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Growth characteristics and yield of jute mallow when intercropped with common cereal crops in Tanzania

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Abstract

In Tanzania, farmers harvest Jute mallow for granted when it grows without being cultivated. This limits its potential production and possibilities for exploiting its fully benefit in nutrition and market. This study was conducted to find a better intercropping combination which is agronomically viable with higher yield advantages by integrating Jute mallow in commonly grown cereals in Tanzania. Field experiment was conducted at Hombolo Agricultural Research Centre in Dodoma and the Nelson Mandela African Institution of Science and Technology (NM-AIST) farm in Arusha to assess the growth and yield performance of jute mallow when intercropped with either maize, sorghum or finger millet. The experiment was set in a randomized complete block design (RCBD) with three replications. Results showed that growth parameters of Jute mallow with sorghum and jute mallow with finger millet intercrops such as plant height, number of branches and number of leaves were not affected by intercropping. Jute mallow intercropped with maize suppressed growth and yield performance of Jute mallow. Among intercropped stands, Jute mallow intercropped with sorghum and with finger millet was not affected by intercropping on fresh leaf yield. However, all intercropped stands had yield advantages over mono-cropped stands, jute mallow-sorghum intercrop had the highest yield advantage with a LER of 1.7 and 1.53 in Dodoma and Arusha respectively. If farmers opt for intercropping and maximizing land use, this study recommends jute mallow to be intercropped with sorghum and with finger millet for better yields and sustainable growth.

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Introduction

African indigenous leaf vegetables are important sources of household nutrition and are highly valued for their nutritional and medicinal importance all over Africa (Ndinya, 2005). They improve human health, ensure food security (Maihuri and Rawat, 2013) and are great source of income to small household farmers especially to women in rural areas who are habitually involved in cultivating and sale of the vegetables (Schippers, 2000). Jute mallow (*Corchorus olitorius*) is one of the most common African indigenous vegetable which is highly adoptive to local conditions, tolerate harsh climate and highly nutritious. (Keding *et al.*, 2009). Jute mallow plays a great role in sustainable agriculture as it has low dependency on fertilizers, reasonably tolerant to water stress conditions and pest and diseases (Dhar *et al.*, 2018).

Despite all these advantages, this tropical leafy vegetable is mostly produced as small-scale vegetable in household home gardens (Maina and Mwangi, 2008). Also, the status of jute mallow in Tanzania is underprivileged as it is mostly considered as a poor man's crop despite its high nutritional base (Peter, 2008). The crop usually receives no management and grows in the farmers' fields as a volunteer crop without being organized into a proper farming format (Ojiewo *et al.*, 2013). As a result, farmers harvest it for granted when it grows without being cultivated. This limits its potential production and possibilities for exploiting its fully benefit in nutrition and market. Promotion towards production and consumption of jute mallow could assist in lessening problems of food insecurity and alleviate malnutrition in developing countries with reference to the growing population (Cordeiro, 2013). Intercropping system is one of sustainable practices that can assist in increasing availability of jute mallow along with efficient utilization of land resources for improved productivity. Besides, intercropping provides insurance against total crop failure, financial loss (Singh, Prasad and Pal, 2001) and involves benefits associated with yield advantages such as efficient use of growth factors and better use of solar energy (Matusso *et al.*, 2014). In Tanzania, preference is mostly given to cereal crops during cultivation, this provides a chance to integrate jute mallow in an intercropping system with commonly grown cereals. A study by Sarkar, Majumdar and Kundu (2013) showed that there is an increase in total equivalent yield of Jute crop in a strip crop association with rice under an interrow spacing of 20cm. Also, jute mallow-papaya intercrop showed a Land Equivalent Ratio of 1.60 which indicates that jute mallow intercropped stands are more advantageous than mono-cropping. (Aiyelaagbe and Jolaoso, 1992). A number of studies have been made on jute mallow, but the agronomic performance of Jute mallow in different cereal intercropping systems in Tanzania has not been characterized. Thus, this experiment was designed to evaluate growth and yield of jute mallow when intercropped with commonly grown cereals (Maize, sorghum and finger millet) with the aim of and maximizing land use and land resources (soil nutrients, solar radiation, water) and eventually improving the availability of jute mallow, Farmers can use the generated results to make proper cropping combination and promoting the cultivation of Jute mallow for improved crop productivity.

