Sudan University of Sciences and Technology

College of Graduate Studies

Effect of Intercropping of Clitoria(*Clitoria Ternatea L*)on Growth Yield of Maize (*Zeamays L.*)

أثر الزراعة المختلطة مع الكلايتوريا على نمو وإنتاجية الذرة الشامية

A Thesis submittal in Partial Fulfillment of the Requirements for the Degree of M.Sc. in (Agronomy)

By

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Dedication

To my parents

To my brothers

And to my extended Family aunts and uncles

Acknowledgement

First I want thank Allah who support me with ultimate help,patience andstrength to complete this project successfully.

Iam greatly indebted to the guidance,support, encouragement andcontinued help along the study time of **Prof.Ahmed Ali Mohammed Osman.**

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Abstract

Afield and a pot experiment wereconductedin season2016\2017 in the demonstration farm of theCollege of the College of AgriculturalStudies,SudanUniversity of Science and Technology,in Shambat, to study the effect ofintercropping maize cultivars Hudeib2 and var 113with clitoria,and to choose the best seed rate of clitoria.

The treatment consisted two of maizecultivarsand five level of intercropping arranged in split plot designwith three replication .Data werecollected in plant heightnumber of leaves,stem diameter,fresh weighand dry weight.

Resultsshowed the were significant different effectin plant height, stem diameter an dry weight in the field experiment. Significantdifferent and highlysignificant different was observed between cultivars in number leaves and stem diameter respectively insecondexperiment. Also, highlysignificant different were reported among intercropping levels in plant height and fresh weight in the same experiment.while therewere non significant differences on number of leaves and fresh weight.

مستخلص الدراسة

أجريت تجربة المزرعةوالأصيص بالمزرعةالتجريبية في كلية الدراسات الزراعية جامعة السودان للعلوم والتكنولوجياشمبات وذلك فيموسم2016 -2017 بهدف دراسة تأثير الكلايتوريا علي صنفين من الذرةالشامية حديبة2و var 113ومعرفة أفضل معدل بذور

وصممت التجربة علي القطاعات المنشقة,وشملت صنفين من الذرةالشامية وخمسه معاملات من خليط الذرةالشامية والكلايتوريا وثلاث مكررات .ثم رصد معايير النمو الخضري والإنتاجية المتمثلة في طول النبات، وعدد الأوراق، وسمك الساق، الوزن الرطب والوزن الجاف.

وأظهرت نتائج التحليل الإحصائي وجود فروقات معنوية لطول النبات ,وسمك الساق والوزن الجاف ب النسبة لتجربة الحقل ,ولوحظ في التجربةالثانية (الأصيص) وجود فروق معنوية بين عدد الوراق وفرق معنوي عالي جدا لسمك الساق علي التوالي ,وأيضاوجود فروقات معنوية عاليه لمستويات المعاملات في طول النبات والوزن الرطب وذلك في التجربةالثانية .

CHAPTER ONE

INTRODUCTION

Improved agronomic management was reported to improve nitrogen level in the soil. Various production practices, including plant follow crop of rotations and intercropping system have helped to counteract loss of nitrogen from the agricultural system.

The shortage of feed particularly during the dry season is one of the major factor limiting livestock productivity in Sudan. Animal is of low resource in Africa usually gaining weight during the rainy season, part of which is lost during the harsh period of the dry season. Live weight loss during this period for the reason of protein deficit in the diet of rural areas communities. Therefore the strategies for alleviation protein deficiency are by supplementation with produced forage legume and grasses which showed great potential alleviate this problem (Omer, 2008).

Intercropping is a method of growing two crops or more in the same area of land at certain time. Intercropping is used to improve soil properties. Fodder mixtures have many benefual used for land to gain increased efficiency of land use, because the legume crops and grasses with different roots absorb food from different soil layers, as well as more efficient use of solar energy and can also improve the soil physical and chemical properties.

Forage intercropping is defined as mixed forages contain a species or more of a legume sown with a species or more of grasses with a certain seed rate. These mixtures can be used for pasture, hay, silage and multipurpose (Ibrahim, 2005).

