RESPONSES OF SWEET PEPPER (*Capsicum annuum* L.) VARIETIES AND FRUIT COMPOSITIONS TO APPLIED POULTRY MANURE AND JATROPHA SEED EXTRACT IN THE NIGERIAN SAVANNAH

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DECLARATION

"I hereby declare that this work is the product of my own research efforts: undertaken under the supervision of Professor B. M. Auwalu and Professor I. B. Mohammed and has not been presented and will not be presented elsewhere for the award of a degree or certificate. All sources have been dully acknowledged".

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CERTIFICATION

"This is to certify that the research work for this thesis and the subsequent preparation of this thesis by Emon Matai Parmaina (SPS/11/PAG/00001) were carried out under our supervision.

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APPROVAL

This thesis entitled "Responses of Sweet Pepper (*Capsicum annuum* L.) Varieties and Fruit Compositions to Applied Poultry Manure and Jatropha Seed Extract in the Nigerian Savannah" by Emon Parmaina Matai has been examined and was found to meet the regulations governing the award of the degree of DOCTOR OF PHILOSOPHY (Agronomy) of the Bayero University, Kano and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to the LORD GOD ALMIGHTY for His Faithfulness and Grace upon my life all I have is of Him and to Him alone. May His name alone be glorified!

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ABSTRACT

Field trials were conducted at two locations during the 2014 and 2015 rainy seasons. The locations were the Bayero University, Kano Teaching and Research Farm in the Sudan Savannah Agro-ecological zone and Federal College of Horticulture, Dadin-Kowa Teaching and Research Farm in the Northern Guinea Savannah Agro-ecological zone. The trials were carried out with the aim of investigating the growth and yield responses of three varieties of sweet pepper as affected by varying levels of poultry manure and jatropha seed extracts. The treatments consisted of three sweet pepper varieties (Kwadon local, Bellboy and Yolo Wonder) used as main treatments, four levels of poultry manure (0, 3, 6 and 9 t ha^{-1}) assigned as sub-plot treatments and four levels of Jatropha seed extract (0, 1, 2 and 3 % EC) used as sub-sub plot treatments. The soils of the experimental sites were texturally classified as sandy loam. The results indicated that plant height, number of leaves and pest scored $plant^{-1}$ statistically varied among the three varieties of sweet pepper, and were influenced by the use of varying levels of poultry manure and jatropha seed extract. Bellboy produced the tallest plant and number of leaves while, the shortest plant with fewer leaves were produced by Yolo Wonder. Application of 9 t ha^{-1} of poultry manure produced the tallest plant with more leaves. The shortest plant with less leaves were produced by the control treatments (0 tons ha^{-1} of poultry manure and 0 % *EC* of jatropha seed extract). Sweet pepper plants applied with higher levels of poultry manure and jatropha seed extracts had lower pest scored $plant^{-1}$ compared to the control treatments. Similarly, the number of fruits $plant^{-1}$, fresh fruit weight $plant^{-1}$ and yield greatly varied among the varieties tested as well as with varying levels of poultry manure and jatropha seed extract. Combined application of 9 t PM ha^{-1} and 2 % EC of jatropha seed extract to yolo wonder resulted in the highest fresh fruit yield $plant^{-1}$ and fresh fruit yield ha^{-1}. The lowest number of fruits $plant^{-1}$, fresh fruit weight $plant^{-1}$ and yield of sweet pepper were produced by the control treatments (0 tons ha^{-1} of poultry manure and 0 % *EC* of jatropha seed extract). The results of the proximate analysis of the sweet pepper fruits harvested indicated that the percentages fruits crude proteins, capsaicin, Vitamin A and C were all influenced by the varietal difference and the varying levels of the applied poultry manure and jatropha seed extracts. Yolo Wonder recorded the highest fruits crude proteins, Vitamin A and C. There was a direct relationship between growth and yield of the sweet peppers. This was evident in this study as plant height, number of branches and numbers of leaves were positively and significantly correlated with number of fruits, weight of fruits harvested and the yield of the sweet peppers. Therefore, it can be deduced that Yolo Wonder, 9 tons ha^{-1} of poultry manure and 2 % *EC* of jatropha seed extract can be adopted for production of sweet pepper on sandy loam soils of BUK and Dadin-Kowa. The results of the regression of fresh yield (t ha^{-1}) of sweet pepper against poultry manure for BUK and Dadin-Kowa indicated a linear regression with the highest rate of 9 t PM ha^{-1} that gave yield of 28.7 t ha^{-1} for the two years combined at BUK and the same poultry manure rate gave 25.4 t ha^{-1} for the two years combined at Dadin-Kowa.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Sweet Pepper (*Capsicum annuum* L.) together with tomato, egg plant and potato belong to the Solanaceae family. It is believed to originate from the Mexican and Central American regions (Marcelis *et al*., 2004). It is one of the most varied and widely grown vegetables in the world (Berke *et al*., 1999; Marcelis *et al*., 2004). Sweet pepper is an annual crop with flowers and fruits borne singly. Sweet pepper cultivars grow best in a loamy or silty loam soil with good water-holding capacity. But they can grow on many soil types, as long as the soil is well drained. The soil pH should be between 5.5 and 6.8 (Berke *et al*., 1999). As observed by Abdulmalik *et al*. (2012), pepper is the second most important crop among the solanaceous fruits. From the nutrients point of view, obtained from this group of vegetable crops, some peppers are by far superior to both tomato and egg plant in vitamins A and C contents. Pepper also contains appreciable quantities of protein and minerals (Yamaguchi, 1983). The fruits are harvested and consumed at different maturity stages; green, red and not fully riped.

There are 23 different species of pepper in the *Capsicum genus* but only five are cultivated namely *C. annuum, C. frutescence, C. Chinese, C. pubescens, and C. baccatum*. They all contain varying amounts of active chemical compounds called capsaicinoids which is responsible for the pungency or spiciness in peppers. Capsaicin contents in sweet pepper can rise with other pepper types. The concentration of capsaicinoids in peppers is according to the genetic and environmental factors. Sweet pepper has the relatively lowest contents of capsaicinoids (Grundberg, 2014).

The global pepper production in 2015 was up to 34.6 million metric tons (MT) of fresh fruits. China alone accounted for some 17.65 million MT (51 %), Mexico produced 2.31 million MT, Turkey gave 2.20 million MT and Indonesia had 1.70 million MT. However, there was an estimated world demand for this commodity of about 52 million MT which was an indication of a global deficit of sweet pepper (Dagnoko *et al*., 2013; Anonymous, 2014). In Nigeria, pepper is cultivated either as rain fed or irrigated crop, mainly in the Northern states where production has been mainly limited to peasant farmers (Olarewaju, 1980). Katung (2011) indicated that from 10,000 to 20,000 ha of land was utilized for the cultivation of pepper in Nigeria annually. Between the years 1989 to 1991, the estimated production of pepper was 740,000 MT from 82,000 hectares, by 2002 pepper production has declined to 715,000 MT despite the increased acreage of 90,000 hectares (FAO, 2003). The average yield of peppers production in Nigeria started to rise again from 7.94 t ha^{-1} in 2003 to 8.33 t ha^{-1} in 2012, which was abysmally far below the world average of 14.82 t ha^{-1} in 2012 (Dagnoko *et al*., 2013; Anonymous, 2014).

Flowering and fruit-set in sweet pepper had been reported (Olarewaju, 1980) to be adversely affected by incidence of flower shedding and fruit abortion. Nitrogen was marked out to contribute to the phenomena. Bellboy, a sweet pepper variety was observed to be very susceptible to flower shed and fruit abortion (Olarewaju, 1980). Abscission of flower buds, flowers and fruits is an important yield- limiting factor in many crops including pepper (Wien *et al*., 1989; Marcelis *et al*., 2004). Sweet pepper yields vary widely depending on variety. The problems of low fruit yield of pepper are often related to poor crop nutrition, pest and disease attack, and other factors that result into poor fruit-set. According to Berke *et al*. (1999) day length and relative humidity do not affect flowering and fruit-set. Poor fruit-set may be due to incomplete pollination or effects of environmental factors such as temperature, moisture and nutrient stress. Nitrogen is also known to be the most important nutrient affecting fruit yield in pepper. Nitrogen influences flower development of several vegetable crops including pepper, tomato and cucumber (Kinet *et al*., 1985). Poultry manure can serve as substitute to inorganic nitrogenous compound fertilizers since it has high nitrogen contents. Poultry manure at 9 t PM ha^{-1} resulted in higher fruit yield of pepper compared to FYM at 30 t ha^{-1} and poultry manure had the highest manganese, zinc and phosphorus contents campared to other manures (Aliyu and Kuchinda, 2002).

According to Ganiger (2010) modern agriculture which largely depends on chemical fertilizers, pesticides, herbicides etc, though resulted in increased production, has adversely affected the soil productivity and environmental quality. It has also led to a variety of concerns including ecological, economical, soil and human health. Thus, sustainable agriculture in form of organic agriculture is supposed to be the right answer for minimizing problems due to synthetic chemicals. Yadav (2003) reported that large scale usage of high chemical fertilizers with one or two nutrient elements had caused increased deficiencies of several secondary (S and Ca) and micro (Zn, Mn, Fe, B and Cu) nutrients which are causing serious concern in limiting the sustainability of the production system. Consequently, many farmers are seeking for alternative practice like organic farming to make crop production sustainable. Lampkin (1990) observed that use of organic manure helps in healthy soil and helps in proper energy flow in soil, crop, and water environmental systems. Organic manure also keeps biological life cycle alive and helps in sustaining considerable levels in yield. These are mainly based on principles of restoration of soil organic matter in form of humus. These functions of organic manure are possible due to increasing microbial population, skilful application of the factors contributing to soil life and health and by treating manures and compost in bio dynamic way (Pathak and Ram, 2003). Ganiger (2010) further observed that application of organic manure which is an important component in organic farming apart from improving the soil physical, chemical and biological properties with direct impact on moisture retention, root growth and nutrient conservation, can also reduce the cost of production. Organic farming of vegetables is most appropriate as most of the vegetables are consumed in the fresh form and pesticidal residues have adverse effect on human health.

Jatropha (*Jatropha curcas*) oil has various uses and apart from its use as a biofuel, the oil has been locally used to produce soap, medicine and pesticides (Shanker and Dhyani, 2006). Literature findings revealed several successful application of *Jatropha curcas* which include functions like soil and water conservation, soil reclamation, erosion control, live fences, green manure, lightning fuel, source for bio-diesel, local use in soap production, insecticide and as raw material for pharmaceutical and cosmetic industries (Islam *et al*., 2011). All parts of the plant show insecticidal properties (Grainge and Ahmed, 1988; Consoli *et al*., 1989; Jain and Trivedi, 1997; Meshram *et al*., 1994) against insect pests like cotton bollworm and on pests of pulses, vegetables, potato and corn (Kaushik and Kumar, 2004). Therefore, Jatropha has fewer problems of pest and disease. As such, when *Jatropha curcas* grows as solitary plant in the landscape or in small stands it rarely shows signs of pests and diseases.

1.2 PROBLEM STATEMENT

As earlier stated, pepper cultivation in Nigeria is either as rain fed or irrigation crop, mainly in the Northern states where production has been mainly limited to peasant farmers on small farms of less than 0.5 ha (Olarewaju, 1980). Bhattara *et al.* (2011) reported that the integrated use of right rates of organic manure and biofertilizers could give higher yields and protect the soils. Some common constraints that bedeviled sweet pepper production in Nigeria include low soil fertility, inadequate and high prices of fertilizers, pest and diseases, lack of high yielding varieties and poor cultural practices. Pepper is considered very expensive in Nigeria during the lean season compared to other vegetables due to the continuous decline in its production, which is also highly seasonal (Abdulmalik *et al*., 2012). This yield reduction had been attributed mainly to poor flowering and fruit-set which may be as a result of effects of environmental factors such as pest, moisture, nutrient and heat stress. When pepper is exposed to biotic and environmental stress during the flowering and fruiting period, abscission of flowers and flower buds may occur. Nitrogen is also known to be the most important nutrient affecting fruit yield in pepper. Nitrogen influences flower develoPMent of several vegetable crops including pepper, tomato and cucumber. But, most of the soils in Nigeria have low nitrogen. As observed by Ganiger (2010) that modern agriculture in quest for high crop yields largely depends on chemical fertilizers, pesticides, herbicides etc, though resulted in increased production, has negatively affected the soil productivity, beneficial insects and environmental quality. Again, constant use of high chemical fertilizers and synthetic pesticides had resulted into increased deficiencies of several macro and micro nutrients which are causing serious concern in limiting the sustainability of the production system. It has also lead to a variety of concerns including ecological, economical, soil and human health etc. as such, many farmers are now seeking for alternative practice like organic farming to make crop production sustainable. Abscission of flower buds, flowers and fruits is also an important yield- limiting factor in many crops including pepper this could also be due to varietal and poor nutritional status. Lack of pollinating insects can also cause problems of incomplete pollination. As a result of the above mentioned problems, many of the peasant farmers often recorded poor crop growth and yield performances. Apparently, in spite of potential benefits of organic manure in soil improvement and sustainable increase in vegetable crops yield, there is little or no published data on the recommended varieties and proper quantity of organic manure and natural pesticides for sweet pepper production (Bhattara *et al*., 2011). A number of varieties for different ecological zones were developed and disseminated by Institute for Agricultural Research (IAR) Samaru, Zaria and National Horticultural Research Institute (NIHORT), Ibadan (Anonymous, 2010). There is however little information on their organic manure and natural pesticide requirements especially for the study area.

1.3 JUSTIFICATION FOR THE STUDY

Pepper is one of the most varied and widely grown vegetables in the world. It is well known that pepper is the second most important crop among the solanaceous fruits. As earlier observed, from the nutritional point of view, pepper is by far superior to both tomato and egg plant in vitamins A and C content. They also contain appreciable quantities of protein and minerals. However, its production is grossly affected by environmental stresses, poor nutrition and variety. It is also believed that sustainable agriculture in form of organic agriculture is supposed to be the right answer for tackling problems due to synthetic chemicals. As already observed, application of organic manure which is an important component in organic farming apart from improving the soil physical, chemical and biological properties with direct impact on moisture retention, increase soil fertility, mulching, root growth and nutrient conservation, can also reduce the cost of production (Bhattara *et al*., 2011). Use of organic manure in production of vegetables is also most appropriate as most of the vegetables are consumed in the fresh form and pesticide residues have adverse effect on human health. Many researchers reported that crop yields in the savannas can be improved by application poultry manures and ensuring proper pest and diseases management (Abdulmalik *et al*., 2012). It is therefore important to determine the right amount of poultry manure and jatropha seed extracts to be used in these savannah soils for sustainable production of sweet pepper in Nigeria.

Many varieties of sweet pepper have been developed in different parts of the world. Some of high yielding and disease resistant types like Yolo Wonder, California Wonder, Red knight, Marconi and Socrates should be studied for sustainable yields in the Nigerian savannah soils. Farmers in the savannah zones should therefore be encouraged to cultivate these varieties for increased fruit yields (Trinklein, 2010; Amans, 2011).

Jatropha has been documented as a traditional medicinal plant in many countries, and the effectiveness of the resulting remedies has been, in part, scientifically demonstrated. The purgative effect of the seed is the most important (Shanker and Dhyani, 2006; Warra, 2012). All parts of the plant show insecticidal properties against insect pests like fruit worms of tomato and pepper, cotton bollworm and on pest of pulses, vegetables and corn (Kaushik and

Kumar, 2004). However, its application showed phytotoxicity, expressed as reduced germination, when high rates of up to 5 t ha^{-1} was used (Henning, 2004). Therefore, it is important to determine the appropriate levels of the jatropha seed extracts to be used for the cultivation of sweet pepper to increase fruit yields but to equally avoid its phytotocity effects.

1.4 OBJECTIVES OF THE STUDY

The main objective of this study was to examine the responses of sweet pepper varieties and fruit composition to applied poultry manure and jatropha seed extract in the Nigerian savannah. The specific objectives of the study were:

- To evaluate the growth, yield, fruit composition and pest resistance of three sweet pepper varieties.
- To determine the effect of poultry manure on growth, yield, fruit quality and pest control in sweet pepper production.
- To determine the effect of jatropha seed extract on growth, yield, fruit quality and pest control in sweet pepper production.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 PERFORMANCE OF SWEET PEPPER VARIETIES

There are many local cultivars of sweet pepper grown in West Africa. Nigeria alone has more than 200 selections of pepper (Idowu-Agida *et al*., 2012). Sweet pepper is one of the most popular cultivars grown by local farmers in Negeria and the yield obtained ranges from 2.5 to 10.5 t/ha which is very low compared with 18 to 36 t/ha obtained in developed countries. The genus Capsicum contains about 20 species but the popularly cultivated species are sweet pepper (*Capsicum annuum*) and hot pepper (*Capsicum frutescens*) both serving as a food and cash crops in Nigeria and other countries. Much foreign exchange can be earned from exportation of this crop to other countries of the world (Verroens *et al*., 2006).

Grundberg (2014) reported that there are 2,000 – 3,000 varieties of sweet pepper grown worldwide today. Sweet pepper is known as "Tattase" in northern Nigeria, which has many local varieties (Ahmed, 2004; Amans, 2011). According to Juroszeko and Tsai (2011) among the sweet pepper varieties, there are considerable differences in growth habits, maturity, nutrient requirement, fruit characteristics, tolerance to extreme temperatures and resistance to diseases. De Charlo *et al*. (2011) observed that some differences amongst the cultivars were mainly due to cultivar types, production techniques and production cycle. Some sweet pepper are indeterminate in nature such that the plant continues to grow and producing flowers and fruits for year so long as environmental factors like water , nutrients, temperature and adequate space are available. Some varieties could be early, medium or late maturing types. The early ones mature in 40 – 60 days after transplanting (DAT), for instance, Islander (45 DAT), Neapolitan (60 DAT), Windsor (58 DAT), et cetera. The medium maturing types take from 61 – 80 DAT for example Yolo Wonder (75 DAT), Califonia Wonder (65 to 75 DAT), Socrates

(64 DAT), Re Knight (63 DAT), Aladdin (70 DAT), Bellboy (65 to 70 DAT), Kwadon local (70 to 75 DAT) and so on. The late cultivars mature after 80 DAT like Chinese Giant (82 DAT), Marconi (80 DAT), Hercules (83 DAT) and Sweet summer (86 DAT) (Albert, 2009; Juroszeko and Tsai, 2009; Triniklein, 2010).

The group of pungent components peculiar to the fruits of Capsicum plants is called capsaicinoids. The environment, especially the climate, light intensity, soil type, moisture level, fertilization and temperature during plant growth, is considered to have an impact on capsaicinoid levels, as does the age of the fruit. However, sweet pepper has no hot taste as capsaicin is controlled by a single dominant gene and this pepper is recessive for this gene. Capsaicin content is traditionally measured by organoleptic tests involving preferably a panel of nonaddicted consumers. Today, high-performance liquid chromatography (HPLC) and enzyme imunoassay (EIA) tests are used to more precisely measure capsaicin content (Guthrie *et al*., 2004; Canton-Flick *et al*., 2008). Anonymous (2014) cited that all varieties of sweet pepper (C. *annuum* L.) have relatively very low contents of capsaicinoids, the hot or pungent chemicals in the fruits, usually about 0.01 % of the fruit dry weight, which make them less spicy when compared to the chili pepper (C. frutescens) that has more than 1.0 % capsaicinoids (Al Othman *et al*., 2011). Bajaj *et al*. (1979) found that the capsaicinoids contents in sweet pepper fruits increased with increasing nitrogen doses applied to the crop

Pepper is considered an excellent source of bioactive nutrients. Ascorbic acid (vitamin C), carotenoids (Vitamin A) and phenolic compounds are its main antioxidant constituents (Marin, *et al*., 2004). The levels of vitamin C, carotenoids and phenolic compounds in peppers and other vegetables depend on several factors, including cultivar, agricultural practice (organic or conventional), maturity and storage conditions (Lee and Kader, 2000).

Conventional production methods in open fields are commonly practiced. Although there is an increasing awareness of farmers and consumers in the health and environmental consequences related to the abusive use of chemical inputs, farmers have little interest in organic farming perhaps due to the lack of resistant varieties to the main biotic constraints, and lack of access to organic markets and regulatory mechanisms (Dagnoko *et al*., 2013).

2.2 PEPPER PRODUCTION AS AFFECTED BY POULTRY MANURE

Bosland and Votava (2000) reported that pepper required adequate amounts of major and minor nutrients to produce well. Also, increasing nitrogen fertilization has been found to decrease ascorbic acid concentrationin several fruits and vegetables (Lee and Kader, 2000). Poultry Manure can serve as substitute to inorganic nitrogenous compound fertilizers since it has high nitrogen contents. Poultry Manure at 9 t PM ha^{-1} resulted in higher fruit yield of pepper compared to FYM at 30 t PM ha^{-1} and Poultry Manure had the highest manganese, zinc and phosphorus contents (Aliyu and Kuchinda, 2002).

Alabi (2006) found that Poultry Manure levels significantly increased pepper plant height, number of leaves and branches per plant and leaf area up to 125 kg PM/ha level and concluded that poultry droppings increased the yield components of pepper more significantly than farm yard manure. He recorded higher fruit weight and yield of pepper with 100 g Poultry Manure/hole + 100 % NPK (130: 458: 262: kg N: P205:K20/ha) compared with treatments of 150 g peat compost/hole + 70 or 100 % NPK; 100g wood chip compost (pine) per hole + 70 or 100 % NPK. Alabi (2006) found that increased nitrogen did not affect the number of flower buds or fruit set. However, plants receiving excess nitrogen produced excess foliage and decreased yield (Stroehlein and Oebker 1979). Nitrogen is also known to be the most important nutrient affecting fruit yield in pepper. Nitrogen influences flower development of several vegetable crops including pepper, tomato and cucumber (Kinet *et al*., 1985). Significant effect of Poultry Manure rate on the nutrient quality of pepper is also supported by an earlier study on passion fruits, which showed that nutritional quality of the juice varied with Poultry Manure rate (Ani and Baiyeri, 2008). Karakurt, *et al*. (2009) reported that humic acid application significantly influenced total carbohydrate content and total yield of pepper. Ikeh *et al.* (2012) observed that application of 10 t/ha of PM had significantly higher than 0 t/ha and 4 t/ha of PM plant height, number of leaves, number of branches and leaf area of pepper. For number of fruits, 5 t/ha of PM performed significantly better than 0 t/ha and statistically was the same with 10 t/ha of PM. For weight of fruits, 10 t/ha of PM was significantly higher than 0 t/ha and was statistically the same with 5 t/ha of PM. Ikeh *et al.* (2012) earlier reported similar results and concluded that application of 10 t/ha and 6 t/ha of PM were statistically the same on the fresh fruit yield (t/ha) in pepper.

Organic materials have been found to play critical roles in both long and short term nutrient availability and maintenance of soil organic matter in small holder systems in the tropics and represent key materials in reversing nutrient depletion (Adekola *et al*., 2013). The use of adequate levels of nutrients by any crop is essential in order to increase its production and yield. Organic manure that is more available as homestead wastes is a popular alternative to inorganic fertilizer and may be more affordable (Ndubuaku *et al*., 2010, 2014). Again, composts has been used to increase crop productivity and yields, and their use is usually associated with improved soil structure and enhanced soil fertility, increased soil microbial populations and activity and an improved moisture-holding capacity of the soil. Main effect of poultry manure rates on growth and yield of green pepper showed a significant difference, whereas application of 10 t/ha of PM was found to be significantly higher than other manure rates in plant height, number of leaves and number of branches (Dominic *et al.,* 2017).

2.3 PERFORMANCE OF SWEET PEPPER AS AFFECTED BY APPLICATION OF JATROPHA SEED EXTRACTS

Jatropha seed extract contains curcin, a highly toxic protein similar to ricin in Castor, making it unsuitable for animal feed. However, it does have potential as good organic pesticides (Shanker and Dhyani, 2006), replacing chemical pesticides. It also has nitrogen content

(Shanker and Dhyani, 2006) similar to that of neem oil extract, castor bean, and cow/chicken manure. Application showed phytotoxicity, expressed as reduced germination, when high rates of up to 5 % jatropha seed extract were used. The GTZ project in Mali carried out a trial with pearl millet where the effects of manure (6 t/ha PM), physic nut oil extract (5 % EC) and mineral fertilizer (100 kg ammonium phosphate and 50 kg urea/ha) on pearl millet were compared (Islam *et al*., 2011).

2.4 INTERACTION OF TREATMENTS ON SWEET PEPPER VARIETIES

Aliyu and Kuchinda (2002) reported significant interactions betweet poultry manure and variety on total fresh yield of sweet pepper. Application of 9 t ha^{-1} of poutry manure to Yolo Wonder led to highest fresh fruit weight. Alabi (2006) cited that there was significant interaction of poultry dropping on the growth and yield of the pepper variety. Significant interactions between poultry manure rate and variety of sweet pepper was also reported by Ani and Baiyeri (2008) on the nutrient quality of pepper and variety of passion fruits, which showed that nutritional quality of the juice of the passion fruits varied with poultry manure rate. Application of 125 kg PM/ha level of the poultry dropping produced highest plant height, fruit weight and yield of Califonia Wonder. Amans *et al*. (2011) cited that there was better growth and yield of cv. Yolo Wonder treated to 10 t ha^{-1} poultry manure. Ikeh *et al.* (2012) also reported significant interactions between poultry manure and variety of sweet pepper. Application of 10 t/ha of PM statistically had highest fresh fruit yield (t/ha) in cv. Yolo Wonder. Unfortunately there were scanty literatures on the interaction between variety of sweet pepper and jatropha seed extract, and between poultry manure and jatropha seed extract.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 LOCATION OF THE EXPERIMENTAL SITE

Field trials was conducted at two locations for the 2014 and 2015 rainy seasons, at the Teaching and Research Farm of the Federal College of Horticulture, Dadin Kowa in the Northern Guinea Savannah Agro-ecological zone (Latitudes $10^0 18^,$ 10’’ N and Longitude $11^0$31’9’’ E at an altitude of 221 m) and at the Teaching and Research Farm of the Bayero University, Kano in the Sudan Savannah Agro-ecological zone (Latitude $11^0$58” N and Longitude $8^0$25” E at an altitude of 458 m). Soil sample from five random points of each of the experimental sites were collected at 0-30 cm depth prior to commencement of the experiment and after the completion of the experiments. The soils were later bulked and composite samples taken to the Abubakar Tafawa Balewa University Lab and analyzed for physical and chemical properties using standard procedures as described by Black (1965).

3.2 TREATMENTS, EXPERIMENTAL DESIGN AND PLOT SIZE

The treatment consisted of three sweet pepper varieties (Kwadon local, Bellboy and Yolo Wonder) were assigned to the main plot, four levels each of poultry manure (0, 3, 6 and 9 t PM ha^{-1}) which were assigned to sub-plot and Jatropha seed extracts (Botanical pesticides) (0, 1, 2 and 3 % emulsify-able concentrate (EC)) allocated to sub-sub plot. The treatment combinations were replicated three times. Sub-sub plots measured 2 m x 3 m (6 m^2) each were marked out with pegs and each sub-sub plot and sub-plot was separated from another by a 0.5 m border while 1m was left out between main plots and replicates. The size of the main plots was 9.5 m x 13.5 m (128.25 m^2) each and that of the sub-plots was 9.5 m x 3 m (28.5 m^2) each. . As such, the experiment was laid out in a Split-split Plot Design replicated three times.

3.3 DESCRIPTION OF VARIETIES

The three varieties used in the reaseach were Kwadon local, Bellboy and Yolo Wonder, both of which have inderterminate growth habit under favorable environmental conditions and are medium maturing sweet pepper. The Bellboy and Yolo Wonder seeds were sourced from the "Seed Project Company Limited", 44 Buhari Shooping Complex, Hadeja road, Kano, Nigeria and Kwadon local was from "A. A. Minangi Seed Project Campany Limited", 13 Babban Layi, Gombe main market, Gombe, Nigeria.

3.3.1 Kwadon local

Kwadon local is an indigenious sweet pepper variety mostly ground by the local farmers especially in and around Dadin-Kowa area. It is known to be heat tolerant and produce large number of fruits but, the fruits are considered smaller in size compared to Bellboy.

3.3.2 Bellboy

This is a medium maturing sweet or bell pepper. It is taller and grows to heights of 80 – 110 cm. It grows well in drained, weakly acidic soils (pH 6.0 – 6.8). It has erect bristled stem that bears many branches and simple leaves. Bellboy is an improved variety which equally produces quite a number of fruits much similar to Kwadon local but the fruits are large and bell-shaped with many lobes and have potential yield of about 20 t ha^{-1}. The seeds are dull yellow; larger than Kwadon local's. The cultival is resistant to tobacco mosaic virus (TMV) (Anonymous, 2014).

3.3.3 Yolo Wonder

This sweet pepper variety was developed by the Cambell Soup Company in Yolo county Califonia US, in 1952 as a strain of Califonia Wonder. It is taller and grows to heights of 60 – 90 cm in weakly acidic to weakly alkaline soils (pH 5.6 – 7.7). The erect stem and branches bear many simple broad, dark green leaves which cover and protect the plant against sunscald. Its fruits are medium sized, blocky-shaped and with fewer lobes and potential yield of about 22 t ha^{-1}. The seeds are dull yellow, smaller than Califonia Wonder's. The plant is more resistant to tobacco mosaic virus (TMV) than the Califonia Wonder (Anonymous, 2014).

3.4 CULTURAL PRACTICES

3.4.1 Nursery Management

The nursery area was harrowed and the soil was brought to a fine tilth. The nursery beds of 2m length, 1 m width with 15 cm height were prepared. Three nursery seedbeds were prepared each for a pepper variety. Plant debris was collected and burnt in-situ on each of the prepared seedbed. Thereafter, the ash was worked into the soil of the nursery beds. This was done to sterilize the soils of the nursery beds against soil pest.

3.4.2 Sowing of Seeds and After Care

As a preventive measure against seed and soil borne diseases the bell pepper seeds were treated with seed dressing chemical; Apron plus (Metalaxyl) at rate of 0.25 a.i. kg/plot (5g of chemical to 1 kg of seed) before sowing. The seeds were sown in rows of 15 cm apart each occupying a seperate nursery bed. Meanwhile, the beds were adequately watered before and after seed sowing. The beds were later covered with paddy straw mulch that protected the seeds. Regular watering was done in the morning and evening hours for 42 days. Necessary plant protection measures including avoidance of flooding by raising the seedbed, roughing of weak plants, physical control of leaf miners and application of tarmarin ash, were under taken to raise healthy sweet pepper seedlings (Anon., 2005). Watering was stopped 3 days to transplanting which harden the seedlings. These seedlings were lifted with care with the aid of hand fork after watering the seedbeds in the evening on the day of transplanting.

3.4.3 Extraction of Oil from Jatropha Seed

The extraction of oil from the Jatropha seed was done mechanically using a simple oil extraction machine, after sourcing the jatropha seeds. The oil extract was later used for formulating the 1, 2 and 3 % *EC* by adding 1 ml of kerosene to 1 ml of the jatropha seed oil and then dilute with 98 ml of water that formed the 1 % EC. Whereas 2 and 3 % ECs were formed by adding 2 ml and 3 ml of kerosene to 2ml and 3ml of the jatropha seed oil which were diluted with 96 ml and 94 ml of water respectively. These were used as treatments on sweet pepper with the aim of controlling pests and diseases of pepper.

3.4.4 Land Preparation

The fields for the experiment were prepared by ploughing, harrowing and ridges spaced at 75 cm were made a week prior to transplanting of the pepper seedlings. Thereafter, beds of 2 m x 3 m (6 m^2) each were made as plots. Each plot was marked out with pegs according to the experimental design.

3.4.5 Application of Poultry Manures

Poultry manure was applied as per the treatments. Each of the sub-plot treatments (poultry manure levels) were assigned and worked into the respective plots accordingly, a week before transplanting of the seedlings for proper decomposition of organic substance.

3.3.6 Transplanting of the Pepper Seedlings

Transplanting of pepper seedlings were done after 42 days of their nursery. Transplanting of the seedlings was done in the evening to minimize transplanting shock, when the soil of the experimental sites was adequately moist. The pepper seedlings were transplanted on 12th June, 2014 at BUK and 14th June, 2014 at Dadin-Kowa. Whereas in 2015, transplanting of the pepper seedlings was done on 5th and 8th June, 2015 respectively, a bit earlier than in

2014. The pepper seedlings were transplanted at plant spacing of 40 x 75 cm (Anon., 2005), giving a number of 20 plants sub-sub plot^{-1} and a total of 2, 880 plants for the experiment.

3.4.7 Irrigation

The plots were irrigated uniformly at an interval of 3-5 days depending upon the soil and climate conditions so as to maintain adequate moisture in root zone in open field conditions (Ganiger, 2010). This was done during the short period of drought experienced in the two seasons under study, until the rainfall stabilized. The irrigation was provided through surface-ditch-system for 3 weeks in each of the seasons, which commenced from the dates of transplanting to the time rainfall stabilized.

3.4.8 Weed Control

Manual weeding at 2, 6 and 10 WAT was done to keep the experimental plots weed-free during the two seasons' trials in order to avoid weed competition with the crops.

3.4.9 Pest and Disease Control

Four levels of Jatropha seed extracts (0, 1, 2 and 3 % EC) were used as the sub-sub plot treatments, according to experimental design, in order to test their efficacy on the control of pests and diseases particularly, fruit worms and wilt observed on the sweet pepper.

3.5 DATA COLLECTION

3.5.1 Growth Characters

Five randomly selected plants were tagged in each treatment plot for recording growth characters and the mean of the observations on these five plants were computed and recorded.

Plant height: heights (cm) of five randomly tagged plants per net plot were determined using metre rule (2, 4 and 6 WAT) from the ground level to the tip of the main shoot and the mean was calculated and recorded.

Number of leaves before the first flower: number of leaves of the five randomly tagged plants per net plot was taken (2, 4 and 6 WAT) by counting and the mean was later calculated and recorded.

Number of primary branches: the number of primary branches was determined at 2, 4 and 6 WAT by counting the primary branches of the five randomly tagged plants per net plot and the mean calculated and recorded.

Leaf area (LA) and leaf area index (LAI): Leaf Area (L) was determined by multiplying the product of measured length and width of the leaf of plant from each plot with a constant factor 0.76 as described by Watson (2015). The ground area (P) of each of the plant sampled was also determined. These were used to determine the Leaf Area Index (LAI) mathematically using the following equations as described by Roderick (1990) and Sepeto-lu and Budak (1994):

LAI = L / P, Where P = Ground Area, L = Leaf Area.

Days to 50 % flowering: Days to 50 % flowering were determined for each plot when 50 % of the crops on each plot started flowering and these were recorded.

Number of pest scored plant^{-1}: the number of pest scored plant^{-1} was taken from the five tagged plants per net plot and the mean was calculated and recorded.

Number of flowers plant^{-1}: the number of flowers formed plant^{-1} was counted from the five randomly tagged plants per net plot and the mean was calculated and recorded.

Percentage number of aborted flowers plant^{-1}: this was taken by counting the number of flowers shed before opening on the five tagged plants in the net plot and the mean was calculated and recorded.

Percentage number of aborted fruits plant^{-1}: this was taken by counting the fruit aborted from the five tagged plants in the net plot and the mean was calculated and recorded.

3.5.2 Yield Characters

The five tagged plants used for recording growth characters were also used for recording the yield characters. The followings were observed and recorded.

Number of fruits plant^{-1}: the total number of fruits harvested from five tagged plants was counted from 5 pickings and the mean was computed and recorded as number of fruits per plant.

Fresh weight of fruits plant^{-1}: the fresh weights of fruits harvested from the five randomly tagged plants in the net plot was determined by weighing using electronic weighing balance and the mean was calculated and recorded. This was done for each picking and later total from the number of 5 pickings were deduced and recorded for each plot.

Dry weight of fruits plant^{-1}: the dry weights of fruits after 5 days air drying of the fruits harvested from the five randomly tagged plants in the net plot was measured with the aid of electronic weighing balance and the mean was calculated and recorded. This was done for each picking and later total from the number of 5 pickings were determined and recorded for each plot.

Fresh and dry fruit yield (t ha^{-1}): fresh and dry fruit yield ha^{-1} was calculated using the values obtained from the calculated mean fruit fresh and dry weight per plant above. The total fruit fresh and dry weights (t PM ha^{-1}) were obtained by determining the fresh and dry weights of fruits plant^{-1}, then dividing the 10,000 m^2 by plant area (6 m^2) and then multiply by the fruit fresh and dry weights plot^{-1} of each treatment and the results obtained were recorded.

3.5.3 Chemical Composition of Pepper Fruit Tissue

Ten grams (10 g) sample of dry fruits from each net plot was collected for nutritional analysis and these were grouded separately with a wiley mill and passed through 0.5 mm sieve for each plot. The powdered samples were kept separate for the tissue composition analysis.

The percentage (%) nitrogen, potassium and phosphorus: these were determined by laboratory analysis of the dry powdered samples extracts of fruit. Nitrogen in the fruits was determined by micro-kjedahl method as outlined by Bremner (1965). Phosphorus digest was determined by the Vanadomolybdate method (Juo, 1979) and potassium digest was determined by flame photometer.

Fruits crude protein (g 100g^{-1}): this was determined by multiplying each of the value of the fruit nitrogen content obtained by a correction factor of 6.25 as described by Krishna and Ranjhan (1980).

Fruits phenolic compound (Capsaicinoids), vitamin A and vitamin C (mg kg^{-1}) contents: capsaicinoids content (CPS%) the pungent substances in sweet pepper fruit, was evaluated for each plot using Soxhlet method. Ethyl alcohol as organic solvent was used to remove the capsaicinoids from initially ground pepper fruit tissue sample (W1) after which the sample was dried to constant weight (W2). The CPS% was calculated with the following formula (Guthrie et al., 2004; Canton-Flick *et al*., 2008).

Capsaicinoids (%) = $(W_1 – W_2)/ W_1 \times 100$

Where W_1 is the initial weight of sample and W_2 is the final weight after drying.

The vitamin A and C were determined using the Liquid Chromatography-electro-spray/time of flight mass Spectrometry (Garce-Claveer *et al*., 2006). All the data obtained for the nutritional analysis were collected and recorded.

3.6 Data Analysis

The data collected in all cases were subjected to Analysis of Variance (ANOVA) as described by Snedecor and Cochran (1967). Duncan Multiple Range Test (DMRT) (Duncan, 1955) was used to compare the treatment means. Simple correlation and regression analysis were done to assess the type of relationship among the variables and the fruit yield. The fruit yields per hectare was regressed against poultry manure and jatropha seed extracts levels, the PROC Mixed Procedure of SAS was used for correlation and regression analyses (SAS, Institute, 2001).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 RESULTS

4.1.1 Soil Analysis and Weather Data

The soils at BUK and Dadin-kowa were characterized as sandy loam. The p^H at both sites was slightly acidic and they were low in organic carbon, total nitrogen content, medium available phosphorus and low cation exchange capacity. The nutrient contents and exchangeable bases such as Ca^{2+}, Mg^{2+}, K^+ and Na^+ of the soil at Dadin-Kowa were however higher than those of the soil at BUK in the two seasons (Table 1). The weather data for the two years are as in the appendices I and II. They showed more rainfall and higher relative humidity at Dadin-Kowa than in BUK in both seasons while temperatures at BUK were higher than at Dadin-Kowa. The rainfall regime and relative humidity that occurred in 2014 and 2015 at both locations were of no much difference.

4.1.2 Growth Characters of Sweet Pepper

Plant height (cm): the mean plant height of sweet pepper as affected by variety, poultry manure (PM) and jatropha seed extract (JSE) at 2,4 and 6 weeks after transplanting (WAT) during the 2014 rainy season at Dadin Kowa are presented in Table 2. The result indicated significant differences ($P \leq 0.05$) among the treatments with respect to plant height of sweet pepper. Varietal differences were observed among the three varieties of sweet pepper in terms of plant height. At 2, 4 and 6 WAT, it was observed that the two varieties; Kwadon local and Bellboy had statistically similar height and in turn out grew Yolo Wonder. The least mean plant height of 8.94 cm was obtained from Yolo Wonder at 2 WAT (Table 2).

Table 1: Physical and chemical Properties of the Soils of the Experimental Sites at 0 – 30 cm Soil Depths during 2014 and 2015 Rainy Seasons at BUK and Dadin-Kowa.

	2014		2015	
Soil Characteristics	BUK	Dadin-Kowa	BUK	Dadin-Kowa.
Particle size distribution (Physical Properties)				
Sand (%)	66.5	53.2	65.3	49.7
Silt (%)	20.8	30.0	19.9	31.3
Clay (%)	12.5	16.8	12.02	16.6
Textual Class	Sandy-Loam	Sandy-Loam	Sand-Loam	Sand-Loam
Chemical properties of soil				
P^H in water (1.2.5)	6.82	6.40	6.40	6.50
P^H in $CaCl_2$ (1.2.5)	5.90	5.50	6.20	5.80
Organic carbon (g kg^{-1})	0.59	0.68	0.63	0.87
Total Nitrogen (g kg^{-1})	0.12	0.30	0.33	0.46
Available Phosphorus (PPM)	4.85	5.86	6.91	6.72
Exchangeable Bases (Meg/100g)				
Ca^{2+}	2.26	4.35	3.18	5.30
Mg^{2+}	1.01	0.82	1.14	0.88
K^+	0.51	0.45	0.52	0.61
Na^+	0.28	0.35	0.30	0.39
CEC	5.02	5.50	5.87	6.33

KEY

PPM - Parts per million   Meg - Metric gramme(s)
g - Gramme   % - Percent
m - Meter

At each of the sampling period application of 3 t PM ha^{-1} generally resulted in increase in pepper height. Further increase in rate of PM to 6 t PM ha^{-1} significantly increased plant height at all except 6 WAT where the character remained statistically similar. Increase in PM beyond 6 t PM ha^{-1} improved height only at 6 WAT while at 2 and 4 WAT the increase in height was not significant (Table 2).

Application of JSE equally favored plant growth of sweet pepper. The applied JSE had taller plants of sweet pepper than the control treatment (0 % *EC*). At 2, 4, and 6 WAT increase in JSE from 0 to 1 % EC and further to 2 % EC had resulted in corresponding increase in plant height. Further increase in JSE to 3 % EC did not significantly affect plant height at each of the sampling period.

Interactions between sweet pepper variety and JSE and that between PM and JSE on plant height at 6 WAT during 2014 rainy season at Dadin Kowa are presented in Table 3. There was highly significant interaction between variety and JSE as well as between PM and JSE at 6 WAT on plant height of sweet pepper. When plant height of sweet pepper is considered at different JSE concentrations and increasing PM levels, it was clear that at 0 to 1 % JSE, plant height increased up to the application of 6 t PM ha^{-1}. At 2 and 3 % JSE concentration however, plant height increased up to 9 t PM ha^{-1}. At 0 and 3 t PM ha^{-1}, application of increasing levels of JSE had no significant effect on the plant height of sweet pepper. On the other hand, at 6 and 9 t PM $ha^{-1,}$ plant height of sweet pepper increased significantly with the application of 1 and 2 % JSE respectively. At all levels of JSE, Kwadon local and Bellboy were significantly taller than Yellow Wonder. The plant height of Kwadon local and Bellboy responded to the application of 1 % JSE. Application of JSE did not significantly affect the plant height of Yolo Wonder. As rate of applied % JSE concentration at 6 WAT is held constant plant heights of Bellboy and Kwadon local were statistically similar but at par with height of Yollow wonder (Table 3).

Table 2: Plant Height (cm) of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts at 2, 4 and 6 Weeks After Transplanting (WAT) during 2014 Rainy Season at Dadin Kowa.