Materials and methods

Study area

Field experiments were conducted at farms of Nelson Mandela -African Institution of Science and Technology (NM-AIST) in Arusha and Hombolo Agricultural Research Institute in Dodoma, Tanzania. The NM-AIST farm is located at latitude - 3^{o}24' S and Longitude 36^{o}47' East at an altitude of 1168m.a.s.l., the Hombolo Research Station is located at latitude 5^{o}54' 29" S and longitude 35^{o}57'36" E, altitude of 1020m.a.s.l. Hombolo is found in a semiarid area having annual mean rainfall and temperature of 438.9 mm per annum and up to 35.1^{o}C respectively. Arusha has a mean annual rainfall of above 1000mm per year and a mean annual temperature of 24^{o}C.

Soil sampling

Soil samples were collected for lab analysis. Five soil samples were randomly taken from the experimental fields at a depth of 0-30cm, packed in sample bags and taken to the lab for analysis. The soil was then analysed for chemical and physical properties.

Study materials

The study involved Jute mallow intercropped with Maize, sorghum and finger millet. Accession "*Sudan 2*" for Jute mallow used was obtained from World Vegetable Center- Arusha. Seeds for sorghum "*Macia*" were obtained from Ilonga Agricultural Research Insitute and those of maize "*UHS 401*" and finger millet "*U15*" were obtained from Uyole Agricultural Research Institute.

Experimental design and establishment

The experiment followed a randomized complete block design (RCBD) with 3 replications in two different locations. In each block, there were 7 treatments namely; 1) T1. Jute mallow intercropped with maize, 2) T2. Jute mallow intercropped with sorghum, 3) T3. Jute mallow intercropped with finger millet, 4) T4 Sole jute mallow. The experiment was set in Dodoma on 5th of March 2019 and in Arusha on 3rd April 2019. In each site, the land was prepared by clearing, ploughing and layout before plantation. Plot size was 3m*3m. Each treatment plot was separated by 1m between treatment and 2m apart between blocks. The cereals followed the interrow spacing of 75cm and intra-row spacing of 60cm. Three seeds were sown per hill and thinned to 2 plants after emergence. To intercrop jute mallow, two rows were included between each cereal crop used in the experiment. To maintain similar plant population per ha, spacing of jute mallow was 25cm x 16cm for intercropped stands and 20cm x 20cm for sole jute mallow treatment. Three seeds were sown per hill and thinned to two plant after emergence. Plants were irrigated throughout the growing season.

Sampling and Data collection

Sampling for jute mallow was done on plants growing at the four central rows in each plot, while for cereals sampled plants for data collection were taken from the two central rows of each plot. Four plants samples were randomly selected from each plot for data collection. Data collected on jute mallow included: plant height, number of branches, number of leaves, stem diameter, leaf length, leaf width, canopy size and days to 50% flowering, fresh and dry leaf yield, number of pods, number of seeds per pod, seeds yield and 1000 seed weight. Data on growth parameters was collected six weeks after planting during leaf harvest. Leaf harvest was done on middle rows of half of each plot and the other half was left for data on days to 50% flowering and seed yield. Harvested leaves were solar dried for 6 hours and oven dried at 60°C for 2 days. Sampled plants from each plot were measured and an average value was calculated as a representative of each replicate.

Assessment of advantages of the intercrops over sole crops was obtained by calculating the Land Equivalent Ratio (LER). It is a tool used to assess and evaluate the competition of intercrop systems. It was calculated by the following formula;

$$\text{LER} = \frac{\text{intercrop jute mallow}}{\text{sole jute mallow}} + \frac{\text{intercrop cereal}}{\text{sole cereal}}$$

When the value of LER>1 = there is a yield advantage of farming as intercrops rather than monocrops. LER<1 = there is a yield advantage of farming as monocrops rather than intercrops. And when LER=1 means that there is no difference on the yield of intercrops and monocrops of the crops. Therefore, LER shows the effectiveness of intercropping system on utilizing the surrounding resources in the same piece of land in comparison with mono-cropping system (Fetene, 2003; Wahla *et al.*, 2009).

Data analysis

The data collected was subjected to analysis of variance (ANOVA) using the STATISTICA software (version 8.0). Treatment means were separated using the Fisher's Least Significance Difference (LSD) test at p=0.05 level of significance.

