PDF - EFFECT OF INTRODUCING GARDEN EGG TO FLUTED PUMPKIN IN A RELAY INTERCROP ON SOLE AND COMBINED GROWTH OF THE CROP MIXTURES - researchcub.infoABSTRACT

The effect of introducing garden egg (Solanum aethiopicum)to fluted pumpkin (Telfairia occidentalis) in a relay intercrop on the growthof crop mixture under rainfed conditions (September to November, 2014) wasinvestigated at the Faculty of Agriculture University of Benin, Benin CityNigeria.

Garden egg and a local variety of fluted pumpkin were sownsole and intercrop. Garden egg and fluted pumpkin were planted sole andintercropped to evaluate their interaction effect on growth parameters such asplant height, stem girth, leaf number, and leaf area. Data obtained weresubjected to analysis of variance (ANOVA).

The study reveals that intercropping of garden egg withfluted pumpkin significantly increased the growth of garden egg, asintercropped garden egg had significant increase as against sole garden egg.The same was not found to be true for fluted pumpkin as sole fluted pumpkin hadsignificant growth increase but when intercropped, there was significantreduction in growth.

CHAPTER ONE

1.0 INTRODUCTION

Self-sustaining, low-input, and energy-efficientagricultural systems in the context of sustainable agriculture have always beenin the centre of attention of many farmers, researchers, and policy makersworldwide (Altieri et al., 1983; Altieri, 1999). However, most practices ofmodern agriculture, e.g. mechanization, monocultures, improved crop varieties,and heavy use of agrochemicals for fertilization and pest management, led to asimplification of the components of agricultural systems and to a loss ofbiodiversity. Restoring on-farm biodiversity through diversified farmingsystems that mimic nature is considered to be a key strategy for sustainableagriculture (Jackson et al., 2007; Scherr and McNeely, 2008). On-farmbiodiversity, if correctly assembled in time and space, can lead toagroecosystems capable of maintaining their own soil fertility, regulatingnatural protection against pests, and sustaining productivity (Thrupp, 2002;Scherr and McNeely, 2008). Biodiversity in agroecosystems can be enhanced intime through crop rotations and sequences in space through cover crops,intercropping, and agroforestry (Altieri, 1999; Malézieux et al., 2009). Whilemodern agriculture has brought vast increases in productivity to the world’sfarming systems, it is widely recognized that much of this may have come at theprice of sustainability (Tilman et al., 2002; Lichtfouse et al., 2009). This isbecause modern farming systems imply the simplification of the structure of theenvironment over vast areas, replacing natural plant diversity with only alimited number of cultivated plants in extensive areas of arable monocultures(Vandermeer et al., 1998). By contrast, on farm biodiversity is familiar totraditional farmers mainly in developing countries, where traditional farmingsystems are characterized by their great degree of genetic diversity in theform of mixed cropping and agroforestry patterns, based on numerous varietiesof domesticated crop species as well as their wild relatives (Altieri, 1999).These farming systems offer a means of promoting diversity of diet and income,stability of production, reduced insect and disease incidence, efficient use oflabor, intensification of production with limited resources, and alsomaximization of returns under low levels of technology (Anil et al., 1998;Malézieux et al., 2009). Intercropping, also referred to as mixed cropping orpolyculture, is the agricultural practice of cultivating two or more crops inthe same space at the same time (Andrews and Kassam, 1976; Ofori and Stern,1987; Anil et al., 1998). The component crops of an intercropping system do notnecessarily have to be sown at the same time nor they have to be harvested atthe same time, but they

should be grown simultaneously for a great part of theirgrowth periods. In intercropping, there is normally one main crop and one ormore added crop(s), with the main crop being of primary importance for economicor food production reasons. The two or more crops in an intercrop normally arefrom different species and different plant families, or less commonly they maybe simply different varieties or cultivars of the same crop, such as mixing twoor more kinds of wheat seed in the same field. The most common advantage ofintercropping is to produce a greater yield on a given piece of land byachieving more efficient use of the available growth resources that wouldotherwise not be utilized by each single crop grown alone. There are manydifferent kinds of species that can be used for intercropping such as annuals,e.g. cereals and legumes, perennials, including shrubs and trees, or a mixtureof the two (annuals and perennials). In the case of shrubs and trees the termmostly used is agroforestry. The objective of this paper is to provide anoverall view and evaluation of annual intercropping, summarizing its mainadvantages supported by a number of key examples from the published literaturewhich point out its great value in the context of sustainable agriculture. Thispaper focuses on relay intercropping and not on agroforestry using garden eggand fluted pumpkin intercrop as case study.