Treatments	2 WAT	4 WAT	6 WAT
Variety			
Kwadon local	16.27[a]	21.69[a]	27.10[a]
Bellboy	17.66[a]	26.60[a]	31.66[a]
Yolo Wonder	8.94[b]	13.67[b]	18.16[b]
SE $\pm$	1.890	2.260	2.264
Poultry Manure (t PM ha^{-1})			
0	11.64[c]	16.06[c]	19.33[c]
3	13.60[b]	19.06[b]	24.28[b]
6	16.47[a]	22.42[a]	26.33[b]
9	16.42[a]	23.76[a]	30.56[a]
SE $\pm$	0.577	1.122	1.392
Jatropha Seed Extract (% *EC*)			
0	12.63[c]	17.42[c]	21.67[c]
1	14.06[b]	19.63[b]	24.64[b]
2	16.06[a]	22.26[a]	26.25[a]
3	16.36[a]	22.06[a]	27.97[a]
SE$\pm$	0.297	0.355	0.447
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	**
PM*JSE	NS	NS	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Table 3: Interactions between Variety and Jatropha Seed Extracts and between Poultry Manure and Jatropha Seed Extract on Plant Height (cm) of Sweet Pepper at 6 WAT during 2014 Rainy Season at Dadin Kowa.

Treatment	Jatropha Seed Extracts (JSE) (% *EC*)			
	0	1	2	3
Variety				
Kwadon local	22.50^{c}	25.83^{bc}	30.33^{ab}	29.75^{ab}
Bellboy	26.92^{bc}	30.50^{ab}	34.75^{a}	34.42^{a}
Yolo Wonder	15.58^{d}	17.58^{d}	19.67^{cd}	19.75^{cd}
SE $\pm$		2.36		
Poultry Manure (t PM ha^{-1})				
0	17.11^{e}	18.44^{e}	21.44^{de}	20.33^{de}
3	20.67^{d}	23.67^{d}	26.78^{cd}	26.00^{cd}
6	23.33^{d}	27.56^{cd}	30.89^{bc}	31.56^{bc}
9	25.56^{d}	28.89^{c}	33.89^{a}	34.00^{a}
SE $\pm$		1.59		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

In 2015 rainy season at the various sampling period PM and JSE recorded significant effects on height of the three varieties of sweet pepper at Dadin- Kowa (Table 4). There was significant variation in height of the three sweet peppers at 4 and 6 WAT only. Generally Kwadon local was taller at 4 and 6 WAT than the other two varieties except Bellboy that had statistically similar height. At 2 WAT plant heights of the three sweet pepper varieties did not significantly differed. Yolo Wonder had statistically similar height values (Table 4).

Plant height of sweet pepper was significantly affected by application of PM at 2, 4 and 6 WAT in 2015 rainy season at Dadin-Kowa. The tallest plants were generally produced by 9 t PM ha^{-1} throughout the sampling periods that was at far with that of 6 t PM ha^{-1} at 2 WAT only. While the least mean plant heights were consistently recorded by the control treatment (0 t PM ha^{-1}). Application of 3 t PM ha^{-1} generally increased plant height of sweet ppepper. Further increase to 6 and 9 t PM ha^{-1} had resulted in a corresponding increase in plant height only at 4 and 6 WAT, while the character remained statistically unaffected at 2 WAT (Table 4).

Similarly, plant height was significantly enhanced by the application of JSE at 2, 4 and 6 WAT in 2015 rainy season at Dadin-Kowa. Tallest plants were generally produced when 3 % JSE concentration was applied. Height produced when 3 % JSE concentration was applied were statistically similar to that of 2 % JSE concentration at 2 and 4 WAT sampling periods only Meanwhile, at 6 WAT each increase in JSE rate from 0 – 1 % and further to 2 % and 3 % JSE concentration had resulted to corresponding increase in plant heights of sweet pepper.

No significant interactions were observed among the variety, PM and JSE on plant height of sweet pepper during the 2015 rainy season trial at Dadin Kowa (Table 4).

Table 4: Plant Height (cm) of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts at 2, 4 and 6 Weeks After Transplanting (WAT) during 2015 Rainy Season at Dadin- Kowa.

Treatment	2 WAT	4 WAT	6 WAT
Variety			
Kwadon local	21.69	22.06[a]	22.29[a]
Bellboy	20.83	21.15[ab]	20.96[b]
Yolo Wonder	19.15	19.54[b]	19.40[b]
SE $\pm$	1.017	0.996	0.772
Poultry Manure (t PM ha^{-1})			
0	17.83[c]	18.42[d]	18.25[d]
3	20.44[b]	20.67[c]	20.64[c]
6	21.33[ab]	21.67[b]	21.39[b]
9	22.61[a]	22.92[a]	23.25[a]
SE $\pm$	0.747	0.762	0.672
Jatropha Seed Extracts (% *EC*)			
0	17.86[c]	18.22[c]	18.33[d]
1	20.47[b]	20.58[b]	20.56[c]
2	21.75[a]	22.06[a]	21.72[b]
3	22.14[a]	22.81[a]	22.92[a]
SE$\pm$	0.531	0.442	0.568
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Table 5 shows plant heights of sweet pepper varieties as significantly affected by PM and JSE for the combined at 2, 4 and 6 WAT during the 2014 and 2015 rainy season at Dadin-Kowa. The varieties of sweet pepper had significantly different plant heights. Bellboy and Kwadon local had statistically similar and taller plants than Yolo Wonder at all the sampling periods. Application of 3 t PM ha^{-1} generally increased height of sweet pepper. Further increase in PM rate to 6 t PM ha^{-1} led to further increase in plant height at 4 WAT only while the character remained significantly unaffected at 2 and 6 WAT. Increase in PM rate to 9 t PM ha^{-1} increased sweet pepper height at 2 WAT only while no significant response was recorded at other sampling periods. Tallest and shorter plants were produced by the application of 9 and 0 t PM ha^{-1} respectively in all the sampling periods.

Similarly, application of JSE significantly enhanced plant height of sweet pepper throughout the sampling periods. Sweet peppers treated with the applied % JSE concentration significantly out grow the control treatment (0 % *EC*) at 2, 4 and 6 WAT. At 2 WAT, statistically similar plant heights produced by 1, 2 and 3 % JSE concentration that was taller that far the control. Significant increase in plant heights was observed with each increase in % JSE concentration up to 2 % *EC* beyond which the character remained significantly unaffected at 4 and 6 WAT.

When plant height of sweet pepper is considered at different JSE concentrations and increasing PM levels, only the interaction between PM and JSE on plant height of sweet pepper for the two years combined at 6 WAT was significant ($P \leq 0.05$) (Table 6). When no PM was applied, plant height increased with increasing rate of JSE concentration from 0 to 1 % EC. Further increase in concentration of JSE from 1 to 2 % EC and from 2 to 3 % EC did not affect the plant height of sweet pepper. At 0 % JSE concentration, increasing the rates of PM application from 0 t PM ha^{-}1 to 3 t PM ha^{-}1 and from 3 t PM ha^{-}1 to 9 t PM ha^{-}1 resulted into corresponding increase in plant height.

Table 5: Plant Height (cm) of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts at 2, 4 and 6 WAT during the Two Years Combined at Dadin- Kowa.

Treatment	2 WAT	4 WAT	6 WAT
Variety			
Kwadon local	18.98^{a}	21.88^{a}	24.70^{a}
Bellboy	19.20^{a}	23.38^{a}	26.30^{a}
Yolo Wonder	14.04^{b}	16.60^{b}	18.77^{b}
SE $\pm$	1.239	1.407	1.387
Poultry Manure (t PM ha^{-1})			
0	14.74^{c}	17.24^{c}	18.79^{c}
3	16.97^{b}	19.86^{b}	22.46^{b}
6	18.40^{b}	22.04^{a}	24.86^{ab}
9	19.51^{a}	23.33^{a}	26.92^{a}
SE $\pm$	0.540	0.752	0.914
Jatropha Seed Extracts (% *EC*)			
0	15.19^{b}	17.82^{c}	20.00^{c}
1	17.26^{a}	20.06^{b}	22.60^{b}
2	18.42^{a}	22.17^{a}	24.99^{a}
3	18.75^{a}	22.43^{a}	25.44^{a}
SE$\pm$	0.318	0.279	0.361
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Table 6: Interactions between Poultry Manure and Jatropha Seed Extract on Plant Height (cm) of Sweet Pepper at 6 WAT during the Two Years Combined at Dadin Kowa.

Treatment	Jatropha Seed Extracts (JSE) (% *EC*)			
Poultry Manure (t PM ha^{-1})	0	1	2	3
0	16.72^{h}	18.50^{gh}	19.94^{fg}	20.00^{fg}
3	19.44^{fg}	21.61^{def}	24.11^{c}	24.67^{bc}
6	21.22^{ef}	23.78^{cd}	26.72^{b}	27.72^{b}
9	22.61^{de}	26.50^{b}	29.17^{a}	29.39^{a}
SE $\pm$		1.107		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

However, the plant heights produced by 3 t PM ha^{-1} and 6 t PM ha^{-1} and by 6 t PM ha^{-1} and 9 t PM ha^{-1} are respectively not significantly different. The combined application of 9 t PM ha^{-1} with either 2 or 3 % JSE concentration produced the tallest sweet pepper plants. These are followed by the plant heights obtained from the interactions between 6 t PM ha^{-1} with either 2 or 3 % JSE concentration and 9 t PM ha^{-1} and 1 % JSE concentration. The shortest sweet pepper plants were produced by the interaction between 0 t PM ha^{-1} and 0 % JSE concentration which was not statistically different from plant height produced by interaction between 0 t PM ha^{-1} and 1 % JSE concentration.

Table 7 shows plant heights (cm) of three sweet pepper varieties as enhanced by rates of PM and JSE at 2, 4 and 6 WAT during 2014 rainy season at BUK. There was significant variation in the height of three sweet pepper varieties evaluated. No significant difference ($P \leq 0.05$) in height was observed between Kwadon local and Bellboy at all the sampling periods; both of which were taller than Yolo Wonder.

PM significantly affected plant height of sweet pepper at 4 and 6 WAT sampling periods of 2014 in BUK. There was no significant difference in height of sweet pepper among the different levels of PM at 2 WAT. Mean plant heights of sweet pepper were significantly enhanced by the application of PM at 4 and 6 WAT with the tallest plant recorded from 9 t PM ha^{-1} at 6 WAT (Table 7). It was followed by that of 3 and 6 t PM ha^{-1} that was statistically at par. The least mean plant height was from the control which in turn was statistically not different from that of 3 t PM ha^{-1} at 6 WAT only.

Plant height of sweet pepper was not significantly affected by the application of JSE at all the sampling periods except at 2 WAT when the least plant height was recorded by the control treatment. The increase in plant height was only up to 1 % JSE concentration.

Table 7: Plant Height (cm) of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts at 2, 4 and 6 WAT during 2014 Rainy Season at BUK.

Treatment	2 WAT	4 WAT	6 WAT
Variety			
Kwadon local	15.76[a]	21.58[a]	27.94[a]
Bellboy	18.51[a]	25.17[a]	30.54[a]
Yolo Wonder	8.94[b]	11.30[b]	16.03[b]
SE ±	1.374	1.877	1.804
Poultry Manure (t PM ha^{-1})			
0	13.51	17.81[c]	23.21[c]
3	14.12	19.29[b]	24.61[bc]
6	13.84	19.33[b]	25.17[b]
9	14.61	20.96[a]	27.36[a]
SE ±	0.482	0.553	0.712
Jatropha Seed Extract (% *EC*)			
0	13.16[b]	18.96	24.36
1	14.64[a]	19.60	24.95
2	14.21[a]	19.62	25.12
3	14.26[a]	19.22	24.92
SE±	0.331	0.553	0.721
Interactions			
Var*PM	**	**	**
Var*JSE	*	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Table 8: Interactions between Variety and Poultry Manure on Plant Height (cm) of Sweet Pepper at 2, 4 and 6 WAT during 2014 Rainy Season at BUK.

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
		2 WAT		
Kwadon local	14.25^{b}	17.25^{ab}	15.10^{b}	16.43^{ab}
Bellboy	18.35^{a}	17.18^{ab}	18.87^{a}	19.65^{a}
Yolo Wonder	7.92^{c}	7.93^{c}	7.57^{c}	8.33^{c}
SE $\pm$		1.552		
		4 WAT		
Kwadon local	18.73^{c}	23.60^{bc}	21.17^{bc}	22.43^{bc}
Bellboy	23.70^{abc}	23.28^{abc}	25.57^{ab}	28.12^{a}
Yolo Wonder	11.00^{d}	10.98^{d}	11.27^{d}	11.97^{d}
SE $\pm$		2.053		
		6 WAT		
Kwadon local	24.53^{b}	28.77^{b}	26.98^{b}	31.47^{ab}
Bellboy	29.33^{ab}	28.23^{b}	30.37^{ab}	34.23^{a}
Yolo Wonder	15.77^{c}	16.83^{c}	15.15^{c}	16.37^{c}
SE $\pm$		2.096		

Means followed by unlike letter(s) are significantly different ($P \leq 0.05$) using DMRT

Further increase up to 2 - 3 % EC ha^{-1} resulted in no significant increase in plant height of aweet pepper (Table 7).

The interaction between PM and variety on plant height of sweet pepper is as shown in Table8. Variation in PM rate from 0 – 9 t PM ha^{-1} had no significant effect on the height of each varieties at 2 and 4 WAT and only Kwadon local and Yolo Wonder at 6 WAT. Bellboy when supplied with 9 t PM ha^{-1} had the tallest plants statistically camparable to when it was fertilized with 6 and 0 t PM ha^{-1} but taller than par when it received 3 t PM ha^{-1} at 6 WAT. Kwadon local and Bellboy had statistically similar height that was taller than Yolo Wonder when no manure was applied at 4 and 6 WAT. Similar response was also observed when 3 t PM ha^{-1} was applied at all sampling periods, 6 t PM ha^{-1} applied at 4 and 6 wat and 9 t PM ha^{-1} was supplied at 2 and 6 WAT. Generally, application of 9 t PM ha^{-1} to Bellboy resulted in the highest values of plant heights while the least was from Yolo Wonder when 6 t PM ha^{-1} (at 2 and 6 WAT) or 3 t PM ha^{-1} (at 4 WAT) was applied.

Variation in JSE rate from 0 – 3 % EC had no significant effect on the height of each variety at 2 WAT (Table 9). Bellboy when sprayed with 1 % EC ha^{-1} had the tallest plants statistically camparable to when it was applied with 0, 2 and 3 % EC, similarly when Kwadon local was applied with 2 % EC ha^{-1} which both had statistically similar height that was taller than Yolo Wonder when 0 - 3 % EC ha^{-1} was applied at 2 WAT. Generally application of 1 % EC ha^{-1} to Bellboy had the tallest sweet pepper height while the least height was from Yolo Wonder irrespective of the rate of JSE (at 2 WAT).

The results in Table 10 show plant height of sweet pepper varieties as affected by rate of PM and JSE at 2, 4 and 6 WAT during the 2015 rainy season at BUK. There was significant variation in heights of the three pepper varieties at 4 and 6 WAT only.

Table 9: Interactions between Variety and Jatropha Seed Extracts on Plant Height (cm) of Sweet Pepper at 2 WAT during 2014 Rainy Season at BUK.

Treatment	Jatropha Seed Extract (% *EC*)			
Variety	0	1	2	3
		2 WAT		
Kwadon local	14.88^{b}	15.98^{b}	16.42^{ab}	15.75^{b}
Bellboy	16.90^{ab}	19.80^{a}	18.52^{ab}	18.83^{ab}
Yolo Wonder	7.10^{c}	8.15^{c}	7.70^{c}	8.20^{c}
SE $\pm$		1.461		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 10: Plant Height (cm) of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts at 2, 4 and 6 WAT during 2015 Rainy Season at BUK.

Treatment	2WAT	4WAT	6 WAT
Variety			
Kwadon local	17.21	17.29[a]	17.35[a]
Bellboy	17.02	17.46[a]	17.56[a]
Yolo Wonder	13.81	14.29[b]	14.65[b]
SE $\pm$	1.167	1.006	1.063
Poultry Manure (t PM ha^{-1})			
0	13.39[c]	15.53[d]	13.47[d]
3	15.33[b]	15.92[c]	16.61[b]
6	17.03[a]	17.06[b]	16.97[b]
9	18.31[a]	18.89[a]	19.03[a]
SE $\pm$	0.722	0.653	0.718
Jatropha Seed Extract (% *EC*)			
0	14.83[b]	15.11[b]	15.17[b]
1	16.44[a]	16.61[a]	19.94[a]
2	16.33[a]	17.91[a]	17.50[a]
3	16.44[a]	16.47[a]	16.47[a]
SE$\pm$	0.598	0.520	0.576
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Plant heights recorded by Bellboy were not statistically different from those obtained by Kwadon local though taller than Yolo Wonder. Similarly, plant heights of sweet pepper were significantly favored by the application of PM at 2, 4 and 6 WAT. Statistically tallest plants were produced by the application of 9 t PM ha^{-1} throughout the sampling periods; height recorded at this rate was at far with 6 t PM ha^{-1} at 2 WAT only. The least mean plant heights were consistently recorded by the control treatment. The tallest plnats achieved at 9 t PM ha^{-1} was statistically followed by that of 6 t PM ha^{-1} at 4 and 6 WAT as well as 3 t PM ha^{-1} 2 and 6 WAT. Spraying of JSE had significant effect on height of sweet pepper at all the sampling periods. The three applied JSE rates resulted in statistically similar but taller plants than the control. Plant height significantly varied among the three sweet pepper varieties, PM and JSE when data at 2, 4 and 6 WAT in 2014 and 2015 were combined at BUK (Table 11).

Bellboy consistently had the highest mean plant height that was not statistically different from those produced by Kwadon local at all the sampling periods but significantly more than far Yolo Wonder at 2, 4 and 6 WAT. The least mean plant height values recorded by Yolo Wonder was in turn not statistically different from that of Kwadon local at 2 and 4 WAT only.

Plant heights when 3, 6 and 9 t PM ha^{-1} was applied, were statistically taller than least obtained from the control treatment (0 t PM ha^{-1}) at 2, 4 and 6 WAT. Application of 3 t PM ha^{-1} generally enhanced height of pepper. Further increase in PM rate to 6 t PM ha^{-1} enhanced plant height at 2 WAT only. While the character remained statistically similar at 4 and 6 WAT. Increase in PM rate to 9 t PM ha^{-1} further increased plant height at 4 and 6 WAT and remained statistically similar at 2 WAT.

Similarly, application of JSE significantly influenced plant height of sweet pepper throughout the sampling periods. The result of the combined analysis of the two years combined at BUK indicated that the three applied JSE rates had statistically similar and higher

Table 11: Plant Height (cm) of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts at 2, 4 and 6 WAT during the Two Years Combined at BUK

Treatment	2 WAT	4 WAT	6 WAT
Variety			
Kwadon local	14.37^{ab}	17.96^{ab}	22.32^{a}
Bellboy	16.89^{a}	21.20^{a}	25.03^{a}
Yolo Wonder	11.68^{b}	14.20^{b}	17.62^{b}
SE ±	1.254	1.459	1.559
Poultry Manure (t PM ha^{-1})			
0	12.75^{c}	15.71^{c}	19.26^{c}
3	14.17^{b}	17.57^{b}	21.21^{b}
6	14.44^{a}	18.01^{b}	21.97^{b}
9	15.89^{a}	19.86^{a}	24.19^{a}
SE ±	0.342	0.487	0.554
Jatropha Seed Extract (% *EC*)			
0	13.29^{b}	16.94^{b}	20.62^{b}
1	14.67^{a}	17.99^{a}	21.92^{a}
2	14.72^{a}	18.31^{a}	22.20^{a}
3	14.57^{a}	17.92^{a}	21.89^{a}
SE±	0.384	0.344	0.473
Interactions			
Var*PM	**	**	*
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

mean plant height values than the control treatment (0 % *EC*) at 2, 4 and 6 WAT. This indicate no interaction, no differential response on height of each of the three varieties of sweet pepper at 2 and 4 WAT and only Bellboy at 4 and 6 WAT. Bellboy when fertilized with 9 t PM ha^{-1} had the tallest plants statistically comparable with 6, 3 and 0 t PM ha^{-1} at 2 WAT and with 6 t PM ha^{-1} but taller than far when it received 3 t PM ha^{-1} at at 4 and 6 WAT. Kwadon local and Bellboy had statistically similar height that was taller than Yolo Wonder when 3 and 6 t PM ha^{-1} was applied at all the sampling periods and when supplied with 9 t PM ha^{-1} at 2 and 6 WAT only. When no PM was applied Kwadon local and Yolo Wonder had similar height in all the sampling periods. Generally application of 9 t PM ha^{-1} to Bellboy had the highest values of plant heights while the least was from Yolo Wonder when no manure was applied at all the sampling periods (Table 12).

Number of leaves plant^{-1}

Number of leaves of three Sweet Pepper varieties as affected by rate of PM and JSE at 2, 4 and 6 WAT during 2014 rainy season at Dadin Kowa is presented in Table 13. The result revealed significant variations in leaf production among the three pepper varieties and response of number of leaves to PM and JSE at 2, 4 and 6 WAT though at 2 WAT there was no significant difference in number of leaves ($P \leq 0.05$) among the three varieties.

However, at 4 and 6 WAT, Bellboy produced higher mean numbers of leaves of 64.71 and 84.02 respectively that was more than mean numbers of leaves obtained by Kwadon local and Yolo Wonder; no significant difference ($P \leq 0.05$) existed in the number of leaves of Kwadon local and Yolo Wonder during the sampling periods.

Application of 3 t PM ha^{-1} and further increase to 6 t PM ha^{-1} significantly increased leaf numbers of sweet pepper throughout the sampling periods. Further increase in PM rate to 9 t PM ha^{-1}, significantly enhanced leaf production at 2 and 4 WAT while at 6 WAT no

Table 12: Interactions between Variety and Poultry Manure on Plant Height (cm) of Sweet Pepper at 2, 4 and 6 WAT during the Two Years Combined at BUK.

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
		2 WAT		
Kwadon local	12.38^{cde}	15.12^{abcd}	14.51^{abcde}	15.47^{abcd}
Bellboy	15.26^{abcd}	15.80^{abc}	17.68^{ab}	18.82^{a}
Yolo Wonder	10.63^{e}	11.59^{de}	11.12^{de}	13.38^{bcde}
SE $\pm$		1.552		
		4 WAT		
Kwadon local	15.37^{cd}	19.09^{bc}	18.13^{bc}	19.28^{bc}
Bellboy	18.77^{b}	19.73^{b}	22.07^{ab}	24.23^{a}
Yolo Wonder	13.47^{d}	13.91^{d}	13.84^{d}	16.07^{bcd}
SE $\pm$		1.632		
		6 WAT		
Kwadon local	19.02^{cd}	22.42^{bc}	22.66^{bc}	25.19^{ab}
Bellboy	22.37^{b}	23.37^{b}	26.10^{ab}	28.28^{a}
Yolo Wonder	16.38^{d}	17.83^{d}	17.16^{d}	19.10^{cd}
SE $\pm$		1.767		

Means followed by unlike letter(s) are significantly different ($P \leq 0.05$) using DMRT

Significant difference ($P \leq 0.05$) in the number of leaves was observed between the pepper applied with 6 t PM ha^{-1} and 9 t PM ha^{-1}. The lowest mean leaf number was generally from the control treatment (0 t PM ha^{-1}). Each increase in levels of JSE from 0 – 1, 1 – 2 and 2 – 3 % EC ha^{-1} had led to a corresponding increase in the number of leaves of sweet pepper at 2, 4 and 6 WAT. The highest mean leaf numbers of 21.06, 52.89 and 78 75 were obtained with the application of 3 % EC ha^{-1} at 2, 4 and 6 WAT, respectively. While the corresponding lowest mean leaf numbers of 13.66, 36.26 and 56.25 were produced by the control treatment (0 % EC ha^{-1}).

Variation in PM rate from 0 – 9 t PM ha^{-1} applied to the three sweet pepper varieties significantly enhanced increase in number of leaves at 4 WAT. The three sweet pepper varieties supplied with 0 – 3 t PM ha^{-1} and Kwadon local and Yolo Wonder fertilized with 3 – 9 t PM ha^{-1} to had statistically similar number of leaves respectively. Increase in PM rate to 3 t PM ha^{-1} to all varieties of pepper resulted in statistically no significant increase in number of leaves. Further increase to 6 and 9 t PM ha^{-1} supplied to the three pepper varieties resulted in corresponding increase in numbers of leaves. Application of 9 t PM ha^{-1} to Bellboy produced the highest mean number of leaves statistically similar when 6 t PM ha^{-1} was applied while the lowest mean number of leaves was produced by Yolo Wonder with no application of PM. Meanwhile, Kwadon local and Yolo Wonder supplied with 9 t PM ha^{-1} recorded statistically similar leaf numbers (Table 14).

Similarly, variation in JSE rate applied to the three sweet pepper varieties significantly enhanced more production of leaves at 2, 4 and 6 WAT. 3 % EC ha^{-1} applied to Bellboy produced the highest mean leaf numbers that are not significantly different ($P \leq 0.05$) from those obtained by the application of 2 % EC ha^{-1} at 2, 4 and 6 WAT in 2014 rainy season at Dadin-Kowa.

Table 13: Number of Leaves of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extract at 2, 4 and 6 WAT during 2014 Rainy Season at Dadin-Kowa.

Treatment	2 WAT	4 WAT	6 WAT
Variety			
Kwadon local	18.17	44.52[b]	63.79[b]
Bellboy	19.17	64.71[a]	84.02[a]
Yolo Wonder	16.81	38.19[b]	60.40[b]
SE $\pm$	1.221	5.668	5.894
Poultry Manure (t PM ha^{-1})			
0	13.69[d]	34.89[d]	53.25[c]
3	16.58[c]	42.25[c]	66.03[b]
6	20.19[b]	51.36[b]	76.53[a]
9	21.72[a]	54.72[a]	79.81[a]
SE $\pm$	0.751	1.469	2.414
Jatropha Seed Extract (% *EC*)			
0	13.66[d]	36.26[d]	56.25[d]
1	17.06[c]	43.19[c]	66.26[c]
2	20.22[b]	50.89[b]	76.33[b]
3	21.06[a]	52.89[a]	78.75[a]
SE$\pm$	0.279	0.937	1.010
Interactions			
Var*PM	NS	**	NS
Var*JSE	**	**	**
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

When 2 – 3 % EC ha^{-1} was applied the leaf remained statistically similar. However when the rate of JSE varied the number of leaves of the three pepper varieties remained the same at 2 WAT. Kwadon local produced similar number of leaves when rate of JSE varied from 0 – 3 % EC ha^{-1} and from 0 - 1 % EC ha^{-1} at 4 and 6 WAT respectively.

Yolo Wonder applied with 0 – 2 % EC ha^{-1} produced similar number of leaves that are statistically lower than when 3 % EC ha^{-1} was applied which was in turn statistically similar to number of leaves produced with the application of 1 % and 2 % EC ha^{-1} at 4 and 6 WAT. Bellboy applied with 2 and 3 % EC ha^{-1} recorded similar number of leaves (at 4 and 6 WAT) that was greater than the ones produced by the applied 1 % EC ha^{-1} that was statistically not different from those produced by 2 % EC ha^{-1} which in turn was more than the number of leaves produced by the 0 % JSE concentration that was similar to the leaf numbers produced by Bellboy when applied with 1 % JSE concentration (at 4 and 6 WAT). Number of leaves of all the three varieties remained statistically the same when 0 – 1 % JSE concentration was applied. Kwadon local and Bellboy had statistically similar number of leaves that are at far with number of leaves produced by Yolo Wonder when 2 or 3 % JSE concentration was applied at 4 WAT. Inrease in JSE rate statistically resulted into corresponding increase in number of leaves of all the three sweet pepper varieties at 6 WAT. However, number of leaves of Kwadon local and Yolo Wonder remained statistically similar irrespective of the the variation in JSE rates at 6 WAT and when 2 or 3 % JSE concentration was applied at 4 WAT (Table 14).

Significant PM x JSE interactions were recorded on number of leaves of sweet pepper at 2, 4 and 6 WAT sampling periods in 2014 rain season at Dadin-Kowa (Table 15). The application of 3 and 2 % JSE concentration with 9 t PM ha^{-1} produced statistically the highest leaf numbers of sweet pepper than any other combination at 2, 4 and 6 WAT sampling periods respectively.

Table 14: Interactions between Variety and Poultry Manure and between Variety and Jatropha Seed Extracts on Number of Leaves of Sweet Pepper at 2 and at 2, 4 and 6 WAT respectively, during 2014 Rainy Season at Dadin-Kowa.

Treatment	Poultry Manure (t PM ha[1])			
Variety	0	3	6	9
		4 WAT		
Kwadon local	35.33[de]	41.92[cde]	49.17[bcd]	51.67[abc]
Bellboy	42.08[cde]	47.83[cd]	64.25[ab]	66.67[a]
Yolo Wonder	29.25[e]	37.00[cde]	40.67[cde]	45.83[cd]
SE $\pm$		6.081		
	Jatropha Seed Extracts (% *EC*)	2 WAT		
	0	1	2	3
Kwadon local	13.17[d]	17.25[c]	20.92[ab]	21.33[ab]
Bellboy	15.00[cd]	18.08[bc]	21.33[ab]	22.25[a]
Yolo Wonder	13.42[d]	15.83[cd]	18.42[bc]	19.58[ab]
SE $\pm$		1.291		
		4 WAT		
Kwadon local	35.75[de]	41.50[cde]	49.92[abcd]	50.92[abcd]
Bellboy	42.42[cde]	52.00[bc]	60.92[ab]	63.50[a]
Yolo Wonder	30.58[e]	36.08[cde]	41.83[cde]	44.25[bcd]
SE $\pm$		5.840		
		6 WAT		
Kwadon local	50.67[d]	60.58[cd]	70.67[bc]	73.25[bc]
Bellboy	67.50[bc]	80.58[ab]	92.75[a]	95.25[a]
Yolo Wonder	50.58[d]	57.67[cd]	65.58[bcd]	67.75[bc]
SE $\pm$		6.086		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 15: Interactions between Poultry Manure and Jatropha Seed Extracts on Number of Leaves of Sweet Pepper at 2, 4 and 6 WAT during 2014 Rainy Season at Dadin-Kowa

Treatment	Jatropha Seed Extracts (% *EC*)			
Poultry Manure (t PM ha^{1})	0	1	2	3
		2 WAT		
0	10.56^{f}	12.78^{f}	15.67^{e}	16.78^{de}
3	12.78^{f}	15.78^{e}	18.33^{d}	19.44^{cd}
6	15.11^{e}	19.00^{cd}	22.89^{b}	23.78^{a}
9	17.00^{d}	20.67^{c}	24.00^{a}	25.22^{a}
SE $\pm$		0.893		
		4 WAT		
0	28.67^{i}	32.11^{hi}	38.33^{fg}	40.44^{f}
3	34.00^{gh}	40.11^{f}	46.89^{e}	48.00^{de}
6	41.56^{f}	48.56^{de}	56.11^{cd}	59.22^{bc}
9	40.78^{f}	52.00^{cd}	62.22^{ab}	63.89^{a}
SE $\pm$		2.189		
		6 WAT		
0	42.33^{h}	51.56^{f}	58.22^{ef}	60.89^{de}
3	54.44^{fg}	62.33^{d}	73.56^{c}	73.78^{c}
6	65.11^{d}	76.67^{c}	84.67^{b}	87.67^{ab}
9	63.11^{de}	74.56^{c}	88.89^{ab}	92.67^{a}
SE $\pm$		2.981		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

It was observed that irrespective of the amount of PM applied, significant increase in leaf numbers were recorded with corresponding increase in % JSE concentrationthroughout the sampling periods. Similarly, it was also observed that irrespective of the amount of JSE applied, significant increase in number of leaves of sweet pepper were recorded with the corresponding increase in PM levels in all the sampling periods. When no JSE was applied to sweet pepper, increase in PM from 0 – 9 t PM ha^{-1} recorded orresponding increase in number of leaves. But, 0 and 3 t PM ha^{-1} (at 2 WAT) and 6 and 9 t PM ha^{-1} (at 4 and 6 WAT) had statistically similar number of leaves. However, statistically similar number of leaves was recorded with applied 0 and 3 t PM ha^{-1} and with applied 6 and 9 t PM ha^{-1} when combined with application of 3 % EC ha^{-1} to sweet pepper at 2 WAT. Again application of 6 and 9 t PM ha^{-1} combined with 0 % or 1 % JSE concentration at 4 WAT and with all JSE rates at 6 WAT produced statistically similar number of leaves respectively. When no poultry manure was applied, increase in JSE rates resulted in corresponding increase in number of leaves of sweet pepper throughout the csampling periods. But statistically similar number of leaves was recorded when 0 % and 1 % EC ha^{-1} (at 2 and 4 WAT) and when 2 % and 3 % EC ha^{-1} (at 2, 4 and 6 WAT) were applied to sweet pepper. Generally, combined application of 9 t PM ha^{-1} with 3 % EC ha^{-1} produced the highest number of leaves that are statistically similar to those produced by the combined application of 9 t PM ha^{-1} with 2 % EC ha^{-1} at all the sampling periods.

Table 16 shows number of leaves for three sweet pepper varieties as influenced by the poultry manure and jatropha seed extracts in 2015 rainy season trial at Dadin-Kowa. It was observed that at 2, 4 and 6 WAT sampling periods, varieties of sweet pepper were statistically differed in terms of leaf number. Bellboy had statistically similar number of leaves with Kwadon local that was significantly more than that of Yolo Wonder at 2, 4 and 6 WAT.

Table 16: Number of Leaves of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts at 2, 4 and 6 eeks after Transplanting (WAT) during 2015 Rainy Season at Dadin- Kowa.

Treatment	2 WAT	4 WAT	6 WAT
Variety			
Kwadon local	22.52^{ab}	44.85^{ab}	56.79^{ab}
Bellboy	24.40^{a}	48.44^{a}	61.38^{a}
Yolo Wonder	20.94^{b}	37.62^{b}	51.69^{b}
SE $\pm$	0.943	3.053	2.379
Poultry Manure (t PM ha^{-1})			
0	16.75^{d}	31.56^{c}	42.03^{c}
3	21.28^{c}	41.47^{b}	53.06^{b}
6	25.08^{b}	48.00^{a}	63.36^{a}
9	27.36^{a}	53.53^{a}	68.03^{a}
SE $\pm$	0.926	2.645	3.299
Jatropha Seed Extract (% *EC*)			
0	19.31^{c}	36.17^{c}	47.31^{d}
1	21.17^{b}	42.08^{b}	53.69^{c}
2	24.44^{a}	47.44^{a}	61.11^{b}
3	25.56^{a}	48.86^{a}	64.36^{a}
SE$\pm$	0.694	1.136	1.157
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

The least leaf numbers were produced by Yolo Wonder that was at far with that of Kwadon local throughout the sampling periods.

Applications of PM significantly affected number of leaves of sweet pepper at 2, 4 and 6 WAT during the 2015 rainy season trial at Dadin-Kowa. The highest leaf numbers were produced by the application of 9 t PM ha^{-1} at 2, 4 and 6 WAT it was followed by leaf number from application of 6 t PM ha^{-1} at 4 and 6 WAT then 3 t PM ha^{-1} at 4 and 6 WAT which inturn was at per with that from application of 6 t PM ha^{-1} at 4 and 6 WAT only. The least numbers of leaves were from the control treatment, throughout the sampling periods.

Similarly, number of leaves of sweet pepper was significantly affected by the application of jatropha seed extracts at 2, 4 and 6 WAT during the 2015 rainy season trial at Dadin-Kowa. The highest leaf numbers were produced by the application of 3 % JSE concentration at 2, 4 and 6 WAT and was statistically similar to leaf produced from application of 2 % JSE concentration at 2 and 4 WAT only. This is followed by leaf produced when 1 % JSE concentration was applied at 2 and 4 WAT and 2 % and then 1 % EC ha^{-1} at 6 WAT. While, the least numbers of leaves were from the control treatment, throughout the sampling periods.

Only the interaction between PM and JSE on number of leaves of sweet pepper was significantly at 6 WAT during the 2015 rainy season at Dadin-Kowa. Table 17 shows the interaction of rates of PM and JSE on number of leaves of sweet pepper at 6 WAT of 2015 in Dadin-Kowa. Application of 9 t PM $ha^{-1}$of PM in combination with 3 % EC ha^{-1} produced the highest leaf number of sweet pepper at 6 WAT that was statistically similar to number of leaves produced from applied 9 t PM ha^{-1} in combination with 2 % EC ha^{-1} and 6 t PM ha^{-1} combined with 3 % EC ha^{-1} compable with number of leaves produce by application of 6 t PM ha^{-1} in combination with 2 % EC ha^{-1}.

Table 17: Interactions between Poultry Manure and Jatropha Seed Extracts on Number of Leaves of Sweet Pepper at 6 WAT during 2015 Rainy Season at Dadin-Kowa.

Treatment	Jatropha seed extracts (% *EC*)			
	0	1	2	3
Poultry Manure (t PM ha^{1})		6 WAT		
0	36.67^{i}	40.33^{hi}	43.33^{hi}	47.78^{gh}
3	43.22^{hi}	50.67^{fg}	58.33^{de}	60.00^{de}
6	53.11^{efg}	60.56^{de}	68.44^{bc}	71.33^{ab}
9	56.22^{ef}	63.22^{cd}	74.33^{ab}	78.33^{a}
SE $\pm$		3.860		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

. The least leaf number was produced from the interaction between 0 t PM ha^{-1} and 0 % EC ha^{-1} which was statistically similar to leaf number of sweet pepper produced by 0 t PM ha^{-1} when combined with 1 or 2 % JSE concentration. Application of PM and JSE had significant effects on number of leaves of three sweet pepper varieties when data for 2, 4 and 6 WAT sampling periods of 2014 and 2015 were combined at Dadin-Kowa (Table 18). Bellboy consistently recorded the highest mean numbers of leaves statistically similar to that of Kwadon local at 2 and 6 WAT only. While, Yolo Wonder had the least numbers of leaves throughout the sampling periods but which was at far with that of Kwadon local at 4 WAT only. Increasing PM rate from 0 – 3, 3 – 6 and 6 – 9 t PM ha^{-1} had resulted in a corresponding increase in leaf production at 2, 4 and 6 WAT. However, there was no significsnt difference between leaves produced from supply of 3 and 6 t PM ha^{-1} at 6 WAT only. Application of 9 t PM ha^{-1} recorded the highest number of leaves while, the least numbers of leaves were recorded by 0 t PM ha^{-1} throughout the sampling periods.

The same trend was observed with the application of jatropha seed extracts of sweet pepper. Statistically higher number of leaves was recorded by the application of 3 % EC ha^{-1} but, was not significantly different from those recorded by the application of 2 % EC ha^{-1} at 2 WAT only. This was followed by leaf number recorded fron 2 % EC ha^{-1} at 4 and 6 WAT, and 1 % EC ha^{-1} at 2 WAT only. The least numbers of leaves were recorded by the 0 % EC ha^{-1} throughout the sampling periods.

There was a significant interaction between variety and jatropha seed extracts at 6 WAT on number leaves of sweet pepper on one hand and PM and JSE interaction on number of leaves of sweet pepper at 2, 4 and 6 WAT. Bellboy when sprayed with either 2 or 3 % EC ha^{-1} produced statistically similar and the highest numbers of leaves at 6 WAT sampling periods. This was followed by leaf number by Bellboy when sprayed with 1 % EC ha^{-1}

Table 18: Number of Leaves of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts at 2, 4 and 6 WAT in 2014 and 2015 Combined Rainy Season at Dadin- Kowa.

Treatment	2 WAT	4 WAT	6 WAT
Variety			
Kwadon local	32.52[a]	45.31[b]	55.23[a]
Bellboy	33.81[a]	58.68[a]	66.33[a]
Yolo Wonder	27.42[b]	38.11[b]	49.17[b]
SE $\pm$	1.993	3.342	2.965
Poultry Manure (t PM ha^{-1})			
0	23.22[d]	33.92[d]	43.34[c]
3	29.13[c]	45.00[c]	53.82[b]
6	34.14[b]	49.68[b]	63.44[b]
9	38.51[a]	54.54[a]	67.14[a]
SE $\pm$	1.412	1.727	1.873
Jatropha Seed Extract (% *EC*)			
0	24.63[c]	36.21[d]	46.76[d]
1	30.33[b]	42.92[c]	54.14[c]
2	34.41[a]	49.58[b]	62.00[b]
3	35.60[a]	51.43[a]	64.82[a]
SE$\pm$	0.754	0.778	0.786
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	**
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

which was statistically similar to number of leaves recorded by Kwadon local sprayed with either 2 or 3 % EC ha^{-1} (Table 19). The least number of leaves from Kwadon local and Yolo Wonder in the absence of jatropha seed extracts spray at 6 WAT. Number of leaves produced by Kwadon local and Yolo Wonder are statistically similar for any rate of jatropha seed extract at 6 WAT.

The highest numbers of leaves of sweet pepper were obtained from the combined application of 9 t PM ha^{-1} and either 2 or 3 % EC ha^{-1} jatropha seed extracts at 2, 4 and 6 WAT while lowest values for number of leaves was when both PM and JSE were not applied. Numbers of leaves recorded by the application of 2 and 3 % JSE concentration are statistically similar irrespective of PM rates applied at 2, 4 and 6 WAT. Again, number of leaves produced by application of 6 and 9 t PM ha^{-1} was statistically similar with no spray of JSE at 4 WAT only, and when 0 – 2 % JSE concentration was sprayed at 6 WAT only. Further increase in rate of JSE from 2 – 3 % JSE concentration with applied 9 t PM ha^{-1} resulted to increase in number of leaves that was at far with 6 t PM ha^{-1} combined with 3 % JSE concentration only. Generally combined application of 9 t PM ha^{-1} with either 2 or 3 % JSE concentration produced the highest mean number of leaves of sweet pepper at 2, 4 and 6 WAT sampling periods (Table 19).

Number of leaves of three sweet pepper varieties as affected by rate of PM and JSE at 2, 4 and 6 WAT during 2014 rainy season at BUK is presented in Table 20. The result revealed significant variations in leaf production among the three pepper varieties and response of number of leaves to PM and JSE at 2, 4 and 6 WAT sampling periods at BUK. However, at 4 and 6 WAT, Bellboy produced the higher mean numbers of leaves that was more than mean numbers of leaves obtained by Kwadon local and Yolo Wonder at 2 and 4 WAT only; no

Table 19: Interactions between Variety and Jatropha Seed Extracts and between Poultry Manure and Jatropha Seed Extracts on Number of Leaves of Sweet Pepper at 6 and at 2, 4 and 6 WAT during the Two Years Combined at Dadin- Kowa.