Results

Soil properties of the experimental areas

The soils pH was 6.04 and 6.41 for Arusha and Dodoma respectively. The values of Nitrogen (0.1%), Phosphorus (21.3 mg/kg) and Potassium (3.35 Cmol/Kg) in Arusha were relatively higher than

Nitrogen (0.09%) Phosphorus (15.1 mg/kg) and Potassium (0.83 Cmol/Kg) in Dodoma. The Cation exchange capacity and calcium content of Arusha and Dodoma were 15.20 Cmol/Kg, 24.78 Cmol/Kg and 9 Cmol/Kg, 2.46 Cmol/Kg respectively. Soil texture of the two sites were Clay loam and Sand-loam in Arusha and Dodoma respectively.

Growth parameters of jute mallow intercropped with maize, sorghum and finger millet

The results showed that site effect was significant on number of branches, number of leaves, leaf length and leaf width (Table 1). Jute mallow performed significantly higher in Dodoma than Arusha on number of branches (8.5plant^{-1}) and number of leaves (82plant^{-1}). On the other side Arusha had significantly higher values of leaf length (7.75cm) and leaf width (3.47cm) than Dodoma. Treatment effect was significant on plant height, number of branches, number of leaves, stem diameter, leaf length, leaf width and canopy size (Table 1). Jute mallow with maize intercrop significantly suppressed the growth of jute mallow in plant height, number of branches, number of leaves, stem diameter and leaf length as compared with Jute mallow sole crops and jute mallow intercropped with Sorghum and finger millet.

Even though sole jute mallow had higher values, but intercropping did not affect significantly the growth of jute mallow (plant height, number of branches and leaf length) intercropped with sorghum and finger millet. Stem diameter was significantly ($P \leq 0.05$) reduced when jute mallow was intercropped with sorghum (0.55cm) and maize (0.55cm). Jute mallow-sorghum intercrop significantly ($P \leq 0.01$) increased leaf width (3.2cm). Jute mallow intercropped with sorghum had the highest value of canopy size which was significantly different from Jute mallow with maize intercrop and at par with sole jute mallow and jute mallow with finger millet intercrops.

Table 1, Intercropping effect on growth parameters of Jute mallow intercropped with cereals at six weeks after planting.

	Height(cm)	No. of branches	No. of leaves	Stem diameter (cm)	Leaf length (cm)	Leaf width(cm)	Canopy(cm)
Arusha	66.62±2.61a	7.03±0.24b	75.23±1.90b	0.57±0.01a	7.75±0.19a	3.47±0.04a	26.35±0.67a
Dodoma	62.51±3.22a	8.5±0.47a	82±3.84a	0.59±0.02a	6.89±0.17b	2.47±0.07b	26.83±0.66a
Jute mallow +Maize	44.59±1.67b	5.58±0.24b	60.98±1.21b	0.55±0.02b	6.86±0.21b	2.87±0.18b	24.44±1.08b
Jute mallow +Sorghum	69.42±2.62a	8.13±0.54a	81.75±4.08a	0.55±0.02b	7.32±0.27ab	3.2±0.16a	28.18±1.02a
Jute mallow +Finger millet	70.56±2.56a	8.59±0.52a	85.9±3.27a	0.58±0.02ab	7.34±0.19ab	2.98±0.15b	27.74±0.67a
Sole jute mallow	73.69±2.79a	8.76±0.41a	85.81±3.67a	0.64±0.02a	7.76±0.38a	2.84±0.18b	26±0.50ab
2-Way ANOVA F-statistics							
Site	2.793 ns	14.93***	4.93*	1.179 ns	15.67***	177.84***	0.342 ns
Treatment	29.81***	15.06***	15.29***	4.16*	2.86*	4.79**	4.34**
Site* Treatment	0.271 ns	1.420 ns	1.708 ns	0.893 ns	4.60**	1.502 ns	2.221 ns

Values presented are means ±SE. Different letter(s) within the same column are significantly different at *p=0.05* as determined by Fisher's Least Significance Difference test. ns=Non significant, *, **, *** = Significant at $p \leq 0.05$: $p \leq 0.01$ and $p \leq 0.001$ respectively.