In Sudan, intercropping of cereals with legumes is a predominant feature in the cropping system which practiced in small holding as a means of maximizing the use of limited land as well as attaining food security to the

subsistence farmers. In western Sudan, the usually intercropping system practice is a cereal-legume mixture, where millet and sorghum are widely used as a cereal component of intercropping with crops such as cowpea, groundnut, sesame or roselle. Therefore, this system is considered to help farmers utilizing their limited resource (natural and labor resources)for attaining yield stability, obtaining higher yield per unit area, and having better control of weeds, pests, and diseases. The essential future of intercropping system are that they exhibit intensification in space and time, competition between and among the system components for light, water and nutrient and the proper management of them (Ahmed,*et.al*, 2013).

The Objectivesare:

1- To study the effect of clitoria on maize and to choose the best seed rate of clitoria on maize in intercropping.

CHAPTER TWO

LITERATURE REVIEW

2-1Intercroping

Intercropping is agricultural practice and cultivation of two crops or more in the same space at the time as defined by Andrews and Kassm, 1976. Sullivan, 2003 added that intercropping promotes the interaction between the different plants.

Economic plant species are grown in mixture for many reasons, but the most reason for producing food intercrops is to increase land use efficiency. Land use efficiency in turns, is usually with biological efficiency Abdo *et al* 2011. pointed out, however, there are many practical advantages to intercropping that are not necessarily due to an increase in biological efficiency. Baldev *et al*.,(1993) added that the compatibility of grass legumes intercropping has been increased. The term intercropping usually coupled with sustaining agricultural food and forage for livestock without depleting the earth resources; by application of principles Earless,(2005) Diversity permits better resources use efficiency in agro-ecosystem, due to higher variation. There is greater microhabitat differentiation allowing the components special and varieties of the system to grow in an environment ideally suited to its special requirement Mazaheri and Oveyi, (2004) intercropping is becoming so important to increase crop product and to satisfy food demands of an increasing population. It is acommon cropping system in the developing countries Li *et al*,(1999) the intercropping system are more appropriat in terms of sustainability than sole cropping of cereals since the legume component enrich the soil through nitrogen fixation there was also good ground cover during intercropping which was important with regard to soil conservation especialy at the early stage of maize crop Tilahun,*et. al* (2012). Mukhebi and Onim,(1983) observed that the yield potential of mixed

cropping system could be increased substantially through improved management practice. The high cost of labour for hole weeding owing to the fact that farmers weed up to four times with limited use of herbicide due to lack of sufficient capital and technical knowhow of farmers in Nigeria has made it necessary to focus research efforts into studying compatible crop to be grown in mixture and arrangement that can control weed better.

Production of forage crops is very important to meet population livestock In Sudan. The country, according to recent animal census has 38.3million head of cattle,48.0 million sheep,42.0 million goats and 3.3 million camels Ministry of Animal Resource (2005). The most important forage crop cultivated under irrigation in Sudan are alfalfa,abusabien,clitoria,lubia, phillipsara, Sudan grass and other forage crop like Rhodes grass, Kabbashi (1991).

Most of the animal wealth in Sudan are greatly dependent on the natural vegetation as their major source of feed for maintenance and the production .this attitude is clearly reflected on poor output and performance of animal resulting poor quality of forage and the problems of over and under grazing.The possible solutionto support the natural pastures is to establish and develop the irrigated pastures and encourage the utilization agricultural of products and residues that are produced in huge amounts for animal in the SudanAbuswar,(2005). These mixtures can be used for pasture, hay, silage and multipurpose Ibrahim (2015).The relative time of planting of the intercrop before, at the same time or after the main crop has biological and practical implication. For example, differential sowing minimizes competition for growth limiting factors as peak demand for these factors occur at different time.Also ensure full utilization growth factors because crop occupiesthe land throughout the growing season. Similarly spatial distribution in the field is of great importance when intercropping two or more species, since it effects the efficiency with which solar radiation and space are utilized, Abdo *et al*,(2011) . Cropping system are widely used all over the Sudan. A combination of

intercropping, cropping and mixed cropping is common practice in many parts of Sudan,specially legumes and grasses. Different combination of the crop are a routine in Sudan as cow pea sorghum Musa *et al*,(2012).

