DEDICATION

To the memory of my father and mother

To every one whom I respect, admire and love.

List of content

	Dedication	٢
	List of Contents	٢
	List of Tables	٢
	List of figures	٢
	Acknowledgement	٢
	Declaration	٢
	Abstract	٢
	الخلاصة	٢
	Chapter 1 **Introduction**	
1.1	Pepper (*Capsicum annum* L.).	1
1.2	Egg plant (*Solanum melongena* L.).	2
1.3	Historical background of organic agriculture.	5
1.4	Organic Production.	5
1.4.1	Definition.	7
1.4.2	Certification.	8
1.5	Problems.	8
1.6	Objectives.	9
	Chapter 2 **Literature Review**	
2.1	Pepper (*Capsicum annum* L).	10
2.2	Egg Plant (*Solanum melongena* L.).	11
2.3	Organic production.	12

	Chapter 3 **Materials and Methods**	
3.1	Field Experiments.	25
3.1.1	Experiment site.	25
3.1.2	Plant material.	25
3.1.3	The experiments.	25
3.1.4	Treatment measured.	27
3.1.5	Pest control.	28
3.1.6	Parameters.	28
3.1.6.1	Growth parameters.	28
3.1.6.2	Yield parameters.	28
3.1.7	Plant chemical analysis.	29
3.1.8	Soil analysis at (30cm and 60cm depth).	29
3.1.9	Analysis method and sampling	29
	Chapter 4 **Results and Discussion**	
4.1	Evaluation of three introduced sweet pepper cultivars.	30
4.1.1	Growth parameters.	30
4.1.1.1	Days to 50% flowering.	30
4.1.1.2	Average plant height (cm) at 50% flowering).	31
4.1.1.3	Average plant height (cm) 45days after transplanting.	31
4.1.1.4	Average plant height at fruit setting.	33
4.1.1.5	Average number of leaves at 50% flowering.	33
4.1.1.6	Average number of leaves 45 days after transplanting.	33
4.1.1.7	Average number of leaves at fruit setting.	33
4.1.2	Yield parameters.	36
4.1.2.1	Average number of fruits/plant.	36
4.1.2.2	Average fruit circumference (cm).	36
4.1.2.3	Average fruit length (cm).	38
4.1.2.4	Average fruit weight (g).	38
4.1.2.5	Average Fruits weight/ plant (kgs).	38
4.1.2.6	Average total yield / hectare (tons).	39
4.1.3	Coloration parameters.	39
4.2	Organic production.	46
4.2.1	Growth parameter.	46
4.2.1.1	Average days to 50% flowering.	46
4.2.1.2	Average plant height at 50% flowering and at 45 and 60 days after transplanting and fruit setting.	49
4.2.1.3	Average number of leaves/ plant at 50% flowering and at 45	

	and 60 days and fruit setting.	53
4.2.1.4	Average stem thickness of plant at 50% flowering and at fruit setting.	57
4.2.2	Yield parameters.	60
4.2.2.1	Number of fruits/plant.	60
4.2.2.2	Average Fruit length and circumference in (cm).	62
4.2.2.3	Average fruit weight (g).	67
4.2.2.4	Average fruits weight/plant in (kgs).	69
4.2.2.5	Average total yield / hectare (tons).	70
4.2.3	Plant shoot analysis.	75
4.2.3.1	Plant shoot total nitrogen.	75
4.2.3.2	Plant shoot ammonium nitrogen.	77
4.2.3.3	Plant shoot nitrate nitrogen.	78
4.2.3.4	Plant shoot phosphorous content.	79
4.2.3.5	Plant shoot potassium content.	83
4.2.3.6	Plant shoot calcium content.	85
4.2.3.7	Plant shoot magnesium content.	88
4.2.3.8	Plant shoot sodium content.	89
4.2.4	Fruit analysis.	90
4.2.4.1	Fruit total nitrogen content.	90
4.2.4.2	Fruit ammonium nitrogen content.	94
4.2.4.3	Fruit nitrate nitrogen content.	95
4.2.4.4	Fruit phosphorous content.	96
4.2.4.5	Fruit potassium content.	97
4.2.4.6	Fruit calcium content.	98
4.2.4.7	Fruit magnesium content.	99
4.2.4.8	Fruit sodium content.	102
4.2.5	Soil analysis.	103
4.2.5.1	Soil pH at 30 cm depth.	103
4.2.5.2	Soil pH at 60 cm depth.	106
4.2.5.3	Soil total nitrogen content at 30cm depth.	107
4.2.5.4	Soil ammonium nitrogen content at 30 cm depth.	111
4.2.5.5	Soil nitrate nitrogen at 30cm depth.	112
4.2.5.6	Soil total nitrogen content at 60cm depth.	113
4.2.5.7	Soil ammonium nitrate content at 60cm depth.	117
4.2.5.8	Soil nitrate nitrogen content at 60cm depth.	118
4.2.5.9	Soil phosphorous content at 30 cm depth.	119
4.2.5.10	Soil potassium content at 30cm depth.	120
4.2.5.11	Soil calcium and magnesium content at 30 cm depth.	122