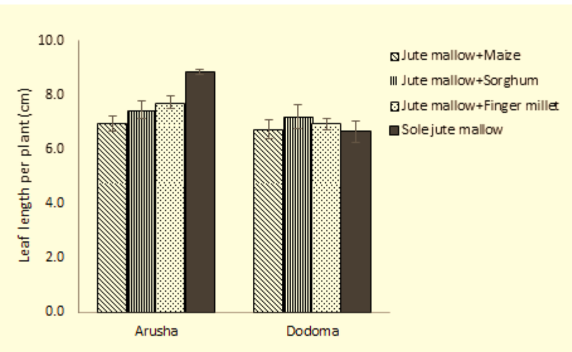

Fig 1. Graph showing site-treatment interaction on leaf length per plant of jute mallow.

Days to 50% flowering, %moisture content and biomass yield per plant of intercropped jute mallow

Site effect was found significant ($P \leq 0.01$) on biomass yield per plant where by Arusha (42.9g) was higher that Dodoma (34.95) (Table 2). Treatment effect was significant ($P \leq 0.001$) for days to 50% flower and biomass yield per plant. Intercropping significantly ($P \leq 0.001$) increased the number of days to 50% flowering. Comparing with other intercropped stands, Jute mallow intercropped with maize significantly recorded the longest number of days to 50% flower (59.75).

Jute mallow with maize and with finger millet intercrops significantly suppressed biomass yield per plant of jute mallow to 32.32g and 33.83g respectively.

The highest value of biomass yield per plant was from sole jute mallow (45.16g) followed by Jute mallow intercropped with sorghum (44.4g) (Table 2).

Table 2. Days to 50% flowering, Moisture content and Biomass yield of Jute mallow under cereal intercrops.

	% Moisture content	Days to 50% flowering	Biomass yield per plant
Arusha	57.68±2.32a	56.3±0.60a	42.9±2.59a
Dodoma	56.36±1.59a	56.21±0.57a	34.95±1.88b
Jute mallow+ Maize	57.97±2.90a	59.75±0.71a	32.32±3.08b
Jute mallow+ Sorghum	53.2±3.04a	56.09±0.45b	44.4±3.70a
Jute mallow+ Finger millet	61.97±3.09a	55.67±0.33b	33.83±2.59b
Sole jute mallow	54.95±1.44a	53.5±0.47c	45.16±2.47a
2-Way ANOVA F-statistics			
Site	0.223ns	0.02 ns	7.79**
Treatment	1.893ns	23.63***	5.69***
Site* Treatment	0.355ns	0.01 ns	0.3187 ns

Values presented are means ±SE. Different letter within the same column are significantly different at p=0.05 as determined by Fisher's Least Significance Difference test. ns=Non significant, **, *** = Significant at p≤0.01 and p≤ 0.001 respectively.

Intercropping effect of cereals (maize, sorghum and finger millet) on jute mallow leaf and seed yield

Results showed that site effect was significant (P≤0.05) on plant weight, stem weight, fresh leaf weight and dry leaf weight. Arusha had significantly higher values of Jute mallow on plant fresh weight (102.57g), stem weight (58.75g), fresh leaf weight (42.19g) and dry leaf weight (42.19g) than Dodoma. (Table 3) Treatment effect was significant (P≤0.05) in plant weight, stem weight, fresh leaf weight and dry leaf weight. Jute mallow with maize intercrop suppressed plant weight, plant stem weight and fresh leaf weight. Dry leaf weight of Jute mallow was reduced when intercropped with sorghum. The study also showed that site effect was significant (P≤0.05) on pods per plant, pod length, seeds per pod, 1000 seed weight and plant seed yield. Jute mallow in Arusha had significantly higher values on pods per plant (15.44g), 1000 seed weight (2.35g) and seed yield per plant (5.3g) than Dodoma. Pod length (6.38cm) and seeds per pod (161.87) in Dodoma was found significantly higher than Arusha (Table 3). Treatment effect was significant (P≤0.05) in pods per plant, pod length, seeds per pod and seed yield per plant. Pods per plant and seeds per pod of jute mallow were suppressed when jute mallow was intercropped with maize. Seed yield per plant of jute mallow was negatively affected by intercropping. Moreover, intercropping effected negatively pod length (5.74g) and plant seed yield (4.9g) in jute mallow and finger millet intercrop (Table 3). Site-treatment interaction was significant in number seeds per pod, 1000 seed weight and plant seed yield (Fig 2). Intercropping had a negative effect of on number of seeds per pod in Dodoma. 1000 seed weight and plant seed yield were suppressed by jute mallow with maize and finger millet intercrops in Arusha. Jute mallow intercropped with finger millet had significantly higher values of 1000 seed weight and plant seed yield in Dodoma. On the same parameters, jute mallow with sorghum intercrop was not affected by intercropping in Arusha. (Fig 2)

Table 3. Plant yield response of jute mallow intercropped with maize, sorghum and finger millet.