Mixed cropping as a method for crop intensification is commonly practiced in density populated countries to provide more food.Recent experimental suggested yield are obtained from mixed cropping system than from growing monoculture crop Ciftci, *andEhmet* (2005). Many of the yield and quality benefits of the mixture may be attributed to nitrogen transfer between the legume to the associated grasses *Geoge et al,;(*1995).Hence, development of compatible, persistent grass-legume mixtures can increase seed yield and quality in grasses.Improved grasses and legumes have been recommended for intensive value. AlsoMelku,(2004) noticed that the advance of maturity in forage is associated with content of detergent fibers (Lignin and detergent insoluble nitrogen),and low content of N, all of which cumulative depress feed intake digestibility.Matt and Dycck,(1993); Poggio(2005),*Banik et al;*(2006)and *Fernandez et al*;(2007) reported that intercropping with cereal reduced infection by Orobanche crenate legume. Whitmore and Schroder.(2007)concluded that intercropping may be a useful mean to reduse nutrient pollution from farming while maintaining yield. At EL Gezira Station. (1986) reported four forage legume (lablab, Phaseolus trilobus, Clitoria ternatea),to fix atmospheric nitrogen in sole cropping and in association with sorghum (*Sorghum bicolor*).He indicated that dry matter yield ranged between 3.3 and 7 t\ha per cut total N yield between 62 and 140 kgN\ha.

Mixed cropping reduced greatly the dry matter and Total N yield in mixture cropping of phaseolus trilobus,Clitoria turnatea and Cajanus cajanus,due to the smothering effects of sorghum However, Abusuwar (2005),reported that the average yield of Clitoria in ELGezira rotation, ranged between 7-12 ton\feddan per cut of fresh and about 2-4 ton\faddan per cut dry matter.On the other hand, increasing demand for animal production in the tropics lead to

integration of crop and livestock production to improve quantity and feeding value of biomass fodder Ghosh, (2004). Also intercropping with cereal and legume not only improve soil provide advantage to the cereal crops which may enhance net returns Amasaib,(2009). Under the range land condition where the plant are allowed to grow unchecked throughout,the crude protein typically decline to quite low levels as the herbage *matures Dzewela et al*,(1990). Young growth is very palatable,but after the plants have seeds they become less attractive Anonymous,(2010).

2-1-1 Importance of intercropping

Improved grasses and legumes have been recommended intensively due to their high forage production and nutritive value. Improved grasses are probably of the cheapest high quality roughages that are grazed or harvested at early stage of maturity.

Intercropping is becoming so important to increase crop productivity and to satisfy food demands of an increasing population. It is a common cropping system in the developing countries Li *et al*,(1999). The most important attraction of intercropping is that the yield advantage can usually by achieved simplyand, namely by growing crops together rather than separately.Will, (1990).Several review emphasized another role for intercropping rather than productivity Baumann,(2004) stated that the intercropping gained an increasing interest in an attempt to substantiate functional agricultural biodiversity production and to reduce pesticide use.

2-1-2Type of intercropping

There are four common practiced types of intercropping as identified by Andrews and Kassam, (1976).

1- Mixed intercropping, in which the two or more crops are grown without row spacing.

2- Row intercropping which is the growing of the two crops at the same time with at least one crop planted in rows.
3- Strip intercropping is the cultivation of two or more crop in strip wide enough to allow crop production and using of machines but close enough to give the chance for crop interaction.
4- Further temporal separation in found in relay cropping where the second crop is sown during the growth (often near the onset of reproductive development or fruiting) of the first crop, so that the first crop is harvested to make room for the full development of the second.

2-2 Importance of Clitoria:

Clitoriaturnatea commonly known as butterfly pea belonging to the family Fabaceae and subfamily Papilionaceae is a perennial leguminous twiner. Clitoria Linn. comprises 60 species distributed mostly within the tropical belt with a few species found in temperate areas. The mostly frequently reported species is Clitoria ternatea. The plant is mainly used as a forage as it is highly palatable for live-stock and it is well adapted to various climates Gomze,(2003). Native to the island of Ternate in the Molluca archipelago, this species is now widely grown as ornamental, fodder or medicinal plant ain,(2003). The plant originated from tropical Asia and lat was distributed widely in South and Central America, East and West Indies, China and India, where it has become naturalized Barik, (2007). Clitoria ternatea is commonly also called Clitoria, blue-pea, kordofan pea (Sudan), cunha (Brazil or pokindong (Philippines). This plant is known as Aparajit (Hindi), Aparajita (Bengali), and Kokkattan (Tamil) in Indian traditional medicine Parimaladevi, (2003). It has several synonyms in Ayurvedic scriptures like: Sanskrit names: Aparajita, Girikarnu, Asphota and Vishnukranta. English names: Butter-fly pea, Mazerion and Winged leaved Clitoria. Local names: Aparajita. (Hin), Aparajita (Beng), Gorani (Guj), Gokarna (Mar) and Buzrula (Arabic).