The objective of this study is to evaluate the influence ofintercropped telfairia and its time of intercropping on the growth yield ofgarden egg.

Meaning of Intercropping

Intercropping is the practice of growing two or more cropsin close proximity and it is practiced by majority of farmers in the tropicaland subtropical regions of the world. The system is widely practiced because itsuppresses weeds and reduces pest disease infestation. (Ibeawuchi, 2007).

The degree of spatial and temporal overlap in the crop ormore crops can be varied. As a result, numerous types of intercropping in whichthe temporal and spatial mixture have been varied to some degree have beenidentified (Andrews and Kassam, 1975).

Types of intercropping (spatial and temporal patterns)

Several types of intercropping, all of which vary thetemporal and spatial mixture to some degree, have been described (Andrews andKassam, 1976). The degree of spatial and temporal overlap in the componentcrops can vary somewhat, but both requirements must be met for a croppingsystem to be an intercrop. Thus, there are several different modes of componentcrops (Willey, 1985). Yield advantage occurs because growth resources such aslight, water, and nutrients are more completely absorbed and converted to cropbiomass by the intercrop over time and space as a result of differences incompetitive ability for growth resources between the component crops, whichexploit the variation of the mixed crops in characteristics such as rates ofcanopy development, final canopy size (width and height), photosyntheticadaptation of canopies to irradiance conditions, and rooting depth (Midmore,1993; Morris and Garrity, 1993; Tsubo et al., 2001). Regularly intercroppedpigeon pea or cowpea can help to maintain maize yield to some extent when maizeis grown without mineral fertilizer on sandy soils in sub-humid zones ofZimbabwe (Waddington et al., 2007). Intercropping maize with cowpea has beenreported to increase light interception in the intercrops, reduce waterevaporation, and improve conservation of the soil moisture compared with maizealone (Ghanbari et al., 2010). This yield advantage occurs when the componentcrops do not compete for the same ecological niches and the interspecificcompetition for a given resource is weaker than the intraspecific competition.Normally, complementary use of resources occurs when the component species ofan intercrop use qualitatively different resources or they use the sameresources at different places or at different times

(Tofinga et al., 1993). Inecological terms, resource complementarity minimizes the niche overlap and thecompetition between crop species, and permits crops to capture a greater rangeand quantity of resources than the sole crops. Improved resource use gives inmost cases a significant yield advantage, increases the uptake of othernutrients such as P, K, and micronutrients, and provides better rooting abilityand better ground cover as well as higher water use efficiency (Midmore, 1993;Morris and Garrity, 1993). Thus, selection of crops that differ in competitiveability in time or space is essential for an efficient intercropping system aswell as decisions on when to plant, at what density, and in what arrangement.Although in this way cropping management decisions specify the design ofintercropping systems, intercrop performance is governed largely by theavailability of and the competition for the environmental resources. Researchhas shown that intercrops are most productive when component crops differgreatly in growth duration (Wien and Smithson, 1981; Smith and Francis, 1986;Fukai and Trenbath, 1993; Keating and Carberry, 1993). For example, when a longduration pigeon pea cultivar was grown in mixture with three cereal crops ofdifferent growth durations, i.e. setaria, pearl millet, and sorghum, the LandEquivalent Ratio was highest with the quick-maturing setaria and lowest withthe slow-maturing sorghum (Rao and Willey, 1980). It must be noted here thatLand Equivalent Ratio shows the efficiency of intercropping for using theenvironmental resources compared with monocropping with the value of unity tobe the critical value. When the Land Equivalent Ratio is greater than one(unity) the intercropping favours the growth and yield of the species, whereaswhen the Land Equivalent Ratio is lower than one the intercropping negativelyaffects the growth and yield of the plants grown in mixtures (Willey, 1979;Willey and Rao, 1980). Asynchrony in resource demand ensures that the latematuring crop can recover from possible damage caused by a quick-maturing cropcomponent and the available resources, e.g. radiation capture over time, areused thoroughly until the end of the growing season (Keating and Carberry,1993). By contrast, when the component crops have similar growth durationstheir peak requirements for growth resources normally occur about the same timeand the competition for the limiting growth resources is intense (Fukai andTrenbath, 1993).