4.2.5.12	Soil phosphorous content at 60cm depth.	126
4.2.5.13	Soil potassium content at 60cm depth.	127
4.2.5.14	Soil calcium and magnesium content at 60 cm depth.	131
4.2.5.15	Soil moisture content at 30cm depth.	132
4.2.5.16	Soil organic carbon content at 30cm depth.	133
4.2.5.17	Soil organic matter content at 30cm depth.	134
4.2.5.18	Soil moisture content at 60 cm depth.	137
4.2.5.19	Soil organic carbon content at 60cm depth.	138
4.2.5.20	Soil organic matter content at 60cm depth.	139
4.2.5.21	Soil clay particles at 30 cm depth.	142
4.2.5.22	Soil silt particles at 30cm depth.	143
4.2.5.23	Soil sand particles at 30cm depth.	144
4.2.5.24	Soil clay particles at 60 cm depth.	145
4.2.5.25	Soil silt particles at 60 cm depth.	148
4.2.5.26	Soil sand particles at 60 cm depth.	149
	Conclusion.	153
	Recommendations.	154
	Literature cited.	155
	Appendice.	168

List of Tables

Table 1	Average days to 50% flowering, plant height at 50% flowering and at 45 days plant height at fruit setting (cm) for the two seasons 2005-2006-2007.	32
Table 2	Average number of leaves at 50 % flowering, 45 days, and at fruit setting for the two seasons 2005-2006-2007.	35
Table 3	Average number of fruit / plant, fruit circumference and fruit length (cm) for the two seasons 2005-2006-2007.	37
Table4	Average fruit weight (g), fruit weight/ plant (kgs) and total yield / hectare (tons) for the two seasons 2005-2006-2007.	45
Table 5	Average days to 50% flowering for pepper and eggplant for the three seasons 2005-2006-2007-2008.	48
Table 6	Average height for pepper plant at 50% flowering and 45 days, 60 days after transplanting and fruit setting for the three seasons 2005-2006-2007-2008.	51
Table7	Average eggplant height at 50% flowering and 45, 60	

days after transplanting and fruit setting in (cm) for the three seasons 2005-2006-2007-2008. 52
Table 8 Average number of leaves per plant of pepper at 50% flowering 45 and 60 days after transplanting and fruit setting for the three seasons 2005-2006-2007-2008. 55
Table 9 Average number of eggplant leaves at 50% flowering, 45 and 60 days after transplanting and fruit setting for the three seasons 2005-2006-2007-2008. 56
Table 10 Average stem thickness for pepper at 50% flowering and fruit setting for the three seasons 2005-2006-2007-2008. 58
Table 11 Average stem thickness for eggplant at 50% flowering and fruit setting for the three seasons 2005-2006-2007-2008. 59
Table 12 Average number of pepper fruits/plant, fruit length and circumference for the three seasons 2005-2006-2007-2008. 65
Table 13 Average number of eggplant fruits/plant, fruit length and circumference for the three seasons 2005-2006-2007-2008. 66
Table 14 Average fruit weight of pepper, fruits/plant and total yield/hectare for the three seasons 2005-2006-2007-2008. 73
Table 15 Average fruit weight of eggplant, fruits weight/plant and total yield/hectare for the three seasons 2005-2006-2007-2008. 74
Table 16 Pepper plant shoot total nitrogen, ammonium nitrogen, nitrate nitrogen and phosphorous contents for the three seasons 2005-2006-2007-2008. 80
Table 17 Eggplant shoot total nitrogen, ammonium nitrogen, nitrate nitrogen and phosphorous contents for the three seasons 2005-2006-2007-2008. 81
Table 18 Pepper shoot potassium, calcium, magnesium and sodium contents for the three seasons 2005-2006-2007-2008. 86
Table 19 Eggplant shoot potassium, calcium, magnesium and sodium contents for the three seasons 2005-2006-2007-2008. 87
Table 20 Pepper fruits total nitrogen, ammonium nitrogen, nitrate nitrogen and phosphorous contents for the three seasons