2-3Background of maize

Maize or corn(*Zea mays L*) is a monoecious plant that belong to the family poaceae. Maize is the third most important cereals (Lerner and Dona,2005).The origin of maize remains uncertain Although its generally a great that it's evolution into modern forms took place in Mexico,and it was introduction to Africa by the Portuguese in the sixteenth century it became the most important staple food crop in the world after wheat and rice and has greet yield potential and attained the leading position among cereals based on production as well as productivity, Keskin.,et al (2005). Advances in maize genomics,breeding and production have significant role on the lives of large propotion of the world's populationXuand Crouch,(2008) maize is amultipurporse crop, provides food for human, Feed for animals and poulty,and fodder for livestock. It is rich source of raw materials for the industry. Also, maize is an important source calories and protein in human diet in many countries of the world and is the main staple food in Africa particularly in eastern Africa Krivanek *et al*., (2007). Nutritionally, Maize is deficient in two essential amino Acids, lysine and tryptophan, Therefor, there are concerns about the supply of the tow essential amino Acids in the regions where it constitutes the daily food. Maize is cultivated throughout the world and greater amounts of maize are produced each year than any other grain IGC,(2013). The United states of America produces 40% of the world harvest. The top ten maize producers in 2013 (production in tons)are United States of America (353,699,441), China (217,730,000), Brazil (80,516,571), Argentina (32,119,211), Ukraine (30,949,550), India (23,290,000), Mexico (22,663,953), Indonesia (18,511,853), France (15,053,000), and south Africa (12,365,000), Sudan is 117 in the world ranking (FAOSTAT, 2014).In 2009,over 159 million hectares of maize were planted worldwide, with and average yield can be significantly higher in certain regions of world FAO,(2009).

2-4The Importance of maize on Sudan:

In Maize, Is recently adopted in the Sudan and may have been introduced during the TurKish colonial period in the nineteenth century Mukhtar,(2006) and commonly grown in limited area under rainfed and flood, irrigated condition Haroun,(2007). Cereal grains are the most importance component of Sudanese diet. Understanding of cereals production characteristics, in the Sudan, is vital for maintenance of efficient and sustainable agricultural and food production Abdel Rahman,(2002).The popular name of maize in the Sudan "*Aishelreef*" is consistent with the above notion.

In the Sudan, maize is considered as minor crop and it is normally grown in Sinnar and Blue Nile states or in small irrigated areas in the Northern states with average production of about 0.697 ton\ha FAO,(2005).

In the Sudan, it is produced in the Northern region (Northern and River Nile states) of the country having long cool and hot seasons (which is considered a suitable area of maize production). The Northern states is charactered by good fertile soil and suitable climate. In addition to the ground water resources in the Nubian sand stone. Also the area free from diseases and pests compared to other partes of the Sudan North state, Ministry of Agriculture,(1995) in the traditional farming of Sudan,the low productivity of maize was attributed to low yield ability of the local open- pollinated cultivars that are normally grown and the greater sensitivity of the crop to water stress Mukhtar,(2006).Recently, there has been increasing interest in developing maize production in Sudan. However, work in maize improvement in the Sudan is limited and only few cultivars have been released and the work in miaze cultural practices is scanty. Maize is nitro positive and needs ample quantity of nitrogen to attain high yield. Nitrogen deficiency is a key factor for limiting maize yield Alvarez and Grigera,(2005) it is, therefore,

imperative to use an optimum amount nitrogen through a suitable and efficient source.

