yield Components

Analysis of variance showed that, yield of lablab intercropped with sorghum had highly significant (p<0.05) difference due to the effect of date of planting. The highest mean value of lablab yield (19.9 qt/ha) were recorded from sorghum + lablab simultaneously intercropping followed by sole lablab ((14.6 qt/ha) whereas the lowest lablab mean grain yield (4.2 qt/ha) was recorded from sorghum + lablab after six weeks intercropped. The grain yield obtained from intercropped lablab with sorghum in different sowing date was the same with potential productivity of lablab. Similar findings reported by [3] reported lower (7.25 qt ha^{-1}) lablab grain yield when lablab was intercropped with maize as compared with the values obtained in this study.

3.2.2. Fresh Biomass and Dry Matter Yield

The combined result of fresh biomass yield and dry matter yield of lablab intercropped with sorghum were presented in table 7. The combined fresh biomass yield where significantly (p<0.05) difference due to lablab intercropped with sorghum. The highest mean fresh biomass was recorded from sorghum + lablab simultaneous intercropping (58.9 t/ha) followed by sole lablab (52.4 t/ha) whereas the lowest (20.7 t/ha) was recorded from sorghum + lablab after six weeks intercropped (table 7). Fresh biomass yield of lablab was decreasing as sowing date increasing that was due to suppressing and high sun light competition of sorghum over lablab.

There was no statistical (p>0.05) variation observed among the treatments on dry matter yield of lablab due to intercropped with sorghum. Numerically the highest dry matter yield (2.31 t/ha) was recorded from sorghum + lablab after four weeks intercropped whereas the lowest dry matter yield (2.15 t/ha) was recorded from sorghum + lablab after six weeks intercropped (table 5). This result is higher than the findings of [6] 1.05 t/ha intercropped with maize whereas [17] reported higher results from 3.47 to 5.65 t/ha intercropped with sorghum.

3.2.3. Leaf to Stem Ratio and Plot Cover

The combined mean of leaf to stem ratio and plot cover were presented in table 7. Statistical (p< 0.05) variation observed for both leaf to stem ratio and plot cover. Higher leaf to stem ratio was recorded from sorghum + lablab after two weeks (0.68) followed by sorghum + lablab after six weeks intercropped (0.67), while the rest treatments was produce the lowest. The highest plot cover of lablab was recorded from sole sorghum (95%) followed by sorghum + lablab simultaneous (92.2%) whereas the lowest was from sorghum + lablab after four weeks (67.5%) and sorghum + lablab after six weeks (68%) intercropped.

Table 5. *The phenology, growth, yield and yield related characters of Lablab as affected by sowing date grown in sole and intercropped with sorghum in 2019/20.*

Treatments	MD	GBth	DMYtha	LSR	SV	PH (cm)	DI	PC (%)	SY (qt/ha)
S+Lb6w	174.3[ab]	17.1[c]	2.08[c]	0.75[a]	3[a]	120.5[c]	1[b]	68[c]	3.07[e]
S+Lb4w	170.9[b]	25.2[c]	2.31[ab]	0.52[b]	2.5[b]	132.9[c]	1.2[b]	67.5[c]	11.1[c]
S+LbSi	170.3[ab]	71.6[a]	2.2[abc]	0.71[a]	1.3[c]	176.9[a]	1.8[a]	92.2[ab]	20.1[a]
S+Lb2w	180.8[b]	42..1[b]	2.38[a]	0.56[b]	1.3[c]	161.2[b]	2[a]	88.3b	5.6[d]
Sole Lablab	176.8[a]	61.7[a]	2.18[bc]	0.52[b]	0.7[d]	135.5[c]	1.7[a]	95[a]	14.6[b]
Mean	173.2	43.5	2.23	0.62	1.8	145.4	1.5	82.2	10.9
CV%	1.96	27.64	7.14	13.2	4.3	6.78	22	6.13	20.9
LSD 5%	4.06	6.04	0.91	0.09	14	11.8	0.4	0.09	3.2
p-value	***	***	*	***	***	**	**	***	***

* = significant, ** = very significant, *** = highly significant, S+Lb6w= Sorghum + lablab after six weeks, S +Lb4w= Sorghum + lablab after four weeks, S+Lbsi= Sorghum + lablab simultaneous, S+Lb2w= Sorghum + lablab after two weeks, PH =Plant height, MD = maturity date, DI = diseases incidence, PC = plot cover, SV =Stand vigor, SY (qt/ha) = Seed yield quintal per hectare, DMY = dry matter yield, GBth = green biomass yield.