Treatment	Jatropha seed extracts (% *EC*)			
	0	1	2	3
Variety		6 WAT		
Kwadon local	44.61^{f}	51.90^{def}	61.31^{bc}	63.24^{bc}
Bellboy	53.33^{de}	61.32^{b}	72.72^{a}	75.05^{a}
Yolo Wonder	42.22^{f}	46.00^{ef}	52.03^{def}	56.12^{cd}
SE $\pm$		3.193		
Poultry Manure (t PM ha^{1})		2 WAT		
0	18.71^{i}	22.44^{h}	25.93^{fg}	26.00^{fg}
3	24.11^{gh}	28.12^{ef}	31.44^{de}	32.76^{d}
6	26.13^{fg}	33.94^{d}	37.91^{b}	38.78^{b}
9	22.15^{h}	36.92^{bc}	42.56^{a}	45.12^{a}
SE $\pm$		2.913		
Poultry Manure (t PM ha^{1})		4 WAT		
0	27.33^{j}	32.17^{ij}	37.28^{gh}	38.89^{fg}
3	34.44^{hi}	40.44^{fg}	46.56^{e}	46.56^{e}
6	40.56^{fg}	47.39^{e}	54.11^{cd}	56.67^{bc}
9	42.50^{f}	51.67^{d}	60.39^{ab}	63.61^{a}
SE $\pm$		2.190		
Poultry Manure (t PM ha^{1})		6 WAT		
0	34.34^{i}	42.11^{h}	47.45^{fg}	49.33^{fg}
3	44.92^{gh}	51.27^{ef}	59.38^{cd}	59.76^{c}
6	53.02^{ef}	60.82^{c}	67.97^{b}	71.73^{b}
9	54.44^{de}	62.23^{c}	73.34^{ab}	78.35^{a}
SE $\pm$		2.316		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

significant difference ($P \leq 0.05$) existed in the number of leaves of Kwadon local and Bellboy at 6 WAT only. Generally the lowest number of leaves was produced by Yolo Wonder throughout the sampling periods.

Application of 3 t PM ha^{-1} and further increase to 6 t PM ha^{-1} significantly increased leaf numbers of sweet pepper throughout the sampling periods. Further increase in poultry manure rate to 9 t PM ha^{-1}, significantly enhanced leaf production at 6 WAT while at 2 and 4 WAT no significant difference ($P \leq 0.05$) in the number of leaves was observed between the pepper applied with 6 t PM ha^{-1} and 9 t PM ha^{-1}. The lowest mean leaf number was generally from the control treatment (0 t PM ha^{-1}).

Variation in JSE rates had statistically no significant effect on number of leaves of sweet pepper at 2, 4 and 6 WAT in 2014 at BUK. Increase in rate of JSE from 0 – 1 % JSE concentration recorded number of leaves that was statistically not significantly different. Further increase to 2 % JSE concentration resulted to production of lower number of leaves at 2 WAT only. Number of leaves of sweet pepper was statistically similar when sprayed with 0 – 3 % JSE concentration at 4 and 6 WAT only.

Variation in PM rate from 0 – 9 t PM ha^{-1} applied to the three sweet pepper varieties significantly enhanced increase in number of leaves at 4 WAT. The three sweet pepper varieties supplied with 0 – 3 t PM ha^{-1} and Kwadon local and Yolo Wonder fertilized with 3 – 9 t PM ha^{-1} to had statistically similar number of leaves respectively. Increase in PM rate to 3 t PM ha^{-1} to all varieties of pepper resulted in statistically no significant increase in number of leaves. Further increase to 6 and 9 t PM ha^{-1} supplied to the three pepper varieties resulted in corresponding increase in numbers of leaves. Application of 9 t PM ha^{-1} to Bellboy produced the highest mean number of leaves statistically similar when 6 t PM ha^{-1} was applied

Table 20: Number of Leaves of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts at 2, 4 and 6 WAT during 2014 Rainy Season at BUK.

Treatment	2 WAT	4 WAT	6 WAT
Variety			
Kwadon local	14.87[b]	55.52[b]	90.91[a]
Bellboy	16.37[a]	68.34[a]	85.63[a]
Yolo Wonder	6.96[c]	15.32[c]	27.57[b]
SE ±	1.430	8.254	8.033
Poultry Manure (t PM ha^{-1})			
0	11.82[c]	36.84[c]	56.47[c]
3	12.68[b]	47.99[b]	69.82[b]
6	13.25[a]	48.04[ab]	62.48[bc]
9	13.21[a]	52.69[a]	83.31[a]
SE ±	0.433	2.396	4.990
Jatropha Seed Extract (% *EC*)			
0	12.79[ab]	43.85	64.64
1	13.20[a]	46.35	68.30
2	12.19[b]	47.10	70.66
3	12.77[ab]	48.27	68.49
SE±	0.422	2.722	4.641
Interactions			
Var*PM	NS	**	**
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	**	NS	NS

Means followed by unlike letter(s) within columns are significantly different (P≤ 0.05) using DMRT

while the lowest mean number of leaves was produced by Yolo Wonder with no application of PM. Meanwhile, Kwadon local and Yolo Wonder supplied with 9 t PM ha^{-1} recorded statistically similar leaf numbers (Table 21).

Similarly, variation in JSE rate applied to the three sweet pepper varieties significantly enhanced more production of leaves at 6 WAT. 3 % EC ha^{-1} applied to Bellboy and Kwadon local produced the highest mean leaf numbers that are not significantly different ($P \leq 0.05$) from those obtained by the application of 2 % EC ha^{-1} at 6 WAT in 2014 rainy season at BUK. Increase in JSE rates from 0 – 1 % EC and from 2 – 3 % EC resulted in corresponding increase in number of leaves of Kwadon local and Bellboy at 6 WAT only. Increase in JSE rates from 0 – 3 % EC ha^{-1} did not affect the production of leaves of Yolo Wonder at 4 and 6 WAT in 2014 rainy season at BUK (Table 21).

Table 22 shows the interaction of variety, PM and JSE on he number of leaves of sweet pepper at 2 WAT of 2014 in BUK. Spraying of 1 % JSE concentration had significantly increased leaf number of Kwadon local fertilized with either 3 or 6 t PM ha^{-1} and Bellboy fertilized with 9 t PM ha^{-1} only. While others remained significantly unaffected, further increase in JSE rate to 2 % EC ha^{-1} had depressed leaf production of Kwadon local supplied with either 6 or 9 t PM ha^{-1} and Bellboy fertilized with 0 or 3 t PM ha^{-1} only but leaf production in other instances remained statistically same. Increase in JSE rate beyond 2 % EC ha^{-1} did not caused any significant increase or decrease of this character except for Kwadon local fertilized with 6 t PM ha^{-1} that had significant improvement in leaf production. At fixed JSE rate of 0 % EC ha^{-1} only increased in PM rate from 6 to 9 t PM ha^{-1} resulted in significant increase and decrease in the number of leaves of Kwadon local and Bollboy respectively. Variation in PM rate from 0 – 6 t PM ha^{-1} did not significantly affect leaf production of these latter two mentioned varieties.

Table 21: Interactions between Variety and Poultry Manure and between Varieties, Poultry Manure and Jatropha Seed Extracts on Number of Leaves of Sweet Pepper at 4 and 6 WAT and at 2 WAT respectively, during 2014 Rainy Season at BUK.

Treatment	Poultry Manure (t PM ha^{1})			
Variety	0	3	6	9
		4 WAT		
Kwadon local	42.48^{e}	63.98^{bc}	55.52^{d}	60.10^{cd}
Bellboy	53.87^{cd}	64.93^{bc}	72.27^{b}	82.30^{a}
Yolo Wonder	14.17^{f}	15.07^{f}	16.35^{f}	15.68^{f}
SE $\pm$		9.002		
		6 WAT		
Kwadon local	77.51^{cd}	98.73^{b}	78.92^{cd}	108.42^{ab}
Bellboy	67.72^{d}	81.22^{c}	79.89^{cd}	113.63^{a}
Yolo Wonder	24.24^{e}	29.53^{e}	28.68^{e}	27.91^{e}
SE $\pm$		10.980		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 22: Interactions between Varieties, Poultry Manure and Jatropha Seed Extracts on Number of Leaves of Sweet Pepper at 4 and 6 WAT and at 2 WAT respectively, during 2014 Rainy Season at BUK.

Treatment		Jatropha Seed Extracts (% *EC*)			
Variety	Poultry Manure (t PM ha^{1})	0	1	2	3
Kwadon local	0	13.53[b]	14.67[b]	12.87[b]	12.80[b]
	3	14.87[b]	15.13[a]	17.20[a]	15.20[a]
	6	14.13[b]	16.13[a]	13.20[b]	17.47[a]
	9	16.20[a]	16.40[a]	14.13[b]	13.93[b]
Bellboy	0	17.13[a]	17.80[a]	11.27[bc]	14.93[b]
	3	16.80[a]	16.47[a]	14.53[b]	14.20[b]
	6	18.00[a]	18.07[a]	16.53[a]	17.93[a]
	9	14.53[b]	16.80[a]	19.13[a]	17.73[a]
Yolo Wonder	0	6.87[d]	6.53[d]	6.67[d]	6.73[d]
	3	6.80[d]	6.47[d]	7.47[cd]	7.00[cd]
	6	7.40[cd]	6.67[d]	6.27[d]	7.20[cd]
	9	7.20[cd]	7.27[cd]	7.00[cd]	8.13[cd]
SE ±			2.017		

Means followed by unlike letter(s) are significantly different (P≤ 0.005) using DMRT

Varying the PM rates had no significant effect on number of leaves of Yolo Wonder at 0, 1, 2 or 3 % JSE concentration. At 1 % EC ha^{-1} the applied PM rates had statistically similar and more leaf number than far the unfertilized Kwadon local. Varying PM rate at fixed JSE of 1 % had no significant effect on number of leaves when fertilized with 0, 6 or 9 t PM ha^{-1} than 3 t PM ha^{-1}. In the case of Bellboy at the same JSE rate, fertilization withhigher rates (6 and 9 t PM ha^{-1}) had statistically similar and more number of leaves than 0 and 3 t PM ha^{-1} that were also statistically similar. Similar response was observed when JSE rate was raised to 3 % EC ha^{-1}. The only exception was from Kwadon loal that had statistically similar and higher number of leaves when fertilized with either 3 or 6 t PM ha^{-1}. The lowest leaf number recorded by this variety when no PM was applied was statistically at far with that of 9 t PM ha^{-1} (Table 22).

Number of leaves of three sweet peppers was significantly affected by rates of PM and JSE at 2, 4 and 6 WAT during 2015 rainy season at BUK (Table 23). No statistical difference in leaf number was observed among the three varieties of sweet pepper tested at 2, 4 and 6 WAT sampling times.

Number of leaves was significantly affected by the application of PM during 2015 rainy season at BUK. Increase in PM rate from 0 – 3, then to 6 and to 9 t PM ha^{-1} had resulted in corresponding increase in leaf numbers with highest obtained with application of 9 t PM ha^{-1} at 2, 4 and 6 WAT sampling periods. The least number of leaves was consistently produced by the control treatment.

Similarly, application of JSE significantly affected the leaf number of sweet pepper during 2015 rainy season at BUK. Pepper sprayed with 3 % JSE concentration had the highest number of leaves but was not statistically different from those obtained from Significant interactions were observed among the treatment combinations during the 2015 rainy season at BUK (Table 24).

Table 23: Number of Leaves of Three Sweet Pepper Varieties as Affected by Poultry Manure x and Jatropha Seed Extracts at 2, 4 and 6 WAT during 2014 Rainy Season at BUK.

Treatment	2 WAT	4 WAT	6 WAT
Variety			
Kwadon local	32.06	58.58	60.35
Bellboy	33.44	60.42	65.60
Yolo Wonder	29.94	53.44	63.81
SE $\pm$	2.219	3.186	2.106
Poultry Manure (t PM ha^{-1})			
0	22.00^{d}	39.89^{d}	42.22^{d}
3	27.94^{c}	51.11^{c}	60.81^{c}
6	35.06^{b}	64.00^{b}	69.97^{b}
9	42.25^{a}	74.92^{a}	81.36^{a}
SE $\pm$	2.735	4.168	3.268
Jatropha Seed Extract (% *EC*)			
0	27.33^{c}	47.33^{c}	52.64^{c}
1	29.83^{b}	55.11^{b}	61.08^{b}
2	34.92^{a}	63.39^{a}	69.95^{a}
3	35.17^{a}	64.08^{a}	70.89^{a}
SE$\pm$	0.694	1.136	1.157
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	**	**	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Table 24: Interactions between Poultry Manure and Jatropha Seed Extracts on Number of Leaves of Sweet Pepper at 2 and 4 WAT during 2015 Rainy Season at BUK.

Treatment	Jatropha seed extracts (% *EC*)			
Poultry Manure (t PM ha^{1})	0	1	2	3
		2 WAT		
0	19.8^{h}	20.22^{h}	23.89^{g}	24.00^{fg}
3	24.44^{fg}	26.22^{fgh}	30.44^{efg}	30.67^{def}
6	32.00^{cde}	33.56^{bcd}	38.22^{bc}	36.44^{bcd}
9	33.00^{bcd}	39.33^{b}	47.11^{a}	49.56^{a}
SE $\pm$		3.342		
		4 WAT		
0	36.33^{g}	36.89^{g}	43.33^{fg}	43.00^{fg}
3	41.11^{fg}	48.44^{ef}	58.44^{de}	56.44^{de}
6	54.22^{de}	62.33^{cd}	68.78^{c}	70.67^{c}
9	57.67^{de}	72.78^{bc}	83.00^{ab}	86.22^{a}
SE $\pm$		5.157		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Application of 9 t PM ha^{-1} interacted positively with the application of 3 % JSE to produce the highest leaf numbers of sweet pepper at 2 and 4 WAT. Though, these were not statistically different from the number of leaves produced by 9 t PM ha^{-1} + 2 % JSE concentrations at the same periods of observations. The least pepper leaf number was produced when neither PM nor JSE was sprayed.

The effect of application of PM and JSE at 2, 4 and 6 WAT on number of leaves of three sweet pepper varieties for combined data of 2014 and 2015 rainy season Rainy Season in BUK is presented on Table 25. No statistical difference in number of leaves was observed among the three varieties of sweet pepper at 2 WAT only. However at 4 and 6 WAT varietal difference in leaf production was observed. Bellboy generally had statistically similar leaf number with Kwadon local (at 4 WAT only) that was more than for Yolo Wonder (at 4 and 6 WAT). The lower leaf number recorded by Yolo Wonder was in turn statistically similar with that of Kwadon local at 6 WAT only. Number of leaves was statistically enhanced by the application of PM. Each increase in manure rates up to the highest of 9 t PM ha^{-1} had resulted to a corresponding increase in number of leaves. The highest numbers of leaves were produced by application of 9 t PM ha^{-1} while the least was from 0 t PM ha^{-1} at 2, 4 and 6 WAT.

Similarly, application of JSE exhibited significant effects on the number of leaves of sweet pepper throughout the sampling period. Application of 1 % and further increase to 2 % JSE concentration significantly increased leaf production. Beyond 2 % JSE concentration rate no significant increase in leaf number was recorded at 2, 4 and 6 WAT. Again the least number of leaves was obtained by the control treatment (Table 25).

Interaction between PM and JSE significantly influenced number of leaves of sweet pepper at 2 WAT of the 2014 and 2015 combined data at BUK. The highest numbers of leaves were produced by the interactive effects of 9 t PM ha^{-1} with either 3 % *EC* or 2 % *EC* of JSE.

Table 25: Number of Leaves of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts at 2, 4 and 6 WAT during the Two Years Combined at BUK.

Treatment	2 WAT	4 WAT	6 WAT
Variety			
Kwadon local	23.46	57.10[a]	76.11[b]
Bellboy	24.90	64.41[a]	75.64[a]
Yolo Wonder	18.46	34.43[b]	45.73[b]
SE $\pm$	1.685	5.190	4.123
Poultry Manure (t PM ha^{-1})			
0	16.91[d]	38.41[d]	49.33[d]
3	20.31[c]	49.63[c]	65.30[c]
6	24.15[b]	56.01[b]	66.23[b]
9	27.73[a]	63.80[a]	82.33[a]
SE $\pm$	1.397	2.754	3.112
Jatropha Seed Extract (% *EC*)			
0	20.06[c]	45.62[c]	58.64[c]
1	21.52[b]	50.73[b]	64.73[b]
2	23.55[a]	55.22[a]	70.24[a]
3	23.97[a]	56.21[a]	69.72[a]
SE$\pm$	0.610	1.643	2.701
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	**	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Table 26: Interactions between Poultry Manure and Jatropha Seed Extracts on Number of Leaves of Sweet Pepper at 2 WAT in 2014 and 2015 Combined Data at BUK.

Treatment	Jatropha seed extracts (% *EC*)			
Poultry Manure (t PM ha^1)	0	1	2	3
		2 WAT		
0	16.20^{h}	16.61^{h}	17.08^{gh}	17.74^{gh}
3	18.63^{fgh}	19.46^{efgh}	21.76^{def}	21.40^{def}
6	22.59^{cde}	23.59^{bcd}	25.11^{bc}	25.32^{bc}
9	22.82^{cde}	26.41^{b}	30.27^{a}	31.41^{a}
SE $\pm$		1.751		

Means followed by unlike letter(s) are significantly different (P$\leq$ 0.005) using DMRT

The least numbers of leaves were obtained by the interaction between 0 t PM ha^{-1} with any of % of JSE rate (Table 26).

Number of primary branches

Number of primary branches of three sweet peppers was significantly affected by Variety, PM and JSE at 4, 6 and 8 WAT in 2014 rainy season at Dadin-Kowa (Table 27). The result indicated that varietal effects on number of primary branches of sweet pepper were not statistically different among the three varieties of sweet pepper throughout the sampling periods. However, at 4 WAT Yolo Wonder had the highest number of primary branches. At 6 WAT Bellboy recorded the highest primary branches and at 8 WAT the statistically higher number of branches was recorded by Kwadon local.

The number of primary branches of sweet pepper was significantly affected by the application of PM during 2014 rainy season at Dadin-Kowa. At 4, 6 and 8 WAT, 9 t PM ha^{-1} statistically recorded the highest mean number of primary branches. While the least numbers of primary branches was obtained from the control treatment throughout the sampling periods. Similarly, numbers of primary branches were significantly affected by the application of JSE at 4, 6 and 8 WAT. The highest numbers of branches were obtained with the application of 3 % JSE concentration but this was statistically not different from those obtained with application of 2 % EC ha^{-1}.

Interaction between variety and JSE significantly enhanced number of branches of sweet pepper during the 2014 rainy season at Dadin-Kowa at 6 and 8 WAT. All the varieties favorably interacted with 3 % EC ha^{-1} and recorded the highest numbers of primary branches but not statistically different from numbers of branches recorded as result of interaction between the varieties and 2 % EC ha^{-1} at 6 and 8 WAT.

Table 27: Number of Primary Branches at 4, 6 and 8 WAT of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 Rainy Season at Dadin-Kowa.

Treatment	4 WAT	6 WAT	8 WAT
Variety			
Kwadon local	3.85	9.52[a]	15.90[b]
Bellboy	4.06	10.23[a]	15.79[a]
Yolo Wonder	4.29	10.04[b]	14.98[b]
SE ±	0.470	0.732	1.136
Poultry Manure (t PM ha^{-1})			
0	2.75[d]	6.69[d]	11.28[d]
3	3.50[c]	8.94[c]	14.06[c]
6	4.58[b]	11.19[b]	17.47[b]
9	5.44[a]	12.89[a]	19.42[a]
SE ±	0.319	0.413	0.510
Jatropha Seed Extracts (% *EC*)			
0	2.69[c]	6.97[c]	11.19[c]
1	3.50[b]	8.94[b]	14.53[b]
2	4.94[a]	11.67[a]	17.97[a]
3	5.14[a]	12.14[a]	18.53[a]
SE±	0.143	0.199	0.284
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	**	**
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	**

Means followed by unlike letter within columns are significantly different (P≤ 0.05) using DMRT

Table 28: Interactions between Variety and Jatropha Seed Extracts on Number of Primary Branches of Sweet Pepper at 6 and 8 WAT during 2014 Rainy Season at Dadin-Kowa.

Treatment	Jatropha Seed Extracts (% *EC*)			
Variety	0	1	2	3
		6 WAT		
Kwadon local	6.17[c]	8.17[b]	11.67[a]	12.08[a]
Bellboy	7.25[bc]	9.50[b]	11.75[a]	12.42[a]
Yolo Wonder	7.50[bc]	9.17[b]	11.58[a]	11.92[a]
SE ±		0.790		
		8 WAT		
Kwadon local	10.83[c]	15.08[abc]	18.50[ab]	19.17[a]
Bellboy	11.42[c]	14.42[bc]	18.42[ab]	18.92[a]
Yolo Wonder	11.33[c]	14.08[bc]	17.00[ab]	17.50[ab]
SE ±		1.699		

Means followed by unlike letter(s) are significantly different (P≤ 0.005) using DMRT

Table 29: Interactions between Poultry Manure and Jatropha Seed Extracts on Number of Primary Branches of Sweet Pepper at 4, 6 and 8 WAT during 2014 Rainy Season at Dadin-Kowa.

Treatment	Jatropha Seed Extracts (% *EC*)			
Poultry Manure (t PM ha[1])	0	1	2	3
		4 WAT		
0	1.67^{g}	2.56^{ef}	3.44^{e}	3.33^{e}
3	2.44^{g}	3.00^{ef}	4.22^{de}	4.33^{cd}
6	3.00^{ef}	3.89^{cd}	5.33^{b}	6.11^{ab}
9	3.89^{de}	4.56^{c}	6.67^{a}	6.67^{a}
SE $\pm$		0.404		
		6 WAT		
0	4.44^{i}	6.00^{h}	7.89^{fg}	8.44^{f}
3	6.22^{h}	7.78^{fg}	10.67^{de}	11.11^{cd}
6	7.33^{g}	10.00^{e}	13.33^{b}	14.11^{b}
9	9.89^{e}	12.00^{c}	14.78^{a}	14.89^{a}
SE $\pm$		0.537		
		8 WAT		
0	8.00^{g}	10.44^{f}	13.00^{e}	13.67^{e}
3	10.44^{f}	13.33^{e}	15.89^{d}	16.56^{cd}
6	12.56^{e}	16.67^{cd}	20.00^{b}	20.67^{b}
9	13,78^{e}	17.67^{c}	23.00^{a}	23.22^{a}
SE $\pm$		0.708		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

The least numbers of primary branches were obtained by interaction between Kwadon local and 0 % EC ha^{-1} at 6 and 8 WAT sampling times (Table 28).

PM x JSE interaction statistically affected the number of primary branches at 4, 6 and 8 WAT sampling periods during 2014 rainy season at Dadin-Kowa. Interaction between 9 t PM ha^{-1} and 3 % JSE concentration recorded the highest numbers of primary branches but were not statistically different from those recorded by interaction between 9 t PM ha^{-1} and 2 % EC ha^{-1} throughout the sampling times (Table 29). However, 0 t PM ha^{-1} x 0 % EC ha^{-1} interactions always had the least numbers of primary branches throughout the sampling periods. Increase in % JSE concentration irrespective of increase in t PM ha^{-1} resulted in corresponding increase in number of primary branches of sweet pepper. Similarly, increase in t PM ha^{-1} irrespective of increase in % *EC* of JSE resulted in corresponding increase in number of primary branches of sweet pepper at 4, 6 and 8 WAT sampling times (Table 29).

Table 30 shows the interactions of variety, PM and JSE on number of branches of sweet pepper at 8 WAT of 2014 rainy season in Dadin-Kowa. Application of 1 % EC ha^{-1} significantly increased branching of Kwadon local fertilized with 3, 6 and 9 t PM ha^{-1}, Bellboy fertilized with either 0 or 9 t PM ha^{-1} and Yolo Wonder fertilized with 9 t PM ha^{-1} only while other remained significantly same. Further increase in JSE rate to 2 % EC ha^{-1} increased branching in Kwadon local supplied with either 6 or 9 t PM ha^{-1}, Bellboy given 9 t PM ha^{-1} and Yolo Wonder fertilized with 6 t PM ha^{-1} only, other remained significantly same. Increase in JSE rate to 3 % EC ha^{-1} did not affect branching of any of the three varieties of sweet pepper regardless of the PM rate. At fixed JSE rate of 0 % EC ha^{-1} application of PM had no significant effecton branching of Kwadon local only.

Table 30: Interactions between Variety, Poultry Manure and Jatropha Seed Extracts on Number of Primary Branches of Sweet Pepper at 8 WAT during 2014 Rainy Season at Dadin-Kowa.

Treatment	Poultry Manure	Jatropha Seed Extracts (% *EC*)			
	(t ha^{1})	0	1	2	3
Variety			8 WAT		
Kwadon local	0	8.00^{g}	11.00^{fg}	13.33^{efg}	14.33^{de}
	3	10.67^{fg}	14.67^{de}	17.00^{cd}	17.33^{cde}
	6	11.33^{fg}	17.00^{de}	21.67^{ab}	22.67^{ab}
	9	13.33^{eg}	17.67^{cd}	22.00^{ab}	22.33^{ab}
Bellboy	0	8.00^{g}	11.00^{f}	13.33^{efg}	13.67^{ef}
	3	10.00^{fg}	12.67^{ef}	15.33^{def}	16.33^{d}
	6	14.00^{def}	17.33^{cde}	20.00^{bc}	20.67^{ab}
	9	13.67^{ef}	16.67^{d}	25.00^{a}	25.00^{a}
Yolo Wonder	0	8.00^{g}	9.33^{fg}	12.33^{fg}	13.00^{ef}
	3	10.67^{fg}	12.67^{ef}	15.33^{def}	16.00^{def}
	6	12.33^{fg}	15.67^{def}	18.33^{bc}	18.67^{bc}
	9	14.33^{def}	18.67^{bc}	22.00^{ab}	22.33^{ab}
SE $\pm$			2.004		

Means followed by unlike letter(s) are significantly different (P$\leq$ 0.005) using DMRT

While application of 9 t PM ha^{-1} to Bellboy and Yolo Wonder produced more branches than at lower manure rates. At 1 % EC ha^{-1}, the applied PM rates had resulted to statistically similar but number of branches than 0 t PM ha^{-1} in the case of Kwadon local. In the case of Bellboy and Yolo Wonder 9 t PM ha^{-1} had resulted in more branches compared to other PM rates. At 2 % and 3 % EC ha^{-1} higher PM rates (6 or 9 t PM ha^{-1}) had resulted in more branches for each of the sweet pepper variety compared to lower rates (0 or 3 t PM ha^{-1}). Application of 9 t PM ha^{-1} in combination with either 2 or 3 % EC ha^{-1} to Bellboy had resulted in the highest number of branches statistically similar to that of Kwadon local and Yolo Wonder at the same PM and JSE rates. The lowest number of branches was recorded by all the varieties when they received neither PM and JSE.

Response of number of primary branches of three sweet peppers to application of PM and JSE at 4, 6 and 8 WAT during 2015 rainy season at Dadin-Kowa is presented on Table 31. No statistical differences ($P \leq 0.05$) were observed among the varieties with respect to number of primary branches of sweet pepper throughout the sampling periods.

Applications of the varying levels of PM significantly affected the number of primary branches of sweet pepper at 4, 6 and 8 WAT sampling times. Application of 9 t PM ha^{-1} recorded the highest numbers of primary branches of sweet pepper throughout the sampling periods but they were not statistically different from those of pepper fertilized with 6 t PM ha^{-1} as observed at the same periods. The least numbers of primary branches were recorded by the control treatment at all the sampling periods.

Similar trends were observed by application of JSE on number primary branches of sweet pepper at 4, 6 and 8 WAT sampling periods in 2015 rainy season at Dadin-Kowa. Application of JSE positively enhanced the number of primary branches of sweet pepper.

Table 31: Number of Primary Branches at 4, 6 and 8 WAT of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2015 Rainy Season at Dadin-Kowa.

Treatment	4 WAT	6 WAT	8 WAT
Variety			
Kwadon local	10.08	11.31	12.56
Bellboy	9.06	10.23	11.69
Yolo Wonder	10.65	10.66	10.92
SE $\pm$	2.012	0.751	0.834
Poultry Manure (t PM ha^{-1})			
0	7.31^{b}	8.44^{c}	9.39^{c}
3	9.11^{b}	10.14^{b}	11.50^{b}
6	10.00^{ab}	11.28^{a}	12.69^{a}
9	13.36^{a}	11.67^{a}	13.31^{a}
SE $\pm$	1.826	0.514	0.502
Jatropha Seed Extracts (% *EC*)			
0	7.31^{b}	8.36^{c}	9.58^{c}
1	9.17^{ab}	10.28^{b}	11.50^{b}
2	12.89^{a}	11.36^{a}	12.89^{a}
3	10.36^{ab}	11.53^{a}	12.92^{a}
SE$\pm$	1.968	0.294	0.312
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Sweet peppers applied with 3 % EC ha^{-1} recorded the highest numbers of primary branches though not significantly different from those obtained by the application of 2 % EC ha^{-1} at 6 and 8 WAT only. At 4 WAT sweet pepper applied with 2 % EC ha^{-1} produced the highest number of branhes but statistically similar to 1 % and 3 % EC ha^{-1} which are in turn not statistically different from that of the control treatment. However, all the applied levels of JSE statistically outnumber the primary branches of sweet pepper recorded by control treatment at 6 and 8 WAT sampling times (Table 31).

All interactions among the treatment factors had no statistical effect on the number of primary branches of sweet pepper at 4, 6 and 8 WAT during the 2015 rainy season at Dadin-Kowa (Table 31).

Table 32 shows number of primary branches of three sweet pepper varieties as influenced by PM and JSE at 4, 6 and 8 WAT in 2014 and 2015 combined rainy season data at Dadin-Kowa. Numbers of primary branches did not significantly differ among the three varieties of sweet pepper tested at 4, 6 and 8 WAT sampling periods.

PM significantly affected the number of primary branches of sweet pepper in 2014 and 2015 combined rainy season data at Dadin-Kowa. Increase in rates of PM from 0 – 3, 6 and 9 t PM ha^{-1} had resulted in a corresponding increase in branching. The highest PM rate of 9 t PM ha^{-1} generally recorded the highest number of primary branches (Table 32).

Similarly, JSE statistically enhanced the number of primary branches of sweet pepper in 2014 and 2015 combined rainy season data at Dadin-Kowa. However, there was no statistical difference in the number of branches between pepper sprayed with 2 and 3 % EC ha^{-1} and are significantly more than par other rates at 4, 6 and 8 WAT. All the varying levels of JSE statistically had higher number of primary branches than the control treatment at 4, 6 and 8 WAT sampling periods. As such the least numbers of primary branches were recorded by the

Table 32: Number of Primary Branches at 4, 6 and 8 WAT of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts in 2014 and 2015 Rainy Season Combined Data at Dadin-Kowa.

Treatment	4 WAT	6 WAT	8 WAT
Variety			
Kwadon local	7.49	10.40	13.68
Bellboy	6.93	10.24	13.29
Yolo Wonder	6.99	9. 82	12.33
SE ±	0.392	0.374	0.571
Poultry Manure (t PM ha^{-1})			
0	5.36[d]	7.54[d]	9.88[d]
3	6.74[c]	9.53[c]	12.29 [c]
6	7.92[b]	11.26[b]	14.40[b]
9	8.53[a]	12.28[a]	15.85[a]
SE ±	0.259	0.386	0.371
Jatropha Seed Extracts (% *EC*)			
0	5.47[c]	7.67[c]	9.85[c]
1	6.78[b]	9.58[b]	12.53[b]
2	8.06[a]	11.51[a]	14.85[a]
3	8.54[a]	11.85[a]	15.18[a]
SE±	0.236	0.169	0.237
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	**
PM*JSE	NS	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different (P≤ 0.05) using DMRT

control treatment throughout the sampling times (Table 32).

Interactions between variety and JSE statistically affected the number of primary branches of sweet pepper at 8 WAT sampling times during the two years combined at Dadin-Kowa. At 6 WAT all the varieties interacting with 0 % EC ha^{-1} had the least numbers of primary branches. At the same time Kwadon local and Bellboy interacted with 3 % EC ha^{-1} and recorded the highest number of primary branches though they were not statistically different from those recorded by the interactive effects of Kwadon local and Bellboy x 2 % EC ha^{-1} (Table 33).

Likewise, interaction between PM and JSE positively affected the number of primary branches of sweet pepper at 6 and 8 WAT during the two years combined at Dadin-Kowa. The interaction between 9 t PM ha^{-1} and 3 % EC ha^{-1} had the highest number of primary branches which was not statistically different from that recorded by the interactive effects of 9 t PM ha^{-1} x 2 % EC ha^{-1} during the two years combined at Dadin-Kowa. The least number of primary branches of sweet pepper was recorded by the interaction between 0 t PM ha^{-1} and 0 % EC ha^{-1} (Table 33).

The result in Table 34 indicated that variety; PM and JSE significantly affected the number of primary branches of sweet pepper at 4, 6 and 8 WAT during the 2014 rainy season at BUK. Initially at 4 and 6 WAT sampling times number of branches was not statistically different among the varieties of sweet pepper. But at 8 WAT there was significant difference among the varieties with respect to number of branches. Bellboy had the highest number of branches although not significantly different from recorded by Kwadon local at 8 WAT sampling period, while the least number of branches was recorded by Yolo Wonder at the same time of sampling.

Table 33: Interactions between Variety and Jatropha Seed Extracts and between Poultry Manure and Jatropha Seed Extracts on Number of Primary Branches of Sweet Pepper at 8 WAT and at 6 and 8 WAT respectively, during the Two Years Combined at Dadin-Kowa.

Treatment	Jatropha Seed Extracts (% EC)			
	0	1	2	3
Variety		8 WAT		
Kwadon local	10.17^{d}	13.08^{bc}	15.25^{a}	16.21^{a}
Bellboy	9.96^{d}	12.38^{c}	15.33^{a}	15.50^{a}
Yolo Wonder	9.42^{d}	12.13^{c}	13.96^{b}	13.83^{b}
SE $\pm$		0.673		
Poultry Manure (t ha^{1})		6 WAT		
0	5.56^{i}	6.94^{h}	8.44^{f}	9.22^{c}
3	7.39^{gh}	9.00^{e}	10.83^{d}	10.89^{d}
6	8.28^{fg}	10.39^{d}	12.78^{bc}	13.61^{ab}
9	9.44^{e}	12.00^{c}	14.00^{a}	13.67^{ab}
SE $\pm$		0.485		
Poultry Manure (t ha^{1})		8 WAT		
0	7.44^{g}	9.17^{f}	11.17^{de}	11.72^{de}
3	9.33^{f}	12.00^{d}	13.89^{c}	13.94^{c}
6	10.89^{e}	14.00^{c}	16.11^{b}	16.61^{b}
9	11.72^{de}	14.94^{c}	18.22^{a}	18.44^{a}
SE $\pm$		0.553		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Application of PM statistically improved the number of branches of sweet pepper than the control treatment. At 4 WAT numbers of branches recorded were not significantly different on sweet pepper as affected by the various levels of PM except that recorded by the control treatment. However, at 6 and 8 WAT the numbers of primary branches recorded were statistically different among the applied PM. 9 t PM ha^{-1} had statistically the highest number of primary branches at 6 and 8 WAT sampling times.

Similarly, application of JSE to sweet pepper statistically enhanced number of branches at 6 and 8 WAT sampling times. At 4 WAT sampling the numbers of primary branches were significantly different with the entire applied % EC ha^{-1}. However, at 6 and 8 WAT sampling periods the application of 2 % EC ha^{-1} recorded the highest mean numbers of primary branches. Other treatment levels had numbers of primary branches that are not statistically different throughout the sampling times (Table 34).

Interaction between variety and PM had statistically positive effects on number of primary branches of sweet pepper at 8 WAT (Table 35). 9 t PM ha^{-1} applied to Bellboy recorded significantly the highest mean number of branches this was followed by that obtained by application of 9 t PM ha^{-1} to Kwadon local. Fewer numbers of branches were recorded by Yolo Wonder irrespective of the levels of PM.

Table 36 showed the number of primary branches of sweet pepper as affected by variety, PM and JSE at 4, 6 8 WAT during 2015 rainy season at BUK. No significant difference was observed among the varieties with respect to number of primary branches throughout the sampling periods. Application of PM significantly enhanced the number of primary branches of sweet pepper at 4, 6 and 8 WAT. Application of 9 t PM ha^{-1} produced the highest numbers of primary branches of sweet pepper throughout the sampling times.

Table 34: Number of Primary Branches at 4, 6 and 8 WAT of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 Rainy Season at BUK.

Treatment	4 WAT	6 WAT	8 WAT
Variety			
Kwadon local	3.16	13.04	21.09[a]
Bellboy	3.25	12.14	22.14[a]
Yolo Wonder	2.94	12.61	18.21[b]
SE $\pm$	0.656	2.446	2.001
Poultry Manure (t PM ha^{-1})			
0	2.56[b]	10.78[c]	17.09[c]
3	3.12[a]	13.09[ab]	20.74[b]
6	3.41[a]	12.85[b]	19.56[b]
9	3.38[a]	13.66[a]	24.54[a]
SE $\pm$	0.318	0.710	1.235
Jatropha Seed Extracts (% *EC*)			
0	2.99[c]	12.14[c]	19.61[c]
1	3.21[b]	12.66[b]	20.33[b]
2	3.10[a]	12.86[a]	21.65[a]
3	3.17[a]	12.72[a]	20.33[a]
SE$\pm$	0.244	0.711	1.157
Interactions			
Var*PM	NS	NS	**
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Table 35: Interactions between Variety and Poultry Manure on Number of Primary Branches of Sweet Pepper at 8 WAT during 2014 Rainy Season at BUK.

Treatment	Poultry Manure (t PM ha^{-1})			
	0	3	6	9
Variety				
Kwadon local	16.70^{d}	23.47^{bc}	18.35^{cd}	25.85^{ab}
Bellboy	17.60^{d}	20.00^{bc}	21.40^{bc}	29.57^{a}
Yolo Wonder	16.97^{d}	18.75^{cd}	18.92^{c}	18.20^{cd}
SE $\pm$		2.727		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

The least numbers of primary branches were obtained by the control treatment in all the sampling periods. The numbers of primary branches were not statistically different with the applications of 3 and 6 t PM ha^{-1} during the observed periods (Table 36).

Applications of 2 and 3 % JSE concentration was found to have significant effects on the number of primary branches of sweet pepper over control treatment of 0 % EC ha^{-1}. However, no statistical difference was observed between the applied 2 and 3 % EC ha^{-1} concentration as they affect the number of primary branches of sweet pepper at the times of measurements.

Interactions among the treatment factors were not found to have significant effect on number of primary branches of sweet pepper during the 2015 rainy season at BUK throughout the sampling times (Table 36).

Number of primary branches of sweet pepper as affected by variety, PM and JSE at 4, 6 and 8 WAT in 2014 and 2015 combined data at BUK was as presented in Table 37. No significant difference was observed among the varieties with respect to number of primary branches throughout the sampling periods. Numbers of primary branches of sweet pepper were statistically enhanced by applications of various levels of PM than the control treatment by far in all the sampling periods. The highest numbers of primary branches of sweet pepper were obtained when 9 t PM ha^{-1} was applied. These were followed by the application of 6 t PM ha^{-1} though not statistically different from the ones produced by the application of 3 t PM ha^{-1} in 4, 6 and 8 WAT sampling periods. The least numbers of primary branches were recorded by the control treatment throughout the times (Table 37).

Similarly, Numbers of primary branches of sweet pepper were statistically enhanced by applications of various levels of JSE than the control treatment in all the sampling periods. Although, no significant differences were observed between the applied 2 and 3 % EC ha^{-1}

Table 36: Number of Primary Branches at 4, 6 and 8 WAT of Three Sweet Pepper as Affected by Variety, Poultry Manure and Jatropha Seed Extracts during 2015 Rainy Season at BUK.

Treatment	Number of Primary Branches(WAT)		
	4	6	8
Variety			
Kwadon local	12.06	13.54	15.08
Bellboy	13.35	15.17	17.79
Yolo Wonder	14.12	15.65	17.48
SE $\pm$	2.044	1.861	1.813
Poultry Manure (t PM ha^{-1})			
0	8.56^{d}	9.97^{d}	11.14^{d}
3	12.36^{c}	13.86^{c}	15.25^{c}
6	14.11^{b}	15.72^{b}	18.56^{b}
9	17.69^{a}	19.58^{a}	22.19^{a}
SE $\pm$	0.965	1.023	1.330
Jatropha Seed Extracts (% *EC*)			
0	11.83^{b}	13.39^{b}	14.81^{c}
1	12.81^{ab}	14.22^{b}	16.36^{b}
2	14.17^{a}	15.72^{a}	17.94^{a}
3	17.69^{a}	15.81^{a}	18.03^{a}
SE$\pm$	0.668	0.716	0.748
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

on number of primary branches of sweet pepper, throughout the sampling periods. However, they all obtained statistically greater numbers of primary branches than the control treatment (Table 37).

Interactions among the variety, PM and JSE were found to have significant effect on number of primary branches of sweet pepper in 2014 and 2015 combined data at BUK throughout the sampling periods (Table 38). 9 t PM ha^{-1} with 2 % EC ha^{-1} was not statistically different from 9 t PM ha^{-1} with 3 % EC ha^{-1} applied to Bellboy both had statistically the highest numbers of primary branches. But then these were not significantly different from numbers of primary branches recorded by the applications of 9 t PM ha^{-1} with 3 % EC ha^{-1} the other varieties.

The same observation was made when 9 t PM ha^{-1} with 3 % EC ha^{-1}, 9 t PM ha^{-1} with 2 % EC ha^{-1} and 6 t PM ha^{-1} with 3 % EC ha^{-1} and 6 t PM ha^{-1} with 2 % EC ha^{-1} were applied to Kwadon local at 6 WAT (Table 37). The least number of primary branches was recorded by the control treatments of 0 t PM ha^{-1} with 0 % EC ha^{-1} applied to any of variety of sweet pepper.

Table 38 shows the interactions of variety, PM and JSE on number of branches of sweet pepper at 8 WAT of 2014 and 2015 combined data at BUK. Application of 1 % EC ha^{-1} significantly increased branching of Kwadon local fertilized with 3, 6 and 9 t PM ha^{-1}, Bellboy and Yolo Wonder fertilized with either 6 or 9 t PM ha^{-1} only while other remained significantly same. Further increase in JSE rate to 2 % EC ha^{-1} increased branching in Kwadon local supplied with either 6 and 9 t PM ha^{-1}, Bellboy given 9 t PM ha^{-1} and Yolo Wonder fertilized with 6 t PM ha^{-1} only, other remained significantly same. Increase in JSE rate to 3 % EC ha^{-1} did not affect branching of any of the three varieties of sweet pepper regardless of the PM rate. At fixed JSE rate of 0 % EC ha^{-1} application of PM had significant effect on branching of

Table 37: Number of Primary Branches at 4, 6 and 8 WAT of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during the Two Years Combined at BUK.

Treatment	4 WAT	6 WAT	8 WAT
Variety			
Kwadon local	7.61	13.29	18.09
Bellboy	8.30	13.65	19.97
Yolo Wonder	8.53	14.13	17.86
SE ±	1.063	1.993	1.651
Poultry Manure (t PM ha^{-1})			
0	5.56^{c}	10.38^{c}	14.11^{c}
3	7.74^{b}	13.48^{b}	17.99^{b}
6	8.76^{b}	14.29^{b}	19.06^{b}
9	10.54^{a}	16.62^{a}	23.37^{a}
SE ±	0.549	0.612	0.924
Jatropha Seed Extracts (% *EC*)			
0	7.41^{c}	12.77^{c}	17.21^{c}
1	8.01^{bc}	13.44^{b}	18.35^{b}
2	8.63^{ab}	14.29^{a}	19.80^{a}
3	8.54^{a}	14.26^{a}	19.18^{a}
SE±	0.346	0.503	0.749
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	**	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Table 38: Interactions between Variety, Poultry Manure and Jatropha Seed Extracts (JSE) on Number of Primary Branches of Sweet Pepper at 8 WAT during the Two Years Combined at BUK.