2-5Utilization of Maize

Miaze the American- Indian word for corn, means literally "that sustains life "it provides for humans, animals and servesd as important raw material for the production of starch, oil and protein,alcoholic beverages, food sweeteners and more recently fuel.The green plant made into silage, has been used with great success in the dairy and beef industries. The straw is good forage for ruminant animals in the developing countries. The erect stalks, which in some varieties are strong have used long lasting fences and wallsin many other regions,it is consumed as a vegetable it is agrain crop. The grain are rich in Vitamins A, C and E, carbohydrates, essential minerals and protein. Maize is processed prepared in various forms depending on the country. Ground maize is prepared into porridge in Eastern and Southern Africa. In all parts of Africa, green (Fresh) maize is boiled or roasted on its cob and served as to a snack. A heavy reliance on maize the diet, night blindness IITA,(1992).

2-2-3 Botanical Feature

Botanicaly, maize or corn is a member of the Mayday which belongs to the grass family (Gramineae) and is a tall annual plant with an extensive adventitious root system. It is a cross pollinated monoecious plant, the kernels are often white or yellow in color but also black,red and mixtures of colors are found. The maize kernel the known botanically as caryopsis (Krivanek*et al*., 2007)

CHAPER THREE

MATERIALS AND MATHODS

3-1 The experimental site.

Were conducted ducted at latewinter at the demonstration farm of the College of Agricultural Studies, Sudan University of Science and Technology.

Theclimate of the locality is tropical semiarid with only three months of rainfall during July,August and September.

The soil isatypical clay soil characterized by a deep cracking moderately alkaline clay,and low permeability, low nitrogen content and pH ranging between 7.5-8 Abdel Hafeez, (2001) it is permeability is related to both high pH 7.5 -8) content (50 -60) and high in sub soil Saeed,(1968).

Source of Seeds

The material used in the study was consisted of two cultivars, Hudiba 2 and Var 113 of corn (*Zea May L*). Which from Agricultural Research Corporation (ARC),Wad Medani and Shamba tResearch Station.

3-2Field Experiment

3-2.1 Land Preparation for the first experiment

The land was ploughed using disc plough and then followed by harrowing, leveling and ridging. The Experiment was laid out in a split Block Design (SPD) and three replication. The area of experiment was divided into 30plots each 2*3 meter, each plot consisted of 3 ridges North- South 70cm apart, and 20cm spacing between plant.

3-2-2The Treatment and layout:

1- OneMaize seed per hole broadcasted as pure stand
2- One Maize with 1seed rate of clitoria
3- One Maize with 2 seed rate of clitoria
4- One Maize with 3 seed rate of clitoria
5- OneMaize with 4 seed rate of clitoria

Seeds were sown by hand on7\3\2016,Irrigation water was applied immediately after sowing seeds. Hand weeding was done once 4 week after planting sowing.

3-3 Pots Experiment

The second experiment was carried out in pots

The experiment was laid out arrangement in a Split Plot Design, The of experiment was carried out in pots.

The Treatment and layout

1- OneMaize broadcasted as pure stand
2- OneMaize with 1seed rate of clitoria
3- OneMaize with 2 seed rate of clitoria
4- OneMaize with 3 seed rate of clitoria
5- OneMaize with 4 seed rate of clitoria

Seeds were sown by hand on 21\4\2016.Irrigation water was applied immediately after sowing.

3-4 Characters studied

Five plants were randomly selected from each plot and tagged. Measures were taken room these tagged plants at 50% flowering stage.

3.4.1.Plant height (cm)

The plant height was measured from the base of the main stem to the tip of panicle using meter tape average plant height was calculated.

3.4.2 Number of leave

It was the counted from five tagged plants and the average was determined.

3.4.3Stem diameter (cm)

It was determined by measuring on the stalk at 10cm above the ground level, average was determined. Average was different for the five selected plant.

3.4.1 Fresh Weight (g/plant)

Five plants were selected randomly from each plot and weighed, then the average fresh weight per plant was recorded.

3.4.1 Dry Weight (g/plant)

The same plants were oven dried at a temperature of 80^{O} C for 48hours and then weighed and average dry weight per plant was recorded.

3.4.1.6 Statistical analysis

The analysis of variance was carried out according to standard statistical procedures described by Gomes and Gomez (1948),using split plot Design.The least significant difference test was used for mean separation. Data of all parameters were analyzed using the computer package **Gen-Stat**.

CHABTER FOURE

Results

4-1 Plant height:

The statistical analysis Table1 showed significant difference at (p= 0.05) in plant height .stem diameter and plant dry weight.

The highest means of plant height was obtained 4 seeds intercropping (Table 3)(82.5cm),while control obtained the highest plant height experiment 2(Table4)(35.40 cm).