Table 6. *The phenology, growth, yield and yield related characters of Lablab as affected by sowing date grown in sole and intercropped with sorghum in 2020/21.*

Treatments	MD	GBth	DMYtha	LSR	SV	PH (cm)	DI	PC (%)	SY (qt/ha)
S+Lb6w	195[a]	24.3[b]	2.12	37[ab]	1.5[a]	81[c]	4.1[ab]	84[bc]	5.4[c]
S+Lb4w	181[b]	30[b]	2.32	35[ab]	1.5[a]	83[bc]	3.3[b]	80[c]	14.3[b]
S+LbSi	192[a]	46.4[a]	2.13	39[a]	1[b]	111[a]	4.43[a]	89[ab]	19.7[a]
S+Lb2w	190[a]	24.6[b]	2.21	33[b]	1.5[a]	97[ab]	3.67[ab]	83[c]	13.3[b]
Sole lablab	182[b]	43[ab]	2.51	35[ab]	1.2[ab]	97[ab]	4.3[ab]	91[a]	14.7[b]
Mean	188	33.67	2.25	35.5	1.33	94	3.96	86	11.6
CV%	3	43.13	14.4	15.2	29.93	14.1	22.11	5.5	24.7
LSD 5%	6.9	15.63	0.4	6.5	0.48	16.1	1.06	5.71	3.5
p-value	**	*	NS	**	***	***	***	***	**

NS= Non-significant, * = significant, ** = very significant, *** = highly significant, S+Lb6w= Sorghum + lablab after six weeks, S +Lb4w= Sorghum + lablab after four weeks, S+Lbsi= Sorghum + lablab simultaneous, S+Lb2w= Sorghum + lablab after two weeks, PH =Plant height, MD = maturity date, DI = diseases incidence, PC = plot cover, SV =Stand vigor, SY (qt/ha) = Seed yield quintal per hectare, DMY = dry matter yield, GBth = green biomass yield.

Table 7. *Combined mean of phenology, growth, yield and yield related characters of Lablab as affected by sowing date grown in sole and intercropped with sorghum of two years (2019/20 - 2020/21).*

Treatments	MD	GBth	DMYt/ha	LSR	SV	PH (cm)	PC	SY (qt/ha)
S+Lb6w	184.7[a]	20.7[c]	2.15	0.67[a]	2.25[a]	100.8[d]	76.0[c]	4.2[e]
S+Lb4w	175.9[c]	27.6[cb]	2.31	0.53[b]	2[a]	17.9[d]	73.8[c]	12.7[c]
S+LbSi	180.4b	58.9[a]	2.16	0.52[b]	1.42[b]	129.1[ab]	90.6[ab]	19.9[a]
S+Lb2w	182.7[ab]	33.4[b]	2.29	0.68[a]	1.17[bc]	143.9[a]	85.7[b]	9.43[d]
Sole Lablab	179.4[b]	52.4[a]	2.29	0.54[b]	0.93[c]	116.3[c]	93.0[a]	14.6[b]
Mean	180.6	38.6	2.24	0.59	1.55	119.61	83.8	12.9
CV%	2.2	27.96	10.5	10.86	26.42	7.66	7.17	13.17
LSD 5%	3.29	8.85	0.19	0.05	0.34	7.51	4.93	1.31
p-value	***	***	NS	***	***	**	**	**

NS= Non-significant, * = significant, ** = very significant, *** = highly significant, S+Lb6w= Sorghum + lablab after six weeks, S +Lb4w= Sorghum + lablab after four weeks, S+Lbsi= Sorghum + lablab simultaneous, S+Lb2w= Sorghum + lablab after two weeks, PH =Plant height, MD = maturity date, DI = diseases incidence, PC = plot cover, SV =Stand vigor, SY (qt/ha) = Seed yield quintal per hectare, DMY = dry matter yield, GBth = green biomass yield.

4. Conclusions and Recommendations

Intercropping of lablab with sorghum has influenced on yield and yield components of sorghum. So, it is important to develop optimum sowing date of sorghum-lablab intercropping. The highest yield of sorghum grain yield was recorded from sole sorghum followed by sorghum + lablab intercropping after four weeks whereas the lowest was from Sorghum + lablab simultaneous intercropped. The highest grain yield of lablab recorded from Sorghum + lablab simultaneous intercropped whereas the lowest yield was recorded from sorghum + lablab after six weeks intercropped. The grain yield of intercropped lablab with sorghum in different sowing date was the same with potential productivity of lablab that intercropping lablab with sorghum has no influence on grain yield of lablab. In conclusion, this study has revealed that, lablab sown after four weeks later than sorghum is the appropriate sowing date in sorghum-lablab intercropping system. Therefore, it is recommended as the most compatible association to improve yields and yield related treats in the study area and other areas with similar agro-ecologies. Further studies should be conducted to test fodder nutritional quality and changes in soil macro and micro minerals.

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