In intercropping crops could be arranged in any of thefollowing forms.

Mixed cropping – Here component crops are totally, mixed inthe available space without any form of arrangement.

Row cropping– The component crops are arranged in alternaterows. A variation of row cropping includes multiple rows of another.

Relay cropping– Here the second crop is sown at the onset ofreproductive development or fruiting of the first crop such that when the fruitis harvested it gives room for the full development of the second.

Strip cropping- This involves sowing more than one crop indifferent strips.

Intercropping as previously mentioned has an increased yieldadvantage thus useful in poverty and hunger alleviation as an insurance againstcrop failure and positive effect on soil properties (Ehigiator and Ikhidero,1999).

Garden Egg (Solanum aethiopicum)

The name “Garden egg plant” was derived from the shape ofthe fruits of some varieties which are white and shaped like chicken eggs (Chenet al., 2001). The plant (Solanum spp) is a vegetable with increasingpopularity in the world (Pessarakli and Dris, 2003), and it originated fromTropical Africa (Norman, 1992). It is an economic flowering plant belonging tothe family Solanaceae, of which members of about

1,400 species found throughoutthe temperate and tropical regions of the world are mostly herbaceous plants.The fruit of the plant comes in a wide array of shapes and colours, some areyellow and small with green stripes; there are the big yellow ones with whitecolour and flat ribbed green types among others (Chen et al., 2001). Theimportance of the garden-egg cannot be overemphasized. It is consumed on dailybasis by urban families and also represents the main source of income forproducing households in West Africa (Danquah- Jones, 2000). Nutritionally,garden egg contains water (92.5%), protein (1%), fat (0.3%), and carbohydrates(6%). They contain between 30 and 50% of iron (Fe), fiber, potassium (K),manganese (Mn), copper (Cu) and vitamins; thiamin (vitamin B1), B6, folate,magnesium and niacin. Egg plant also contains phyto-nutrients such as nasuninand chlorogenic acid (Sabo and Dia, 2009). It is a very good source of dietaryfiber, potassium, manganese, copper and vitamin B6, folate, magnesium andniacin. Egg plant also contains phyto-nutrients such as nasunin and chlorogenicacid. It is a valuable vegetable for canning industries for garden-egg paste,sautéed garden-egg and other products. The fruits are fried, stewed, marinatedand prepared in other ways. The garden egg plant with its bitter taste andspongy texture could really make an amazing pot of stew with a nice aroma. Wheneaten with boiled yam or rice, it becomes a delicacy you do not want to miss atthe slightest opportunity. Medicinally, they are processed and used in thepreparation of condiments and products used in treating different diseases andhealth problems (Burkill, 1985). A meal of garden egg is proven to be of benefitsto patients suffering from raised intraocular pressure (glaucoma) andconvergence insufficiency, as well as in heart diseases and Arteriosclerosis(Harish et al., 2008). The plant can be regarded as a brain food because ithouses the anthocyanin phytonutrient found in its skin, Nasunin, a potentantioxidant and free radical scavenger that has been shown to protect cellmembranes from damage. Studies have shown that nasunin protects the fats inbrain cell membranes. Nasunin is not only a potent free radical scavenger, butis also an iron chelator. Iron is an essential nutrient, necessary for oxygentransport, normal immune function and collagen synthesis, but when it becomestoo much in the blood stream; it becomes a major concern. Excess iron increasesfree radical production and is associated with an increased risk of heartdisease and cancer. Menstruating women, who lose iron every month in theirmenstrual flow, are unlikely to be at risk, but in post-menopausal women andmen, iron, which is not easily excreted, can accumulate. By chelating iron,nasunin lessens free radical formation with numerous beneficial resultsincluding protecting the blood cholesterol from peroxidation, preventingcellular damage that can promote cancer, and lessening free radical damage injoints, which is a primary factor in rheumatoid arthritis. The predominantphenolic compound found in garden eggs is chlorogenic acid, which is one of themost potent free radical scavengers found in plant tissues. The chlorogenicacid performs antimutagenic (anticancer) activities in the body. It alsoperforms anti- LDL (bad cholesterol) activities by increasing the levels of HDL(good cholesterol) in the body and at the same time has antiviral andantimicrobial properties. Consuming high amounts of garden eggs have been foundto be beneficial for people with glaucoma because it lowers the eye pressure.Egg plant contains measurable amounts of oxalates which are naturally occurringsubstances found in plants, animals, and human beings. When oxalates become tooconcentrated in body fluids, they can crystallize and cause health problems.For this reason, individuals with already existing and untreated kidney or gallbladder problems may want to avoid eating egg plant. Chewing thoroughly while eating,can enable you get significant benefits, including absorption of calcium fromcalcium-rich foods plant foods that also contain oxalic acid. As such, eatinggarden eggs does not stop you from meeting your calcium requirements. Egg plantis low in calories