4-2 Number of leaves:

No significant difference were shown between (intercropping levels) with first experiment(2.26) and second experiment(0.29)respectively (Tabl1)(Table2),and there was significant difference between the two cultivars of maize in the second experiment (Table2).However the interactions there were non significant difference in first and second experiment.

The highest means is obtained by 4 seeds intercropping levels first experiment (Table3),while lowest was reached in treated 1 seed (Table3).

2-3 Stem Diameter:

(Table1) exposed significant differences among (intercropping levels) in the first experiment(0.513), whereas the second experiment showed no significant difference (0.063) (Table2). High significant difference between the two cultivars.

Table 1: Mean squares of analysis of variance of two maize cultivars and 5 levels of intercropping with clitoria at shambat First experiment.

Character	Source						
	Varity (d.f=1)	**Error(a) (d.f=2)**	**Intercropping (d.f=4)**	**Variets* Intercropping (d.f=4)**	**Error(b) (d.f=16)**	**F. calculate**	**F. table**
Plant height (cm)	273.1^{Ns}	88.2	58.8**	45.2^{N}	143.2	4.05	1%= 4.77 5%= 3.01
Number of Leave	1.26^{Ns}	6.79	$2,26^{Ns}$	0.46^{Ns}	1.36	1.72	
Stem Diameter (cm)	1.06^{Ns}	0.31	0.513*	0.11^{Ns}	0.155	3.4	
Plant fresh Weight(g)	434^{Ns}	2599	35.18^{Ns}	111.2^{Ns}	1038	3.38	
Plant Dry Weight(g)	969.3^{N}	204.4	657.7*	124.3^{N}	208.3	3.15	

NS= Non Significant at P=0.05

*=Significant at P=0.05

**=High Significant at P=0.01

Table 2: Mean squares of analysis of variance of two maize cultivars and 5 levels of intercropping with clitoria at Shambat for the second experiment 2016/4/21

Character	Source						
	Varity (d.f=1)	**Error(a) (d.f=2)**	**Intercropping (d.f=4)**	**Variets* Intercropping (d.f=4)**	**Error(b) (d.f=16)**	**F. calculate**	**F. table**
Plant height (cm)	30.6^{Ns}	83.3	3.6^{Ns}	33.4**	7.88	0.45	1%= 4.77 5%= 3.01
Number of Leave	2,35*	0.14	0.29^{Ns}	0.60^{Ns}	0.61	0.47	
Stem Diameter (cm)	1.07**	0.015	0.063^{Ns}	0.055^{Ns}	0.09	0.63	
Plant fresh Weight(g)	28.5^{Ns}	2.29	46.7*	52.18**	16.45	2.84	
Plant Dry Weight(g)	12.2^{Ns}	1.15	2.28^{Ns}	1.56^{Ns}	2.23	1.02	

NS= Non Significant at P=0.05

*=Significant at P=0.05

**=High Significant at P=0.01

Ofmaize in the secondexperiment. The interaction was not significant in the first and the second experiment (Table1)(Table2).

The highest means is reached by control and 4 seeds (5.4cm and 5.4cm) respectively.As shown by (Table 3) var113 the highest stem diameterobtained by 2 seeds between two cultivars intercropping levels.

4-4 Fresh weight:

The analysis of variance showed there were no significant difference betweenintercroppinglevels first experiment(35.18),(Table1), whereas high significant difference in the second experiment (46.7),(Table2). The interaction showsno significant difference from first experiment.

The highest means demonstrated by 2 and 4 seeds (136.5g and 112.0g) respectively of intercropping levels (Table3),while the lowest was reached by 1 seed(65g) of intercropping levels. The var113 gave the highestfresh weight (134g) among the other Hudeiba 2 (130g) (Table3) firstexperiment.

4-5 Dry Weight:

The significant differences were shown by intercropping levels in the first experiment (Table 1) (65.7), and non significant difference were shown in the second experiment, (2.28) (Table 2). The interaction were not significant difference from first and second experiment. The dry weigh thigher means of first experiment (45.6g) than the second experiment (15.7). The highest means was recorded by sole crop in first experiment. Whereas in the second season.Showed by thecontrol best all (intercropping).