Treatment	Poultry Manure ($t\ PM\ ha^{1}$)	Jatropha Seed Extracts (% *EC*) 0	1	2	3
Variety			6WAT		
Kwadon local	0	9.40^{g}	9.47^{fg}	10.80^{fg}	10.17^{fg}
	3	10.70^{fg}	11.17^{de}	14.93^{cd}	14.50^{cde}
	6	11.80^{fg}	13.83^{de}	16.47^{ab}	16.40^{ab}
	9	13.07^{eg}	18.50^{cd}	15.53^{ab}	16.90^{ab}
Bellboy	0	9.23^{g}	10.83^{fg}	9.07^{fg}	9.60^{fg}
	3	12.33^{fg}	13.30^{ef}	13.77^{def}	13.10^{ef}
	6	14.67^{def}	15.97^{cde}	15.50^{bc}	16.70^{ab}
	9	15.17^{ef}	16.63^{d}	19.50^{a}	17.70^{ab}
Yolo Wonder	0	10.77^{fg}	11.47^{f}	11.90^{efg}	11.77^{efg}
	3	11.80^{efg}	13.30^{ef}	15.50^{de}	15.73^{de}
	6	14.13^{fg}	14.27^{def}	15.60^{bc}	16.73^{ab}
	9	15.13^{def}	16.03^{bc}	16.93^{ab}	17.97^{ab}
SE $\pm$			2.663		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Yolo Wonder only. At 1 % JSE concentration, the applied PM rates had resulted to statistically similar but number of branches than 0 t PM ha^{-1} in the case of Kwadon local. In the case of Bellboy and Yolo Wonder 9 t PM ha^{-1} had resulted in more branches compared to other PM rates. At 2 % and 3 % EC ha^{-1} higher PM rates (6 or 9 t PM ha^{-1}) had resulted in more branches for each of the sweet pepper variety compared to lower rates (0 or 3 t PM ha^{-1}). Application of 9 t PM ha^{-1} in combination with either 2 or 3 % EC ha^{-1} to Bellboy and Yolo Wonder had resulted in the highest number of branches statistically similar to that of Kwadon local at the same PM and JSE rates. The lowest number of branches was recorded by all the varieties when they received neither PM nor JSE.

Leaf area index (LAI)

Leaf area index (LAI) of sweet pepper as in Table 39 was significantly enhanced by variety, PM and JSE during the 2014 rainy season trials at Dadin-Kowa, BUK and their combined location.

Highly significant difference was noted among the applied quantities of PM as they affect the LAI of sweet pepper during the the two years combined at Dadin-Kowa. 9 t PM ha^{-1} recorded the highest LAI of sweet pepper at Dadin-Kowa than all the other levels of the applied PM and the control treatment at far. This was followed by the LAI produced of sweet pepper by the applied 6 t PM ha^{-1}. Similarly, during the the two years combined BUK. The highest LAI was recorded by the applied 9 t PM ha^{-1} though not significantly different from that obtained by the 6 t PM ha^{-1}. The least LAI was obtained by the control treatment of 0 t PM ha^{-1} at both the locations. No statistical difference observed in LAI of sweet pepper by all the PM levels at BUK in 2014 rainy season (Table 39).

Table 39: Leaf Area Index (LAI) of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 and the Two Years Combined at Dadin-Kowa and BUK.

Treatment	Dadin-Kowa			BUK		
	2014	2015	2014/2015 (Combined)	2014	2015	2014/2015 (Combined)
Variety						
Kwadon local	0.92	0.76^{b}	0.84^{b}	0.82	1.42^{b}	1.12^{b}
Bellboy	0.89	1.53^{a}	1.21^{a}	0.74	1.54^{a}	1.14^{b}
Yolo Wonder	0.98	1.65^{a}	1.32^{a}	0.90	1.64^{a}	1.27^{a}
SE $\pm$	0.050	0.251	0.251	0.102	0.251	0.073
Poultry Manure (t PM ha^{-1})						
0	0.81^{d}	1.20^{c}	1.01^{c}	0.76^{c}	1.19^{c}	0.97^{c}
3	0.91^{c}	1.51^{b}	1.21^{b}	0.83^{b}	$1,51^{b}$	1.17^{b}
6	0.98^{b}	1.67^{a}	1.33^{a}	0.85^{a}	1.65^{ab}	1.25^{ab}
9	1.03^{a}	1.79^{a}	1.41^{a}	0.85^{a}	1.78^{a}	1.31^{a}
SE $\pm$	0.035	0.106	0.106	0.0 67	0.108	0.053
Jatropha Seed Extracts (% *EC*)						
0	0.84^{c}	1.45^{b}	1.14^{b}	0.76^{b}	1.45^{b}	1.11^{b}
1	0.94^{b}	1.54^{a}	1.24^{a}	0.84^{a}	1.53^{a}	1.19^{a}
2	0.97^{ab}	1.59^{a}	1.28^{a}	0.85^{a}	1.58^{a}	1.22^{a}
3	0.98^{a}	1.59^{a}	1.29^{a}	0.84^{a}	1.56^{a}	1.20^{a}
SE$\pm$	0.030	0.047	0.051	0.065	0.058	5.346
Interactions						
Var*PM	NS	NS	NS	NS	NS	NS
Var*JSE	NS	NS	NS	NS	NS	NS
PM*JSE	NS	NS	NS	NS	NS	NS
Var*PM*JSE	NS	NS	NS	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Similar trend was observed in terms of the applied JSE on the LAI of sweet pepper observed during the two years combined at Dadin-Kowa and BUK. The application of 3 % EC ha^{-1} recorded the highest LAI though not statistically different from those obtained by applied 2 % EC ha^{-1} to sweet pepper. The least LAIs were recorded by the control treatment of 0 % EC ha^{-1}. It was observed that LAIs of sweet pepper were not statistically different among the applied JSE levels at BUK in 2014 rainy season (Table 39). No interaction among the treatment factors statistically affected the LAI of sweet pepper in all the locations during the 2014 rainy season.

Table 39 also depicted almost the same result as observed in the other LAI. It clearly indicated that no statistical differences were observed among the three varieties as related to LAI of sweet pepper in all the locations during the 2015 rainy season at BUK. Contrary to this was that, application of PM significantly influenced the LAI of sweet pepper in the same year under observation at all the locations with the highest recorded by the applied 9 t PM ha^{-1}. However the highest was not statistically different from those observed by the application of 6 t PM ha^{-1}. The least LAIs of sweet pepper during the 2015 rainy season at all the locations were recorded by the control treatment (Table 39).

Positive effects of the applied JSE on LAI were observed at the locations under study during the 2015 rainy season. 3 and 2 % EC ha^{-1} produced highest leaf area indexes that were not statistically different. The least LAIs were obtained from the control treatment in all locations during the period of observation (Table 39).

Interactions among the treatment factors do not statistically affect the LAI of sweet pepper at all the locations during the 2015 rainy season (Table 39).

Table 40: Days to 50 % Flowering of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014, 2015 and the Two Years Combined at Dadin-Kowa and BUK.

Treatment	Dadin-Kowa			BUK		
	2014	2015	2014/2015	2014	2015	2014/2015
Variety						
Kwadon local	58.31	50.65[b]	50.64[b]	51.50[b]	51.04	51.50
Bellboy	59.21	51.23[ab]	55.28[a]	53.90[a]	51.08	51.77
Yolo Wonder	58.13	51.75[a]	54.87[a]	54.29[a]	51.60	52.26
SE $\pm$	1.789	0.198	0.562	0.985	0.398	3.910
Poultry Manure (t PM ha^{-1})						
0	58.44[a]	52.11[a]	55.26[a]	54.14	53.00[a]	51.97[a]
3	58.56[a]	51.31[b]	54.41[b]	53.47	51.56[b]	48.17[b]
6	58.61[a]	50.83[bc]	54.22[b]	53.25	50.97[bc]	49;53[b]
9	58.58[a]	50.28[c]	53.28[c]	53.39	50.11[c]	47.04[c]
SE $\pm$	0.467	0.397	0.552	0.479	0.476	1.776
Jatropha Seed Extracts (% *EC*)						
0	58.31	52.06[a]	55.18[a]	53.44	52.00[a]	52.67[a]
1	58.61	51.31[b]	54.27[b]	53.75	51.53[b]	49.64[b]
2	58.69	50.83[b]	54.36[b]	53.58	51.03[b]	49.68[b]
3	58.58	50.61[b]	54.33[b]	53.47	51.08[b]	50.72[b]
SE$\pm$	0.250	0.211	0.440	0.276	0.240	1.284
Interactions						
Var*PM	NS	NS	NS	NS	NS	NS
Var*JSE	NS	NS	NS	NS	NS	NS
PM*JSE	NS	NS	NS	NS	NS	NS
Var*PM*JSE	NS	NS	NS	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Days to 50 % flowering

Table 40 shows days to 50 % flowering for the three sweet peppers as affected by PM and JSE during the 2014, 2015 rainy season and the year combined rainy seasons at Dadin-Kowa and BUK. No statistical difference in days to 50 % flowering was observed among the three varieties of sweet pepper with respect to days to 50 % flowering during the 2014 rainy season at Dadin-Kowa and 2015 and the combined at BUK. Yolo Wonder and Bellboy had statistically similar but late flowering compared to Kwadon local that flowered earlier. The Kwadon local generally flowered much earlier at Dadin-Kowa and BUK.

There was no statistical difference in days to 50 % flowering was observed among the various levels of PM to sweet pepper during the 2014 rainy season at both BUK and Dadin-Kowa and BUK except at 2015 rainy season and year combined. Applied PM significantly affected the day to 50 % flowering of sweetpepper. The sweet peppers that do not receive PM flowered later than those that were treated. Sweet peppers that received 9 t PM ha^{-1} had early flowering which was not statistically different from those recorded by the application of 6 t PM ha^{-1}.

Similar trend was equally observed with the applied % JSE concentration on three sweet pepper varieties with respect to days to 50 % flowering. No statistical difference in day to 50 % flowering was recorded among the various levels of the JSE during the 2014 rainy season at Dadin-Kowa and BUK. However in 2015 and the year combined all the applied levels of JSE resulted to similar and early flowering in sweet pepper compared to control treatment that delayed flowering.

None of the factor interactions on days to 50 % flowering was during the 2014 and 2015 rainy season and the combined at Dadin-Kowa and BUK.

Number of pest scored plant^{-1}

The effect of rates of poultry manure and jatropha seed extract on numbers of pest scored plant^{-1}of sweet pepper as affected by variety, poultry manure and jatropha seed extracts during the 2014 and 2015 rainy seasons and the year combined at Dadin-Kowa and BUK were as shown in Table 41. Statistical difference was observed between Kwadon local and the other two varieties of sweet pepper as they affect number of pest scored plant^{-1}. However, there was no significant difference between Bellboy and Yolo Wonder in all the locations and the combined during the 2014 rainy season.

At Dadin-Kowa and BUK the numbers of pest scored plant^{-1} were statistically different among the various levels of poultry manure applied to sweet pepper during the 2014 and 2015 rainy seasons. But, the combined analysis indicated no statistical difference in number of pest scored plant^{-1} as affected by the different quantities of applied poultry manure to sweet pepper. Evenly though, no significant difference between 6 t PM ha^{-1} and 3 t PM ha^{-1} and between 6 t PM ha^{-1} and 9 t PM ha^{-1} in terms of numbers of pest scored plant^{-1}observed in 2014 and 2015 rainy seasons at Dadin-Kowa and BUK (Table 41).

Applications of different levels of % *EC* of jatropha seed extracts to sweet pepper recorded statistically different numbers of pest scored plant^{-1}at Dadin-Kowa and BUK during the 2014 and 2015 and their combined rainy seasons. However, no statistical difference was observed at Dadin-Kowa and BUK between 2 % and 3 % EC ha^{-1} and between 2 % and 1 % EC ha^{-1}. In the two years combined data no statistical difference was observed in number of pest scored plant^{-1} recorded by applied 1 %, 2 % and 3 % EC ha^{-1} of jatropha seed extracts on the three sweet pepper varieties. Interactions among the treatment factors do not significantly affect the number of pest scored plant^{-1}of sweet pepper during the 2014 and 2015 rainy season and the year combined at Dadin-Kowa and BUK.

Table 41: Number of Pest Scored Plant^{-1} of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Season and the Combined Data at Dadin-Kowa and BUK.

Treatment	Dadin-Kowa			BUK		
	2014	2015	2014/2015	2014	2015	2014/2015
Variety						
Kwadon local	3.19^{a}	2.40	3.10^{a}	3.15^{a}	2.13^{a}	2.65^{a}
Bellboy	3.02^{b}	2.52	2.58^{b}	2.80^{b}	1.17^{b}	1.86^{b}
Yolo Wonder	2.95^{b}	2.44	2.75^{b}	2.66^{b}	1.16^{b}	2.32^{a}
SE $\pm$	0.06	0.192	0.183	0.094	0.424	0.894
Poultry Manure (t PM ha^{-1})						
0	3.28^{a}	3.00^{a}	2.83	3.06^{a}	2.06^{a}	2.53
3	3.14^{a}	2.44^{b}	2.72	2.93^{b}	2.00^{a}	2.47
6	2.97^{b}	2.03^{b}	2.67	2.82^{bc}	1.67$^{\mathbf{b}}$	2.37
9	2.83^{b}	2.33^{b}	2.50	2.67^{c}	1.58^{b}	2.28
SE $\pm$	0.201	0.172	0.230	0.163	0.231	0.173
Jatropha Seed Extracts (% *EC*)						
0	3.31^{a}	2.91^{a}	3.13^{a}	3.30^{a}	2.75^{a}	3.04^{a}
1	3.17^{a}	2.67^{a}	2.67^{b}	2.92^{b}	1.72^{b}	2.29^{b}
2	2.97^{ab}	2.28^{b}	2.36^{b}	2.67^{bc}	1.50^{bc}	2.10^{b}
3	2.78^{b}	2.25^{b}	2.36^{b}	2.57^{c}	1.33^{c}	2.42^{b}
SE$\pm$	0.181	0.130	0.204	0.142	0.243	0.218
Interactions						
Var*PM	NS	NS	NS	NS	NS	NS
Var*JSE	NS	NS	NS	NS	NS	NS
PM*JSE	NS	NS	NS	NS	NS	NS
Var*PM*JSE	NS	NS	NS	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Number of flowers plant^{-1}

The results in Table 42 show the response number of flowers plant^{-1} of three sweet peppers as affected by applications of poultry manure and jatropha seed extracts during the 2014 and 2015 rainy season and the year combined at BUK. Number of flowers formed plant^{-1} did not statistically differed among the varieties of sweet pepper in 2014 rainy season but they were statistically different among the varieties in 2015 rainy season and the combined data for the two years at BUK. Bellboy and Yolo Wonder generally had statistically similar but more flowers than Kwadon local.

All the varying levels of poultry manure applied to sweet pepper statistically had more number of flowers plant^{-1} than the control treatment. Each addition of 3 t PM ha^{-1} had led to corresponding increase in number of flowers plant^{-1} with the highest obtained at 9 t PM ha^{-1} of Poultry Manure during the 2014 and 2015 rainy season and the year combined at BUK.

Likewise, application of jatropha seed extracts positively affected the number of flowers plant^{-1} of sweet pepper during the 2014 and 2015 rainy season and the year combined at BUK. Increase in JSE ha^{-1}from 0 – 1 % and further to 2 % EC ha^{-1} had improved flower formation significantly. Further increase in JSE to 3 % EC ha^{-1} increased numbers of flowers in 2014 only whilein 2015 and the combined it was not statistically different from the numbers of flowers formed plant^{-1} by the application of 2 % EC ha^{-1}. The control treatment had the least numbers of flowers compared to other levels of jatropha seed extracts.

Table 43 shows that interaction between jatropha seed extracts and poultry manure statistically influenced the formation of numbers of flowers of three sweet pepper varieties during the 2014 and 2015 rainy season and the year combined at BUK.

Table 42: Number of Flowers Plant^{-1} of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Season and the Years Combined at BUK.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	40.62	29.85^{b}	34.74^{b}
Bellboy	41.21	33.02^{a}	36.61^{a}
Yolo Wonder	39.95	31.88^{a}	35.86^{a}
SE $\pm$	4.155	2.386	3.253
Poultry Manure (t PM ha^{-1})			
0	30.81^{d}	22.72^{d}	27.67^{d}
3	35.36^{c}	29.31^{c}	34.33^{c}
6	45.81^{b}	34.17^{b}	39.99^{b}
9	49.81^{a}	40.14^{a}	44.97^{a}
SE $\pm$	1.294	1.236	1.380
Jatropha Seed Extracts (% *EC*)			
0	34.22^{d}	28.08^{c}	31.65^{c}
1	39.44^{c}	29.86^{b}	35.15^{b}
2	41.17^{b}	34.11^{a}	39.64^{a}
3	45.95^{a}	34.28^{a}	40.51^{a}
SE$\pm$	0.673	0.742	0.564
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Table 43: Interaction between Poultry Manure and Jatropha Seed Extracts on Number of Flowers Plant^{-1} of Sweet Pepper during the 2014 and 2015 Rainy Season and the Two Year Combined at BUK.

Treatment	Jatropha seed extracts (% *EC*)			
Poultry Manure (t PM ha^{1})	0	1	2	3
		2014		
0	27.00^{i}	32.00^{h}	34.67^{fgh}	36.78^{fgh}
3	33.89^{gh}	38.22^{efg}	41.22^{de}	44.11^{cd}
6	39.44^{def}	43.78^{cd}	49.78^{b}	50.22^{b}
9	40.56^{de}	47.78^{bc}	55.00^{a}	55.89^{a}
SE $\pm$		1.812		
		2015		
0	21.22^{g}	22.00^{g}	23.78^{fg}	23.89^{fg}
3	26.33^{ef}	27.78^{ef}	30.78^{de}	32.33^{cd}
6	31.22^{d}	31.56^{d}	38.56^{b}	35.33^{bc}
9	33.56^{cd}	38.11^{b}	43.33^{a}	45.56^{a}
SE $\pm$		1.860		
		2014/2015 (Combined)		
0	24.11^{h}	27.00^{gh}	29.22^{fg}	30.33^{fg}
3	30.11^{fg}	33.00^{ef}	36.00^{de}	38.22^{d}
6	35.33^{de}	37.67^{d}	44.17^{b}	42.78^{b}
9	37.06^{d}	42.94^{bc}	49.17^{a}	50.72^{a}
SE $\pm$		1.254		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

9 t PM ha^{-1} applied with either 2 % EC or 3 % EC ha^{-1} had the highest numbers of flowers plant^{-1} of three sweet peppers which was significantly at far with sprayed 1 % EC ha^{-1} and in turn at far with the control treatment during the 2014 and 2015 rainy season and the two years combined at BUK. But the least numbers of flowers plant^{-1} was generally recorded by the combined application of 0 t PM ha^{-1} and 0 % *EC* of jatropha seed extracts ha^{-1} in all the seasons and their combined (Table 43)

Table 44 presented the result on number of flowers plant^{-1} of the three varieties of sweet pepper as influenced by application of Poultry Manure and jatropha seed extracts during the 2014 and 2015 rainy season and the two years combined at Dadin-Kowa. The three sweet pepper varieties recorded significantly similar number of flowers plant^{-1}during the 2014 and 2015 rainy season and the two years combined at Dadin-Kowa.

Application of poultry manure statistically enhanced the formation of flowers plant^{-1} of sweet pepper during the 2014 and 2015 rainy season and the two years combined at Dadin-Kowa. The 9 t PM ha^{-1} treatment recorded the highest numbers of flowers that was followed by 6 t PM ha^{-1} treatment and were followed by 3 t PM ha^{-1} while the least numbers of flowers were from the control treatment (0 t PM ha^{-1}) in 2014 only. However in 2015 and the combined number of flowers recorded from the use of 6 t PM ha^{-1} were statistically similar to that of 3 t PM ha^{-1}.

Spraying of 1 % EC ha^{-11} increased numbers of flowers plant^{-1} of sweet pepper during the 2014 and 2015 rainy season and the two years combined at Dadin-Kowa further increase to 2 % EC ha^{-1} also increased the character generally. However, no statistical differences were observed between the numbers of flowers plant^{-1} by the applications of 2 and 3 % EC ha^{-1} to sweet pepper in all the seasons. The control consistently had the least numbers of flowers plant^{-1}.

Table 44: Number of Flowers Plant^{-1} of Three Varieties of Sweet Pepper as affected by Poultry Manure and Jatropha Seed Extracts during the 2014 and 2015 Rainy Season and Combined at Dadin-Kowa

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	44.48	41.62	43.09
Bellboy	42.71	44.25	43.58
Yolo Wonder	43.29	39.85	42.26
SE $\pm$	5.950	4.551	6.663
Poultry Manure (t PM ha^{-1})			
0	28.19^{d}	32.61^{c}	29.00^{c}
3	39.67^{c}	42.36^{b}	41.26^{b}
6	47.06^{b}	45.81^{b}	46.43^{b}
9	59.06^{a}	49.81^{a}	55.28^{a}
SE $\pm$	2.802	3.473	2.860
Jatropha Seed Extracts (% *EC*)			
0	36.44^{c}	35.22^{c}	35.87^{c}
1	42.03^{b}	40.44^{b}	41.78^{b}
2	47.78^{a}	45.18^{a}	46.78^{a}
3	47.72^{a}	46.97^{a}	46.85^{a}
SE$\pm$	1.184	2.553	1.494
Interactions			
Var*PM	NS	NS	NS
Var*JSE	**	NS	NS
PM*JSE	NS	NS	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Table 45: Interactions between Variety and Jatropha Seed Extracts and between Poultry Manure and Jatropha Seed Extracts on Number of Flowers Plant^{-1} of Sweet Pepper during the 2014 and 2015 Rainy Season and the Combined at Dadin-Kowa.

Treatment	Jatropha Seed Extracts (% *EC*)			
	0	1	2	3
Variety		2014		
Kwadon local	37.67^{gh}	45.17^{bc}	50.17^{a}	45.92^{b}
Bellboy	35.00^{def}	39.25^{cd}	45.33^{b}	50.17^{a}
Yolo Wonder	37.95^{de}	40.00^{cd}	46.00^{ab}	48.33^{ab}
SE $\pm$		5.82		
Poultry Manure (t PM ha^{1})		2014/2015 (Combined)		
0	26.17^{h}	28.39^{gh}	31.17^{fgh}	30.28^{fgh}
3	35.22^{fg}	38.17^{ef}	45.11^{de}	46.56^{de}
6	39.28^{ef}	45.56^{de}	52.72^{cd}	48.17^{d}
9	52.00^{cd}	63.00^{ab}	58.11^{bc}	66.39^{a}
SE $\pm$		3.86		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Interactions between variety and JSE and between PM and JSE on number of flowers formed plant^{-1} of sweet pepper during the 2014 rainy season at Dadin-Kowa were as shown in Table 45. All the varieties positively interacted with 3 % EC ha^{-1} and recorded higher numbers of flowers that were not statistically different from those recorded by the interactions between the varieties and 2 % EC ha^{-1}. The least numbers of flowers were recorded by the interactive effects between the varieties and 0 % EC ha^{-1}.

Similarly, interaction between PM and JSE statistically influenced number of flowers formed plant^{-1} of sweet pepper during the 2014 and 2015 combined data at Dadin-Kowa. The highest number of flowers was formed by the interactive effects of 9 t PM ha^{-1} and 3 % EC ha^{-1}. All the interactions between the varying quantities of poultry manure and the different levels of jatropha seed extracts recorded higher numbers of flowers of sweet pepper than those obtained by the interaction between 0 t PM ha^{-1} and JSE (Table 45).

Interactions among the treatment factors do not significantly affect the number of flowers plant^{-1} of sweet pepper during the 2015 rainy season at Dadin-Kowa.

Number of Aborted flowers plant^{-1}

The results in Table 46 showed the number of aborted flowers plant^{-1} of sweet three peppers as affected by poultry manure and jatropha seed extracts during the 2014 and 2015 rainy season and the two years combined at BUK. There was statistical variation in number of flower aborted plant^{-1} among the three varieties in 2015 rainy season and combined only.

A significant difference in the number of aborted flowers plant^{-1} was observed between Bellboy and Yolo Wonder only, with Bellboy having the highest number of flower aborted and Yolo Wonder obtained the least number of flower shed. The number of aborted flowers plant^{-1} by Kwadon local was not statistically different from those of Bellboy as well as Yolo Wonder.

Table 46: Number of Aborted Flowers Plant^{-1} of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during the 2014 and 2015 Rainy Seasons and the Combined at BUK.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	19.67	16.17^{ab}	17.75^{ab}
Bellboy	21.00	18.62^{a}	19.44^{a}
Yolo Wonder	18.04	15.27^{b}	16.11^{b}
SE $\pm$	2.084	0.271	1.035
Poultry Manure (t PM ha^{-1})			
0	18.80	17.95^{a}	18.65^{a}
3	19.92	16.78^{b}	17.36^{b}
6	19.50	15.36^{c}	16.31^{c}
9	17.96	15.42^{c}	15.68^{c}
SE $\pm$	0.885	0.371	0.386
Jatropha Seed Extracts (% *EC*)			
0	20.28^{a}	18.42^{a}	19.32^{a}
1	19.36^{b}	17.80^{b}	18.54^{b}
2	19.31^{b}	16.75^{b}	17.35^{b}
3	19.33^{b}	16.84^{b}	17.28^{b}
SE$\pm$	0.648	0.211	0.334
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Abortion of flowers shed plant^{-1} of sweet pepper was statistically influenced by the application of poultry manure in 2015 and the combined only. The highest numbers of flowers shed plant^{-1} were generally recorded by the control treatment followed by 3 t PM ha^{-1}. While the least aborted flowers plant^{-1} were in both instances recorded by 9 t PM ha^{-1} and 6 t PM ha^{-1} that statistically had similar number of flowers aborted plant^{-1}.

The number of Flowers aborted plant^{-1} of sweet pepper was also statistically affected by the application of jatropha seed extracts in both seasons and the combined. Generally more flowers shed plant^{-1} when no jatropha seed extract was sprayed than for the jatropha seed extracts rates that were statistically similar. Interactions of factors did not significantly affect the number of flower shed plant^{-1} of sweet pepper during the 2014 and 2015 rainy season and the two years combined at BUK.

The results in Table 47 showed the number of aborted flowers plant^{-1} of three sweet peppers as affected by application of poultry manure and jatropha seed extracts during 2014 and 2015 rainy season and the combined at Dadin-Kowa.

It was observed that numbers of flowers aborted plant^{-1} were not statistically different among the varieties of sweet pepper at Dadin-Kowa during the 2014 rainy season. Whereas during the 2015 rainy season and the two years combined at Dadin-Kowa, these were statistically different among the varieties of sweet pepper. The least number of aborted flowers plant^{-1} was obtained by Bellboy though not statistically different from those recorded by Kwadon local, while the highest number of flowers shed plant^{-1} was recorded by Yolo Wonder. Number of aborted flowers plant^{-1} of sweet pepper was not statistically affected by the application of poultry manure during the 2014 rainy season at Dadin-Kowa. However, during the 2015 and the year combined the numbers of flower aborted plant^{-1} of sweet pepper was statistically affected by the application of poultry manure.

Table 47: Number of Aborted Flowers Plant^{-1} of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	16.71	12.19^{b}	14.95^{b}
Bellboy	16.62	11.15^{b}	13.39^{b}
Yolo Wonder	17.27	14.29^{a}	16.28^{a}
SE $\pm$	1.427	1.358	1.221
Poultry Manure (t PM ha^{-1})			
0	17.25	15.24^{a}	16.24^{a}
3	16.78	15.22^{a}	14.50^{b}
6	16.36	12.08^{b}	14.72^{b}
9	16.42	13.64^{b}	15.03^{b}
SE $\pm$	1.570	1.310	1.038
Jatropha Seed Extracts (% *EC*)			
0	18.42^{a}	14.94^{a}	16.18^{a}
1	16.00^{ab}	11.92^{b}	14.46^{b}
2	15.75^{b}	11.83^{b}	14.29^{b}
3	15.64^{b}	12.47^{b}	14.56^{b}
SE$\pm$	0.731	1.025	0.690
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

The least aborted flowers plant^{-1} was recorded by 9 and 6 t PM ha^{-1} during the 2015 and the combined. Meanwhile, no statistical difference was observed in least numbers of aborted flowers plant^{-1} recorded by the applications of 9, 6 and 3 t PM ha^{-1} when the two years data were combined. Liewise there was no significant difference in number of aborted flowers recorded by 0 and 3 t PM ha^{-1}. The control generally had the highest number of aborted flowers plant^{-1}.

A positive response of number of aborted flowers plant^{-1} was equally observed with the application of jatropha seed extracts to sweet pepper during 2014 and 2015 rainy seasons and the year combined at Dadin-Kowa. The highest numbers of aborted flowers plant^{-1} of sweet pepper was generally recorded by the control treatment of 0 % *EC* of jatropha seed extracts at Dadin-Kowa which in turn was at far with that from 1 % EC ha^{-1} 2014 only. Generally, there were no significant differences in the number of flowers aborted plant^{-1} recorded among the varying applied jatropha seed extracts rates.

Again, number of aborted flowers was generally not statistically affected by the interactions of factors at Dadin-Kowa (Table 47).

Number of fruits plant^{-1}

Table 48 showed the Number of fruits plant^{-1} of three sweet peppers in response to application of poultry manure and jatropha seed extracts during the 2014 and 2015 rainy season and the combined of two year data at BUK. The number of fruits plant^{-1} did not statistically varied among the three varieties of sweet pepper, though, Bellboy had greater numbers of fruits set than the other two varieties in all the separate locations and when combined. The number of fruits plant^{-1} of sweet pepper was also positively affected by the applications of poultry manure during the 2014 and 2015 rainy season and the combined at BUK.

Table 48: Number of Fruits Plant^{-1} of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Seasons and the Two Years Combined at BUK.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	20.63	23.56	22.09
Bellboy	22.54	27.12	24.83
Yolo Wonder	20.04	25.85	22.95
SE $\pm$	3.894	3.288	3.298
Poultry Manure (t PM ha^{-1})			
0	13.17^{c}	16.17^{d}	14.67^{d}
3	18.86^{b}	22.39^{c}	20.62^{c}
6	25.14^{a}	29.11^{b}	27.12^{b}
9	27.11^{a}	34.39^{a}	30.75^{a}
SE $\pm$	1.325	1.264	0.854
Jatropha Seed Extracts (% *EC*)			
0	15.17^{c}	20.47^{c}	17.82^{c}
1	19.64^{b}	23.97^{b}	21.81^{b}
2	24.44^{a}	28.83^{a}	26.64^{a}
3	25.03^{a}	28.78^{a}	26.90^{a}
SE$\pm$	0.757	0.671	0.559
Interactions			
Var*PM	NS	**	**
Var*JSE	NS	NS	NS
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

The least number of fruits plant^{-1} was generally recorded by the control treatment (0 t PM ha^{-1}) of poultry manure. Application of 3 t PM ha^{-1} and further increase to 6 t PM ha^{-1} had resulted to significant increase in number of fruits plant^{-1}. Increase in PM beyond 6 t PM ha^{-1} did not increase the character significantly. The highest values for number of fruits plant^{-1} was generally obtained by the application of 9 t PM ha^{-1}, but, it was not statistically different from the fruits set recorded by the application of 6 t PM ha^{-1}.

Similarly, the number of fruits plant^{-1} of sweet pepper was positively increased by each increase of 1 % EC ha^{-1} up to 2 % EC ha^{-1} during the 2014 and 2015 rainy seasons and the years combined at BUK. The least numbers of fruits plant^{-1} were generally from the control treatment (0 % EC ha^{-1}) in each of the year and the combined. While, the highest numbers of fruits plant^{-1} attained at 2 % *EC* did not differ statistically from that of 3 % *EC* of jatropha seed extracts ha^{-1} during the 2014 and 2015 rainy season and the combined.

Interaction between variety and poultry manure statistically enhanced the number of fruit plant^{-1} of sweet pepper during the 2014 and 2015 rainy season and the years combined at BUK. Bellboy interacted positively with 9 t PM ha^{-1} and recorded the highest number of fruits plant^{-1} which was not significantly different from those recorded by the Yolo Wonder interacting with 9 t PM ha^{-1} and Bellboy interacting with 6 t PM ha^{-1}.

All the sweet pepper varieties recorded the least numbers of fruits plant^{-1} that were statistically different when they interacted with the control level (0 t PM ha^{-1}) of poultry manure (Table 49). Similar trend was observed in the two years combined at BUK. In this case all the three varieties interacted with 6 and 9 t PM ha^{-1} and obtained the numbers of fruits plant^{-1} that were not statistically different. Similarly, the least numbers of fruits plant^{-1} were recorded by the respective interactions between the three varieties and the 0 t PM ha^{-1} and are not significantly different.

Table 49: Interactions between Variety and Poultry Manure on Number of Fruits Plant^{-1} of Sweet Pepper during 2015 Rainy Season and the Years Combined at BUK.

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
		2015		
Kwadon local	15.17^{d}	20.75^{cd}	29.50^{b}	28.83^{b}
Bellboy	17.75^{d}	21.92^{bc}	30.67^{ab}	38.17^{a}
Yolo Wonder	15.58^{d}	24.50^{bc}	27.17^{b}	36.17^{a}
SE $\pm$		3.796		
		2014/2015 (Combined)		
Kwadon local	13.38^{e}	19.88^{d}	27.62^{ab}	27.50^{ab}
Bellboy	16.38^{de}	20.38^{cd}	28.54^{ab}	34.04^{a}
Yolo Wonder	14.25^{e}	21.62^{cd}	25.21^{bc}	30.71^{a}
SE $\pm$		3.528		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 50: Interactions between Poultry Manure and Jatropha Seed Extracts on Number of Fruits Plant^{-1} of Sweet Pepper during 2014 and 2015 Rainy Seasons and the Years Combined at BUK.

Treatment	Jatropha seed extracts (% *EC*)			
Poultry Manure (t PM ha^{1})	0	1	2	3
		2014		
0	9.33^{j}	12.56^{ij}	14.89^{hi}	15.89^{ghi}
3	13.78^{hi}	17.44^{gh}	21,22^{ef}	23.00^{de}
6	19.33^{fg}	23.22^{de}	28.78^{bc}	29.22^{ab}
9	18.22^{fg}	25.33^{cd}	32.89^{a}	32.00^{ab}
SE $\pm$		1.864		
		2015		
0	12.44^{g}	15.33^{fg}	19.11^{e}	17.78^{ef}
3	19.33^{e}	20.56^{de}	23.89^{cd}	25.78^{c}
6	24.56^{c}	26.78^{c}	33.67^{b}	31.44^{b}
9	25.56^{c}	32.22^{b}	38.67^{a}	40.11^{a}
SE $\pm$		1.717		
		2014/2015 (Combined)		
0	10.89^{i}	13.94^{h}	17.00^{fg}	16.83^{fg}
3	16.56^{fg}	19.00^{f}	22.56^{de}	24.39^{cd}
6	21.94^{e}	25.00^{c}	31.22^{b}	30.33^{b}
9	21.89^{e}	29.28^{b}	35.78^{a}	36.06^{a}
SE $\pm$		1.290		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Interactions between poultry manure and jatropha seed extracts on number of fruits plant^{-1} of sweet pepper during the 2014 and 2015 rainy seasons and the years combined at BUK are as shown in Table 50. Number of fruits plant^{-1} of sweet pepper was statistically enhanced by the interactive effects of poultry manure and jatropha seed extracts during the 2014 rainy season at BUK. The interaction between 9 t PM ha^{-1} and 2 % EC ha^{-1} had the highest number of fruits plant^{-1} which does not differ significantly from those obtained by the interactions between 9 t PM ha^{-1} and 3 % EC ha^{-11} and 6 t PM ha^{-1} and 3 % EC ha^{-1} of poultry manure and jatropha seed extracts respectively.

The least number of fruits plant^{-1} was recorded by interaction between control levels of poultry manure and jatropha seed extracts. Similar observations were made during the 2014 and 2015 rainy seasons and the years combined at BUK. During the 2015 rainy season, the interactions between 9 t PM ha^{-1} and 3 % EC ha^{-1} had the highest number of fruit set plant^{-1} which does not differ significantly from those obtained by the interactions between 9 t PM ha^{-1} and 2 % EC ha^{-1}. Likewise, this trend was equally observed during the two years combined at BUK (Table 50).

The results in Table 51 showed the number of fruit plant^{-1} of the three sweet pepper varieties as affected by poultry manure and jatropha seed extracts during the 2014, 2015 and combined for the two rainy seasons at Dadin-Kowa. There are no significant differences in the number of fruits plant^{-1} among the three varieties of sweet pepper during the 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa. Application of poultry manure also significantly enhanced the number of fruits plant^{-1} of sweet pepper during the 2014 and 2015 rainy seasons and the combined at Dadin-Kowa. Each addition of 3 t PM ha^{-1} upto 9 t PM ha^{-1} of poultry manure had led to corresponding increase in numbers of fruits plant^{-1} in 2015 and the combined only. While in 2014 the increase in fruit production per plant was only upto

Table 51: Number of Fruits Plant^{-1} of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during the 2014 and 2015 Rainy Seasons and the Conbined at Dadin-Kowa.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	24.54	25.98	25.26
Bellboy	24.67	26.62	25.65
Yolo Wonder	26.06	27.90	26.98
SE ±	0.884	1.442	1.121
Poultry Manure (t PM ha^{-1})			
0	23.50^{c}	23.75^{d}	24.62^{d}
3	24.33^{b}	25.78^{c}	25.06^{c}
6	25.44^{a}	27.98^{b}	26.71^{b}
9	27.08^{a}	30.53^{a}	28..81^{a}
SE ±	0.460	0.522	0.411
Jatropha Seed Extracts (% *EC*)			
0	24.00^{c}	25.81^{c}	24.90^{c}
1	25.22^{b}	26.56^{b}	25.89^{b}
2	25.78^{a}	27.50^{a}	26.64^{a}
3	25.36^{a}	27.47^{a}	26.42^{a}
SE±	0.396	0.529	0.367
Interactions			
Var*PM	NS	**	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different (P≤ 0.05) using DMRT

Table 52: Interactions between Variety and Poultry Manure on Number of Fruits $Plant^{-1}$ of Sweet Pepper during 2015 Rainy Season at Dadin-Kowa.

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
Kwadon local	23.33^{e}	24.83^{de}	27.17^{bcd}	28.58^{bc}
Bellboy	22.83^{e}	24.83^{de}	28.00^{bcd}	30.83^{ab}
Yolo Wonder	25.08^{cde}	27.67^{bcd}	26.67^{cde}	32.17^{a}
SE $\pm$		1.640		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

6 t PM ha^{-1} beyond which no significant improvement was recorded.

The use of jatropha seed extracts had significant effect on the number of fruits plant^{-1} of sweet pepper. Increase in jatropha seed extract from 0 – 1 and further to 2 EC ha^{-1} increased numbers of fruit sets plant^{-1} of sweet pepper. However, no statistical differences were observed in the numbers of fruits plant^{-1} of sweet pepper sprayed with 2 and 3 % *EC* of jatropha seed extracts ha^{-1} during the two seasons and the combined.

Interactions between the variety and poultry manure significantly affected the number of fruits plant^{-1} of sweet pepper during the 2015 rainy season at Dadin-Kowa. Yolo Wonder interacted favorably with 9 t PM ha^{-1} and produced the highest number of fruits plant^{-1} which was found not different from the fruits plant^{-1} obtained when Bellboy was supplied with 9 t PM ha^{-1}. The least number of fruits plant^{-1} was recorded by the interaction between Kwadon local and 0 t PM ha^{-1} (Table 52).

Number of aborted fruits plant^{-1}

Number of aborted fruits plant^{-1} of three sweet pepper varieties as influenced by application of poultry manure and jatropha seed extracts during the 2014 and 2015 rainy seasons and the years combined at BUK is shown in Table 53. There was no statistical difference in the number of aborted fruits plant^{-1} among the three varieties of sweet pepper during the 2014 and 2015 rainy seasons and the years combined at BUK. Similarly, application of poultry manure generally did not significantly affect number of aborted fruit plant^{-1} of sweet pepper at BUK. It was observed that the three applied jatropha seed extract rates resulted in statistically similar and lower numbers of aborted fruit plant^{-1} compared to the control. The number of aborted fruit plant^{-1} of sweet pepper differed significantly between applied levels of jatropha seed extracts and the control 2014 and the combined at BUK.

Table 53: Number of Aborted Fruits Plant^{-1} of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Seasons and the Years Combined at BUK.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	2.98	1.83	2.41
Bellboy	2.96	1.93	2.45
Yolo Wonder	2.48	1.69	2.09
SE $\pm$	0.233	0.298	0.230
Poultry Manure (PM) (t PM ha^{-1})			
0	2.95	1.92	2.44
3	2.94	1.72	2.33
6	2.61	1.81	2.21
9	2.72	1.79	2.26
SE $\pm$	0.218	0.162	0.126
Jatropha seed extracts (% *EC*)			
0	3.17^{a}	1.84	2.51^{a}
1	2.78^{b}	1.75	2.27^{b}
2	2.69^{b}	1.91	2.30^{b}
3	2.68^{b}	1.76	2.22^{b}
SE$\pm$	0.122	0.113	0.083
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

In 2015 application of jatropha seed extract had no significant effect on the numbers of fruit aborted plant^{-1} of sweet pepper. Interactions factors did not significantly affect the number of fruits aborted plant^{-1} in both sampling years and the combined at BUK.

Table 54 shows that there was statistical difference among the three varieties of sweet pepper with respect to number of aborted fruit plant^{-1} of sweet pepper during 2014 and 2015 rainy seasons and the years combined rainy at Dadin-Kowa. Yolo Wonder had the highest number of aborted fruits plant^{-1} than Kwadon local and Bell boy that had similar number of aborted fruits plant^{-1} in all the sampling periods.

There were also statistical differences among the varying levels of poultry manure with respect to number of aborted fruits plant^{-1} of sweet pepper. More fruit abortions were recorded with the highest application of poultry manure during 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. The highest aborted fruit plant^{-1} was obtained with the application of 9 t PM ha^{-1} which was not significantly different from those obtained from 6 t PM ha^{-1}. The least numbers of aborted fruits were recorded by 3 t PM ha^{-1} which was not statistically different from those recorded by 0 t ha^{-} during 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. Similarly, there were statistical differences among the applied levels of jatropha seed extracts as they affect the number of aborted fruits plant^{-1} of sweet pepper during 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. The highest number of aborted fruits plant^{-1} of sweet pepper was recorded by the control (0 % *EC*) while, the least aborted fruits plant^{-1} of sweet pepper was obtained with the application of 1 % *EC* of jatropha seed extracts. But, no statistical difference was observed on the effects of the varying levels of jatropha seed extracts on aborted fruits plant^{-1} of sweet pepper during the same periods of observation at Dadin-Kowa (Table 54). Interactons between the variable factors do not significantly affect the number of aborted fruits during 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa.

Table 54: Number of Aborted Fruit Plant^{-1} of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014, 2015 and the Two Years Combined at Dadin-Kowa.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	3.44^{b}	3.42^{b}	3.43^{b}
Bellboy	3.38^{b}	3.40^{b}	3.39^{b}
Yolo Wonder	4.08^{a}	5.81^{a}	4.45^{a}
SE $\pm$	0.422	0.434	0.406
Poultry Manure (t PM ha^{-1})			
0	3.19^{b}	4.06^{bc}	3.62^{b}
3	3.14^{b}	3.94^{c}	3.54^{b}
6	4.00^{a}	4.72^{ab}	4.36^{a}
9	4.19^{a}	5.44^{a}	4.82^{a}
SE $\pm$	0.375	0.424	0.330
Jatropha Seed Extracts (% *EC*)			
0	3.69	5.17^{a}	4.43^{a}
1	3.44	4.14^{b}	3.79^{b}
2	3.83	4.08^{b}	3.21^{b}
3	3.56	4.28^{b}	3.92^{b}
SE$\pm$	0.272	0.401	0.253
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

4.1.3 Yield characters

Number of Marketable fruits plant^{-1}`

Numbers of marketable fruits plant^{-1} of three sweet pepper varieties as affected by poultry manure and jatropha seed extracts during 2014 and 2015 rainy seasons and the years combined at BUK is presented in Table 55. The number of marketable fruits plant^{-1} of sweet pepper did not statistically differed among the three varieties of sweet pepper in both seasons and the combined at BUK.