2005-2006-2007-2008. 92
Table 21 Eggplant fruits total nitrogen, ammonium nitrogen, nitrate nitrogen and phosphorous contents for the three seasons 2005-2006-2007-2008. 93
Table 22 Pepper fruits potassium ,calcium, magnesium and sodium contents for the three seasons 2005-2006-2007-2008. 100
Table 23 Eggplant fruits potassium ,calcium, magnesium and sodium contents for the three seasons 2005-2006-2007-2008. 101
Table 24 Soil pH at 30 cm and 60 cm depth in pepper plant and eggplant plots for the three seasons 2005-2006-2007-2008. 105
Table 25 Soil total nitrogen, ammonium nitrogen and nitrate nitrogen at 30 cm depth in pepper plots for the three seasons 2005-2006- 2007-2008. 109
Table 26 Soil total nitrogen, ammonium nitrogen and nitrate nitrogen at 30 cm depth in eggplant plots for the three seasons 2005-2006- 2007-2008. 110
Table 27 Soil total nitrogen, ammonium nitrogen and nitrate nitrogen at 60 cm depth in pepper plots for the three seasons 2005-2006- 2007-2008. 115
Table 28 Soil total nitrogen, ammonium nitrogen and nitrate nitrogen at 30 cm depth in eggplant plots for the three seasons 2005-2006- 2007-2008. 116
Table 29 Soil phosphorous, potassium and Calcium + magnesium at 30cm depths in pepper plots for the three seasons 2005-2006-2007-2008. 124
Table 30 Soil phosphorous, potassium and Calcium + magnesium at 30cm depths in eggplant plots for the three seasons 2005-2006-2007-2008. 125
Table 31 Soil phosphorous, potassium and Calcium + magnesium at 60 cm depths in pepper plots for the three seasons 2005-2006-2007-2008. 129
Table 32 Soil phosphorous, potassium and Calcium + magnesium at 60cm depths in eggplant plots for the three seasons 2005-2006-2007-2008. 130
Table 33 Soil moisture, organic carbon and organic matter contents at 30 cm depth in pepper plots for the Two seasons 2005-2006 and 2007-2008. 135

Table 34 Soil moisture, organic carbon and organic matter contents at 30 cm depth in eggplant plots for the Two seasons 2005-2006 and 2007-2008. 136
Table 35 Soil moisture, organic carbon and organic matter contents at 60 cm depth in pepper plots for the two seasons 2005-2006 and 2007-2008. 140
Table 36 Soil moisture, organic carbon and organic matter contents at 60 cm depth in eggplant plots for the two seasons 2005-2006 and 2007-2008. 141
Table 37 Soil clay, Silt and Sand particles at 30 cm depth in pepper plots for the two season 2005-2006 and 2007-2008. 146
Table 38 Soil clay, silt and sand particles at 30 cm depth in eggplant plots for the two seasons 2005-2006 and 2007-2008. 147
Table 39 Soil clay, silt and sand particles at 60 cm depth in pepper plots for the two seasons 2005-2006 and 2007-2008. 151
Table 40 Soil clay, silt and sand particles at 60 cm depth in eggplant plots for the two seasons 2005-2006 and 2007-2008. 152