Table 3: Effects interaction of intercropping maize with clitoria grown in field at Shambat 7\3\ 2016

Cultivars	Intercropping	Source				
		Plant Height (cm)	Number Of leave	Stem Diameter (cm)	Plant fresh weight(g)	Plant dry weight(g)
Hudeiba2	Without clitoria	77.3a	5.53a	5.033a	79.0a	45.7a
	1 seed	45.3a	5.71a	4.66a	72.05a	25.5a
	2 seeds	70.8a	6.10a	5.26a	130.0a	35.4a
	3seeds	59.6a	6.53a	4.82a	82.0a	38.9a
	4 seeds	82.5a	6.93a	5.36a	112.0a	54.2a
Var 113	Without clitoria	81.8a	6.5a	5.82a	134a	57.6a
	1 seed	68.2a	6.13a	4.86a	59.0a	43.7a
	2 seeds	79.1a	5.93a	5.48a	123.0a	54.4a
	3seeds	46.8a	6.40a	5.32a	85.0a	35.2a
	4 seeds	81.7a	7.87a	5.51a	112.0a	65.7a
L S D		35.5	3.1a	0.77	76.6	41.44
SE^{+-}		9.86	0.89	0.25	21.22	11.66
C.V %		16.6	18.0	7.6	32.6	31.6

Means in column followed by the same letter (s) were not significant difference using DMRT at $P \leq 0.05$

Table 4: Effect of interaction intercropping maize with clitoria growth in pots at Shambat in 21/4/2016

Cultivars	Intercropping	Plant Height (cm)	Number Of leave	Stem Diameter (cm)	Plant fresh weight(g)	Plant dry weight(g)
Hudeiba2	Without clitoria	35.40a	5.55a	2a	27.33a	17.52a
	1 seed	31.86ab	5.22a	2.1a	20.54bc	14.94a
	2 seeds	33.50ab	5.55a	1.95a	29.66a	15.92a
	3seeds	32.09ab	6.55a	1.95a	20.44bc	15.36a
	4 seeds	30.10ab	5.66a	1.83a	17.77c	14.78a
Var 113	Without clitoria	26.0b	5.20a	1.64a	20.34bc	14.73a
	1 seed	30.55ab	5.0a	1.52a	20.55bc	14.45a
	2 seeds	31.59ab	5.44a	1.49a	20.67bc	14.33a
	3seeds	30.53ab	4.88a	1.45a	25.66ab	14.10a
	4 seeds	33.88ab	5.22a	1.77a	18ab	14.59a
L S D		11.17	1.24	0.49	6.35	2.43
SE^{+}-		2.76	0.41	0.16	2.13	0.82
C.V %		8.9	14.5	17.9	18.3	9.9

Means in column followed by the same letter (s) one not significant difference using DMRT at $P \leq 0.05$

Table 5: Main Effects of intercropping Maize with Clitoria in Pots at Shambat in season 2016-2017

	Plant height (cm)	Number of leave	Stem diameter (cm	Fresh weight (g)	Dry weight (g)
(Maize)					
Hudeiba 2	32.6[a]	6[a]	1.96 a	23.13 a	15.7 a
Var 113	30.6[a]	5[a]	1.58a	21.18 a	14.4 b
SE_$^{+}$	(2.35)	(0.09)	(0.03)	(0.39)	(0.28)
Sign level	Ns	*	**	Ns	Ns
Clitoria					
Sole crop	30.7[a]	5[a]	1.91a	23.8 ab	16.1 a
One seedS	31.2[a]	5[a]	1.76a	20.6 ab	14.7 a
Two seedS	32.7[a]	6[a]	1.73a	25.29 a	15.1 a
Three seedS	31[a]	6[a]	1.63	23.1 ab	14.7 a
Four seeds	32[a]	5[a]	1.83a	18.2 b	14.7 a
SE_$^{+}$	(1.15)	(0.32)	(0.13)	(0.65)	(0.61)
Sign level	Ns	Ns	Ns	*	Ns
CV (%)	8.9	14.5	17.9	18.3	9.9

Means in column followed by the same letter (s) one not significant difference using DMRT at P≤ 0.05

Table 6: Main Effects of intercropping Maize with Clitoria in Field at Shambat in season 2016-2017