	Plant fresh weight (g)	Fresh stem weight (g)	Fresh leaf weight per plant (g)	Dry leaf weight per plant (g)	No. pods per plant	Pod length (cm)	Seeds per pod (No.)	1000 Seed weight (g)	Seed yield per plant(g)
Arusha	102.57±3.83a	58.75±2.43a	42.19±1.86a	17.43±0.92a	15.44±0.46a	5.71±0.08b	144.57±3.31b	2.35±0.07a	5.3±0.30a
Dodoma	79.12±2.77b	45.08±1.95b	32.83±1.21b	14.35±0.73b	13.77±0.36b	6.38±0.11a	161.87±3.35a	2.11±0.06b	4.7±0.21b
Jute mallow +Maize	75.8±4.53b	43.57±3.18b	30.48±1.75b	12.67±0.96b	13.5±0.56b	5.83±0.07b	143.02±3.48b	2.32±0.09a	4.51±0.31b
Jute mallow +Sorghum	94.98±4.96a	54.78±3.81a	39.92±2.50a	18.21±0.88a	14.67±0.62ab	6.33±0.20a	154.73±4.78ab	2.14±0.10a	4.87±0.38b
Jute mallow +Finger millet	91.94±6.24a	52.6±3.86a	37.89±2.63a	13.92±1.06b	14.51±0.40ab	5.74±0.18b	153.53±7.00a	2.19±0.08a	4.9±0.37b

	Plant fresh weight (g)	Fresh stem weight (g)	Fresh leaf weight per plant (g)	Dry leaf weight per plant (g)	No. pods per plant	Pod length (cm)	Seeds per pod (No.)	1000 Seed weight (g)	Seed yield per plant(g)
Sole jute mallow	100.66±5.31a	56.7±2.98a	41.75±2.39a	18.75±1.12a	15.72±0.77a	6.29±0.12a	161.59±4.48a	2.28±0.12a	5.71±0.37a
2-Way ANOVA F-statistics									
Site	33.19***	22.07***	24.20***	10.00**	10.06**	37.65***	20.48***	9.50**	4.96*
Treatment	6.87***	3.98*	6.75***	10.72***	2.97*	7.70***	4.03*	1.060 ns	3.60*
Site* Treatment	1.461ns	0.267ns	0.822ns	0.348ns	2.431ns	2.22ns	5.94**	6.02**	11.02***

Values presented are means ±SE. Different letter(s) within the same column are significantly different at p=0.05 as determined by Fisher's Least Significance Difference test. ns=Non significant, *, **, *** = Significant at p≤0.05: p≤0.01: and p≤ 0.001 respectively.