List of figures

Figure.1	First season from left to right three cultivars picked after ripening (Fellini ,Niebla, and Jumillia).	40
Figure.2	Niebla cultivar from left to right 5, 7 and 10 days in field after coloration started in the second season.	40
Figure.3	Jumilia cultivar from left to right 5, 7 and 10 days in field after coloration started in the second season.	41
Figure.4	Fellini cultivar from left to right 5, 7 and 10 days in field after coloration started in the second season.	41
Figure.5	Three cultivars from left to right (Fellini, Niebla and Jumillia) picked 15 days after coloration started in the second season	42
Figure.6	Three cultivars from left to right (Fellini, Niebla and Jumillia) picked 21 days after coloration started in the second season.	42
Figure.7	Three cultivars from left to right (Fellini, Niebla and Jumillia) in room temperature 6 days picked 1/2 colored in the second season.	43
Figure.8	Three cultivars from left to right (Fellini, Niebla and Jumillia) in room temperature 9 days picked 1/2 colored in the second season.	43
Figure.9	Three cultivars from left to right (Fellini, Niebla and Jumillia) in refrigerator 9 days picked 1/2 colored in the second season.	44
Figure.10	Three cultivars from left to right (Fellini, Niebla and Jumillia) in refrigerator 16 days picked 1/2 colored in the second season.	44

ACKNOWLEDGEMENT

I would like to express my gratitude and sincere thanks to my supervisor Prof. Saif ELdien Mohamed Elamin, Sudan University of Science and Technology, and my co-supervisor Prof. Elamin Abdel-Magid Elamin, University of Khartoum for their guidance, criticism, continuous encouragement and critical reading of the manuscript.

The efficient typing of Uztaz Elyas Ahmed is greatly appreciated. My appreciation and thanks to Mr. Abdel-bagi Omer for his assistance in soil and plant analysis and statistical analysis. My appreciation continued to my family members, wife, daughter and sons for their help.

DECLARATION

I declare that the work presented in this manuscript is completely the results of my own investigation, and that all references to the ideas and work of other research and the source of information given in this field have been specifically acknowledged. I also declare that the work embodied in this thesis has not already been accepted in substance for any degree and is not being consonantly submitted in candidature for any degree,

Candidate. M. A. Abbas

Abstract

Two experiments were conducted at Shambat in the farm of the College of Agricultural Studies, Sudan University of Science and Technology. During the growing seasons 2005-2006 and 2007. In the first experiment three introduced varieties were tested for growth total yield and coloration parameters. The layout was a complete randomized block of four replications and four treatments, Niebla F_1, Jumillia F_1 and FelliniF_1 were introduced varieties and California Wonder was standard variety. Urea fertilizer and superphosphate at a rate of 125 kg and 62.5 kg per hectare was used respectively, the weeding interval of 15 to 21 days, and the irrigation interval 5 to 7 days.

Variety Niebla performed better than the other varieties Jumillia, California Wonder and Fellini. Niebla, Jumillia and Fellini took shorter time to germinate than the standard variety (7-10 days) for the three varieties and (15-21 days) for the standard variety. Niebla had the highest plants, greater number of leaves/plant, and the stem thickness. Niebla F_1 had higher average number of fruits/plant, average fruit weight, average fruit weight/plant and overall total yield followed by JumilliaF_1, California Wonder and Fellini F_1.

In the first season the growth, yield and coloration parameters were poor compared with the second season. The minimum temperature in the first season ranged between 16 -27.5°C and maximum ranged between 33.6-40.2°C. In the second season minimum temperature ranged between 12.9-19.9°C and the maximum temperature 27.5-36.6°C.This variations in

temperature through the growing season gave this variation in growth and yield.

In the second experiment the layout is a complete randomized block design of four replications with five treatments: 10 cubic meter, 15 cubic meter, 20 cubic meter chicken manure, Urea + super phosphate and control. The crops used: pepper variety (California Wonder) and egg plant variety (Black Beauty). Chicken manure treatments had positive effect on growth, yield, chemical shoot content, fruit chemical content parameters. Results of soil analysis showed significant effects on soil physical and chemical properties of soil moisture and texture, and N, NH_4-N, NO_3-N, P, K, Ca, Mg, organic matter and organic carbon.

Chicken manure plots had significant effect on days to 50% flowering, plant height, number of leaves/plant and stem thickness. The yield of both crops significantly affected. The number of fruits per plant, fruit weight and fruit weight per plant were significantly greater.

The shoot and fruit chemical analysis, chicken manure showed greater levels of Mg^+, Ca^+, K^+, P and total N%, however in case of NH_4-N% it was higher compared to No_3-N% in both shoot and fruit than that of urea + superphosphate .