Marketable Fruits plant^{-1} of sweet pepper was statistically differed among the varying levels of applied poultry manure during 2014 and 2015 rainy seasons and the combined data at BUK. Increase in poultry manure rate upto 6 t PM ha^{-1} in 2014 and 9 t PM ha^{-1} in 2015 and the combined had led to increase in maretable fruits plant^{-1}. The least number of marketable fruits plant^{-1} was recorded by the control treatment, while the highest number of marketable fruits plant^{-1} of sweet pepper was obtained by the application of 9 t PM ha^{-1} though not statistically different from those recorded by the application of 6 t PM ha^{-1} during the 2014 rainy season only at BUK.

Significant effects of applied levels of jatropha seed extracts on the marketable fruits plant^{-1} of sweet pepper during 2014 and 2015 rainy seasons and the years combined at BUK indicated significant differences among the treatments. The least number of marketable fruits plant^{-1} of sweet pepper was produced by the control treatment whereas the highest numbers of marketable fruits plant^{-1} were recorded by applied 3 % EC ha^{-1} which were not statistically different from those produced by the application of 2 % EC ha^{-1} during the periods of observation at BUK.

Table 55: Number of Marketable Fruits Plant^{-1} of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Seasons and the Years Combined at BUK.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	17.00	24.74	20.87
Bellboy	19.10	27.27	23.19
Yolo Wonder	17.09	23.90	20.49
SE $\pm$	3.785	1.555	2.613
Poultry Manure (t PM ha^{-1})			
0	9.94^{c}	16.88^{d}	13.41^{d}
3	15.39^{b}	22.68^{c}	19.04^{c}
6	21.89^{a}	28.41^{b}	25.15^{b}
9	23.70^{a}	33.24^{a}	28.47^{a}
SE $\pm$	1.413	1.651	1.165
Jatropha Seed Extracts (% *EC*)			
0	11.81^{c}	20.42^{c}	16.12^{c}
1	16.46^{b}	24.03^{b}	20.24^{b}
2	20.98^{a}	28.21^{a}	24.59^{a}
3	21.68^{a}	28.55^{a}	25.12^{a}
SE$\pm$	0.755	0.782	0.615
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Table 56: Interactions between Poultry Manure and Jatropha Seed Extracts on Number of Marketable Fruits Plant^{-1} of Sweet Pepper during the Two Years Combined at BUK.

Treatment	Jatropha Seed Extracts (% *EC*)			
Poultry Manure (t PM ha^{1})	0	1	2	3
		2014/2015 (Combined)		
0	9.52^{g}	13.13^{f}	15.10^{ef}	15.88^{ef}
3	14.10^{f}	18.14^{de}	21.26^{c}	22.66^{c}
6	19.97^{d}	23.46^{c}	28.82^{b}	28.42^{b}
9	20.88^{cd}	26.30^{b}	33.19^{a}	33.51^{a}
SE $\pm$		1.578		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Interactions between the variable factors do not significantly affect the number of marketable fruits plant^{-1} during 2014 and 2015 rainy seasons and the years combined at BUK except the interaction between PM and JSE which was found to have significant effect on the number of marketable fruits plant^{-1} of sweet pepper during the 2014 and 2015 rainy seasons and the years combined at BUK. The highest marketable fruits plant^{-1} was recorded by interactive effects of applied 9 t PM ha^{-1}and 3 % EC ha^{-1} though not statistically different from marketable fruits plant^{-1} as affected by the interaction between 9 t PM ha^{-1}and 2 % EC ha^{-1} this was followed by the ones obtained from the interaction between 6 t PM ha^{-1}and 3 % *EC* of jatropha seed extracts equally not statistically different from those produced by interaction between 6 t PM ha^{-1}and 2 % EC ha^{-1} of jatropha seed extracts observed in the combined data at BUK. The least number of marketable fruits plant^{-1} of sweet pepper was obtained by interaction between 0 t PM ha^{-1}and 0 % *EC* of jatropha seed extracts the combined at BUK (Table 56).

The results in Table 57 indicated the numbers of marketable fruits plant^{-1} of three sweet pepper varieties as affected by poultry manure and jatropha seed extracts during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa.

There was no statistical difference among the sweet pepper varieties with respect to number of marketable fruits plant^{-1} of sweet pepper during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa. However, numbers of marketable fruits plant^{-1} of sweet pepper were statistically different among the varied levels of poultry manure applied to the sweet pepper during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa. The least numbers of marketable fruits plant^{-1} of sweet pepper were recorded by the control treatment (0 t PM ha^{-1}) while the highest numbers of marketable fruits plant^{-1} of sweet pepper were obtained by the application of 9 t PM ha^{-1} which were not significantly different from

Table 57: Number of Marketable Fruits Plant^{-1} of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Seasons and the Years Combined at Dadin-Kowa.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	23.40	25.14	24.27
Bellboy	24.81	26.29	25.55
Yolo Wonder	23.63	24.07	23.85
SE $\pm$	4.126	1.917	2.979
Poultry Manure (t PM ha^{-1})			
0	15.96^{c}	17.07^{c}	16.51^{c}
3	22.67^{b}	23.51^{b}	22.59^{b}
6	25.39^{a}	27.66^{a}	26.52^{a}
9	26.41^{a}	27.98^{a}	26.59^{a}
SE $\pm$	1.549	1.673	1.061
Jatropha Seed Extracts (% *EC*)			
0	20.98^{d}	23.75^{c}	22.87^{d}
1	23.87^{c}	24.14^{b}	23.50^{c}
2	26.15^{b}	26.70^{a}	26.42^{b}
3	27.43^{a}	27.21^{a}	27.32^{a}
SE$\pm$	0.575	0.905	0.577
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Those recorded by the application of 6 t PM ha^{-1} during the periods of observation at Dadin-Kowa. But in the combined data at Dadin-Kowa, application of 9 t PM ha^{-1} recorded the highest number of marketable fruits $plant^{-1}$ which outnumbers by far the numbers of marketable fruits $plant^{-1}$ of sweet pepper obtained from the application of the other levels of PM and that of the control treatment.

Similarly, there were statistical differences among the varied levels of jatropha seed extracts applied to the sweet pepper during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa with respect to number of marketable fruits $plant^{-1}$ of sweet pepper as shown in Table 57. The highest number of marketable fruits $plant^{-1}$ of sweet pepper was recorded by the application of 3 % EC ha^{-1} during the 2014 rainy season at Dadin-Kowa which was by far higher than other applied levels of jatropha seed extracts including the 0 % *EC* of jatropha seed extracts.

Meanwhile, the least of the marketable fruits $plant^{-1}$ of sweet pepper was recorded by the control treatment (0 % EC ha^{-1}). In 2015 rainy season at Dadin-Kowa, the highest number of harvested fruits $plant^{-1}$ of sweet pepper was obtained by the application of 3 % *EC* of jatropha seed extracts although not statistically different from that recorded by the application of 2 % EC ha^{-1}. In the same location, the least number of marketable fruits $plant^{-1}$ of sweet pepper was recorded by the 0 % EC ha^{-1} (Table 57). Similarly, in the years combined at Dadin-Kowa, there was a significant difference among the varying levels of applied jatropha seed extracts to sweet pepper in terms of number of marketable fruits $plant^{-1}$ of sweet pepper. All the levels of applied jatropha seed extracts gave higher number of marketable fruits $plant^{-1}$ of sweet pepper than the control treatment. Generally 3 % EC ha^{-1} obtained by far the highest number of marketable fruits $plant^{-1}$ of sweet pepper followed by the ones obtained by the application of 2 % EC ha^{-1}.

Table 58: The Interaction between Poultry Manure and Jatropha Seed Extracts on Number of Marketable Fruits Plant^{-1} of Sweet Pepper in the Combined Data at Dadin-Kowa.

Treatment	Jatropha Seed Extracts (JSE) (% *EC*)			
Poultry Manure (t PM ha^{-1})	0	1	2	3
	2014/2015 (Combined)			
0	19.67^{g}	21.30^{fg}	22.08^{fg}	23.01^{f}
3	23.00^{f}	26.77^{e}	27.99^{de}	30.59^{cc}
6	29.23^{cd}	31.92^{c}	35.13^{b}	35.81^{b}
9	31.57^{c}	34.02^{b}	39.30^{a}	39.88^{a}
SE $\pm$		1.457		

Means followed by unlike letter(s) are significantly different (P$\leq$ 0.005) using DMR

The least number of marketable fruits plant^{-1} of sweet pepper was recorded by the control treatment during 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa.

The tnteraction between the varieties and the Jatropha seed extracts significantly influenced the number of marketable fruits plant^{-1} of sweet pepper during the 2014 rainy season at Dadin-Kowa while the other interactions were not statistically significant with respect to number of marketable fruits plant^{-1} of sweet pepper. Similarly, during the 2015 rainy season at Dadin-Kowa, the interactions between all the variable factors did not significantly affect the number of marketable fruits plant^{-1} of sweet pepper. The interaction between Bellboy and 3 % *EC* of jatropha seed extracts had the highest number of marketable fruits plant^{-1} of sweet pepper while, the interaction between Kwadon local and 0 % *EC* of jatropha seed extracts recorded the least number of marketable fruits plant^{-1} of sweet pepper in the combined data at Dadin-Kowa only. On the other hand, the interactions between 9 t PM ha^{-1} and 3 % EC ha^{-1} recorded the highest number of marketable fruits plant^{-1} of sweet pepper which was statistically with number of marketable fruit plant^{-1} obtained from interaction between the between 9 t PM ha^{-1} and 2 % *EC* of jatropha seed extracts. This was followed by the numbers of marketable fruits plant^{-1} of sweet pepper as the results of the interaction between 6 t PM ha^{-1} and 3 % *EC* of jatropha seed extracts which was also not statistically different from those recorded by the interaction between 6 t PM ha^{-1} and 2 % *EC* of jatropha seed extracts. Generally the least number of marketable fruits plant^{-1} of sweet pepper was produced by interaction between 0 t PM ha^{-1} and 0 % *EC* of jatropha seed extracts in the ombined data at Dadin-Kowa (Table 58).

Fresh fruits weight (kg) plant^{-1}

The results in Table 59 show fresh fruit weight plant^{-1} of three sweet pepper varieties as affected by application of PM and jatropha seed extracts during the 2014 and 2015 rainy.

Table 59: Fresh Fruits Weight (Kg) Plant[1] of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014, 2015 and the Two Years Combined s at BUK.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	0.59^{b}	0.41^{b}	0.50^{b}
Bellboy	0.69^{b}	0.42^{b}	0.55^{b}
Yolo Wonder	1.04^{a}	0.57^{a}	0.80^{a}
SE $\pm$	0.783	0.539	0.517
Poultry Manure (t PM ha^{-1})			
0	0.56^{c}	0.31^{c}	0.43^{c}
3	0.70^{b}	0.40^{b}	0.55^{b}
6	0.91^{a}	0.60^{a}	0.73^{a}
9	0.93^{a}	0.61^{a}	0.77^{a}
SE $\pm$	0.630	0.180	0.549
Jatropha Seed Extracts (% *EC*)			
0	0.69^{d}	0.38^{c}	0.53^{c}
1	0.73^{c}	0.46^{b}	0.59^{b}
2	0.84^{b}	0.56^{a}	0.67^{a}
3	0.93^{a}	0.60^{a}	0.68^{a}
SE$\pm$	0.141	0.191	0.166
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	**	**
Var*PM*JSE	NS	**	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Table 60: Interactions between Poultry Manure and Jatropha Seed Extracts on Fresh Fruits Weight (Kg) Plant^{-1} of Sweet Pepper during 2015 and 2014/2015(Combined) Rainy Seasons at BUK.

Treatment	Jatropha seed extracts (% *EC*)			
Poultry Manure (t PM ha^{1})	0	1	2	3
		2015		
0	0.47^{i}	0.60^{hi}	0.65^{hi}	0.75^{gh}
3	0.63^{hi}	0.71^{gh}	0.84^{fg}	0.98^{def}
6	1.01^{def}	1.17^{bcd}	1.13^{bcd}	1.06^{cde}
9	2.43^{efg}	1.19^{bc}	1.42^{a}	1.33^{ab}
SE $\pm$		0.278		
		2014/2015 (Combined)		
0	0.73^{h}	0.81^{gh}	0.93^{fg}	0.97^{ef}
3	0.99^{ef}	1.01^{ef}	1.16^{de}	1.24^{d}
6	1.31^{cd}	1.45^{bc}	1.55^{b}	1.50^{b}
9	1.25^{d}	1.48^{b}	1.72^{a}	1.71^{a}
SE $\pm$		2.039		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Seasons and the years combined at BUK. Fresh fruit weight plant^{-1} of sweet pepper was significantly varied among varieties tested. Yolo Wonder during the 2014 and 2015 rainy season and the combined data at BUK produced the highest fruit fresh weight than the other two varieties. However, there was no statistical difference between Kwadon local and Bellboy in terms of fruit fresh weight plant^{-1}.

Application of 3 t PM ha^{-1} and further increase to 6 t PM ha^{-1} had led to a corresponding increase in fresh fruit weight plant^{-1} of sweet pepper. Similarly, increasing jatropha seed extracts upto the highest level of 3 % EC in 2014 and 2 % EC only in 2015 and the combined statistically enhances the production of fresh fruits of sweet pepper. The highest fresh fruit weights plant^{-1} were observed with the application of 3 % EC of jatropha seed extracts followed by those obtained with the application of 2 % EC ha^{-1} then those obtained by the application of 1 % EC ha^{-1} but the least fresh fruit weights were recorded by the control treatment during the 2014 rainy season at BUK. However, during 2015 and the combined data at BUK the fresh fruit weights plant^{-1} obtained by the application of 2 % EC ha^{-1} was not statistically different from those produced by the application of 3 % EC of jatropha seed extracts (Table 59).

Interaction between poultry manure and jatropha seed extracts statistically influenced the fresh fruit weights of sweet pepper during the 2015 and the ombined data at BUK. 9 t PM ha^{-1} of poultry manure interacted positively with 2 % EC of jatropha seed extracts and gave the highest fresh fruit weights plant^{-1} during the 2015 rainy season and the years combined at BUK, though not statistically different from those obtained by the interactions between 9 t PM ha^{-1} and 3 % EC ha^{-1}. These were followed by the fresh fruit weights plant^{-1} obtained by the interaction between 6 t PM ha^{-1} and 2 and 3 % EC of jatropha seed extracts then followed by the interaction between 9 t PM ha^{-1} and 1 % EC ha^{-1}. The least fresh fruit weights plant^{-1} were obtained from the interaction between 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts during the same periods of observation at BUK (Table 60).

Similarly, the interactions between Variety, poultry manure and jatropha seed extracts significantly affected the fresh fruit weight $plant^{-1}$ of sweet pepper during the 2015 rainy season at BUK (Table 61). Yolo Wonder interacted very well with 9 t PM ha^{-1} and 2 % EC of jatropha seed extracts and produced the highest fresh fruit weight $plant^{-1}$ of sweet pepper. Though, this was not far different from those obtained by the interactions between 9 t PM ha^{-1} and 3 % EC ha^{-1}, and between 6 t PM ha^{-1} and 2 % EC ha^{-1} with some other levels of interactions between other varieties, poultry manure and jatropha seed extracts. But, the least fresh fruit weights $plant^{-1}$ of sweet pepper were recorded by the interactions between Kwadon local and control levels of poultry manure and jatropha seed extracts during the 2015 rainy season at BUK (Table 61).

Table 62 indicated that fresh fruit weight $plant^{-1}$ of sweet pepper was statistically affected by the varietal difference, varying levels of applied poultry manure and jatropha seed extracts observed during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa. Yolo Wonder had the highest fruit fresh weights $plant^{-1}$ during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa. However, there were no statistical difference between Bellboy and Kwadon local in respect to fresh fruit weight $plant^{-1}$ of sweet pepper measured during the periods of observation at Dadin-Kowa.

Fresh fruit weights $plant^{-1}$ were equally observed to be significantly different among the varying levels of poultry manure during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa. It was observed that 9 t PM ha^{-1} recorded the greatest fresh fruit weights $plant^{-1}$ at Dadin-Kowa during the periods of observation. These were followed by the fresh fruit weights $plant^{-1}$ obtained by the application of 6 t PM ha^{-1} while, the least fresh fruit weights $plant^{-1}$ of sweet pepper were observed with the control treatment during the periods of

Table 61: Interactions between Variety, Poultry Manure and Jatropha Seed Extracts on Fresh Fruits Weight (Kg) Plant^{-1} of Sweet Pepper during 2015 Rainy Season at BUK.

Treatment	Poultry Manure (t PM ha^{1})	Jatropha Seed Extracts (% *EC*) 0	1	2	3
Variety		2015			
Kwadon local	0	3.97^{d}	4.48^{d}	5.23^{d}	5.28^{d}
	3	6.03^{cd}	7.12^{cd}	7.21^{cd}	7.96^{cd}
	6	9.00^{bc}	9.77^{bc}	10.20^{bc}	11.08^{bc}
	9	7.94^{cd}	11.62^{bc}	12.12^{ab}	12.40^{ab}
Bellboy	0	4.26^{d}	5.70^{cd}	6.44^{cd}	7.98^{cd}
	3	4.20^{d}	6.43^{cd}	6.02^{cd}	6.78^{cd}
	6	7.66^{cd}	10.94^{bc}	9.21^{bc}	9.01^{bc}
	9	9.90^{bc}	11.16^{bc}	13.73^{ab}	12.90^{ab}
Yolo Wonder	0	5.94^{cd}	7.53^{cd}	7.88^{cd}	9.23^{c}
	3	8.05^{cd}	7.74^{bc}	12.19^{ab}	14.54^{ab}
	6	13.53^{ab}	14.32^{ab}	14.60^{ab}	14.82^{ab}
	9	9.10^{bc}	12,79^{ab}	16.69^{a}	14.62^{ab}
SE $\pm$			6.336		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Observation at Dadin-Kowa (Table 62). Similarly, application of the varying levels of jatropha seed extracts statistically affected the fresh fruit weight plant^{-1} of sweet pepper during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa. Application of 3 % EC of jatropha seed extracts produced the highest fresh fruit weights plant^{-1} during the times of measurement at Dadin-Kowa. Although, these were not statistically different from the fruit fresh weights plant^{-1} of sweet pepper obtained by the application of 2 % EC of the jatropha seed extracts at the same times of observations and location. Meanwhile, the lowest fresh fruit weights plant^{-1} of sweet pepper were measured throughout from the control treatment (0 % EC of jatropha seed extracts).

Interactions among the treatment factors did not statistically affect the fresh fruit weight plant^{-1} of sweet pepper during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa.

Dry fruits weight (kg) plant^{-1}

Table 63 shows dry fruit weights plant^{-1} of three sweet pepper varieties as influenced by the application of PM and jatropha seed extracts during 2014 and 2015 rainy seasons and the combined data at BUK. No significant difference in dry fruit weight plant^{-1} was observed among the three varieties tested during the 2014 and the combined for the two seasons at BUK except in 2015. Yolo Wonder had the least dry fruit weight plant^{-1} compared to those obtained from Bellboy and Kwadon local. But there was no significant difference between Kwadon local and Bellboy in terms of dry fruit weight plant^{-1} of sweet pepper measured was observed. Application of Poultry Manure statistically improved dry fruit weight plant^{-1} of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at BUK. Application of 6 t PM ha^{-1} and 9 t PM ha^{-1} generally resulted to statistically similar and higher dry fruit weights plant^{-1} than for other rates. The least dry fruit weights plant^{-1} of sweet pepper were obtained from the

Table 62: Fresh Fruits weight (kg) Plant^{-1} of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014, 2015 and the Two Years Combined at Dadin-Kowa.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	8.64^{b}	9.24^{b}	8.94^{b}
Bellboy	10.46^{b}	8.82^{b}	9.64^{b}
Yolo Wonder	14.40^{a}	10.50^{a}	12.45^{a}
SE $\pm$	3.735	3.566	3.530
Poultry Manure (t PM ha^{-1})			
0	8.54^{c}	8.33^{c}	8.44^{c}
3	9.49^{c}	9.26^{b}	9.37^{c}
6	12.63^{b}	9.56^{b}	11.09^{b}
9	14.00^{a}	10.95^{a}	12.48^{a}
SE $\pm$	1.540	1.275	0.806
Jatropha Seed Extracts (% *EC*)			
0	10.19^{c}	8.38^{c}	9.28^{c}
1	11.07^{b}	9.26^{b}	10.16^{b}
2	11.53^{ab}	10.18^{a}	10.85^{a}
3	11.88^{a}	10.28^{a}	11.07^{a}
SE$\pm$	0.990	0.852	0.510
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

Table 63: Dry Fruits Weight (Kg) Plant^{-1} of Three Sweet Pepper Varietie as Affected by Poultry Manure and Jatropha Seed Extracts during 2014, 2015 and the Two Years Combined at BUK.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	0.13	0.11^{a}	0.12
Bellboy	0.12	0.12^{a}	0.12
Yolo Wonder	0.13	0.09^{b}	0.11
SE $\pm$	0.039	0.011	0.021
Poultry Manure (t PM ha^{-1})			
0	0.09^{c}	0.08^{c}	0.09^{c}
3	0.12^{b}	0.10^{b}	0.11^{b}
6	0.15^{a}	0.13^{a}	0.14^{a}
9	0.16^{a}	0.12^{a}	0.14^{a}
SE $\pm$	0.033	0.040	0.016
Jatropha Seed Extracts (% *EC*)			
0	0.11^{c}	0.09^{b}	0.10^{c}
1	0.12^{b}	0.11^{a}	0.12^{b}
2	0.14^{a}	0.11^{a}	0.13^{a}
3	0.14^{a}	0.12^{a}	0.13^{a}
SE$\pm$	0.017	0.029	0.020
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	*	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

0 t PM ha^{-1}. Similarly, application of jatropha seed extracts significantly affected the fruit dry weights plant^{-1} of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at BUK. The applied 3 % EC and 2 % EC of jatropha seed extracts recorded statistically similar and heavier fruit dry weights plant^{-1} of sweet pepper than for other rates at all sampling seasons observed. The least fruit dry weights plant^{-1} of sweet pepper were from the control treatment during the periods of observation (Table 63).

Interaction between poultry manure and jatropha seed extracts as shown in Table 64 statistically influenced the fruit dry weight plant^{-1} of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at BUK. Application of 9 t PM ha^{-1} interacted positively with the applied 2 % EC and 3 % EC of jatropha seed extracts and recorded the highest fruit dry weights plant^{-1} of sweet pepper though not significantly different from the fruit dry weights plant^{-1} produced by the interactive effects between the applied 6 t PM ha^{-1} and 1, 2 and 3 % EC of jatropha seed extracts measured during the 2015 and the combined data at BUK. The lowest fruit dry weight of sweet pepper was obtained by the interaction between the applied 0 t PM ha^{-1} and 0 % EC (control levels of poultry manure and jatropha seed extracts respectively) (Table 64).

Table 65 shows that fruit dry weights plant^{-1} of three sweet pepper varieties were significantly affected by the application of poultry manure and jatropha seed extracts during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. Although, no statistical difference was observed among the varieties of sweet pepper with respect to fruit dry weight plant^{-1} during the periods of observation at Dadin-Kowa. Application of poultry manure statistically enhanced the fruit dry weights plant^{-1} of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa.

Table 64: Interactions between Poultry Manure and Jatropha Seed Extracts on Dry Fruit Weight (Kg) Plant^{-1} of Sweet Pepper during 2015 and the Two Years Combined s at BUK.

Treatment	Jatropha seed extracts (% *EC*)			
Poultry Manure (t PM ha^{1})	0	1	2	3
		2015		
0	0.08^{g}	0.08^{g}	0.09^{efg}	0.09^{efg}
3	0.10^{de}	0.11^{cd}	0.09^{efg}	0.10^{de}
6	0.11^{cd}	0.14^{a}	0.14^{a}	0.13^{ab}
9	0.08^{g}	0.12^{bc}	0.14^{a}	0.14^{a}
SE $\pm$		0.105		
		2014/2015 (Combined)		
0	0.07^{h}	0.08^{gh}	0.09^{fg}	0.10^{ef}
3	0.10^{ef}	0.11^{de}	0.11^{de}	0.12^{cd}
6	0.12^{cd}	0.14^{ab}	0.15^{ab}	0.15^{ab}
9	0.10^{ef}	0.13^{bc}	0.16^{a}	0.16^{a}
SE $\pm$		0.106		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

The highest dry fruit weights plant^{-1} of sweet pepper were observed with the applied 9 t PM ha^{-1} during the periods of observations. But, during the 2014 rainy season at Dadin-Kowa, the dry fruit weight plant^{-1} recorded by the applied 9 t PM ha^{-1} was not significantly different from the fruit dry weight plant^{-1} of sweet pepper obtained by the application of 6 t PM ha^{-1}. The least dry fruit weights plant^{-1} were recorded by the control treatment (0 t PM ha^{-1}) (Table 65).

Similarly, application of jatropha seed extracts significantly influenced the production of heavier dry fruit weights plant^{-1} of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. Applied 3 and 2 % EC of jatropha seed extracts to sweet pepper recorded the highest dry fruit weights plant^{-1} that are not statistically different and these were followed by those obtained by the application of 1 % EC of jatropha seed extracts. The lowest dry fruit weights plant^{-1} of sweet pepper were recorded by the control treatment (0 % EC of jatropha seed extracts) (Table 65).

Interaction among the treatment factors do not statistically affect the dry fruit weight plant^{-1} of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa.

Fruit fresh yield (t ha^{-1})

The results in Table 66 showed that fresh fruits yield (t ha^{-1}) of three sweet pepper varieties was statistically influenced by the applications of Poultry Manure and jatropha seed extracts during the 2014 and 2015 rainy seasons and the years combined at BUK. The highest yields of fresh fruits (t ha^{-1}) were generally recorded by Yolo Wonder that was at far with that of Bellboy in 2015 only. These were followed by the fruits fresh yield obtained from Bellboy in 2014 and the combined that was not statistically different from fresh fruit yield recorded by Kwadon local when the two years data were combined. Fresh fruits yield (t ha^{-1}) of sweet pepper was significantly enhanced by increasing levels of poultry manure upto 6 t PM ha^{-1}.

Table 65: Dry Fruit Weight (kg) Plant^{-1} of Three Sweet Pepper as Affected by Variety, Poultry Manure and Jatropha Seed extracts during 2014, 2015 and the Two Years Combined at Dadin-Kowa.

Treatment	2014	2015	2014/2015(Combined)
Variety			
Kwadon local	0.30	0.27	0.28
Bellboy	0.31	0.25	0.27
Yolo Wonder	0.32	0.28	0.30
SE $\pm$	0.199	0.282	0.257
Poultry Manure (t PM ha^{-1})			
0	0.25^{d}	0.23^{d}	0.24^{d}
3	0.29^{c}	0.26^{c}	0.27^{c}
6	0.33^{b}	0.27^{b}	0.30^{b}
9	0.36^{a}	0.31^{a}	0.33^{a}
SE $\pm$	0.174	0.145	0.118
Jatropha Seed Extracts (% *EC*)			
0	0.28^{b}	0.24^{c}	0.26^{c}
1	0.31^{a}	0.26^{b}	0.28^{b}
2	0.31^{a}	0.28^{a}	0.30^{a}
3	0.32^{a}	0.29^{a}	0.30^{a}
SE$\pm$	0.077	0.088	0.061
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

The fruit fresh yields (t ha^{-1}) of sweet pepper were produced by application of 6 t PM ha^{-1} was statistically similar to that of 9 t PM ha^{-1} during the 2014 and 2015 rainy seasons and the years combined at BUK. The lowest fresh fruit yields were from the 0 t PM ha^{-1} in all the seasons under study.

Similarly, varying the levels of jatropha seed extracts significantly affected fresh fruit yields of sweet pepper each year and the combined. Incrasing jatropha seed extract fron 0 – 1 and further 2 % EC ha^{-1} led to a corresponding increase in fruit yield ha^{-1} at BUK. The applied 3 % EC of jatropha seed extracts had the highest value for fresh fruit yields though that was not statistically different from those produced by the applied 2 % EC of the jatropha seed extracts to sweet pepper.

Interaction between variety and jatropha seed extracts significantly influenced fresh fruit yield of sweet pepper during the 2014 rainy season at BUK. Yolo Wonder responded more to application of 2 or 3 % EC ha^{-1} and had the highest fruit fresh yields of sweet pepper. The least fruit fresh yields were obtained from Kwadon local interacting with all the levels of jatropha seed extracts and that obtained from the interaction between Bellboy and 0 % EC ha^{-1} (Table 66).

Interaction between the applied poultry manure and jatropha seed extracts had significant effects on sweet pepper fruit fresh yield during the 2014 and 2015 rainy seasons and the combined data at BUK (Table 67). In 2014 varying the jatropha seed extract did not affect fruit fresh yield of each of the sweet pepper variety significantly. Similarly, yield of the three sweet pepper varieties did not statistically vary at fixed jatropha seed extract rate of 0 % EC ha^{-1}. At fixed jatropha seed extract of 1 % EC ha^{-1} Yolo Wonder had statistically similar fruit yield ha^{-1} with Bellboy but were than far with Kwadon local; the latter variety had also statistically similar fruit yield with Bellboy. However at fixed jatropha seed extract of 2 % and 3 % EC ha^{-1} fresh fruit yield of Bellboy and Kwadon local were statistically similar and lower

Table 66: Fruit Fresh Yield (t ha^{-1}) of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Seasons and the Years Combined at BUK.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	12.6^{c}	16.1^{b}	14.3^{b}
Bellboy	14.1^{b}	17.7^{ab}	15.9^{b}
Yolo Wonder	22.4^{a}	19.2^{a}	20.8^{a}
SE $\pm$	0.95	0.84	0.042
Poultry Manure (t PM ha^{-1})			
0	11.8^{c}	8.9^{c}	10.4^{c}
3	14.7^{b}	14.5^{b}	14.6^{b}
6	18.8^{a}	24.6^{a}	21.3^{a}
9	20.2^{a}	25.7^{a}	22.9^{a}
SE $\pm$	0.79	0.68	0.78
Jatropha Seed Extracts (% *EC*)			
0	14.2^{c}	12.3^{c}	13.2^{c}
1	15.6^{b}	17.1^{b}	16.3^{b}
2	17.8^{a}	19.9^{a}	18.9^{a}
3	17.8^{a}	21.4^{a}	19.6^{a}
SE$\pm$	0.19	0.21	0.16
Interactions			
Var*PM	NS	NS	NS
Var*JSE	**	NS	NS
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

than for the highest recorded by Yolo Wonder. Application of 1 % EC ha^{-1} significantly increased fruit fresh yield of sweet pepper only for 3, 6 and 9 t PM ha^{-1} rates and remained significantly same at 0 t PM ha^{-1} rate. Further increase in jatropha seed extract to 2 % EC ha^{-1} increased fruit yield of sweet pepper that either received 6 or 9 t PM ha^{-1} and remained statistically unaffected at lower manure rates increase to 3 % EC ha^{-1} jatropha seed extract at general did not affect the character statistically. At each of the jatropha seed extract level, increasing manure rate upto 9 t PM ha^{-1} for 0 and 3 % EC ha^{-1} and 6 t PM ha^{-1} for 1 and 2 % EC ha^{-1} jatropha seed extract led to a corresponding increase in fruit yield of sweet pepper ha^{-1}. Further increase in poultry manure rate to 9 t PM ha^{-1} did not affect the character statistically.

Variation in jatropha seed extract rate had no significant effect on fruit fresh yield of sweet pepper for 0 and 3 t PM ha^{-1} only. At higher poultry manure rates of 6 and 9 t PM ha^{-1} jatropha seed extract of 3 % EC ha^{-1} had the highest fruit yield value that was statistically similar with that of 2 % EC ha^{-1}; the least fruit yield values of 15.7 and 14.8 t PM ha^{-1} were obtained when no jatropha seed extract was not sprayed at respective manure rates of 6 and 9 t PM ha^{-1}. In the absence of jatropha seed extract application of either 6 and 9 t PM ha^{-1} had fruit yield that are statistically similar and more than for 0 t PM ha^{-1} only. At fixed applied rate of 1, 2 and 3 % EC ha^{-1} jatropha seed extract, application of 3 t PM ha^{-1} resulted to a significant fruit yield increase for 2 and 3 % EC ha^{-1} and remained unaffected in the case of 1 % EC ha^{-1}. Further increase in the rate to 6 and 9 t PM ha^{-1} led to corresponding increase in fuit yield for 1 and 3 % EC ha^{-1} jatropha seed extract only but remained statistically same for 2 % EC ha^{-1} JSE. Interaction between 9 t PM ha^{-1} of applied poultry manure and 3 % EC of jatropha seed extracts recorded the highest fruit fresh yield of sweet pepper during the 2014 and 2015 rainy seasons at BUK which was not really different from the fresh fruit yield obtained from the interactive effects between 9 and 6 t PM ha^{-1} with the applied 2 % EC of jatropha seed extracts.

Table 67: The Interaction between Variety and Jatropha Seed Extracts and between Poultry Manure and Jatropha Seed Extracts on Fruits Yield (t ha^{-1}) of Sweet Pepper during 2014 and 2015 Rainy Seasons and the Combined Data at BUK.

Treatment	Jatropha Seed Extracts (JSE) (% *EC*)			
	0	1	2	3
Variety		2014		
Kwadon local	11.0^{c}	11.7^{c}	13.6^{c}	13.9^{c}
Bellboy	12.2^{c}	13.8^{bc}	15.2^{bc}	15.3^{bc}
Yolo Wonder	19.4^{abc}	21.2^{ab}	24.7^{a}	24.3^{a}
SE ±		0.99		
Poultry Manure (t PM ha^{-1})		2014		
0	10.2^{i}	11.1^{hi}	12.9^{gh}	13.2^{g}
3	13.6^{g}	14.1^{f}	15.4^{f}	15.6^{f}
6	15.9^{f}	18.0^{de}	21.0^{ab}	20.2^{bc}
9	17.1^{e}	19.2^{cd}	22.0^{ab}	22.4^{a}
SE ±		0.95		
Poultry Manure (t PM ha^{1})		2015		
0	6.5^{gh}	8.9^{gh}	9.7^{gh}	10.5^{fgh}
3	12.1^{efgh}	13.8^{efgh}	14.8^{defg}	17.3^{de}
6	15.7^{def}	20.4^{cd}	25.2^{bc}	25.3^{b}
9	14.8^{defg}	25.3^{b}	30.0^{ab}	32.6^{a}
SE ±		0. 97		
Poultry Manure (t PM ha^{1})		2014/2015 (Combined)		
0	8.3^{i}	10.0^{hi}	11.3^{gh}	11.8^{gh}
3	12.8^{fgh}	13.9^{efg}	15.1^{ef}	16.5^{de}
6	15.8^{ef}	19.2^{cd}	23.1^{bc}	22.7^{b}
9	15.9^{de}	22.3^{c}	26.0^{ab}	27.5^{a}
SE ±		0.61		

Means followed by unlike letter(s) are significantly different (P≤ 0.005) using DMRT

The least fruit fresh yield of sweet pepper was produced by the interaction between the control treatments of 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts during the same seasons under study at BUK.

Similarly, interaction between the applied poultry manure and jatropha seed extracts statistically had significant effects on sweet pepper fruit fresh yield during the years combined data at BUK. Application of 9 t PM ha^{-1} interacted positively with 3 % EC of jatropha seed extracts and recorded the highest fruit fresh yield of sweet pepper. However, this was not statistically different from fruit fresh yield produced by the interaction between the applied 9 t PM ha^{-1} and the 2 % EC of jatropha seed extracts. The least fruit fresh yield of sweet pepper was produced by the interaction between the control treatments of 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts though not statistically different from that obtained by the interaction between the control level of poultry manure and the applied 1 % EC of jatropha seed extracts during the same time of observation.

The result in Table 68 indicated that fruit fresh yields of sweet pepper were significantly affected by the variety, poultry manure and jatropha seed extracts examined during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. The fruit fresh yield of sweet pepper was not statistically different among the three varieties at Dadin-Kowa during the 2014 rainy season at Dadin-Kowa.

However during 2015 rainy season and the combined data at BUK Dadin-Kowa, fruits fresh yields were statistically different among the varieties of sweet pepper. The highest fruit fresh yields of sweet pepper were recorded by the Yolo Wonder. These were followed by those produced by Bellboy though, not significantly different from the fruit fresh yield obtained from Kwadon local.

Application of poultry manure statistically enhanced fruit fresh yield of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. The applied 9 t

Table 68: Fruit Fresh Yield (t ha^{-1}) of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	16.1	17.7^{b}	16.9^{b}
Bellboy	17.4	17.9^{b}	17.6^{b}
Yolo Wonder	18.5	23.6^{a}	21.0^{a}
SE ±	0.73	0.91	0.59
Poultry Manure (t PM ha^{-1})			
0	14.7^{d}	16.6^{c}	15.7^{d}
3	16.3^{c}	19.3^{b}	17.8^{c}
6	18.4^{b}	20.0^{b}	19.2^{b}
9	19.8^{a}	22.9^{a}	21.4^{a}
SE ±	0.58	0.66	0.37
Jatropha Seed Extracts (% *EC*)			
0	16,2^{c}	17.9^{c}	17.1^{c}
1	17.1^{b}	19.4^{b}	18.3^{b}
2	17.8^{a}	20.5^{a}	19.1^{a}
3	18.1^{a}	20.9^{a}	19.5^{a}
SE±	0.52	0.39	0.20
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	**	NS	NS
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different (P≤ 0.05) using DMRT

Table 69: Interactions between Poultry Manure and Jatropha Seed Extracts on Fruit Fresh Yield (t ha^{-1}) of Sweet Pepper during 2014 Rainy Season at Dadin-Kowa

Treatment	Jatropha seed extracts (% *EC*)			
Poultry Manure (t PM ha^{1})	0	1	2	3
0	14.3^{h}	14.6^{h}	15.0^{gh}	14.8^{h}
3	15.7^{g}	16.2^{fg}	16.3^{f}	17.1^{ef}
6	17.1^{ef}	18.1^{de}	19.1^{cd}	19.4^{c}
9	17.6^{e}	19.6^{bc}	20.7^{ab}	21.4^{a}
SE $\pm$		0.65		

Means followed by unlike letter(s) are significantly different (P$\leq$ 0.005) using DMRT

PM ha^{-1} in all the seasons gave the highest fruit fresh yields of sweet pepper. These were followed by the fruit fresh yields produced by application of 6 t PM ha^{-1}. While, the least fruit fresh yields were recorded by the control treatment of 0 t PM ha^{-1} in all the seasons.

Similarly, the application of the varying levels of jatropha seed extracts had significant effects on the fruit fresh yield of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. The applications of 3 % EC and 2 % EC of jatropha seed extracts produced the highest fruits fresh yields that were statistically not different during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. While the least fruit fresh yields were obtained from the control treatment (0 % EC of jatropha seed extracts) at the same periods of observation.

Interactions between the applied poultry manure and jatropha seed extracts on sweet pepper statistically influenced the fruit fresh yield during the 2014 rainy season at Dadin-Kowa. When PM was not applied (0 t PM ha^{-1}), the application of JSE did not affect the fruit fresh yield of sweet pepper. AT the other PM levels (3, 6 and 9 t PM ha^{-1}) fruit fresh yield increased significantly with the application of 2 % JSE. Though, the highest fruit fresh yield of sweet pepper was obtained from the interaction between 9 t PM ha^{-1} and 3 % EC of jatropha seed extracts (Table 69). The least fruit fresh yield was recorded by the interaction between control treatments of 0 t PM ha^{-1} and 0 % EC jatropha seed extracts though not statistically different from the fruit fresh yield measured by the interaction between the 0 t PM ha^{-1} and the applied 1 % EC of jatropha seed extracts observed during the same season (Table 69).

Dry fruits yield (t ha^{-1})

Table 70 is the record of dry fruits yield of sweet pepper varieties as affected by poultry manure and jatropha seed extracts determined during the 2014 and 2015 rainy seasons and the combined data at BUK. The dry fruits yields were not significantly different among the varieties during the 2014 and 2015 rainy seasons and the combined data at BUK, but there were

Table 70: Dry Fruits Yield (t ha^{-1}) of Three Sweet Pepper as Affected by Variety, Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Seasons and the Combined Data at BUK.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	1.6	1.7^{a}	1.6
Bellboy	1.5	1.6^{a}	1.5
Yolo Wonder	1.4	1.3^{b}	1.4
SE $\pm$	0.77	0.84	0.42
Poultry Manure (t PM ha^{-1})			
0	1.1^{c}	1.2^{c}	1.1^{d}
3	1.4^{b}	1.4^{b}	1.4^{c}
6	1.7^{a}	1.8^{a}	1.7^{b}
9	1.8^{a}	1.9^{a}	1.9^{a}
SE $\pm$	0.61	0.85	0.74
Jatropha Seed Extracts (% *EC*)			
0	1.3^{c}	1.3^{c}	1.3^{c}
1	1.5^{b}	1.5^{b}	1.5^{b}
2	1.7^{a}	1.7^{a}	1.7^{a}
3	1.7^{a}	1.8^{a}	1.7^{a}
SE$\pm$	0.41	0.58	0.40
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	NS	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

differences among the three varieties of sweet pepper in terms of dry fruits yield recorded during the 2015 rainy season at BUK. Yolo Wonder the 2015 rainy season recorded the least dry fruits yield compared to the other two varieties of sweet pepper. But, there was no statistical difference between Bellboy and Kwadon local in terms of the dry fruits yield measured at BUK during the 2015 rainy season.

Application of PM statistically improved dry fruits yield of sweet pepper during the 2014 and 2015 rainy seasons and when the two years data was combined at BUK. The dry fruits yields were observed to be much greater by the application of 9 t PM ha^{-1} of poultry manure during the periods under consideration more than dry fruits yields of sweet pepper recorded by the other levels of the applied poultry manure. However during the 2014 and 2015 rainy seasons and the combined data at BUK, application of 6 t PM ha^{-1} had the dry fruits yields that were not statistically different from those obtained by those obtained by the 9 t PM ha^{-1} (Table 70). The lowest dry fruits yields were recorded by the control treatment (0 t PM ha^{-1}) in all the seasons at BUK.

Similarly, application of jatropha seed extracts statistically improved the production of dry fruits of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at BUK. Applications of 2 % EC and 3 % EC of jatropha seed extracts produced the highest dry fruits yields of sweet pepper during seasons studied at BUK. At these seasons, the least dry fruits yields were recorded by the 0 % EC of jatropha seed extracts (Table 70).

Dry fruits yields of sweet pepper were statistically enhanced by the interactions between poultry manure and jatropha seed extracts during the 2015 rainy seasons and the combined data at BUK. During the 2015 rainy season at BUK, 9 t PM ha^{-1} interacted very well with 3 and 2 % EC of jatropha seed extracts and produced the highest dry fruits yields that are not significantly different. These were followed by the dry fruits yield obtained by the interaction between 6 t PM ha^{-1} and 2 % EC of jatropha seed extracts.