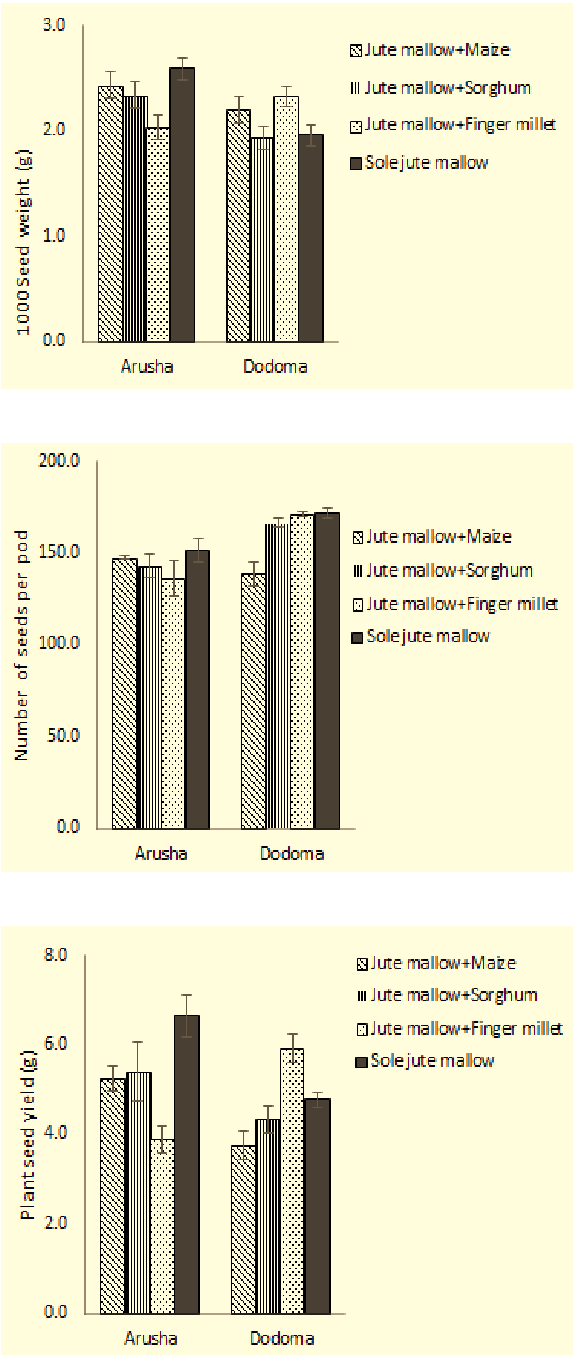

Fig 2. Graphs showing site-treatment interaction on number of seeds per pod, 1000 seed weight and plant seed yield.

LER of jute mallow intercrops

Efficiency of the intercropping system was determined by the LER of each intercropped treatment. The study showed that all intercrops had a LER greater than 1 which means that they all have yield advantages over monocrops (Fetene, 2003; Wahla *et al.*, 2009). Jute mallow with sorghum intercrop had the highest yield advantage with LER of 1.7 and 1.53 for Dodoma and Arusha respectively (Table 4). This means that it requires 70% and 53% more land resource in Dodoma and Arusha to obtain the same yield in mono-cropping. Jute mallow intercropped with finger millet was found to have the lowest L.E.R of 1.23 and 1.22 in Arusha and Dodoma indicating that there is a yield advantage of 23% in Arusha and 22% in Dodoma (Table 4). However, there was no significant difference of L.E.R. among the intercrops in Arusha.

Table 4. LER of Jute mallow intercrops in Arusha and Dodoma.

	Treatment	Arusha	Dodoma
Arusha	Jute mallow +Maize	1.31±0.12a	1.28±0.06b
Arusha	Jute mallow +Sorghum	1.53±0.12a	1.7±0.08a
Arusha	Jute mallow + Finger Millet	1.23±0.19a	1.22±0.06b
Level of significance		0.360740	0.000342

Values presented are means ±SE. Different letter within the same column are significantly different at *p= 0.05* as determined by Fisher's Least Significance Difference test.

Discussion

Comparing sites, Dodoma had higher number of leaves and number of branches of jute mallow relative to Arusha. Arusha had higher leaf length and leaf width than Dodoma. This may be attributed by relative low temperatures in Arusha which may have reduced the number of branches and number of leaves per plant but increased the size of the leaf.

Similar findings were found in potato plants where by cooler temperatures lowered total number of branches of potato and increased leaf size. (Manrique *et al*., 1989; Wolf *et al*., 1990) Also a study on factors affecting number of leaves preceding the first inflorescence of Tomato also indicated that number of leaves preceding decreased with lower temperatures (Dieleman, 1992). Nordli *et al*. (2011) also found that low temperature decreases number of leaves of *Hydrangea macrophylla* cultivars before flowering.