الخلاصة

اجريت تجربتان في مزرعة كلية الدراسات الزراعية بجامعة السودان للعلوم والتكنولوجيا بشمبات. في مواسم ٢٠٠٥ – ٢٠٠٦ و ٢٠٠٧.اختبرت التجربة الاولىفى تصميم مربع عشوائى كامل به اربعة مكررات واربعة معاملات مستوردة هى نبيلا ، جوميلا وفيليني (جيل اول) وصنف قياسى محلى وهو كلفورنيا وندر. هذة ألاصناف من الفلفلية ثم اختبارها في النمو والإنتاج الكلى والتلوين. استخدم السماد اليوريا والسوبرفوسفيت بمعدل ١٢٥ و٦٢.٥ كيلوجرام للهكتار و اجريت عملية العزيق على فترات ١٥ – ٢١ يوم والرى على فترات ٥ الى ٧ يوم نيبلا وجميلة وفيليني اخذت زمن اقصر (٧- ١٠ ايام) من الصنف القياسى (١٥ – ٢١ يوم) من الانبات. نيبلا كان أفضل من الاصناف الأخرى في النمو والإنتاج الكلى والتلوين تليه جوميلا، كلفورنيا وندر ثم فيليبى.

اوضحت النتائج ان الصنف نبيلا الأطول، الأكثر عدد في الأوراق للنبات الواحد وسمك الساق اكبر ومتوسط عدد الثمار للنبات الواحد، متوسط وزن الثمرة الواحده، متوسط وزن الثمار للنبات الواحد وبعد ذلك الإنتاجية الكلية للهكتار تليها جوميلا، كلفورنيا وتدر وفيليبنى.

في الموسم الأول كان النمو، الإنتاجية والتلوين ضعيف إذا ما قورنت مع الموسم الثانى. كانت درجات الحرارة الدنيا في الموسم الأول بين (١٦- ٢٧.٥)°م والدرجات القصوى (٣٣.٦-٤٠.٢) °م. اما الموسم الثانى فدرجات الحرارة الدنيا بين (١٢.٩-١٩.٩) °م والقصوى (٢٧.٥-٣٦.٦) °م. قد يكون هذا الاختلاف فى درجات الحرارة سبب فى هذة النتائج.

التجربة الثانية استخدم التصميم مربع عشوائى كامل به اربعة مكررات وخمسة معاملات ١٠متر مكعب ، ١٥ متر مكعب ، ٢٠ متر مكعب (للهكتار) زبل دجاج ، يوريا + سوبر فوسفيت (١٢٥ – ٦٢.٥ كيلوجرام للهكتار) ومعاملة تحكم، لمحصولين الفلفل الحلو صنف كلفيورنيا وندر و البازنجان بلاك بيوتى. كان لمعاملات السماد العضوى (زبل الدجاج) أثر إيحابي على مكونات النمو، الإنتاج، طول وسمك الساق و مكونات الثمار الكيمياوية. أظهرت نتائج تحليل التربة أثر معنوى على خصائصها الفيزيائية والكيميائية .

اظهرت النتائج ان للسماد العضوى اثر معنوى على عدد الايام لـ ٥٠% أزهار و طول النبات و عدد الأوراق للنبات الواحد وسمك الساق. كما كان له ايضا تأثيرا معنوياً على الإنتاجية في المحصولين وعدد الثمار للنبات الواحد، وزن الثمرة، وزن الثمار للنبات الواحد.

أظهر التحليل الكيميائي للساق والثمار،ان للسماد العضوى مستويات عالية من المغنسيوم، البوتاسيوم، الكالسيوم، الفسفور والنايتروجين الكلى و النايتروجين الامونى فنسبتة المئوية أعلى من النايتروجين النتراتى في كل من الساق ومكوناته والثمار.

اظهر التحليل الكيميائي للتربة ان السماد العضوى فى العمقين ٦٠-٣٠ سم أعلى قيمة لتفاعل التربة و: الكالسيوم، الماغنسيوم، البوتاسيوم، الفسفور والنايتروجين الكلى، النايتروجين الأمونى، الكربون العضوى والمادة العضوية. كما كان له اثر على رطوبة التربة التى وجدت اعلى منه فى اليوريا والسوبر فوسفيت.وكانت حبيبات الطين والقرير اعلى ولكن الرمل أقل في معاملات السماد العضوى مقارنة باليوريا والسيوبرفوسفيت.