Table 71: Interactions between Poultry Manure and Jatropha Seed Extracts on Dry Fruits Yield ($t\ ha^{-1}$) of Sweet Pepper during 2015 Rainy Season and the Years Combined Data at BUK.

Treatment	Jatropha seed extracts (% *EC*)			
Poultry Manure ($t\ PM\ ha^{1}$)	0	1	2	3
		2015		
0	1.1^{f}	1.1^{f}	0.12^{def}	0.13^{ef}
3	1.3^{ef}	1.5^{cde}	0.14^{de}	0.15^{cd}
6	1.5^{ed}	1.7^{bc}	0.19^{ab}	0.18^{bc}
9	1.4^{def}	1.7^{bc}	0.22^{a}	0.23^{a}
SE $\pm$		0.068		
		2014/2015 (ombined)		
0	0.10^{f}	0.11^{ef}	0.12^{e}	0.12^{e}
3	0.12^{e}	0.14^{d}	0.15^{d}	0.16^{cd}
6	0.15^{d}	0.17^{bc}	0.19^{b}	0.18^{b}
9	0.14^{d}	0.17^{bc}	0.21^{a}	0.22^{a}
SE $\pm$		0.010		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

The least dry fruits yield was recorded by the interaction between 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts (Table 71). Similar trend was observed in interaction effects between the applied poultry manure and jatropha seed extracts on the sweet pepper dry fruits yield in the combined data at BUK. Interaction between the applied 9 t PM ha^{-1} and 3 % EC of jatropha seed extracts gave the highest dry fruits yield though not statistically different from that obtained by the interaction between 9 t PM ha^{-1} and 2 % EC of jatropha seed extracts. These were followed by the dry fruits yields obtained by interactions between 6 t PM ha^{-1} with 2 and 3 % EC of jatropha seed extracts. While, the lowest dry fruits yield was observed by effect of interaction between the control treatments in the combined data at BUK.

The results in Table 72 shows that dry fruits yields of sweet pepper were statistically enhanced by varietal effects and applications of varied amounts of poultry manure and jatropha seed extracts during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa. No significant differences were observed among the three varieties of sweet pepper with respect to dry fruits yield.

Application of poultry manure to sweet pepper greatly influenced the production of dry fruits yield during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa. 9 t PM ha^{-1} applied to sweet pepper recorded the highest dry fruits yields in all the seasons of observations. These were followed by dry fruits yields produced by the application of 6 t PM ha^{-1} (Table 72). The least dry fruits yields of sweet pepper were recorded by the control treatment (0 t PM ha^{-1}).

Similarly, application of jatropha seed extracts to sweet pepper significantly enhanced the dry fruits yields during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa. The applied 3 % EC of jatropha seed extracts produced the highest dry fruits yields

Table 72: Dry Fruits Yield (t ha^{-1}) of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014, 2015 and the Two Years Combined at Dadin-Kowa.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	2.0	1.8	1.9
Bellboy	2.0	1.8	1.9
Yolo Wonder	2.0	2.1	2.0
SE $\pm$	0.91	1.26	0.92
Poultry Manure (t PM ha^{-1})			
0	1.6^{d}	1.6^{c}	1.6^{d}
3	1.9^{c}	1.9^{b}	1.9^{c}
6	2.1^{b}	2.0^{b}	2.0^{b}
9	2.2^{a}	2.2^{a}	2.2^{a}
SE $\pm$	0.57	0.53	0.57
Jatropha Seed Extracts (% *EC*)			
0	1.8^{c}	1.8^{c}	1.8^{c}
1	1.9^{b}	1.9^{b}	1.9^{b}
2	2.0^{a}	2.0^{a}	2.0^{a}
3	2.0^{a}	2.0^{a}	2.0^{a}
SE$\pm$	0.27	0.39	0.46
Interactions			
Var*PM	NS	NS	NS
Var*JSE	NS	NS	NS
PM*JSE	**	NS	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Table 73: Interactions between Poultry Manure and Jatropha Seed Extracts on Dry Fruits Yield (t ha^{-1}) of Sweet Pepper during 2014 Rainy Season and the Combined Data at Dadin-Kowa.

Treatment	Jatropha seed extracts (% *EC*)			
Poultry Manure (t PM ha^{1})	0	1	2	3
		2014		
0	1.6^{h}	1.7^{gh}	1.7^{gh}	1.6^{gh}
3	1.8^{fg}	1.9^{ef}	1.9^{ef}	2.0^{de}
6	1.9^{de}	2.1^{bc}	2.1^{bc}	2.1^{bc}
9	2.0^{cde}	2.2^{b}	2.3^{ab}	2.4^{a}
SE $\pm$		0.73		
		2014/2015 (ombined)		
0	1.3^{h}	1.5^{gh}	1.7^{fg}	1.7^{fg}
3	1.5^{gh}	2.4^{ef}	2.4^{ef}	2.9^{de}
6	2.5^{de}	3.4^{cd}	3.9^{bc}	4.0^{bc}
9	3.8^{bc}	4.2^{b}	4.8^{a}	5.2^{a}
SE $\pm$		0.27		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

which were not statistically different from those obtained by the application of 2 % EC of jatropha seed extracts during the same periods of observations. The least dry fruits yields of sweet pepper were obtained by the control treatment (0 % EC of jatropha seed extracts) (Table 72).

Interactions between the applied poultry manure and jatropha seed extracts had significant influence on the dry fruits yield production of sweet pepper during 2014 and 2015 rainy seasons and the years combined at Dadin-Kowa (Table 73). During the 2014 rainy season at Dadin-Kowa, application of 9 t PM ha^{-1} favorably interacted with the applied 3 % EC of jatropha seed extracts and gave the highest dry fruits yield of sweet pepper. However, that was not statistically different from the dry fruit yield recorded by the interaction between the applied 9 t PM ha^{-1} and 2 % EC of jatropha seed extracts. The least dry fruits yield was obtained from the interaction between the 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts.

Similarly, in the combined data at Dadin-Kowa, application of 9 t PM ha^{-1} positively interacted with the applied 3 % EC of jatropha seed extracts and gave the highest dry fruit yield of sweet pepper which was equally not statistically different from the dry fruits yield recorded by the interaction between the applied 9 t PM ha^{-1} and 2 % EC of jatropha seed extracts. In the same veins the least dry fruits yield in this case was also obtained from the interaction between the0 t PM ha^{-1} and 0 % EC of jatropha seed extracts.

4.1.4 Chemical composition of pepper fruits tissue

Fruit crude protein (g $100g^{-1}$) contents

Fruit crude protein contents of three sweet pepper varieties as presented in Table 74 was affected by the application of poultry manure and jatropha seed extracts during the 2014 and 2015 rainy seasons and the years combined at BUK.

Table 74: Fruit Crude Protein (g 100g^{-1}) Contents of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014, 2015 and the Two Years Combined at BUK.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	3.11^{a}	2.41^{a}	2.76^{a}
Bellboy	3.15^{a}	2.41^{a}	2.78^{a}
Yolo Wonder	2.97^{b}	1.92^{b}	2.44^{b}
SE ±	0.036	0.021	0.025
Poultry Manure (t PM ha^{-1})			
0	2.70^{d}	1.85^{c}	2.27^{c}
3	2.92^{c}	2.35^{b}	2.69^{b}
6	3.04^{b}	2.37^{b}	2.66^{b}
9	3.65^{a}	2.42^{a}	3.01^{a}
SE ±	0.039	0.022	0.020
Jatropha Seed Extracts (% *EC*)			
0	2.74^{d}	1.98^{c}	2.36^{d}
1	3.01^{c}	2.11^{b}	2.55^{c}
2	3.22^{b}	2.42^{a}	2.82^{b}
3	3,33^{a}	2.48^{a}	2.90^{a}
SE±	0.041	0.030	0.025
Interactions			
Var*PM	**	**	**
Var*JSE	*	NS	*
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different (P≤ 0.05) using DMRT

The three sweet pepper varieties varied significantly in fruit proteins content. The fruit crude protein contents were observed to be higher in Bellboy during the 2014 and 2015 rainy seasons and the years combined. The higher cruide protein contents of bellboy fruits were in turn not statistically different from that recorded by the Kwadon local in all the seasons and the combined. The least fruit crude proteins were generally from Yolo Wonder.

Similarly, the fruit crude protein contents were significantly influenced by varying amount of poultry manure during the 2014 and 2015 rainy seasons and the years combined at BUK. Application of 9 t PM ha^{-1} consistently produced the highest fruit crude proteins contents. This was followed by fruit crude proteins obtained by the application of 6 and 3 t PM ha^{-1} in 2015 and the combined then 3 t PM ha^{-1} of applied poultry manure in 2014. The least fruit crude protein contents were generally from the control treatment.

In the same vein jatropha seed extracts had significant influence on the fruit crude proteins of sweet pepper during the 2014 and 2015 rainy seasons and the years combined at BUK. Highest and statistically similar fruit crude proteins were generally from sweet pepper treated with 2 and 3 % EC ha^{-1}. This was followed by 1 % EC ha^{-1}. The lowest fruit crude proteins were from the control treatment.

The interactions between variety and poultry manure as shown in Table 75 significantly enhanced the fruit crude proteins of sweet pepper during the 2014 and 2015 rainy seasons and the years combined at BUK. Bellboy interacted favorably with 9 t PM ha^{-1} and developed the highest fruit crude proteins during 2014 rainy season at BUK which is not statistically different from those produced by the interaction between Yolo Wonder and the applied 9 t PM ha^{-1}. The least fruit crude proteins were produced by the interactions between Yolo Wonder and 0 t PM ha^{-1}. The fruit crude protein contents produced by control treatment interacting with Kwadon local are greater than those produced by the interactions between Bellboy and Yolo Wonder with the control treatment respectively.

Table 75: Interactions between Variety and Poultry Manure on Fruit Crude Proteins (g $100g^{-1}$) Contents of Sweet Pepper during 2014 and 2015 Rainy Seasons and the Years Combined at BUK.

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
		2014		
Kwadon local	2.79^{e}	3.27^{c}	3.31^{c}	3.48^{b}
Bellboy	2.63^{f}	2.89^{d}	3.34^{c}	3.75^{a}
Yolo Wonder	2.68^{f}	2.97^{d}	3.50^{b}	3.72^{a}
SE $\pm$		0.068		
		2015		
Kwadon local	2.43^{d}	2.30^{e}	2.50^{bc}	2.48^{c}
Bellboy	1.82^{g}	2.45^{cd}	2.55^{b}	2.84^{a}
Yolo Wonder	1.31^{i}	2.29^{e}	2.20^{f}	1.88^{g}
SE $\pm$		0.038		
		2014/2015 (Combined)		
Kwadon local	2.61^{f}	2.78^{cd}	2.71^{de}	2.93^{b}
Bellboy	2.22^{g}	2.67^{e}	2.94^{b}	3.29^{a}
Yolo Wonder	2.00^{h}	2.63^{e}	2.65^{e}	2.80^{c}
SE $\pm$		0.039		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Similarly, during the 2015 rainy season at BUK the interaction between Bellboy and 9 t PM ha^{-1} enhanced the production of the highest fruit crude proteins, followed by those obtained from the interactions between Bellboy and 6 t PM ha^{-1} then Kwadon local and 9 t PM ha^{-1}. The least was recorded by the interaction between Bellboy and 0 t PM ha^{-1}. Again, the interaction between the Bellboy and 9 t PM ha^{-1} during the the two years combined at BUK had the highest crude protein while the least was recorded by the interaction between Yolo Wonder and 0 t PM ha^{-1} (Table 74).

In like manner, the interactions between variety and jatropha seed extracts positively affected the fruit crude proteins contents of sweet pepper during the 2014 and the two years combined at BUK. In all the seasons the interaction between Bellboy and 3 % EC of jatropha seed extracts produced the highest fruit crude proteins these were followed by those obtained from the interaction between Kwadon local and 3 % EC of jatropha seed extracts and between Bellboy and 2 % EC of jatropha seed extracts. The lowest fruit crude proteins were recorded by interactions between Yolo Wonder and 0 percent EC of jatropha seed extracts in all the seasons under considerations (Table 75).

Interactions between poultry manure and jatropha seed extracts appeared to be highly influential on the fruit crude protein contents of sweet pepper during the 2014, 2015 and the two years combined at BUK (Table 76). The applied 9 t PM ha^{-1} interacted favorably with 3 % EC ha^{-1} and produced the highest fruits crude proteins during the 2014 and the two years combined at BUK. This was followed by fruit crude proteins produced by the interaction between 9 t PM ha^{-1} and 2 % EC ha^{-1}. However, during the 2015 rainy at BUK the highest fruit crude proteins were obtained by the interaction between 6 t PM ha^{-1} and 3 % EC of jatropha seed extracts followed by that produced by interaction between 9 t PM ha^{-1} and 3 % EC ha^{-1} during the same season considered,

Table 76: Interactions between Variety and Jatropha Seed Extracts on Fruit Crude Proteins (g $100g^{-1}$) Contents of Sweet Pepper during 2014 and 2015 Rainy Seasons and the Years Combined at BUK.

Treatment	Jatropha Seed Extracts (JSE) (% EC)			
Variety	0	1	2	3
		<u>2014</u>		
Kwadon local	2.58[d]	3.22[ab]	3.33[a]	3.39[a]
Bellboy	2.87[c]	3.23[ab]	3.29[ab]	3.35[a]
Yolo Wonder	1.78[e]	2.60[d]	2.74[b]	3.15[b]
SE ±		0.071		
		<u>2014/2015 (Combined)</u>		
Kwadon local	2.39[f]	2.68[de]	3.01[a]	3.09[a]
Bellboy	2.43[f]	2.84[b]	3.08[a]	3.09[a]
Yolo Wonder	1.75[h]	2.18[g]	2.59[e]	2.76[cd]
SE ±		0.045		

Means followed by unlike letter(s) are significantly different (P≤ 0.005) using DMRT

Table 77: Interactions between Poultry Manure and Jatropha Seed Extracts on Fruit Crude Proteins (g $100g^{-1}$) Contents of Sweet Pepper during 2014 and 2015 Rainy Seasons and the Years Combined at BUK.

Treatment	Jatropha Seed Extracts (% EC)			
Poultry Manure (t PM ha^{-1})	0	1	2	3
		2014		
0	2.38^{i}	2.56^{h}	$2,90^{f}$	2.95^{f}
3	2.73^{g}	3.20^{d}	3.23^{d}	3.00^{ef}
6	2.71^{g}	2.75^{g}	2.95^{f}	3.25^{d}
9	3.15^{de}	3.53^{c}	3.80^{b}	4.11^{a}
SE $\pm$		0.080		
		2015		
0	1.58^{f}	1.69^{f}	2.05^{e}	2.09^{e}
3	2.18^{d}	2.45^{c}	2.36^{c}	2.44^{c}
6	2.19^{d}	2.33^{c}	2.68^{ab}	2.78^{a}
9	2.20^{d}	2.09^{e}	2.60^{b}	2.69^{ab}
SE $\pm$		0.056		
		2014/2015 (Combined)		
0	1.98^{h}	2.13^{h}	2.47^{f}	2.52^{f}
3	2.46^{f}	2.81^{d}	2.80^{d}	2.72^{d}
6	2.29^{g}	2.54^{f}	2.82^{c}	3.01^{b}
9	2.67^{e}	2.81^{d}	3.20^{b}	3.40^{a}
SE $\pm$		0.048		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

which was not statistically different from the ones obtained by the interaction between 6 and 9 t PM ha^{-1} with 2 % EC of jatropha seed extracts. The lowest fruit crude proteins were recorded by the interactions between 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts in all the seasons observed (Table 76).

Fruits capsaicin ($g100g^{-1}$) contents

Fruits capsaicin contents for the three sweet pepper varieties shown in Table 78 was obtained to be significantly affected by application of poultry manure and jatropha seed extracts in 2014 and 2015 rainy seasons and the years combined at BUK. The fruits capsaicin contents were generally higher in Kwadon local followed by Bellboy and the least was from Yolo Wonder.

Applied 9 t PM ha^{-1} produced the highest fruit capsaicin content during the 2014 and 2015 rainy seasons and the years combined at BUK. This was followed by fruits capsaicin contents of 6 t PM ha^{-1} that was at far with that of 3 t PM ha^{-1} in 2015 and the combined only. While, 3 t PM ha^{-1} had fruit capsaicin content next to 6 t PM ha^{-1} in 2014 only. The least capsaicin was produced by the control treatment (0 t PM ha^{-1}).

Increasing jatropha seed extract level upto 3 % EC ha^{-1} in 2014 and the combined only and 2 % EC in 2015 had resulted to a corresponding increase in fruit capsaicin content. The highest values for fruits capsaicin contents recorded at 3 % EC ha^{-1} of jatropha seed extracts was statistically similar to that of 2 % EC ha^{-1} in 2015 only. The lowest fruits capsaicin contents were consistently recorded by the control treatment.

The interactions between variety and PM as shown in Table 79 significantly enhanced the fruits capsaicin contents of sweet pepper 2014 and 2015 rainy seasons and the years combined at BUK. Kwadon local interacted favorably with 6 and 9 t PM ha^{-1} and developed the highest fruits of capsaicin content during the 2014 rainy season at BUK. The least fruits capsaicin contents were produced by the interactions between Yolo Wonder and 0 t PM ha^{-1}.

Table 78: Fruit Capsaicin (g $100g^{-1}$) Contents of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Seasons and the Years Combined at BUK

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	2.33[a]	1.95[a]	2.14[a]
Bellboy	1.93[b]	1.24[b]	1.59[b]
Yolo Wonder	1.39[c]	0.98[c]	1.18[c]
SE $\pm$	0.015	0.059	0.061
Poultry Manure (t PM ha^{-1})			
0	1.34[d]	0.94[c]	1.14[c]
3	1.85[c]	1.37[b]	1.61[b]
6	2.06[b]	1.53[b]	1.84[b]
9	2.18[a]	1.72[a]	1.95[a]
SE $\pm$	0.025	0.015	0.019
Jatropha Seed Extracts (% *EC*)			
0	1.47[d]	0.94[c]	1.21[d]
1	1.80[c]	1.30[b]	1.55[c]
2	2.06[b]	1.59[a]	1.83[b]
3	2.19[a]	1.74[a]	1.96[a]
SE$\pm$	0.038	0.021	0.021
Interactions			
Var*PM	**	**	**
Var*JSE	*	NS	*
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Capsaicin produced by 6 t PM ha^{-1} then Kwadon local and 9 t PM ha^{-1} interacting with Kwadon local are greater than those produced by the interactions between Bellboy and Yolo Wonder with the varying levels of PM respectively.

Similarly, during the 2015 rainy season at BUK the interaction between Kwadon local with 6 and 9 t PM ha^{-1} enhanced the production of the highest fruits capsaicin contents, followed by those obtained from the interactions between Bellboy and 6 t PM ha^{-1}. The least was recorded by the interaction between Yolo Wonder and 0 t PM ha^{-1}. Again, the interaction between the Bellboy and 9 t PM ha^{-1} at the combined location had the highest fruits capsaicin contents while the least was recorded by the interaction between Yolo Wonder and 0 t PM ha^{-1}. In like manner, the interactions between variety and jatropha seed extracts positively affected the fruits capsaicin contents of sweet pepper during the 2014 and 2015 rainy seasons and the years combined at BUK. In all the seasons, the interaction between the Kwadon local and 2 % EC of jatropha seed extracts and between the three varieties and 3 % EC ha^{-1} produced the highest capsaicin contents of sweet pepper. These were followed by those obtained from the interaction between Kwadon local and 1 % EC of jatropha seed extracts and between Bellboy and 2 % EC ha^{-1}. The lowest fruits capsaicin content was recorded by interactions between Yolo Wonder and 0 % EC of jatropha seed extracts in all the location under considerations (Table 79).

Interactions between poultry manure and jatropha seed extracts appeared to be highly influential on the fruits capsaicin contents of sweet pepper during the 2014, 2015 and the two years combined at BUK (Table 80). The applied 6 t PM ha^{-1} interacted favorably with 3 % EC ha^{-1} and produced the highest fruits capsaicin contents during the 2014 and the two years combined at BUK. These were followed by fruits capsaicin contents produced by the interaction between 9 t PM ha^{-1} and 2 % EC ha^{-1}.

Table 79: Interactions between Variety and Poultry Manure on Fruit Capsaicin (g $100g^{-1}$) Contents of Sweet Pepper during the 2014 and 2015 Rainy Seasons and the Years Combined at BUK.

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
		2014		
Kwadon local	1.70^{f}	2.43^{b}	2.29^{a}	2.28^{a}
Bellboy	1.38^{h}	1.94^{e}	2.08^{d}	2.33^{c}
Yolo Wonder	0.94^{j}	1.18^{i}	1.45^{g}	1.94^{e}
SE $\pm$		0.040		
		2015		
Kwadon local	1.20^{f}	1.85^{c}	2.26^{b}	2.50^{a}
Bellboy	0.95^{h}	1.36^{e}	1.18^{c}	1.47^{d}
Yolo Wonder	0.68^{i}	0.90^{h}	1.15^{g}	1.20^{g}
SE $\pm$		0.023		
		2014/2015 (Combined)		
Kwadon local	1.45^{g}	2.14^{c}	2.58^{a}	2.39^{b}
Bellboy	1.17^{i}	1.55^{f}	1.63^{ef}	1.90^{d}
Yolo Wonder	0.81^{j}	1.04^{j}	1.32^{h}	1.57^{f}
SE $\pm$		0.028		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 80: Interactions between Variety and Jatropha Seed Extracts on Fruit Capsaicin (g $100g^{-1}$) Contents of Sweet Pepper during 2014 Rainy Season and the Combined Data at BUK.

Treatment	Jatropha Seed Extracts (JSE) (% EC)			
Variety	0	1	2	3
		2014		
Kwadon local	1.90^{d}	2.26^{ab}	2.68^{a}	2.26^{a}
Bellboy	1.31^{c}	1.82^{ab}	2.06^{ab}	2.33^{a}
Yolo Wonder	1.21^{e}	1.32^{d}	1.45^{b}	1.94^{a}
SE $\pm$		0.059		
		2014/2015 (Combined)		
Kwadon local	1.54^{f}	2.05^{c}	2.38^{b}	2.58^{a}
Bellboy	1.04^{h}	1.57^{f}	1.77^{e}	1.96^{d}
Yolo Wonder	1.04^{h}	1.03^{h}	1.32^{g}	1.34^{g}
SE $\pm$		0.032		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 81: Interactions between Poultry Manure and Jatropha Seed Extracts on Fruit Capsaicin (g $100g^{-1}$) Contents of Sweet Pepper during 2014, 2015 and the Two Years Combined at BUK.

Treatment	Jatropha Seed Extracts (% EC)			
Poultry Manure (t PM ha^{-1})	0	1	2	3
		2014		
0	1.00^{i}	1.30^{h}	1.41^{h}	1.66^{fg}
3	$1,52^{g}$	1.81^{e}	2.28^{c}	1.80^{ef}
6	1.80	1.87^{e}	2.04^{d}	2.91^{a}
9	1.58^{g}	2.23^{c}	2.52^{b}	2.40^{b}
SE $\pm$		0.070		
		2015		
0	0.74^{j}	0.84^{i}	1.11^{f}	1.09^{g}
3	0.92^{d}	1.18^{f}	1.66^{d}	1.71^{c}
6	1.10^{g}	1.36^{e}	1.60^{d}	2.06^{a}
9	0.98^{h}	1.83^{b}	1.98^{a}	2.08^{a}
SE $\pm$		0.039		
		2014/2015 (Combined)		
0	0.87^{i}	1.07^{h}	1.26^{g}	1.37^{f}
3	1.22^{g}	1.49^{f}	1.97^{c}	1.75^{d}
6	1.45^{f}	1.62^{e}	1.82^{d}	2.49^{a}
9	1.28^{g}	2.03^{c}	2.25^{b}	2.24^{b}
SE $\pm$		0.040		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

However, during the 2015 rainy season at BUK the highest fruit capsaicin content was obtained by the interaction between 6 t PM ha^{-1} and 3 % EC of jatropha seed extracts followed by that produced by interaction between 9 t PM ha^{-1} and 3 % EC of jatropha seed extracts during the same time considered which was not statistically different from the ones obtained by the interaction between 6 and 9 t PM ha^{-1} with 2 % EC of jatropha seed extracts. The lowest fruit capsaicin contents was recorded by the interactions between 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts in all the locations during the same period of observations (Table 80).

Fruits vitamin A (mg kg^{-1}) contents

Table 82 shows fruit vitamin A contents of the three sweet pepper varieties as affected by application of poultry manure and jatropha seed extracts for two years and the years combined at BUK. The three sweet pepper varieties varied significantly in terms of fruit vitamin A content. Fruits vitamin A contents was higher in Kwadon local in 2014 and Bellboy in 2015 and the combined than for either varieties. The least fruit vitamin A contents was from in Yolo Wonder and Bellboy in 2014, Kwadon local in 2015, and kwadon local and Yolo Wonder when the two years data were combined.

Similarly, the fruits vitamin A contents were significantly influenced by varying amount of poultry manure during the 2014 and 2015 rainy seasons and the years combined at BUK. The highest fruit vitamin A content was from application of 9 t PM ha^{-1} in 2014 and 3 t PM ha^{-1} in 2015 and the combined. The values recorded in 2015 from application of 3 t PM ha^{-1} did not differ statistically from that of 9 t PM ha^{-1}. Increase in poultry manure rate to 6 t PM ha^{-1} in 2015 and the combined resulted to a significant decrease in fruit vitamin A content. The least values for vitamin A were consistently produced by the control treatment.

Jatropha seed extracts had significant influence on the fruits vitamin A contents of sweet pepper at BUK. Increasing the levels of jatropha seed extract upto 2 % enhanced fruit vitamin

Table 82: Fruit Vitamin A (mg kg^{-1}) Contents of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Seasons and the Combined Data at BUK.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	12.16^{a}	6.95^{c}	9.05^{b}
Bellboy	11.58^{b}	8.44^{a}	10.01^{a}
Yolo Wonder	11.50^{b}	7.53^{b}	9.52^{b}
SE ±	0.102	0.450	0.189
Poultry Manure (t PM ha^{-1})			
0	10.14^{c}	7.27^{b}	8.71^{c}
3	11.65^{b}	8.90^{a}	10.28^{a}
6	11.40^{b}	7.77^{b}	9.33^{b}
9	13.78^{a}	8.79^{a}	10.79^{b}
SE ±	0.318	0.409	0.292
Jatropha Seed Extracts (% *EC*)			
0	8.10^{c}	6.38^{c}	7.24^{d}
1	11.24^{b}	7.00^{b}	9.12^{c}
2	13.73^{a}	7.36^{b}	10.54^{b}
3	13.91^{a}	8.49^{a}	11.20^{a}
SE±	0.239	0.303	0.186
Interactions			
Var*PM	**	**	**
Var*JSE	*	NS	*
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different (P≤ 0.05) using DMRT

A. Further increase to 3 % EC ha^{-1} also resulted in increase I fruit vitamin A content. The highest fruit vitamin A contents was obtained from 3 % EC of jatropha seed extracts which did not differ from that of 2 % EC. The lowest fruit vitamin A contents were consistently from the control treatment.

The interactions between variety and PM as shown in Table 83 is significantly enhanced the fruit vitamin A of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at BUK. Bellboy interacted favorably with 9 t PM ha^{-1} and developed the highest fruits of vitamin A contents during the 2014 rainy season at BUK which is not statistically different from the one produced by the interaction between Yolo Wonder and the applied 9 t PM ha^{-1}. The least fruits vitamin A content was produced by the interactions between Yolo Wonder and 0 t PM ha^{-1}. The vitamin A produced by control treatment interacting with Kwadon local is greater than those produced by the interactions between Bellboy and Yolo Wonder with the control treatment respectively during the 2014 rainy season and the combined data at BUK.

Similarly, at BUK the interaction between Yolo Wonder and 6 t PM ha^{-1} enhanced the production of the higher fruits vitamin A contents, followed by those obtained from the interactions between Bellboy and 3 t PM ha^{-1} then Kwadon local and 6 t PM ha^{-1}. The least was recorded by the interaction between Kwadon local and 1 t PM ha^{-1}. Again, the interaction between the Bellboy and 3 and 9 t PM ha^{-1} at the combined location had the highest fruits vitamin A content which is statistically different from those obtained by Yolo Wonder interacting with 6 t PM ha^{-1} (Table 83). In like manner, the interactions between variety and jatropha seed extracts positively affected the fruits Vitamin A contents of sweet pepper during the 2014 rainy season and the combined at BUK. During the 2014 rainy season the interaction between Bellboy and 3 % EC of jatropha seed extracts produced the highest fruits vitamin A contents, these were followed by those obtained from the interaction between Bellboy and 2 %

Table 83: Interactions between Variety and Poultry Manure on Fruits Vitamin A (mg kg^{-1}) Contents of Sweet Pepper during 2014 and 2015 Rainy Seasons and the Combined at BUK.

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
		2014		
Kwadon local	12.23^{c}	10.85^{dc}	13.04^{b}	12.51^{bc}
Bellboy	9.49^{e}	13.30^{b}	8.45^{f}	15.07^{a}
Yolo Wonder	8.71^{ef}	10.81^{dc}	12.72^{bc}	13.77^{b}
SE $\pm$		0.488		
		2015		
Kwadon local	6.74^{bc}	5.05^{c}	6.58^{bc}	5.43^{c}
Bellboy	6.38^{bc}	7.21^{ab}	6.87^{bc}	6.31^{bc}
Yolo Wonder	6.70^{bc}	7.43^{ab}	8.36^{a}	5.64^{c}
SE $\pm$		0.761		
		2014/2015 (Combined)		
Kwadon local	9.49^{c}	7.95^{cd}	9.81^{ab}	8.97^{cd}
Bellboy	7.94^{de}	10.75^{a}	7.66^{e}	10.69^{ab}
Yolo Wonder	8.70^{d}	9.12^{c}	10.54^{ab}	9.71^{bc}
SE $\pm$		0.4.77		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 84: Interactions between Variety and Jatropha Seed Extracts on Fruits Vitamin A ($mg\ kg^{-1}$) Contents of Sweet Pepper during 2014 Rainy Season and the Combined Data at BUK.

Treatment	Jatropha Seed Extracts (JSE) (% EC)			
Variety	0	1	2	3
		2014		
Kwadon local	12.23^{c}	10.85^{d}	13.04^{bc}	12.51^{c}
Bellboy	9.49^{e}	13.30^{bc}	13.45^{bc}	15.07^{a}
Yolo Wonder	8.71^{e}	10.81^{d}	12.72^{c}	13.78^{b}
SE $\pm$		0.488		
		2014/2015 (Combined)		
Kwadon local	9.49^{d}	7.95^{f}	9.81^{bc}	8.97^{de}
Bellboy	7.94^{f}	10.75^{b}	13.75^{a}	10.69^{bc}
Yolo Wonder	8.70^{ef}	9.12^{d}	10.54^{bc}	9.71^{cd}
SE $\pm$		0.477		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 85: Interactions between Poultry Manure and Jatropha Seed Extracts on Fruit Vitamin A (mg kg^{-1}) Contents of Sweet Pepper during 2014 and 2015 Rainy Seasons and the Combined Data at BUK.

Treatment	Jatropha Seed Extracts (% EC)			
Poultry Manure (t PM ha^{-1})	0	1	2	3
		2014		
0	7.01^{g}	11.39^{de}	11.48^{de}	10.70^{e}
3	9.04^{f}	10.81^{e}	14.12^{c}	12.38^{d}
6	8.71^{f}	10.67^{e}	12.02^{d}	14.38^{c}
9	7.65^{g}	12.07^{d}	17.05^{b}	18.35^{a}
SE $\pm$		0.522		
		2015		
0	5.16^{gh}	7.31^{de}	8.58^{bc}	8.05^{cd}
3	8.07^{cd}	9.33^{b}	7.53^{de}	10.67^{a}
6	6.70^{ef}	6.79^{ef}	6.71^{ef}	8.86^{bc}
9	5.61^{fgh}	4.56^{h}	6.61^{ef}	6.39^{ef}
SE $\pm$		0.665		
		2014/2015 (Combined)		
0	6.08^{g}	9.35^{de}	10.03^{cd}	9.37^{de}
3	8.56^{f}	10.07^{cd}	10.96^{bc}	11.94^{a}
6	7.70^{f}	8.73^{ef}	9.36^{de}	11.54^{ab}
9	6.63^{g}	8.32^{f}	11.83^{a}	12.37^{a}
SE $\pm$		0.435		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

EC of jatropha seed extracts. The lowest fruits vitamin A content was recorded by interactions between Bellboy and 0 percent EC of jatropha seed extracts in the combined location (Table 84).

Interactions between poultry manure and jatropha seed extracts appeared to be highly influential on the fruits vitamin A contents of sweet pepper during 2014 and 2015 rainy seasons and the years combined at BUK (Table 85). The applied 9 t PM ha^{-1} interacted favorably with 3 % EC of jatropha seed extracts and produced the highest fruits vitamin A contents during the 2014 rainy season and combined at BUK. This was followed by fruits vitamin A content produced by the interaction between 9 t PM ha^{-1} and 2 % EC of jatropha seed extracts at Dadin-Kowa. However, during the 2015 rainy season at BUK the highest fruits vitamin A content was obtained by the interaction between 3 t PM ha^{-1} and 3 % EC ha^{-1} followed by that produced by interaction between 3 t PM ha^{-1} and 1 % EC of jatropha seed extracts during the same time considered which was not statistically different from the ones obtained by the interaction between 6 t PM ha^{-1} with 3 % EC ha^{-1}. The lowest fruits vitamin A contents were recorded by the interactions between 0 t PM ha^{-1} and 0 % EC ha^{-1} in all the seasons at BUK.

Fruits vitamin C (mg kg^{-1}) contents

Fruits vitamin C contents of the three sweet pepper varieties as shown in Table 86 was highly significantly affected by application of poultry manure and jatropha seed extracts during the 2014 and 2015 rainy seasons and the combined at BUK. The fruits vitamin C contents were observed higher in Kwadon local at 2014 and the Combined. This was not statistically different from the fruits vitamin A contents recorded by the Bellboy and Yolo Wonder 2015. The least fruits vitamin C contents were from Yolo Wonder.

Similarly, the fruits vitamin C contents were significantly influenced by varying amount of PM during the 2014 and 2015 rainy seasons and the combined at BUK. Application of 9 t PM ha^{-1} produced the highest vitamin C measured in sweet pepper grown in the 2014 and 2015 rainy seasons and the combined at BUK. This was followed by fruits vitamin C contents obtained by the application of 6 and then 3 t PM ha^{-1}. The least vitamin C was produced by the control treatment.

In the same vein jatropha seed extracts had significant influence on the fruits vitamin C contents of sweet pepper during the 2014 and 2015 rainy seasons and the combined at BUK. The highest fruits vitamin C contents were obtained from the sweet pepper treated with 3 % EC ha^{-1} in all the seasons under observations this was not statistically different from the ones recorded by the application of 2 % EC ha^{-1}. The lowest fruits vitamin C contents were recorded throughout by the control treatment (Table 86).

The interactions between variety and poultry manure as shown in Table 87 is significantly enhanced the fruits vitamin C contents of sweet pepper during the 2014 and 2015 rainy seasons and the combined at BUK. Bellboy interacted favorably with 9 t PM ha^{-1} and developed the highest fruits vitamin C contents during the 2014 rainy season at BUK which is not statistically different from the one produced by the interaction between Kwadon local and the applied 9 t PM ha^{-1}, and between Yolo Wonder and 3 t PM ha^{-1}.

Similarly, during the 2015 rainy season at BUK the interaction between Bellboy and 9 t PM ha^{-1} enhanced the production of the highest fruits vitamin C contents, followed by those obtained from the interactions between Kwadon local and 9 t PM ha^{-1} then Yolo Wonder and 9 t PM ha^{-1}. The least was recorded by the interaction between Bellboy and 0 t PM ha^{-1}. Again, the interaction between the Bellboy and 9 t PM ha^{-1} in the years combined at BUK had the highest fruits vitamin C contents while the least was recorded by the interaction between Yolo Wonder and 0 t PM ha^{-1} (Table 87).

Interactions between PM and JSE appeared to be highly influential on the % fruits crude proteins of sweet pepper during the 2014 and 2015 rainy seasons and the combined at BUK (Table 88). The applied 9 t PM ha^{-1} interacted favorably with 3 % EC ha^{-1} and produced the highest fruits vitamin C contents during the 2014 and 2015 rainy seasons and the combined

Table 86: Fruit Vitamin C (mg kg^{-1}) Contents of Three Sweet pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during 2014 and 2015 Rainy Seasons and the Years Combined at BUK.

Treatment	Fruits Vitamin C contents		
	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	281.4	255.1^{a}	268.3^{a}
Bellboy	282.1	214.1^{b}	248.1^{b}
Yolo Wonder	271.8	214.6^{b}	243.2^{b}
SE $\pm$	4.17	4.66	4.17
Poultry Manure (t PM ha^{-1})			
0	219.9^{d}	195.8^{c}	207.8^{d}
3	302.7^{b}	253.3^{a}	278.0^{b}
6	258.4^{c}	212.6^{b}	235.5^{c}
9	332.9^{a}	250.0^{a}	291.4^{a}
SE $\pm$	4.54	4.54	3.35
Jatropha Seed Extracts (% *EC*)			
0	226.3^{c}	205.2^{c}	215.8^{c}
1	261.7^{b}	202.2^{c}	232.0^{b}
2	316.6^{a}	245.8^{b}	281.2^{a}
3	309.2^{a}	258.6^{a}	283.9^{a}
SE$\pm$	4.08	4.34	3.17
Interactions			
Var*PM	**	**	**
Var*JSE	NS	NS	NS
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

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Table 87: Interactions between Variety and Poultry Manure on Fruit Vitamin C (mg kg^{-1}) Contents of Sweet Pepper during 2014 and 2015 Rainy Seasons and the Combined Data at BUK.

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
		2014		
Kwadon local	231.9^{de}	320.2^{b}	242.1^{cd}	331.4^{ab}
Bellboy	209.0^{f}	257.5^{c}	315.9^{b}	346.2^{a}
Yolo Wonder	218.9^{ef}	330.3^{ab}	217.2^{ef}	320.9^{b}
SE $\pm$		7.98		
		2015		
Kwadon local	194.6^{e}	279.4^{a}	256.4^{b}	290.2^{a}
Bellboy	212.4^{d}	225.0^{cd}	185.9^{bc}	233.0^{c}
Yolo Wonder	180.4^{e}	255.6^{b}	195.5^{e}	226.9^{cd}
SE $\pm$		8.25		
		2014/2015 (Combined)		
Kwadon local	213.2^{e}	299.8^{ab}	249.3^{d}	310.8a
Bellboy	210.7^{ef}	241.2^{d}	250.9^{d}	289.6^{b}
Yolo Wonder	199.6^{f}	293.0^{b}	206.3^{ef}	273.9^{c}
SE $\pm$		6.53		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 88: Interactions between Poultry Manure and Jatropha Seed Extracts on Fruits Vitamin C (mg kg^{-1}) Contents of Sweet Pepper during 2014 and 2015 Rainy Seasons and the Combined Data at BUK.

Treatment	Jatropha Seed Extracts (% EC)			
Poultry Manure (t PM ha^{-1})	0	1	2	3
		2014		
0	162.4^{k}	219.0^{i}	258.8^{fg}	239.5^{h}
3	286.5^{de}	271.3^{e}	331.1^{b}	321.8^{b}
6	190.1^{j}	242.5^{gh}	302.4^{c}	298.6^{cd}
9	266.4^{f}	314.3^{bc}	373.9^{a}	376.8^{a}
SE $\pm$		8.40		
		2015		
0	168.9^{i}	193.5^{fg}	204.7^{ef}	216.0^{de}
3	229.4^{cd}	234.9^{c}	265.0^{b}	283.0^{a}
6	189.3^{gh}	176.0^{hi}	238.9^{c}	246.2^{c}
9	233.2^{c}	204.3^{ef}	274.3^{ab}	288.3^{a}
SE $\pm$		8.78		
		2014/2015 (Combined)		
0	165.6^{i}	206.3^{g}	231.8^{f}	227.7^{f}
3	258.0^{de}	253.1^{e}	298.1^{b}	302.9^{b}
6	189.7^{h}	209.2^{ef}	270.7^{cd}	272.4^{c}
9	249.8^{e}	259.3^{de}	324.1^{a}	332.6^{a}
SE $\pm$		6.43		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

at BUK. This was followed by fruits Vitamin C contents produced by the interaction between 9 t PM ha^{-1} and 2 % EC of jatropha seed extracts. The lowest fruits Vitamin C contents were recorded by the interactions between 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts in all seasons under observations (Table 88)

Fruit crude protein (g $100g^{-1}$) contents for Dadin-Kowa

The effect of application of poultry manure and jatropha seed extract on fruit crude proteins of the three sweet pepper varieties is presented in Table 89 during the 2014 and 2015 rainy seasons and the combined at Dadin-Kowa. The fruit crude protein contents of the three sweet pepper varieties statistically differed in 2014 and 2015 only with Bellboy having more fruit protein than the two other pepper varieties in 2014 but was not statistically different from the fruit crude proteins recorded by the Kwadon local during the 2015 rainy season. The least fruit crude proteins were consistently from Yolo Wonder.

Similarly, the fruits crude proteins were significantly influenced by varying amount of poultry manure during the 2014 and 2015 rainy seasons and the combined at Dadin-Kowa. 9 t PM ha^{-1} of applied poultry manure produced the highest fruit crude proteins measured in sweet pepper grown during the 2014 and 2015 rainy seasons and the combined at Dadin-Kowa. These were not statistically different from the fruit crude proteins obtained by the application of 6 t PM ha^{-1}. The least fruit crude proteins were produced by the control treatment (Table 89).

In the same vein jatropha seed extracts had significant influence on the fruit crude protein contents of sweet pepper during the 2014 and 2015 rainy seasons and the combined at Dadin-Kowa. The highest fruit crude proteins was obtained from the sweet pepper treated with 3 % EC of jatropha seed extracts in all the seasons under observations this was followed by the ones treated by the application of 2 % EC than that of 1 % EC ha^{-1}. The lowest fruits crude proteins were consistently from the control treatment.

Table 89: Fruit Crude Proteins (g $100g^{-1}$) Contents of Three Sweet pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	3.10^{c}	2.78^{a}	2.94
Bellbo`y	3.53^{a}	2.81^{a}	3.17
Yolo Wonder	3.33^{b}	2.66^{b}	3.00
SE $\pm$	0.051	0.079	0.020
Poultry Manure (t PM ha^{-1})			
0	2.87^{c}	2.43^{b}	2.65^{c}
3	3.25^{b}	2.84^{a}	3.04^{b}
6	3.57^{a}	2.86^{a}	3.22^{a}
9	3.60^{a}	2.86^{a}	3.23^{a}
SE $\pm$	0.059	0.064	0.040
Jatropha Seed Extracts (% *EC*)			
0	2.96^{d}	2.57^{d}	2.77^{d}
1	3.06^{c}	2.66^{c}	2.85^{c}
2	3.55^{b}	2.77^{b}	3.16^{b}
3	$3,71^{a}$	3.00^{a}	3.36^{a}
SE$\pm$	0.023	0.087	0.045
Interactions			
Var*PM	**	**	**
Var*JSE	NS	NS	NS
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different (P$\leq$ 0.05) using DMRT

The interactions between variety and poultry manure as shown in Table 89 is significantly enhanced the fruit crude protein contents of sweet pepper during the 2014 and 2015 rainy seasons and the combined at Dadin-Kowa.