	Plant height (cm)	Number of leave	Stem diameter (cm	Fresh weight (g)	Dry weight (g)
(Maize)					
Hudeiba 2	69 a	6.16 a	5 a	95 a	39.9 a
Var 113	75 a	6.57 a	5.4 a	102.6 a	51.3 a
SE_$^{+}$	(7.68)	(6.67)	(0.75)	(13.16)	(8.69)
Sign level	Ns	Ns	Ns		Ns
Clitoria					
Sole crop	80 a	6 a	5.4 a	106.5	51.7 ab
One seedS	61 b	5.9 a	4.8 b	65.5	34.6 b
Two seedS	75 ab	6.02 a	5,4 a	126.5	44.9 ab
Three seedS	62 b	6.47 a	5.1 b	83.6	37.0 b
Four seeds	82 a	7.4 a	5.4 a	112	60.0 a
SE_$^{+}$	(4.88)	(0.47)	(0.16)	(13.15)	(5.89)
Sign level	**	Ns	*	Ns	*
CV (%)	16.6	18	7.6	32	31.6

Means in column followed by the same letter (s) one not significant difference using DMRT at P≤ 0.05

CHAPTER FIVE

DISCUSSION

Effect of clitoria intercropping with maize to know the best seed rate. According to this the soil was analysis before addition of clitoria and after addition of clitoria.

The overall mean of plant height in the first experiment (72.1 mg) was slightly highest; cultivar for Hudeiba 2while showed high significant mean of plant height, however, it is worth mentioning that one of advantage of intercropping is the benefit that grasses gain on the expense of legumes. These result were in line with Osman and Abuek (1982).

Number of leave per plantaffected by the addition of clitoria. This may be due to the fact that maize utilized the small amount of nitrogen fixed by clitoria. Similar results were obtained by Undie (2012).

On the other hand, fresh and dry weight for each plant of Maize with clitoria showed that the intercropping levels was increase, This could be explained that maize used the nitrogen released by clitoria one of the advantage of intercropping as grass always higher dry matter than legumes this agreed with the finding indicated by Bakh Shwain(2010).

The result were obtained was increasing plant nitrogen ratio and soil,this result is similar to the finding of Kalamani and Michael,(2001). who reported that increasing the nitrogen levels in run-down cultivated paddocks,the butter Fly Pea planted into run down cultivated paddocks,the soil fertility returns to its original level. Growing along the higher in protein due to soil nitrogen levels.

CONCLUSION AND RECOMMENDATIONS

According to the finding of the study the following conclusion can be lugged.

First Experiment

1. Analysis of variance for Plant height is cleared that cultivar Hudeib2 and Var113recorded the highest plants(81.0cm) and(81.8cm)respectively.
2. Forage fresh weight showedthe highestfresh weight(134g) recorded byVar113.
3. Intercropping increasedprotein percentage.Thehighestprotein percentage recordedin Hudeiba2under4 seeds rate (9.8N), whereasVar113 at 3 seeds rate (8.5n).While the lowest protein recorded by 1seed rate in the two cultivars.
4. Intercropping increased the amount of nitrogen in the Soil.Thehighest nitrogen recorded by Hudeiba2 with 3and 4 seeds ratewhich (0.054N) (0.051N)respectively. While var113 of follow the same treat 3and 4 seed rate (0.046N) (0.040N),and lowest nitrogen recorded by Hudeiba2 (0.041N).

Second Experiment

1- The highest plant were recorded by cultivar Hudeiba 2 with control (35.40cm).
2- Forage fresh weight, showed the highest Hudeiba 2 by2seeds rate (29.66g), whileVar 113 was 3seeds rate (25.66g).
3- The dry weight It isclear that beast best treatmentrecorded by cultivar Hudeiba2.

Recommendation:

The experiment should be repeatedagain under different environmental condition and location,due to environmental variation and confirm the results.

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Appendix

Chemical Analysis of Plants

Analysis of variance

Variate: s_plant

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Rep stratum	2	19.5607	9.7803	9.52	
Rep.Var stratum					
Var	1	2.7000	2.7000	2.63	0.246
Residual	2	2.0540	1.0270	1.48	
Rep.Var.Treat stratum					
Treat	4	2.0513	0.5128	0.74	0.578
Var.Treat	4	0.3833	0.0958	0.14	0.966
Residual	16	11.0853	0.6928		
Total		29	37.8347		