and high in fibre. The egg plant is good for carbohydratecounters and dieters can actually snack on garden eggs in-between meals.

Production of garden-egg is highly concentrated with 85% ofthe output coming from five (5) countries. Presently, China is the world largest producer (56% ofgarden-egg output), followed by India (26%), Egypt, Turkey and Indonesia.Meanwhile, more than 2,048,788ha are devoted to cultivation of garden egg (FAO,2008). In the United State of America, Georgia is the largest producing State.African garden-egg is one of the most commonly consumed fruit vegetable in theTropical Africa, in quantity and value and probably, the third afterLycopersicum esculentum (tomato) and Alum cepa (onions) and before Okra.According to Girth et al. (1989), a rough estimate for a few countriesindicates an annual production of 8,000 tonnes in Senegal, 60,000 tonnes inCote d' Ivoire and 4,500 tonnes in Burkina Faso.

In Nigeria, garden egg is a very important vegetable cropgrown on commercial scale in some parts of the country. However, the smallscale growers account for at least 86% of the total production. In the South-East of Nigeria, specifically, in Abia State, garden-egg popularly called"Mikimiki " (big sized green fruit with very deep and sweet "endocarp") isgrown commercially while in the savannah zone of Nigeria; the yellow, white andthick green skinned varieties are grown on large scale.

Fluted Pumpkin (Telfairia Occidentalis)

This leafy vegetable belongs to family Cucurbitaceae. Theterm fluted is used in description of the female flower which has a flute likeappearance. It is believed to be indigenous to East, central and west Africabetween latitude 7oS and 5oN and longitude 2oE and 38oN (Howes 1950). InNigeria, it is referred to as Ugu by Igbos, Iroko by the Yorubas, Ubon by theEfiks. Its largest diversity in plant population can currently be found in ImoState and other surrounding areas in South-East Nigeria. Pumpkins are largelygrown for their leaves which are used as vegetables and its fruit which isboiled and eaten as desert (Attere 1984).

The fluted pumpkin is a perennial dioecious crop althoughmonoecious forms also exist. The female plants have distinctly stronger shootsand stronger shoots and larger leaves than male plants. The male plantshowever, flowers about 5 months from sowing while it takes the female plantsanother 3 weeks before its first flower is open (Chigwe and Saka 1994).

Pumpkin seeds contain 20-55% oil rich in unsaturated fattyacid oleic and linoleic acid and 23-25% protein, rich in arginine, aspartateand glutamine but they are deficient in lysine and sulphur containing aminoacids. Pumpkin seeds can be eaten in the dry season as snack after roasting orgrinding into butter (Gwanan and Nitcherlein 1995).

Pumpkin also contains high levels of copper, Iron andVitamin A Chandarasckhar et al (2000) reported that pumpkin leaves had thehighest amount of beta-carotene in a form that promoted its absorption inadults, among selected green vegetables. Despite the importance of pumpkin inthe small holder sector in Southern Africa, little research has been done onthis crop (Chigwe and Saka 1994).

According to a research carried out by Ehigiator (1994) andEdo ADP crops grown in mixture by farmers in Edo State were in the order

Maize + cassava

Maize + egusi

Maize + egusi + cassava

Yam + maize + mellon

Yam + maize + egusi mellon + vegetable
Maize + cassava + cowpea
Despite the growing of these crop mixtures by farmers,little is understood on the effect of various crop components in an intercrop.Due to the importance of okro as a staple food crop and of fluted pumpkin inthe diet of people in Nigeria, hence this study on the intercropping effect ofboth crops on their productivity in an ultisol in Benin City, Nigeria.

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