Bellboy interacted favorably with 9 t PM ha^{-1} and developed the highest fruit crude proteins during the 2014 rainy season at Dadin-Kowa which is statistically different from the one produced by the interaction between Yolo Wonder and the applied 9 t PM ha^{-1}. The least fruit crude proteins were produced by the interactions between Yolo Wonder and 0 t PM ha^{-1}. The fruit crude proteins produced by control treatment interacting with Kwadon local are greater than those produced by the interactions between Bellboy and Yolo Wonder with the control treatment respectively.

Similarly, during the 2015 rainy season at Dadin-Kowa the interaction between Bellboy and 9 t PM ha^{-1} enhanced the production of the highest fruit crude proteins, followed by those obtained from the interactions between Bellboy and 6 t PM ha^{-1} then Kwadon local and 9 t PM ha^{-1}. The least was recorded by the interaction between Bellboy and 0 t PM ha^{-1}. Again, the interaction between the Bellboy and 9 t PM ha^{-1} in the combined at Dadin-Kowa had the highest crude proteins while the least were recorded by the interaction between the three varieties and 0 t PM ha^{-1} (Table 90).

Interactions between poultry manure and jatropha seed extracts appeared to be highly influential on the fruit crude protein contents of sweet pepper during the 2014, 2015 and the two years combined at Dadin-Kowa (Table 91). The applied 9 t PM ha^{-1} interacted favorably with 3 % EC of jatropha seed extracts and produced the highest % fruit crude proteins during the 2014 and the combined at Dadin-Kowa. This was followed by fruit crude proteins produced by the interaction between 9 t PM ha^{-1} and 2 % EC ha^{-1}. However, during the 2015 rainy season at Dadin-Kowa the highest fruits crude proteins were obtained by the interaction between 9 t PM ha^{-1} and 3 % EC ha^{-1} which was not statistically different from that produced by interaction between 6 t PM ha^{-1} and 2 % EC ha^{-1} during the same time considered.

Table 90: Interactions between Variety and Poultry Manure on Fruit Crude Proteins (g $100g^{-1}$) Contents of Sweet Pepper during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
		2014		
Kwadon local	2.88^{e}	2.74^{e}	3.40^{cd}	3.37^{cd}
Bellboy	2.88^{e}	3.25^{d}	3.83^{b}	4.15^{a}
Yolo Wonder	2.84^{e}	3.75^{b}	3.48^{c}	3.28^{cd}
SE $\pm$		0.102		
		2015		
Kwadon local	2.49^{cd}	3.10^{a}	2.83^{ab}	2.68^{bcd}
Bellboy	2.39^{d}	2.64^{bc}	3.03^{a}	3.17^{a}
Yolo Wonder	2.41^{d}	2.78^{bc}	2.71^{bc}	2.72^{bc}
SE $\pm$		0.124		
		2014/2015 (Combined)		
Kwadon local	2.68^{e}	2.92^{cd}	3.12^{bc}	3.03^{cd}
Bellboy	2.63^{e}	2.95^{d}	3.20^{b}	3.66^{a}
Yolo Wonder	2.63^{e}	3.27^{b}	3.10^{bc}	3.00^{cd}
SE $\pm$		0.064		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 91: Interactions between Poultry Manure and Jatropha Seed Extracts on Fruit Crude Proteins (g $100g^{-1}$) Contents of Sweet Pepper during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	Jatropha Seed Extracts (% EC)			
Poultry Manure (t PM ha^{-1})	0	1	2	3
		2014		
0	2.57^{h}	2.58^{h}	3.26^{e}	3.06^{f}
3	2.74^{g}	2.90^{f}	3.49^{d}	3.86^{ab}
6	3.26^{e}	3.26^{e}	3.84^{b}	3.93^{ab}
9	3.29^{e}	3.47^{d}	3.62^{c}	4.00^{a}
SE $\pm$		0.071		
		2015		
0	2.10^{e}	2.35^{de}	2.39^{de}	2.88^{b}
3	2.66^{c}	2.95^{b}	2.90^{b}	2.84^{b}
6	2.67^{c}	2.76^{c}	3.09^{ab}	2.91^{b}
9	2.84^{b}	2.52^{cd}	2.70^{c}	3.36^{a}
SE $\pm$		0.163		
		2014/2015 (Combined)		
0	2.33^{g}	2.47^{g}	2.82^{ef}	2.97^{de}
3	2.70^{f}	2.92^{de}	3.19^{c}	3.35^{b}
6	2.96^{de}	3.01^{cd}	3.47^{b}	3.42^{b}
9	3.07^{cd}	3.00^{d}	3.16^{b}	3.68^{a}
SE $\pm$		0.176		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

The lowest fruit crude proteins were recorded by the interactions between 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts in all seasons under observations (Table 91).

Fruit capsaicin (g $100g^{-1}$) contents for Dadin-Kowa

Fruit capsaicin contents of the three sweet pepper varieties as shown in Table 92 was highly significantly affected by application of poultry manure and jatropha seed extracts during the 2014 and 2015 rainy seasons and the combined at Dadin-Kowa. The fruit capsaicin contents were observed to be higher in Kwadon local during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. The least fruits capsaicin contents were determined in Yolo Wonder grown in all the seasons observed at Dadin-Kowa.

Similarly, the fruit capsaicin contents was significantly influenced by varying amount of Poultry Manure during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. 6 t PM ha^{-1} produced the highest capsaicin contents measured in sweet pepper grown during the periods of observations. This was followed by fruits capsaicin contents obtained by the application of 9 t PM ha^{-1} and then 3 t PM ha^{-1}. The least capsaicin was produced by the control treatment.

In the same vein jatropha seed extracts had significant influence on the fruit capsaicin contents of the three sweet pepper varieties during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. The highest fruit capsaicin contents was obtained by the application of 3 % EC of jatropha seed extracts to the three sweet pepper varieties in all the seasons under observations this was followed by the ones recorded by the application of 2 % EC then that of 1 % EC of jatropha seed extracts. The lowest fruit capsaicin contents were consistently from the control treatment.

The interactions between variety and poultry manure as shown in Table 93 significantly enhanced the percentage fruit capsaicin contents of sweet pepper during the 2014 and 2015

Table 92: Fruit Capsaicin (g $100g^{-1}$) Contents of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha Seed Extracts during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	3.10[a]	2.94[a]	3.05[a]
Bellboy	2.63[b]	1.86[b]	2.25[b]
Yolo Wonder	1.91[c]	1.69[b]	1.80[c]
SE ±	0.075	1.010	0.051
Poultry Manure (t PM ha^{-1})			
0	2.06[d]	1.66[d]	1.86[d]
3	2.48[c]	2.07[c]	2.28[c]
6	3.04[a]	2.67[a]	2.86[a]
9	2.62[b]	2.25[b]	2.47[b]
SE ±	0.075	0.068	0.053
Jatropha Seed Extracts (% *EC*)			
0	1.93[d]	1.68[d]	1.81[d]
1	2.29[c]	1.99[c]	2.17[c]
2	2.87[b]	2.37[b]	2.66[b]
3	3.10[a]	2.62[a]	2.86[a]
SE±	0.054	0.082	0.052
Interactions			
Var*PM	**	**	**
Var*JSE	NS	NS	NS
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter(s) within columns are significantly different ($P \leq 0.05$) using DMRT

rainy seasons and the combined data at Dadin-Kowa.Kwadon local interacted favorably with 3 and 6 t PM ha^{-1} and developed the highest fruit capsaicin contents during the 2014 rainy season at Dadin-Kowa. The least fruit capsaicin content was produced by the interactions between Kwadon local and 0 t PM ha^{-1}.

Similarly, during the 2015 rainy season at Dadin-Kowa the interaction between Kwadon local and 6 and 9 t PM ha^{-1} enhanced the production of the highest % capsaicin, followed by those obtained from the interactions between Kwadon local and 6 t PM ha^{-1} then Kwadon local and 9 t PM ha^{-1}. The least was recorded by the interaction between Yolo Wonder and 0 t PM ha^{-1}. Again, the interaction between the Kwadon local and 6 t PM ha^{-1} in the years combined at Dadin-Kowa had the highest fruit capsaicin while the least was recorded by the interaction between Yolo Wonder and 0 t PM ha^{-1} (Table 93).

Interactions between poultry manure and jatropha seed extracts seem to be highly influential on the fruit capsaicin of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa (Table 94). The applied 6 t PM ha^{-1} interacted favorably with 3 % EC of jatropha seed extracts and produced the highest fruits capsaicin contents during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. This was followed by fruit capsaicin produced by the interaction between 9 t PM ha^{-1} and 2 % EC of jatropha seed extracts. The lowest fruits capsaicin contents were recorded by the interactions between 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts in all the seasons of observations (Table 94).

Fruits vitamin A (mg kg^{-1}) contents for Dadin-Kowa

Fruits vitamin A contents of the three sweet pepper varieties is presented in Table 95 was highly significantly affected by application of poultry manure and jatropha seed extracts during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. The fruits Vitamin A contents were observed to be higher in Yolo Wonder in all the seasons under study.

Table 93: Interactions between Variety and Poultry Manure on Fruit Capsaicin (g 100g^{-1}) of Sweet Pepper during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
		2014		
Kwadon local	1.85^{g}	3.76^{a}	3.72^{a}	3.08^{b}
Bellboy	2.38^{c}	2.58^{c}	3.17^{b}	2.41^{cd}
Yolo Wonder	1.94^{fg}	2.10^{ef}	2.24^{def}	2.36^{cde}
SE $\pm$		0.135		
		2015		
Kwadon local	2.28^{c}	2.66^{b}	3.62^{a}	3.22^{a}
Bellboy	1.51^{ef}	2.14^{c}	2.14^{c}	1.63^{de}
Yolo Wonder	1.20^{f}	1.42^{h}	2.25^{c}	1.90^{d}
SE $\pm$		0.150		
		2014/2015 (Combined)		
Kwadon local	2.06^{ef}	3.21^{b}	3.67^{a}	3.24^{b}
Bellboy	1.94^{f}	2.36^{d}	2.66^{c}	2.02^{f}
Yolo Wonder	1.57^{g}	1.76^{g}	2.24^{e}	2.13^{e}
SE $\pm$		0.094		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 94: Interactions between Poultry Manure and Jatropha Seed Extracts on Fruit Capsaicin ($g\ 100g^{-1}$) of Sweet Pepper during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	Jatropha Seed Extracts (% EC)			
Poultry Manure ($t\ PM\ ha^{-1}$)	0	1	2	3
		2014		
0	1.71^{i}	1.77^{i}	2.27^{fg}	2.48^{ef}
3	1.62^{i}	2.20^{gh}	3.05^{c}	3.05^{c}
6	2.31^{fg}	2.57^{e}	3.37^{b}	3.92^{a}
9	2.02^{h}	2.69^{e}	2.80^{de}	2.96^{cd}
SE ±		0.120		
		2015		
0	1.15^{g}	1.64^{f}	2.08^{de}	1.79^{ef}
3	1.63^{f}	1.69^{f}	2.46^{c}	2.50^{c}
6	2.26^{d}	2.47^{c}	2.57^{bc}	3.38^{a}
9	1.68^{f}	2.15^{d}	2.35^{cd}	2.83^{b}
SE ±		0.157		
		2014/2015 (Combined)		
0	1.46^{j}	1.67^{hi}	2.18^{f}	2.13^{fg}
3	1.63^{ij}	1.94^{gh}	2.76^{cd}	2.77^{bc}
6	2.29^{f}	2.52^{e}	2.97^{b}	3.65^{a}
9	1.85^{h}	2.55^{de}	2.57^{de}	2.89^{bc}
SE ±		0.104		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Although during the 2015 rainy season at Dadin-Kowa the fruit vitamin A contents was not statistically different among the three varieties during the same period of observations.

Similarly, the fruit vitamin A contents was significantly influenced by varying amount during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. 9 t PM ha^{-1} produced the highest fruits vitamin A measured in sweet pepper grown in all the seasons under consideration. This was followed by fruits vitamin A contents obtained by the application of 6 t PM ha^{-1} and then 3 t PM ha^{-1}. The least fruits vitamin A was produced by the control treatment.

In the same vein jatropha seed extracts had significant influence on the fruit vitamin A contents of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. The highest fruit vitamin A contents was obtained the sweet pepper treated with 3 % EC of jatropha seed extracts in all the seasons under observations this was followed by the ones recorded by the application of 2 % EC then that of 1 % EC of jatropha seed extracts. The lowest fruit vitamin A contents was recorded throughout by the control treatment.

The interactions between variety and poultry manure as shown in Table 96 significantly enhanced the fruits vitamin A of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. Yolo Wonder interacted favorably with 6 t PM ha^{-1} and developed the highest fruit vitamin A contents during the 2014 rainy season at Dadin-Kowa which is statistically higher than the one produced by the interaction between the two varieties with the applied 9 t PM ha^{-1}. The least fruits vitamin A were produced by the interactions between Kwadon local and 3 t PM ha^{-1}.

Similarly, during the 2015 rainy season at Dadin-Kowa the interaction between Yolo Wonder and 6 t PM ha^{-1} enhanced the production of the highest fruit vitamin A, followed by those obtained from the interactions between Bellboy and 9 t PM ha^{-1} then Kwadon local and 9 t PM ha^{-1}. The least was recorded by the interaction between Kwadon local and 3 t PM ha^{-1}.

Table 95: Fruit Vitamin A (mg kg^{-1}) Contents of Three Sweet Pepper Varieties as Affected by Poultry Manure and Jatropha seed extracts during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	14.92^{c}	10.08	12.50^{b}
Bellboy	15.65^{b}	10.63	13.14^{b}
Yolo Wonder	17.99^{a}	10.64	14.32^{a}
SE $\pm$	0.024	0.639	0.310
Poultry Manure (t PM ha^{-1})			
0	13.09^{d}	9.19^{b}	13.14^{b}
3	13.81^{c}	10.52^{a}	12.17^{c}
6	17.16^{a}	11.76^{a}	14.46^{a}
9	16.67^{b}	10.32^{a}	13.49^{b}
SE $\pm$	0.023	0.693	0.346
Jatropha Seed Extracts (% *EC*)			
0	13.43^{d}	9.35^{b}	11.39^{d}
1	14.84^{c}	9.73^{b}	12.28^{c}
2	17.42^{b}	11.40^{a}	14.41^{b}
3	19.05^{a}	11.33^{a}	15.19^{a}
SE$\pm$	0.226	0.470	0.260
Interactions			
Var*PM	**	**	**
Var*JSE	NS	NS	NS
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Again, the interaction between the Yolo Wonder and 6 t PM ha^{-1} in the years combined had the highest fruits vitamin A while the least was recorded by the interaction between Kwadon local and 3 t PM ha^{-1} (Table 96).

Interactions between poultry manure and jatropha seed extracts appeared to be highly influential on the fruit vitamin A of three sweet pepper varieties during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa (Table 97). The applied 6 t PM ha^{-1} interacted favorably with 3 % EC of jatropha seed extracts and produced the highest fruits vitamin in the 2014 rainy season and the combined data at Dadin-Kowa. This was followed by fruit vitamin A produced by the interaction between 9 t PM ha^{-1} and 3 % EC of jatropha seed extracts.

Similarly, in 2015 rainy season at Dadin-Kowa the highest fruit vitamin A were obtained by the interaction between 6 t PM ha^{-1} and 3 % EC of jatropha seed extracts followed by that produced by interaction between 9 t PM ha^{-1} and 3 % EC of jatropha seed extracts during the same time considered which was not statistically different from the ones obtained by the interaction between 6 t PM ha^{-1} with 2 % EC of jatropha seed extracts. The lowest fruits vitamin A contentswere recorded by the interactions between 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts in all the seasons under considerations (Table 97).

Fruit vitamin C (mg kg^{-1}) contents for Dadin-Kowa

Fruit vitamin C contents of the three sweet pepper varieties is presented in Table 98 was highly significantly affected by the application of poultry manure and jatropha seed extracts during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. The fruit vitamin C was observed to be higher in Yolo Wonder during the seasons under considerations at Dadin-Kowa. Although, this was not statistically different from the fruit vitamin C contents recorded by the Kwadon local in all the seasons observed. The least fruit vitamin C contents were determined in Bellboy grown in all the seasons considered.

Table 96: Interactions between Variety and Poultry Manure on Fruit Vitamin A (mg kg^{-1}) Contents of Sweet Pepper during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
		2014		
Kwadon local	16.01^{g}	$11,81^{j}$	16.86^{e}	14.98^{h}
Bellboy	18.07^{c}	14.77^{h}	13.10^{i}	16.65^{f}
Yolo Wonder	17.20^{d}	14.87^{h}	21.52^{a}	18.37^{b}
SE $\pm$		0.042		
		2015		
Kwadon local	10.08^{bc}	8.52^{cd}	10.91^{b}	10.09^{b}
Bellboy	9.76^{bc}	11.21^{b}	10.30^{b}	11.24^{b}
Yolo Wonder	7.02^{d}	11.85^{b}	14.08^{a}	9.52^{bcd}
SE $\pm$		1.220		
		2014/2015 (Combined)		
Kwadon local	13.41^{bc}	10.16^{e}	13.88^{b}	12.53^{cd}
Bellboy	13.91^{b}	12.99^{bc}	11.70^{d}	13.95^{b}
Yolo Wonder	12.11^{cd}	13.36^{b}	17.80^{a}	14.00^{b}
SE $\pm$		0.605		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 97: Interactions between Poultry Manure and Jatropha Seed Extracts on Fruit Vitamin A (mg kg^{-1}) Contents of Sweet Pepper during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	Jatropha Seed Extracts (% EC)			
Poultry Manure (t PM ha^{-1})	0	1	2	3
		2014		
0	13.61^{e}	16.44^{c}	18.28^{b}	20.04^{a}
3	11.46^{f}	12.23^{f}	15.85^{cd}	15.72^{cd}
6	15.07^{d}	15.48^{d}	17.91^{b}	20.18^{a}
9	13.58^{e}	15.21^{d}	17.64^{b}	20.25^{a}
SE $\pm$		0.391		
		2015		
0	7.01^{f}	9.83^{e}	10.25^{bc}	9.69^{e}
3	9.37^{e}	9.90^{e}	12.62^{ab}	10.20^{de}
6	10.70^{bcde}	10.13^{de}	12.37^{abc}	13.85^{a}
9	10.31^{de}	9.06^{ef}	10.35^{cde}	11.56^{bcd}
SE $\pm$		1.069		
		2014/2015 (Combined)		
0	10.31^{h}	13.14^{ef}	14.26^{cde}	14.86^{bcd}
3	10.41^{h}	11.06^{cd}	14.24^{cde}	12.96^{fg}
6	12.89^{fg}	12.80^{fg}	15.14^{bc}	17.02^{a}
9	11.94^{g}	12.13^{fg}	13.99^{de}	15.91^{b}
SE $\pm$		0.568		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Similarly, the fruit vitamin C contents were significantly influenced by varying amount of poultry manure during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. 9 t PM ha^{-1} produced the highest fruit vitamin C measured in sweet pepper grown during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. This was followed by fruits Vitamin C contents obtained by the application of 6 t PM ha^{-1} and then 3 t PM ha^{-1}. The least Vitamin C was produced by the control treatment (Table 98).

In the same vein jatropha seed extracts had significant influence on the fruit vitamin C contents of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. The highest fruit vitamin C contents were obtained in the sweet pepper treated with 3 % EC of jatropha seed extracts in all the seasons under observations this was followed by the ones recorded by the application of 2 % EC then that of 1 % EC of jatropha seed extracts. The lowest fruit vitamin C was consistently recorded by the control treatment.

The interactions between variety and poultry manure as shown in Table 99 is significantly enhanced the vitamin C (mg kg^{-1}) content of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa. Yolo Wonder interacted favorably with 9 tons ha^{-1} and produced the highest vitamin C during the 2014 rainy season at Dadin-Kowa which is statistically different from the one produced by the interaction between Kwadon local and the applied 9 tons ha^{-1}, and between Bellboy wonder and 9 tons ha^{-1}.

Similarly, during the 2015 rainy season at Dadin-Kowa the interaction between Yolo Wonder and 9 tons ha^{-1} enhanced the production of the highest vitamin C, followed by those obtained from the interactions between Kwadon local and 9 tons ha^{-1} then Bellboy and 9 tons ha^{-1}. The least was recorded by the interaction between Yolo Wonder and 0 tons ha^{-1}.

Again, the interaction between the Yolo Wonder and 9 tons ha^{-1} in the years combined at Dadin-Kowa had the highest vitamin C while the least was recorded by the interaction between Yolo Wonder and 0 tons ha^{-1} (Table 99).

Table 98: Fruit Vitamin C (mg kg^{-1}) Contents of Three Sweet pepper Varieties as affected by Poultry Manure and Jatropha Seed Extracts during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	2014	2015	2014/2015 (Combined)
Variety			
Kwadon local	301.3^{b}	280.0^{a}	290.7^{a}
Bellboy	302.6^{b}	238.9^{b}	270.8^{b}
Yolo Wonder	320.9^{a}	250.7^{b}	285.8^{a}
SE $\pm$	5.43	8.39	4.20
Poultry Manure (t PM ha^{-1})			
0	281.4^{b}	190.4^{c}	235.9^{d}
3	336.8^{a}	263.6^{b}	300.2^{b}
6	290.1^{b}	253.0^{b}	271.5^{c}
9	324.8^{a}	319.2^{a}	322.0^{a}
SE $\pm$	6.47	14.10	7.52
Jatropha Seed Extracts (% *EC*)			
0	237.5^{d}	219.5^{c}	228.5^{d}
1	287.1^{c}	245.8^{b}	266.4^{c}
2	347.9^{b}	266.8^{b}	307.3^{b}
3	360.7^{a}	294.0^{a}	327.4^{a}
SE$\pm$	3.68	11.20	5.92
Interactions			
Var*PM	**	**	**
Var*JSE	NS	NS	NS
PM*JSE	**	**	**
Var*PM*JSE	NS	NS	NS

Means followed by unlike letter within columns are significantly different ($P \leq 0.05$) using DMRT

Table 99: Interactions between Variety and Poultry Manure on Fruit Vitamin C (mg kg^{-1}) Contents of Sweet Pepper during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	Poultry Manure (t PM ha^{-1})			
Variety	0	3	6	9
		2014		
Kwadon local	263.4^{f}	330.8^{b}	288.8^{de}	322.1^{bc}
Bellboy	305.6^{cd}	312.5^{bc}	262.5^{f}	329.9^{b}
Yolo Wonder	275.2^{ef}	322.3^{bc}	319.0^{bc}	367.3^{a}
SE $\pm$		11.13		
		2015		
Kwadon local	198.8^{ef}	312.9^{b}	296.1^{b}	312.3^{b}
Bellboy	195.0^{ef}	240.1^{cd}	240.8^{cd}	279.1^{bc}
Yolo Wonder	176.6^{f}	237.8^{cde}	222.0^{def}	366.1^{a}
SE $\pm$		22.76		
		2014/2015 (Combined)		
Kwadon local	231.1^{gh}	321.9^{ab}	292.5^{cd}	317.2^{bc}
Bellboy	250.7^{fgh}	$276,3^{de}$	251.6^{efg}	304.5^{bc}
Yolo Wonder	225.9^{h}	302.6^{bc}	270.5^{def}	344.2^{a}
SE $\pm$		12.04		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Table 100: Interactions between Poultry Manure and Jatropha Seed Extracts on Fruit Vitamin C (mg kg^{-1}) Contents of Sweet Pepper during the 2014 and 2015 Rainy Seasons and the Combined Data at Dadin-Kowa.

Treatment	Jatropha Seed Extracts (% EC)			
Poultry Manure (t PM ha^{-1})	0	1	2	3
		2014		
0	234.5^{gh}	248.0^{fg}	324.5^{d}	318.7^{d}
3	217.2^{h}	322.2^{d}	383.8^{b}	324.2^{d}
6	224.9^{h}	253.8^{f}	329.0^{d}	452.7^{a}
9	273.3^{e}	324.2^{d}	354.3^{c}	347.3^{a}
SE $\pm$		9.09		
		2015		
0	163.8^{g}	168.1^{g}	207.5^{fg}	222.1^{ef}
3	212.1^{f}	256.1^{de}	261.0^{de}	325.3^{ab}
6	225.7^{ef}	239.3^{def}	274.7^{cd}	372.2^{a}
9	276.5^{bcd}	319.7^{abc}	324.0^{ab}	356.3^{a}
SE $\pm$		23.98		
		2014/2015 (Combined)		
0	199.1^{j}	208.0^{j}	266.0^{fg}	270.4^{fg}
3	214.6^{ij}	289.2^{ef}	322.4^{cd}	354.8^{ab}
6	225.3^{hi}	246.5^{gh}	301.8^{de}	382.5^{a}
9	274.9^{f}	322.0^{cd}	339.2^{bc}	351.8^{ab}
SE $\pm$		12.72		

Means followed by unlike letter(s) are significantly different ($P \leq 0.005$) using DMRT

Interactions between poultry manure and jatropha seed extracts appeared to be highly influential on the fruit vitamin C of sweet pepper during the 2014 and 2015 rainy seasons and the combined data at Dadin-Kowa (Table 100). The applied 6 t PM ha^{-1} interacted favorably with 3 % EC of jatropha seed extracts and produced the highest fruits vitamin C during the 2014 and the Two Years Combined s at Dadin-Kowa. This was not statistically different fron the fruits vitamin C produced by the interaction between 9 t PM ha^{-1} and 3 % EC of jatropha seed extracts.

Similarly, during the 2015 rainy season at Dadin-Kowa the highest fruit vitamin C were obtained by the interaction between 6 t PM ha^{-1} and 3 % EC of jatropha seed extracts still not statistically different from that produced by interaction between 9 t PM ha^{-1} and 3 % EC of jatropha seed extracts during the same season considered which equally were not statistically different from the ones obtained by the interaction between 6 t PM ha^{-1} and 9 t PM ha^{-1} with 2 % EC of jatropha seed extracts. The lowest fruit vitamin C contents were recorded by the interactions between 0 t PM ha^{-1} and 0 % EC of jatropha seed extracts in all the seasons studied at Dadin-Kowa (Table 100).

4.1.5 Simple Correlation Studies

The simple matrix of correlation coefficients (r) between some growth, yield and yield related components to fruits fresh yield of sweet pepper during the 2014 and 2015 rainy seasons at BUK and Dadin-Kowa wer presented in Table 101, 102, 103 and 104 respectively.

The results of the study showed that there was significant correlation between fruit fresh yield and most of the growth and yield characters the three varieties of sweet pepper. The plant height, number of leaves, number of primary branches, leaf area index, number of marketable fruits $plnat^{-1}$, fruit fresh weight and dry fruit weight were significantly and positively correlated ($P \leq 0.05$) to fresh fruits yield of the three sweet pepper varieties in 2014 rainy

Table 101: Correlation Matrix (r) Showing Association between Growth, Yield and Yield Related Characters of Three Sweet Pepper Varieties during the 2014 Rainy Season at BUK

	1	2	3	4	5	6	7	8
	PltHt	Leaf	Branch	LAI	FruitMark	Freshwt	Drywt	Fryldt
PltH	1.000							
Leaf	0.880**	1.000						
Branch	0.520**	0.631**	1.000					
LAI	0.137*	0.207*	0.322*	1.000				
FruitMark	0.299*	0.306*	0.374*	0.363*	1.000			
Freshwt	0.245*	0.223*	0.344*	0.437*	0.655**	1.000		
Drywt	0.401*	0.418*	0.305*	0.358*	0.586**	0.450*	1.000	
Fryldt	0.232*	0.353*	0.329*	0.380*	0.772**	0.676**	0.567**	1.000
	1	2	3	4	5	6	7	8

PltHt = Plant height, Leaf = Number of leaves per plant, Branch = Number of braches per plant, LAI = Leaf area index, FruitMark = Number of marketable fruits per plant, Freshwt = Fresh fruits weight per plant, Drywt = Dry fruit weight per plnt, Fryldt = Fruit fresh yield in t per hectare

Table 102: Correlation Matrix (r) Showing Association between Growth, Yield and Yield Related Characters of Three Sweet Pepper Varieties during the 2015 Rainy Season at BUK

	1 PltHt	2 Leaf	3 Branc	4 LAI	5 FruitMark	6 Freshwt	7 Drywt	8 Fryldt
PltHt	1.000							
Leaf	0.535**	1.000						
Branch	0.759**	0.638**	1.000					
LAI	0.648**	0.493*	0.688**	1.00				
FruitMark	0.609**	0.510**	0.645**	0.644**	1.000			
Freshwt	0.437*	0.518**	0.542**	0.623**	0.469*	1.000		
Drywt	0.439*	0.523**	0.540**	0.637**	0.470*	0.957**	1.00	
Fryldt	0.547**	0.517**	0.588**	0.667**	0.483*	0.844**	0.775**	1.000
	1	2	3	4	5	6	7	8

PltHt = Plant height, Leaf = Number of leaves per plant, Branch = Number of braches per plant, LAI = Leaf area index, FruitMark = Number of marketable fruits per plant, Freshwt = Fresh fruits weight per plant, Drywt = Dry fruit weight per plnt, Fryldt = Fruit fresh yield in t per hectare

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Table 103: Correlation Matrix (r) Showing Association between Growth, Yield and Yield Related Characters of Three Sweet Pepper Varieties in the Combined at BUK

	1	2	3	4	5	6	7	8	
	PltHt	Leaf	Branc	LAI	FruitMark	Freshwt	Drywt	Fryldt	PltHt
1.000									
Leaf	0.797**	1.000							
Branch	0.532**	0.653**	1.000						
LAI	0.345 *	0.197*	0.493*	1.000					
FruitMark	0.449*	0.421*	0.646**	0.243*	1.000				
Freshwt	0.237*	0.211*	0.312*	0.530**	0.697**	1.000			
Drywt	0.359 *	0.410*	0.307*	0.339 *	0.521**	0.672**	1.000		
Fryldt	0.297 *	0.301*	0.398*	0.338*	0.615**	0.785**	0.634**	1.000	
	1	2	3	4	5	6	7	8	

PltHt = Plant height, Leaf = Number of leaves per plant, Branch = Number of braches per plant, LAI = Leaf area index, FruitMark = Number of marketable fruits per plant, Freshwt = Fresh fruits weight per plant, Drywt = Dry fruit weight per plnt, Fryldt = Fruit fresh yield in t per hectare

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Table 104: Correlation Matrix (r) Showing Association between Growth, Yield and Yield Related Characters of Three Sweet Pepper Varieties during the 2014 Rainy Season at Dadin-Kowa

	1	2	3	4	5	6	7	8
	PltHt	Leaf	Branch	LAI	FruitMark	Freshwt	Drywt	Fryldt
PltHt	1.000							
Leaf	0.817**	1.000						
Branch	0.639**	0.764**	1.000					
LAI	0.313*	0.546**	0.620**	1.000				
FruitMark	0.593**	0.760**	0.836**	0.740**	1.000			
Freshwt	0.343*	0.378*	0.553**	0.599**	0.611*	1.000		
Drywt	0.353*	0.557**	0.591**	0.481*	0.563**	0.430*	1.000	
Fryldt	0.368*	0.375*	0.564**	0.638**	0.650**	0.969**	0.355*	1.000
	1	2	3	4	5	6	7	8

PltHt = Plant height, Leaf = Number of leaves per plant, Branch = Number of braches per plant, LAI = Leaf area index, FruitMark = Number of marketable fruits per plant, Freshwt = Fresh fruits weight per plant, Drywt = Dry fruits weight per plnt, Fryldt = Fruit fresh yield in t per hectare.

Table 105: Correlation Matrix (r) Showing Association between Growth, Yield and Yield Related Characters of Three Sweet Pepper Varieties during the 2015 Rainy Season at Dadin-Kowa

	1 PltHt	2 Leaf	3 Branch	4 LAI	5 FruitMark	6 Freshwt	7 Drywt	8 Fryldkg
1 PltHt	1.000							
2 Leaf	0.381*	1.000						
3 Branch	0.244*	0.694**	1.000					
4 LAI	0.253*	0.353*	0.390*	1.000				
10 FruitHav	0.442*	0.607**	0.608**	0.442*	1.000			
11 Freshwt	0.525**	0.629**	0.638**	0.411*	0.740**	1.000		
12 Drywt	0.316*	0.431*	0.341*	0.345*	0.594**	0.802**	1.000	
13 Fryldt	0.300	0.535**	0.609**	0.458*	0.756**	0.748**	0.495*	1.000
	1	2	3	4	5	6	7	8

PltHt = Plant height, Leaf = Number of leaves per plant, Branch = Number of braches per plant, LAI = Leaf area index, FruitMark = Number of marketable fruits per plant, Freshwt = Fresh fruits weight per plant, Drywt = Dry fruits weight per plnt, Fryldt = Fruit fresh yield in t per hectare.

Table 106: Correlation Matrix (r) Showing Association between Growth, Yield and Yield Related Characters of Three Sweet Pepper Varieties in the Combined at Dadin-Kowa

	1 PltHt	2 Leaf	3 Branch	4 LAI	5 FruitMark	6 Freshwt	7 Drywt	8 Fryldkg
PltHt	1.000							
Leaf	0.599**	1.000						
Branch	0.592**	0.729**	1.000					
LAI	0.383*	0.450*	0.506**	1.000				
FruitMark	0.518**	0.684**	0.722**	0.582*	1.000			
Freshwt	0.434*	0.504**	0.596**	0.659**	0.676**	1.000		
Drywt	0.335*	0.394*	0.366*	0.415*	0.579**	0.616**	1.000	
Fryldt	0.334*	0.455*	0.587**	0.531**	0.703**	0.859**	0.425*	1.000
	1	2	3	4	5	6	7	8

PltHt = Plant height, Leaf = Number of leaves per plant, Branch = Number of braches per plant, LAI = Leaf area index, FruitMark = Number of marketable fruits per plant, Freshwt = Fresh fruits weight per plant, Drywt = Dry fruits weight per plnt, Fryldt = Fruit fresh yield in t per hectare.

season at BUK (Table 101). A similar trend was observed in 2015 rainy season and the combined at BUK where all the measured growth, yield and yield components positively correlated with fresh fruits yield of the three varieties of sweet pepper (Table 102 and 103). This positive correlation between the yields to the yield components and growth traits is indicative of their complimentary contributions to the yield of the three sweet pepper varieties.

Similarly, in 2014 and 2015 rainy seasons at Dadin-Kowa, the correlation coefficient values showed a significantly ($P \leq 0.05$) positive correlations between the fresh fruits yield and the plant height, number of leaves, number of primary branches, leaf area index, number of marketable fruits plant^{-1}, fresh fruits weight and dry fruits weight of the three sweet pepper varieties (Table 104 to 105). Again, in the combined data at Dadin-Kowa the plant height, number of leaves, number of primary branches, leaf area index, and number of marketable fruits plant^{-1}, fresh fruits weight and dry fruits weight were all found to be positively correlated to the yield of the three varieties sweet pepper (Table 106).

4.1.6 Regression Analyses

Results of the regression analyses of poultry manure rates againt fruit fresh yields of the three sweet pepper varieties for the 2014 and 2015 rainy seasons and the combined at BUK and Dadin-Kowa are shown in figures 4.1 to 4.6. In the two years and the combined the analysis produced liniar responses of the yields to the varying rates of applied poultry manure. The regression equation for 2014 rainy season at BUK was $Y = a + bx^2$, for 2015 was $Y = a + bx$, and that of the combined was $Y = a + bx$. In the 2014 the poultry manure rate of 9 t PM ha^{-1} gave the optimum fruit yield of 29.7 t ha^{-1}. In 2015 9 t PM ha^{-1} resulted in optimum fruit fresh yield of 24.8 t ha^{-1}. While the two years combined showed 9 t PM ha^{-1} led to 28.7 t ha^{-1} fresh fruit of sweet pepper (Fig. 4.1 to 4.3).

Similarly at Dadin-Kowa liniar responses of the yields to the varying rates of applied poultry manure was observed. The regression equation for 2014 rainy season at Dadin-Kowa was Y = a + bx, for 2015 was Y = a + bx, and that of the combined was Y = a + bx. In the 2014 the poultry manure rate of 9 t PM ha^{-1} gave the optimum fruit yield of 26.8 t ha^{-1}. In 2015 9 t PM ha^{-1} resulted in optimum fruit fresh yield of 25.9 t ha^{-1}.

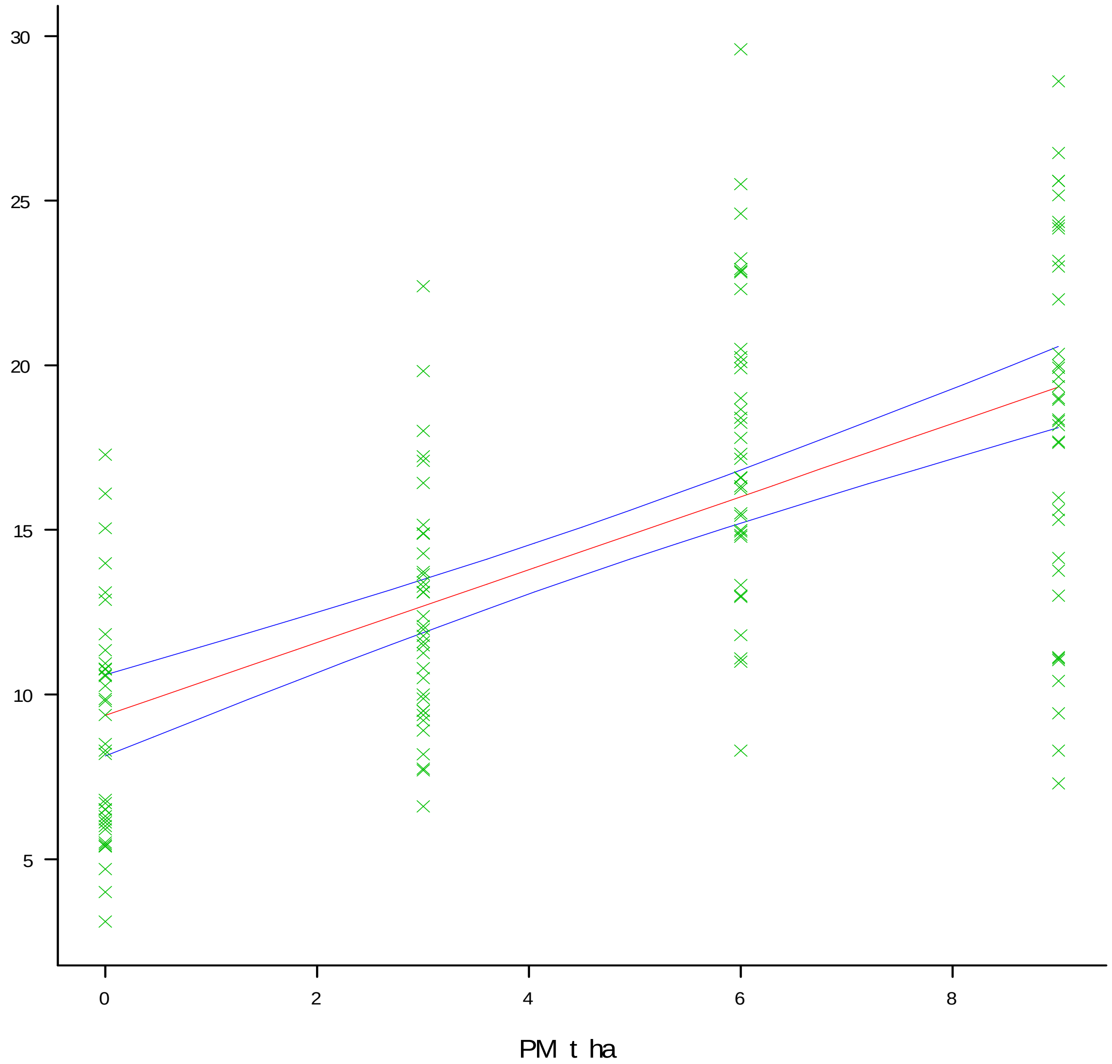

Fig. 4.1: Regression of Fresh Yield (t ha^{-1}) of Sweet Pepper against Poultry Manure at BUK in 2014.

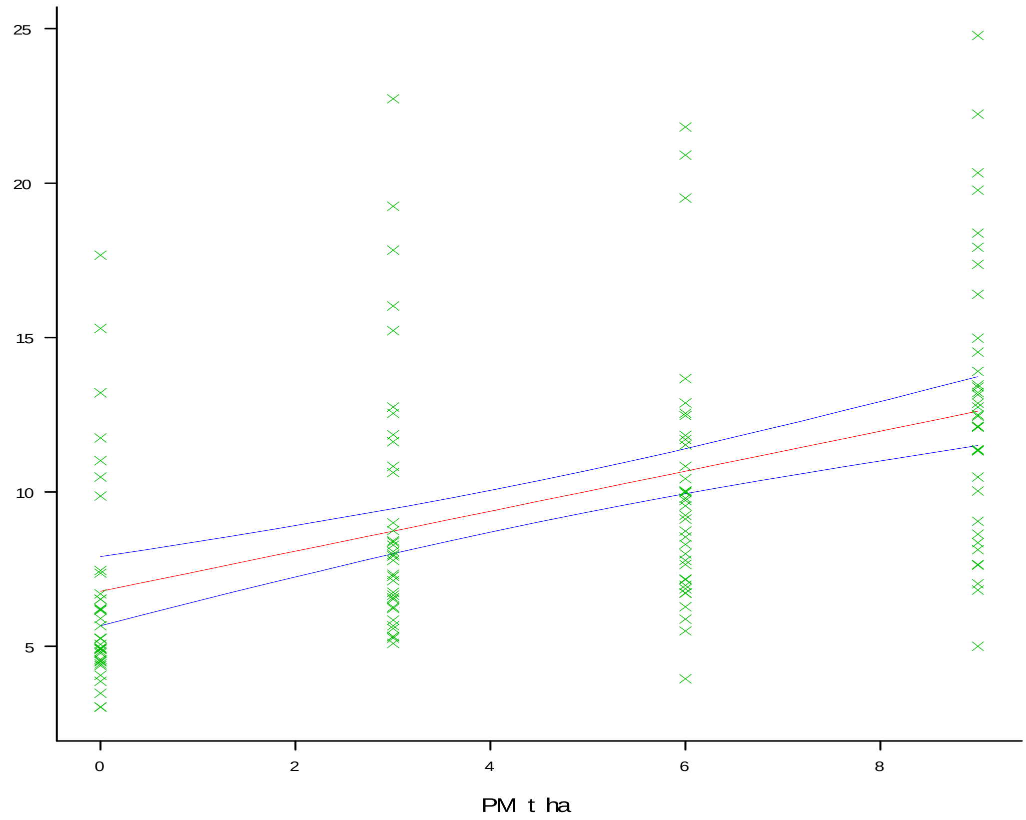

Fig. 4.2: Regression of Fresh Yield (t ha^{-1}) of Sweet Pepper against Poultry Manure at BUK in 2015.