Intercropping of Jute mallow with sorghum and finger millet performed significantly ($P \leq 0.05$) similar to the mono-cropped stands in plant height, number of leaves and number of branches. These attributes are known to highly contribute to the plant leaf yield. However, jute mallow did not perform well when intercropped with Maize. Maize suppressed the growth of Jute mallow. This can be due to the shadow effect from maize leaves, competition on nutrients and underground interactions of plants (Ndakidemi, 2006). Maluleke *et al.* (2005) and Nyoki (2017) reported a decrease in number of leaves per plant and stem girth of a legume plant respectively when intercropped with maize. From this study, it was also found that site treatment interaction on leaf length was significant. Leaf length per plant was significantly increased with monocropping in Arusha while Dodoma showed no significant difference in leaf length. This may be caused by high fertility levels of soils in Arusha which gave good growth resources to the treatment with potential to exploit the resources nicely. This study further reviled that intercropping jute mallow with millet and maize decreased biomass yield of jute mallow. Intercropping also delayed number of days to 50% flowering of jute mallow. Severe nutrients competition and low growth rate of the crops caused by high plant density in intercropping system might have caused low biomass yields and delayed flowering. Maluleke *et al.* (2005) also reported reduced yield in maize/lablab intercrops relative to monocrops and Moriri *et al.* (2010) reported an increase in days to 50% flowering of cowpeas when intercropped with maize relative to its sole stands.

Arusha had higher leaf yields than Dodoma which is because of difference in fertility levels of the sites whereby Arusha had better levels of Nitrogen, Potassium and Phosphorus than Dodoma. The study revealed that whether jute mallow was grown in monoculture or intercropped with finger millet and sorghum, there was no significant difference in the plant fresh weight, fresh stem weight and fresh leaf yield obtained. However, jute mallow with maize intercropping reduced plant fresh weight, stem fresh weight and leaf yield of jute mallow. Competition for light and plant nutrients might have led to reduced leaf yield of jute mallow. Same results were reported by Rabbany, (1996) whereby jute mallow intercropped with stem amaranthus had lower yield and other yield components than mono-cropped stands. In this study, 1000 seed weight did not differ with cropping system. However, seed yield per plant was negatively affected by intercropping. Intercropping jute mallow with maize, finger millet and sorghum significantly lowered the jute mallow seed yield per plant as compared with sole cropping. Also, there was a decrease in number of seeds per pod when jute mallow was intercropped with maize in Dodoma. Possible explanation could be presence of interspecific competition on plant resources which hindered seed yield development and yield attributes in intercropped stands. Katsaruware and Manyanhaire (2009) reported that interspecific competition in intercropping systems hinders better access to resources for growth and yield in intercropped plants than sole crops. Similar results were found by Emuh (2014) whereby pigeon pea intercropped with jute mallow had lower seed yield than sole cropping system. Reduced grain yield was also recorded on soybean when it was intercropped with maize compared with when it was in sole cropping. (Nyoki, 2017)

This study also found that there was a yield advantage of intercropping jute mallow with maize, sorghum and finger millet than mono cropping with LER of 1.31, 1.53 and 1.23 for Arusha and 1.28, 1.7 and 1.22 for Dodoma respectively. This is possibly due to intercropping advantages such as reducing water evaporation and efficient utilization of nutrient resources as described by Ghanbari *et al.* (2010). Aiyelaagbe and Jolaoso, (1992) also reported that there was a yield increment and a high LER of 1.6 when jute mallow was intercropped with papaya. Also, a study by Rabbany, (1996) showed a LER greater than one when jute mallow was intercropped with mungbean, cowpea and stem amaranthus. In this study, jute mallow and sorghum intercrop had the highest LER and the lowest LER was from jute mallow and finger millet intercrop.

Conclusion and recommendation

This study assessed growth and yield performance of Jute mallow under cereal intercrops. As preference is mostly given to cereal crops, this study aimed at increasing the availability of jute mallow by utilizing the space between commonly grown cereals in Tanzania. The study indicated that growth parameters recorded from intercropping of Jute mallow with sorghum and with finger millet such as plant height, number of branches and number of leaves were not affected by intercropping. Intercropping Jute mallow with maize reduced the growth and yield performance of Jute mallow. Fresh leaf yield of Jute mallow intercropped with sorghum and with finger millet was not affected by intercropping. Also, all intercropped stands had yield advantages over mono-cropped stands with Jute mallow and sorghum intercrops having the highest LER. Therefore, if farmers opt for intercropping and maximizing land use, this study recommends jute mallow to be intercropped with sorghum and with finger millet for better yields and sustainable growth. Farmers may use the results generated by this study to make proper cultivating arrangements by including jute mallow in their farming plan, at the same time promoting cultivation of Jute mallow. However upcoming researchers can put their focus on which spacing requirements will be more suitable for the intercropping system of jute mallow with maize, as it relatively did not have better growth and yield performance in specified locations of this study.

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