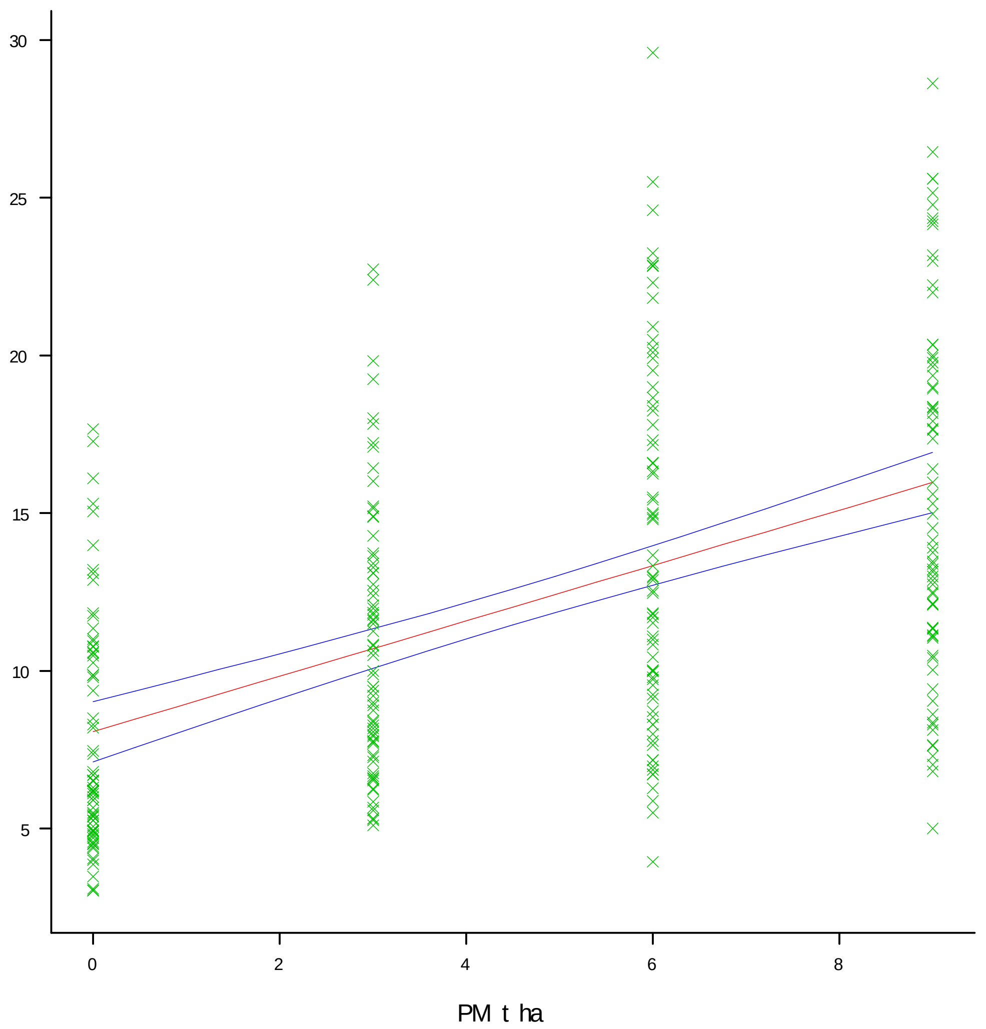

Fig. 4.3: Regression of Fresh Yield (t ha^{-1}) of Sweet Pepper against Poultry Manure at BUK Combined means.

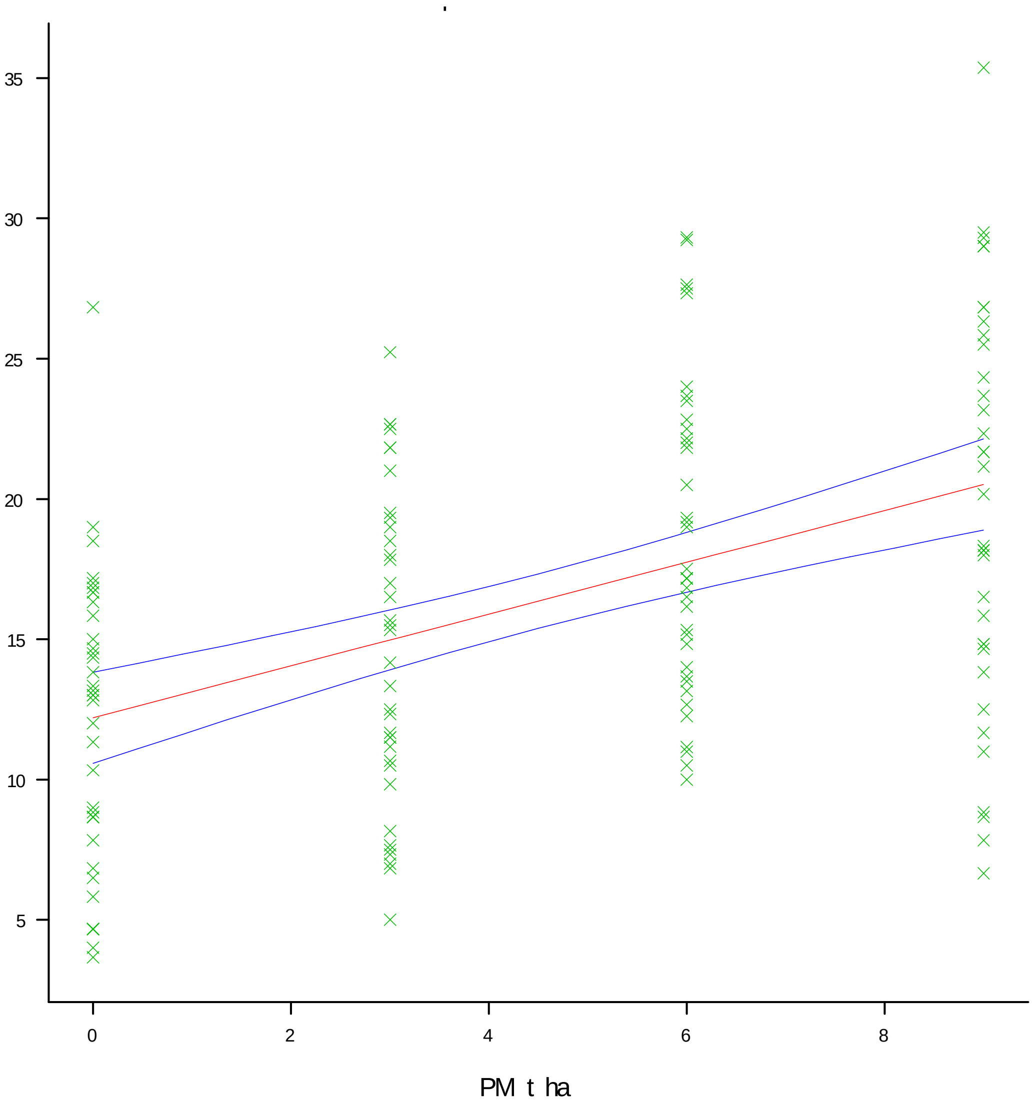

Fig. 4.4: Regression of Fresh Yield (t ha^{-1}) of Sweet Pepper against Poultry Manure at Dadin-Kowa in 2014.

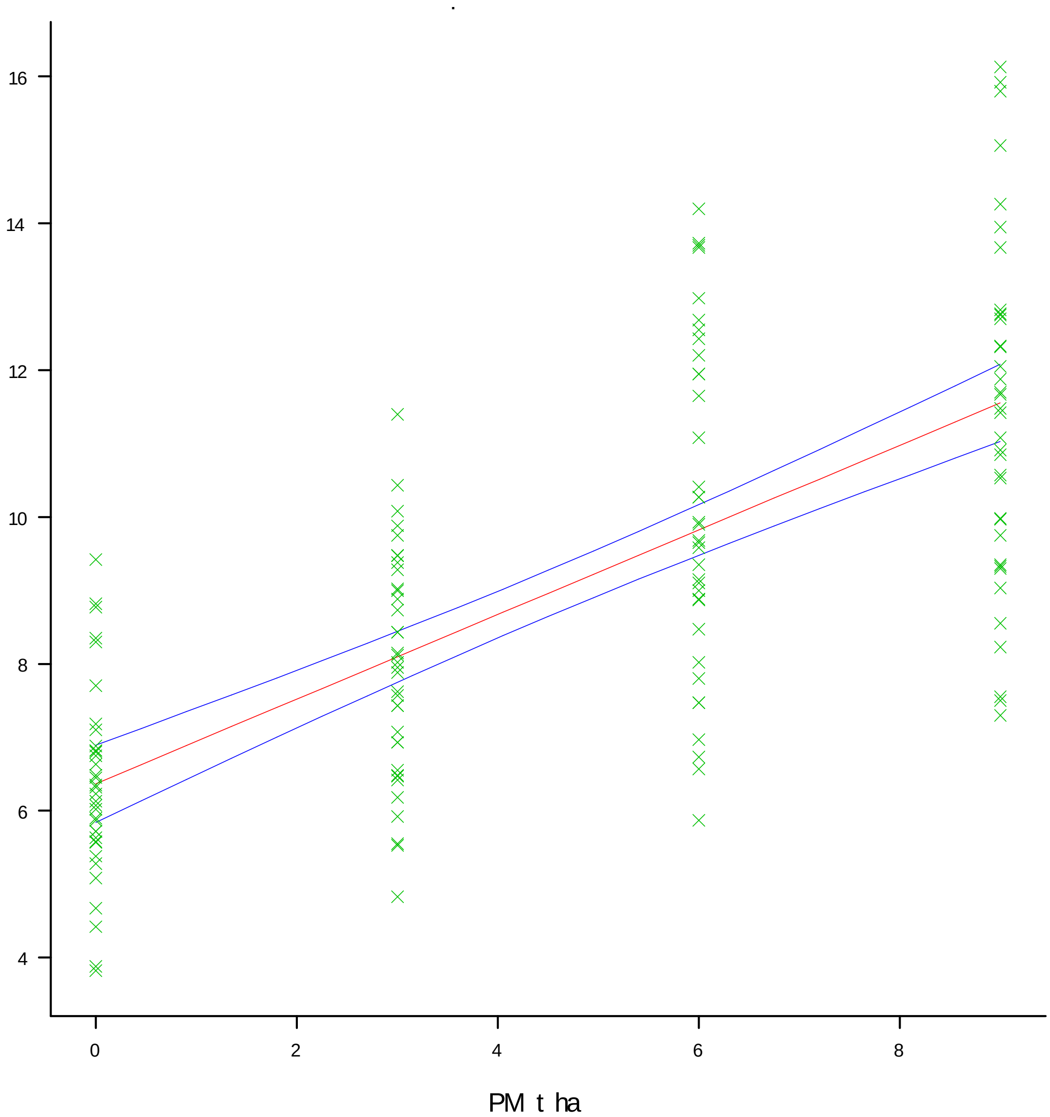

Fig. 4.5: Regression of Fresh Yield (t ha^{-1}) of Sweet Pepper against Poultry Manure at Dadin-Kowa in 2015.

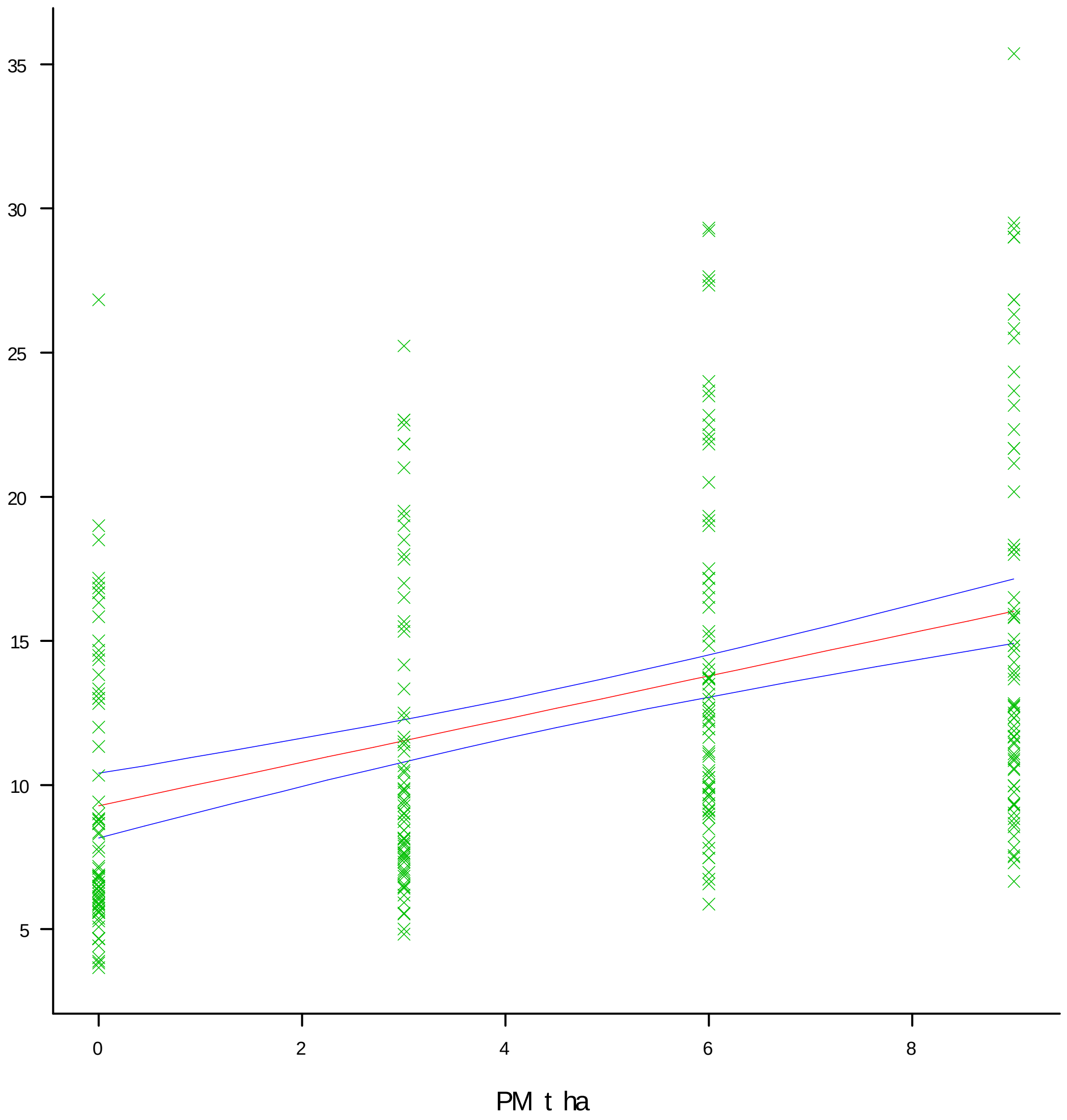

Fig. 4.6: Regression of Fresh Yield (t ha^{-1}) of Sweet Pepper against Poultry Manure at Dadin-Kowa Combined means.

While the two years combined showed 9 t PM ha^{-1} led to 25.6 t PM ha^{-1} fresh fruit of sweet pepper (Fig. 4.4 to 4.6).

4.2 DISCUSSIONS

4.2.1 General Observations

The trials were carried out with the aim of studying the growth and yield responses of three varieties of sweet pepper as affected by varying levels of poultry manure and jatropha seed extracts. The plant heights, number of leaves, number of primary branches, number of pest scored plant^{-1}, number of fruits plant^{-1}, fresh fruits weight, fruit fresh yield and dry fruits yield of the three sweet pepper varieties were significantly ($P \leq 0.05$) enhanced by the varietal difference and the application of varying levels of poultry manure and jatropha seed extracts. The positive response of physiological-time events to varietal difference, poultry manure and jatropha seed extract rates suggested that phenological changes (anthesis and fruiting) in sweet pepper could be influenced by the variety, quantity of nutrient elements (determined by the quantity of poultry manure applied) available for growth and the rates of sprays of jatropha seed extract to the sweet pepper. This is corroborated by the significant increase in growth traits (plant height, number of branches and number of leaves) and yield components (number fruits plant^{-1}, fresh and dry fruit weights) as poultry manure and jatropha seed extract rates increased. This was evident in this study as plant height, number of branches and numbers of leaves, number of marketable fruits plant^{-1}, fresh and dry fruit weights of the three varieties of sweet pepper were significantly influenced by the application of the various rates of poultry manure and jatropha seed extract. Similar finding was reported by Abu *et al*. (2013) from a trial on field grown aromatic peppers.

4.2.2 Varietal response to growth

Varietal difference was observed among the three varieties of sweet pepper in terms of plant height, number of leaves, number of primary branches, and number of pest scored plant^{-1} and number of aborted flowers plant^{-1}. Kwadon local and Bellboy statistically out grow Yolo

Wonder in most of the measured growth characters. Positive effect of variety on number of leaves of sweet peppers at 2, 4 and 6 WAT, initially at 2 WAT of the Sweet peppers there was no significant difference ($P \leq 0.05$) among the three varieties with respect to number of leaves. Perhaps the plants nutrients were initially sufficient for the plant growths at 2 WAT. Similar observation was also made by Shahein *et al*. (2015) that as plant grows their nutrient demand tend to increase. Similarly, the highest number of pest scored plant^{-1} was recorded by Kwadon local while the least was obtained from Yolo Wonder. The number of pest scored plant^{-1} was consistently higher from Kwadon local than Bellboy and Yolo Wonder. These could be attributed to their varietal differences. Vaarietal response to pest and disease attack was equally observed to vary among aromatic peppers (Abu *et al*., 2013).

The growths differences exhibited by the three varieties of pepper could be partly due to their inbuilt gene expression and or as a result of environmental factors of the two locations that affected the crop performance. This was equally observed by Shahein *et al.* (2015) that the growth difference between two pepper hybrids might be correlated with the gene action of the tested hybrids.

4.2.3 Varietal response to yield

The trials were carried out also with the aim of investigating the yield responses of three varieties of sweet pepper. It was observed that number of fruits plant^{-1} though not significantly different ($P \leq 0.05$) among the three varieties of sweet pepper, the fresh fruit weight, fresh fruit yield (t PM ha^{-1}) and dry fruit yields (t PM ha^{-1}) were statistically influenced by the varietal effects. Higher number of fruits was obtained from Bellboy than the other two varieties in all the seasons and the years combined at BUK and Dadin-Kowa. However, in terms of fresh fruit weight and in turn the fresh fruit yield was produced by Yolo Wonder than Kwadon local and Bellboy at both BUK and Dadin-Kowa during the 2014 and 2015 rainy seasons and the years combined. This was possible not because of numbers of the fruits produced but due to fruits sizes of Yolo Wonder that are much larger than the other two varieties. Again, Yolo Wonder had broader leaves with greater leaf area index (LAI) than the Kwadon local and Bellboy which translated into having higher fresh fruit yield than the other two varieties.

4.2.4 Varietal response to Nutrition composition (Proximate analyses)

The proximate analysis of the three varieties sweet pepper fruits harvested showed that the fruits % crude proteins, capsaicin contents, Vitamin A and C contents were all influenced by the varietal difference. Kwadon local recorded the highests fruit capsaicin contents, and Bellboy had the highest % fruit crude proteins, while the highest fruit Vitamin A and C contents were recorded by Yolo Wonder. The fruit capsaicin contents was higher in Kwadon local followed by Bellboy and lower in Yolo Wonder but then higher fruit vitamin A and C was obtained from Yolo Wonder followed by that produced by Bellboy and lower in Kwadon local observed in 2014 and 2015 and the years combined at both BUK and Dadin-Kowa.

4.2.5 Growth response to poultry manure

Application of Poultry Manure positively enhanced the growth of three sweet pepper varieties in all the two years tested and the combined at both BUK and Dadin-Kowa. Application of higher levels of poultry manure produced the highest plant heights and number of leaves of sweet pepper. However, there was no significant growth difference ($P \leq 0.05$) between sweet pepper plants treated with 6 tons ha^{-1} and those treated with 9 t PM ha^{-1} at both 2 and 4 WAT but they were statistically different at 6 WAT. This tends to agree with Abu *et al*. (2013) who stated that “Pepper requires a large quantity of available plant nutrient but it can utilize only a small percentage of the organic N available in the large volume of the soil explored by the tender roots” at the early growth stage. This could be as a result of less food nutrients demand at the early stage of the plant growth than at antheses and fruit production periods. Also, it could be as a result of inbalace between Sources and Sinks at the early growth stages of the plant than at reproductive stages especially at fruiting stage which was observed to be greatly favoured by the highest levels of the poultry manure.

4.2.6 Yield response to poultry manure

The number of fruits plant^{-1}, fresh fruits weight and yield (t ha^{-1}) were greatly enhanced by the application of the varying levels of poultry manure. This increase in number of fruit plant^{-1} was attributed to the high fertility levels particularly the high nitrogen contents in the high rate of poultry manure (Aliyu and Kuchinda, 2002). Similarly, Adekola *et al*. (2013) observed that plant height and pepper fruit yield ha^{-1} increased with increasing levels of N. The highest fresh fruits weights plant^{-1} of sweet pepper were obtained by the application of highest levels of poultry manure (9 t PM ha^{-1}) only during the 2014 rainy season at Dadin-Kowa and BUK. But during the 2015 and the combined, significant influence of the most of the yield components of the three sweet pepper varieties was observed among all the varying levels of poultry manure compared to the control treatment. Again, the highest levels of poultry manure gave the greatest fresh fruit weight and yield Plant^{-1} far above the other levels of poultry manure and all the levels of poultry manure recorded fresh fruits weights and the yield plant^{-1} that statistically out-weighed those obtained from the control treatment. This weight and yield differences in fruits of the three varieties of sweet peppers in 2014 could be as a results of the effect of adequate nutrients from the applications of the 9 t PM ha^{-1}. Similarly, in the same 2015 rainy season at both BUK and Dadin-Kowa application of the 9 t PM ha^{-1} recorded the highest number of fruits and the corresponding yield plant^{-1} which outnumbers by far the numbers of fruits and yield plant^{-1} of the three varieties of sweet peppers obtained from the application of the other levels of poultry manure and that of the control treatment. Similar observation was made by Aliyu and Kuchinda (2002) who recorded that application of poultry nanure at 9 t PM ha^{-1} resulted in higher fruit yield of pepper compared to FYM at 30 t PM ha^{-1} and poultry manure had the highest manganese, zinc and phosphorus contents.

4.2.7 Fruit nutritional response to poultry manure

The proximate analysis of the sweet pepper fruits harvested indicated that the fruits crude proteins, capsaicin, Vitamin A and C contents were all influenced by the varying levels of the applied poultry manure. Sweet pepper plants applied with higher levels of poultry manure consistently produced the highest fruits crude proteins, fruits capsaicin contents, and Vitamin A and C contents. In this study, application of poultry manure increased most of the nutritional properties of the sweet peppers during the 2014 and 2015 rainy seasons and the combined data at both BUK and Dadin-Kowa. However at BUK application of poultry manure beyond 3 t PM ha^{-1} in 2015 resulted into decrease in fruit vitamin A contents. This could be due to the fact that bigger fruits were observed to have lower vitamin contents perhaps as a result of dilution effects, which was supported by the high amount of water the fruits contained. Significant effect of poultry manure rates on the nutrient quality of pepper is also supported by an earlier study on passion fruits, which showed that nutritional quality of the juice varied with poultry manure rate as reported by Ani and Baiyeri (2008).

4.2.8 Growth response to applied jatropha seed extract

Application of Jatropha seed extracts favored plant growth of sweet pepper. There was significant increase in plant heights with increase in % JSE concentration only up to 2 % *EC* beyond which there was reduction in plant growth at 4 and 6 WAT sampling periods. Statistically taller plants were recorded by the application of 3 % JSE concentration. But, there was no significant difference ($P \leq 0.05$) in the plant heights obtained by application of 2 % *EC* and those by 3 % JSE concentration throughout the period of observations. All the varying levels (% EC) of Jatropha seed extracts proved to have significantly affected the plant height and number of leaves of the three varieties sweet peppers than the control treatment (0 % *EC*). In the same vein, number of primary branches of the three varieties of sweet pepper was significantly affected by jatropha seed extracts at 4, 6 and 8 WAT. Higher levels of jatropha seed extracts produced more primary branches than the control treatment in 2014 and 2015 rainy seasons and the combined at both BUK and Dadin-Kowa. However, beyond the applied 2 % EC ha^{-1} JSE number of primary branches remained unaffected.

4.2.9 Yield response to applied jatropha seed extract

The trials showed that the yield of three varieties of sweet pepper was positively affected by application jatropha seed extracts. The increase in the number of fruits of sweet pepper by application of jatropha could be due to its pesticide effects and possibility of its repelling effect that could have enhanced the fruit formation. Similar assertion was made that all parts of the jatropha show insecticidal properties (Grainge and Ahmed, 1988; Consoli *et al*., 1989; Jain and Trivedi, 1997; Meshram *et al*., 1994) against insect pests like fruit worms and on pests of pulses, vegetables, potato and corn (Kaushik and Kumar, 2004). Application of 3 % EC of jatropha seed extracts gave the highest number of fruits $plant^{-1}$, fresh fruit weight and yield of sweet pepper which are not statistically different ($P \leq 0.05$) from those obtained by the 2 % EC of jatropha seed extracts. The lowest number of fruits $plant^{-1}$, fresh fruit weight and yield of sweet pepper were developed by the control treatment.

4.2.10 Fruit Nutritional response to applied jatropha seed extract

The proximate analysis of the three varieties of sweet pepper fruits harvested indicated that the fruits crude proteins, capsaicin contents, Vitamin A and C contents were all influenced by the application of jatropha seed extracts. Thr highest percentage crude proteins, capsaicin contents, vitamin A and C contents was obtained from the application of 3 % EC ha^{-1} JSE that was similar to those recorded by the application of 2 % EC ha^{-1} which were by far with the control treatment. Therefore, the study indicated that application of jatropha seed extracts increased most of the nutritional properties of the three sweet peppers varieties. Significant effect of sprayed jatropha seed extracts on the nutrient quality of pepper is also supported by an earlier study on passion fruits, which showed that nutritional quality of the juice varied with poultry manure rate reported by Ani and Baiyeri (2008).

4.2.11 Interactions

Interaction between variety and poultry manure on growth: an interaction between the variety of sweet pepper and applied poultry manure was significant on growth of the three varieties of sweet pepper at 6 WAT at both BUK and Dadin-Kowa. Bellboy had the tallest plant and highest number of leaves which was similar to that of Kwadon local and by far with Yolo Wonder during the 2014 and 2015 rainy seasons and the combined at both BUK and Dadin-Kowa. The least plant growth was obtained from Yolo Wonder when no poultry manure was applied. This is perhaps due to the varietal difference and the expression of growth performance differences among the three sweet pepper varietie.

Interaction between variety and jatropha seed extract on yield: interaction between variety and jatropha seed extract significantly enhanced fresh fruit yield of the three varieties of sweet pepperduring the 2014 rainy season at BUK. Yolo Wonder responded more and similar to application of 2 % and 3 % EC ha^{-1} JSE and had the highest fresh fruit yields. The least fresh fruit yields were from Kwadon local and Bellboy when no application of jatropha seed extract was made.

Interaction between variety and poultry manure on fruit nutritional qualities: the percentage fruit crude proteins, fruit capsaicin contents and vitamin Aand C contents of the three varieties of sweet pepper was significantly enhanced by interactions between variety and poultry manure during the 2014 and 2015 rainy seasons and the combined at both BUK and Dadin-Kowa. Bellboy interacted favourably with 9 t PM ha^{-1} and produced the highest percentage fruit crude proteins during the two rainy seasons and the combined at BUK and

Dadin-Kowa. The fruits % crude proteins produced by control treatment of poultry manure interacting with Kwadon local are greater than those produced by the interactions between Bellboy and Yolo Wonder with the control treatment respectively. The highest % crude proteins was obtained from the interaction between Bellboy and the higher levels of PM which was similar to that of interaction between Kwadon local and higher application of PM and that of Yolo Wonder and higher levels of PM in 2014 and 2015 rainy seasons at both BUK and Dadin-Kowa. The least fruits crude proteins were produced by the interactions between Yolo Wonder and 0 t PM ha^{-1}. The fruits crude proteins produced by control treatment interacting with Kwadon local are greater than those produced by the interactions between Bellboy and Yolo Wonder with the control treatment respectively. There was clear indication that the fruit capsaicin contents are higher in Kwadon local followed by Bellboy and much lower from Yolo Wonder with or without the application of poultry manure. Generally vitamin A and C contents were significantly enhanced by application of 9 t PM ha^{-1} to Bellboy which was similar to the Vitamin A obtained by the interaction between Kwadon local and the same quantity of Poultry Manure in 2014 and 2015 rainy seasons and the combined at BUK and Dadin-Kowa. The least Vitamin A and C was from Yolo Wonder that received no poultry manure.

Interactions between variety and jatropha seed extract on growth, yield and fruit nutritional qualities: interactions between sweet pepper variety and jatropha seed extract and enhanced production of tallest plant at 6 WAT during the 2014 rainy at Dadin-Kowa. Application of jatropha seed extract to Bellboy enhanced the production of the tallest plants followed by Kwadon local when sprayed with the same levels of Jatropha seed extract. While the least was from Yolo Wonder with or without Jatropha seed extract. It was observed that interaction between sweet pepper variety and jatropha seed extract also enhanced plant growth at 2 WAT during 2014 rainy season at BUK, number of leaves at 2, 4 and 6 WAT and the combined at Dadin-Kowa only, number of primary branches at 6 and 8 WAT and the combined only and Number of flowers formed plant^{-1} during 2014 rainy season at Dadin-Kowa. Again, number of marketable fruit plant^{-1} during the 2014 rainy season at Dadin-Kowa and fresh fruit yield during the 2014 rainy season at BUK, percentage fruit crude proteins and fruit capsaicin contents of the three varieties of sweet pepper during the 2014 and the combined at BUK only were all positively enhanced by variety x jatropha seed extract interactions.

Interaction between poultry manure and jatropha seed extracts on growth, yield and fruit nutritional qualities: interactions between the applied poultry manure and jatropha seed extract had significant influence on growth of the three varieties of sweet pepper. The trials depicted highly significant interaction between poultry manure and jatropha seed extracts at 6 WAT with respect to plant height and number of leaves of the three varieties of sweet pepper. The application of 3 % *EC* and 2 % JSE concentration with 9 t PM ha^{-1} produced statistically the tallest plant and highest leaf numbers of the three varieties of sweet pepper than any other combination at 2, 4 and 6 WAT sampling periods respectively. It was observed that irrespective of the amount of PM applied, significant increase in leaf numbers were recorded with corresponding increase in % JSE concentration throughout the sampling periods. Similarly, it was also observed that irrespective of the amount of JSE applied, significant increase in number of leaves of sweet pepper were recorded with the corresponding increase in PM levels in all the sampling periods. The lowest plant heights and number of leaves were developed by the control treatments (0 t PM ha^{-1} and 0 % *EC* of jatropha seed extracts). Again, interactions between the treatment combinations had significant influence on number of primary branches of sweet pepper. Meanwhile, increase in t PM ha^{-1} irrespective of increase in % *EC* of jaatropha seed extracts resulted in corresponding increase in number of primary branches of sweet pepper at 4, 6 and 8 WAT sampling times. The interaction among the treatments combination showed their complimentary effects on growth and nutrition of sweet pepper in the 2014 and 2015 rainy seasons and the years combined at BUK and Dadin-Kowa. Similar finding was observed by Matai *et al*. (2017).

Interactions between the variable factors do not significantly affect the number of fruits plant^{-1} during the 2014 rainy season at all the locations except the interaction between poultry manure and jatropha seed extracts which was found to have significant effect on the number of fruits plant^{-1} of the three varieties of sweet pepper in the combined data at the two locations. The highest fruit plant^{-1} was recorded by interactive effects of applied 9 t PM ha^{-1} and 3 % *EC* of jatropha seed extracts though not statistically different from fruits per plant as affected by the interaction between 9 t PM ha^{-1} and 2 % *EC* of jatropha seed extracts this was followed by the ones obtained from the interaction between 6 t PM ha^{-1} and 3 % *EC* of jatropha seed extracts equally not statistically different from those produced by interaction between 6 t PM ha^{-1} of and 2 % *EC* of jatropha seed extracts clearly observed in the combined data. The least number of fruits plant^{-1} of sweet pepper was obtained by interaction between 0 t PM ha^{-1} and 0 % *EC* of jatropha seed extracts in 2014 rainy season. Interactions between the applied poultry manure and jatropha seed extracts on sweet pepper statistically influenced the fresh fruit yield during the 2015 rainy season at Dadin-Kowa. The greatest fresh fruit yield of sweet pepper was obtained from the interaction between 9 t PM ha^{-1} and 3 % EC of jatropha seed extracts. The least fruit fresh yield was recorded by the interaction control treatments of 0 tons ha^{-1} of poultry manure and 0 % EC jatropha seed extracts. As such, the applications of poultry manure and jatropha seed extracts seem have complementary effects on the pepper fruit production.

The three varieties of Sweet pepper plants applied with 9 t PM ha^{-1} and 3 % EC of jatropha seed extracts evidently produced the highest fruit crude proteins, fruit capsaicin contents, and Vitamin A and C contents. In this study, application of poultry manure and jatropha seed extracts increased most of the nutritional properties of the sweet peppers. Significant effect of poultry manure and jatropha seed extracts rates on the nutrient quality of pepper is also supported by an earlier study on passion fruits, which showed that nutritional quality of the juice varied with poultry manure rate reported by Ani and Baiyeri (2008).

Interactions among the three sweet pepper varieties, poultry manure and jatropha seed extracts on growth, yield and fruit nutritional qualities: interaction among Variety, poultry and jatropha seed extracts had significant effects on the number of leaves at 2 WAT during 2014 rainy season at BUK, number of primary branches at 8 WAT and 6 WAT during the 2014 at Dadin-Kowa and the combined at BUK respectively, and fresh fruits weights plant^{-1} of sweet pepper during 2015 rainy season at BUK. Spraying of jatropha seed extracts from 1 to 2 % EC ha^{-1} JSE resulted into increased leaf number of the three sweet pepper varieties applied with either 6 or 9 t PM ha^{-1}. Further increase in JSE rate beyond 2 % EC ha^{-1} did not caused significant increase or decrease of number of leaves of the three varieties of sweet pepper. At fixed rate of JSE of 0 % EC ha^{-1}, increase in poultry manure rate from 6 to 9 t PM ha^{-1} resulted in significant increase and decrease in the number of leaves of Kwadon local and Bellboy respectively. Varying the rate of poultry manure had no significant effect on number of leaves of Yolo Wonder. Again, interactions between the treatment combinations had significant influence on number of primary branches of sweet pepper. Meanwhile, increase in t PM ha^{-1} irrespective of increase in % *EC* of jaatropha seed extracts resulted in corresponding increase in number of primary branches of sweet pepper at 4, 6 and 8 WAT sampling times. Yolo Wonder interacted very well with 9 t PM ha^{-1} and 2 % EC of jatropha seed extracts and produced the highest fruit fresh weight plant^{-1} of sweet pepper.

4.2.12 Simple correlation coefficient studies

Significant correlations were observed among almost all the growth and yield characters measured. This is an indication that they have complementary contributions to the fresh fruits yield of sweet pepper. Significantly positive correlation between plant heights, number of leaves, number of primary branches, leaf area index, marketable fruit plant$^{-1,}$ fresh fruits weight and dry fruits weight could be explained by the fact that taller plants with more number of primary branches, higher number of leaves determines greater leaf area which in turn enhanced photosynthesis contributing to high fruit production. Plant growth characters increased as the organic manure level increased, which is attributable to greater supply of plant nutrients with incremental application of poultry manure since the un-amended soil was low in nutrient content. The positive response of physiological-time events to poultry manure rate suggested that phenological changes (anthesis and fruiting) in sweet pepper could be influenced by the quantity of nutrient elements (determined by the quantity of poultry manure applied) available for growth. This is corroborated by the significant increase in growth traits (plant height, number of branches and number of leaves) as poultry manure rate increased. This was evident in this study as plant height, number of branches and numbers of leaves were positively and significantly correlated with number of fruits and weight of fruits harvested. Abu et al. (2013) reported a similar finding for field grown aromatic peppers. In the current study, it was notable from the correlative responses that yield could be predicted from 6-week old plants through the corroborative positive change in the growth traits which are earlier dertimned at the 6 WAT of the three sweet pepper varieties..

4.2.13 Regression analyses

The regression of fresh yield (t ha^{-1}) of sweet pepper against poultry manure in this work as represented in figures 4.1 to 4.6 for BUK and Dadin-Kowa indicated a linear regression with the highest poultry manure rate of 9 t PM ha^{-1} that gave yield of 28.7 t ha^{-1} for the combined at BUK and the same poultry manure rate gave 25.7 t ha^{-1} for the combined at Dadin-Kowa. The greater yield obtained from BUK could be due to the fact that there was less pest attack in the the two seasons at BUK than at Dadin-Kowa which might have resulted to reduction in the fruit yield of the sweet pepper at the later location. This finding corroborate with Dagnoko *et al.* (2013) who stated that pest and disease are major factors affecting yield of sweet pepper.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Field trials were conducted at two locations during the 2014 and 2015 rainy seasons. The locations were the Bayero University, Kano Teaching and Research Farm situated in the Sudan Savannah Agro-ecological zone (Latitude $11^0$58” N and Longitude $8^0$25” E at an altitude of 458 m) and Federal College of Horticulture, Dadin-Kowa Teaching and Research Farm in the Northern Guinea Savannah Agro-ecological zone (Latitudes $10^0$18' 10’’ N and Longitude $11^0$31’9’’ E at an altitude of 221 m).The treatments consisted of three Sweet pepper varieties (Kwadon local, Bellboy and Yolo Wonder) used as main treatments, four levels of Poultry Manure (0, 3, 6 and 9 t PM ha^{-1}) assigned as sub-plot treatments and four levels of Jatropha seed extracts (0, 1, 2 and 3 % EC) used as sub-sub plot treatments. The soils of the experimental sites were texturally classified as sandy loam. The results indicated that plant heights, number of leaves and pest scored $plant^{-1}$ were statistically varied among the three sweet pepper varieties tested and also statistically influenced by the application of poultry manure and jatropha seed extracts to sweet pepper. Bellboy produced the tallest plant with more leaves while, the shortest plants with fewer leaves were produced by Yolo Wonder. Application of 9 t PM ha^{-1} produced the tallest plants with higher number of leaves of sweet pepper. The shortest plants with few leaves were produced by the control treatments. Sweet pepper plants supplied with higher dose of poultry manure and jatropha seed extracts had less pest infestation $plant^{-1}$ compared to the control treatments. Similarly, the number of fruits $plant^{-1}$, fresh fruits weight $plant^{-1}$ and yield of the three sweet pepper varieties were greatly enhanced by the application of poultry manure and jatropha seed extracts. Yolo Wonder supplied with 9 t PM ha^{-1} and 2 % EC of jatropha seed extracts produced the highest fresh fruits weight $plant^{-1}$ and the mean fruit fresh yield (t ha^{-1}) in 2014 and 2015. The lowest number of fruits $plant^{-1}$, fresh fruits weight plant^{-1} and yield of sweet pepper were produced by the control treatments (0 t PM ha^{-1} and 0 % *EC* of jatropha seed extracts). Kwadon local recorded the highests fruits capsaicin contents, and Bellboy had the highest fruit crude proteins, while the highest fruit Vitamin A and C contents were recorded by Yolo Wonder.

Growth characters of the three varieties of sweet pepper were significantly enhanced by the interactions between poultry manure, jatropha seed extracts and the variety. Bellboy interacted favorably with poultry manure and jatropha seed extracts and produced the highest number of fruits plant^{-1}, fresh fruits weight plant^{-1} and yield which was statistically similar to those obtained by the interaction between Yolo Wonder and the applied poultry manure and jatropha seed extracts. The interactions among the treatment factors showed their complementary effects on the yield and yield components of sweet pepper.

5.2 Conclusion

The results of the experiment clearly indicated that the treatments factors positively influenced the yield and yield components of sweet pepper during the two seasons at Dadin-Kowa and BUK. The sweet pepper Varieties; Bellboy and Yolo Wonder performed very well in most of the measured growth and yield characters. It is very clear that poultry manure and jatropha seed extracts contributed to the growth, yield and their components of sweet pepper attaining maximum status at 9 tons ha^{-1} and 2 % *EC* of jatropha seed extracts on sandy loam soils of Dadin-Kowa and BUK. The sweet pepper varieties interacted positively with applied poultry manure and jatropha seed extracts and enhanced growth, yield components of sweet pepper. Therefore, the interactions between sweet pepper varieties, poultry manure and jatropha seed extracts indicated their complementary effects on the growth and yield of sweet pepper. Therefore, it can be deduced that Bellboy and Yolo Wonder, 9 t PM ha^{-1} and 2 % *EC* of jatropha seed extracts can be adopted for production of sweet pepper on sandy loam soils of

BUK and Dadin-Kowa. As such, growth and yield performances and nutritional quality of sweet peppers could be manipulated positively by the application of poultry manure and jatropha seed extracts.

5.3 Recommendations

The findings of this reasearch suggested that the Sweet pepper Varieties; Bellboy and Yolo Wonder seem to be promising varieties for BUK and Dadin-Kowa areas. Again, 9 t PM ha^{-1} and 2 % *EC* of jatropha seed extracts can be adopted for production of sweet pepper on sandy loam soils of BUK and Dadin-Kowa.

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Appendix I: Meteorological Data during the 2014 and 2015 Cropping Seasons at Dadin-Kowa

Months	Total Rainfall (mm)		Mean Temperature (°C)		Relative Humidity (%)		Sunshine (Hrs)	
	2014	2015	2014	2015	2014	2015	2014	2015
January	0.00	0.00	22.5	26.0	27.0	51.0	7.50	8.00
February	0.00	0.00	29.0	30.0	31.0	51.0	7.09	8.30
March	0.00	0.00	33.5	30.5	32.0	45.0	7.08	8.20
April	11.30	28.40	34.0	32.0	49.0	55.0	8.00	10.50
May	143.30	121.50	34.0	32.0	60.0	73.0	7.08	7.09
June	70.20	140.60	31.0	29.5	70.0	72.0	6.07	7.50
July	230.80	270.30	27.5	28.0	73.0	72.0	6.30	7.30
August	260.00	134.50	27.0	28.5	87.0	85.0	7.08	7.20
September	94.70	220.60	28.5	29.0	86.0	76.0	7.08	8.09
October	76.60	42.50	28.5	30.0	62.0	78.0	7.09	7.50
November	0.00	0.00	26.5	27.5	44.0	47.0	9.06	7.09
December	0.00	0.00	26.0	23.5	53.0	34.0	9.20	7.50
Total	938.50	958.40	348.0	346.5	664.0	709.0	79.54	102.57
Mean	78.21	79.87	29.0	28.88	55.33	59.1	6.62	8.55

Source: Meteorological Station of Upper Benue River DeveloPMent Authority, Dadin-Kowa

Appendix II: Meteorological Data during the 2014 and 2015 Cropping Seasons at BUK

Months	Total Rainfall (mm)		Mean Temperature (^oC)		Relative Humidity (%)		Sunshine (Hrs)	
	2014	2015	2014	2015	2014	2015	2014	2015
January	0.00	0.00	25.5	27.0	23.6	28.4	8.50	8.60
February	0.00	0.00	26.0	28.0	31.2	33.2	9.09	9.30
March	0.00	0.00	37.5	38.5	32.7	41.1	10.08	9.20
April	10.20	18.40	39.0	40.0	39.5	**45**.5	11.00	11.50
May	123.30	101.60	38.0	37.0	50.3	53.1	8.08	9.09
June	110.20	150.60	35.0	39.5	60.7	62.6	7.12	8.60
July	170.50	190.30	37.5	34.0	71.6	69.7	7.50	8.20
August	266.30	234.20	29.0	30.5	87.2	75.8	7.08	7.20
September	84.70	120.40	33.5	36.0	86.1	76.0	8.08	7.09
October	66.60	52.10	30.5	30.0	62.5	68.0	8.09	7.80
Novembe	0.00	0.00	26.5	27.5	54.1	37.0	6.06	7.36
December	0.00	0.00	24.0	23.2	33.3	34.0	7.20	6.50
Total	831.80	867.60	382.0	391.2	632.8	624.4	97.88	00.44
Mean	69.31	72.30	31.83	32.60	52.7	52.03	8.16	8.37

Source: Bayero University Metrological Station