Impacts of Selected Plant Extracts on Three Solanacea Cultivars Nursery Development

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K E Y W O R D S

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A B S T R A C T

A trial was carried out at the nursery unit, Faculty of Agriculture, Nnamdi Azikiwe University, Awka to evaluate the impacts of three plant extracts(Siam, Bitter leaf and Moringa) on the growth parameters and biomass of three solanacea nursery crops(tomato, garden egg and pepper).The Randomized completely block design experiment was replicated three times. Despite crop type, moringa extract significantly enhanced early germination and emergence % of all the tested crops, Throughout the course of the work bitter leaf extract produced the biggest fresh and dry bio masses, tomato(28.13g and 3.37g), pepper(84.10g and 10,0g) and garden egg(50.10g and 6.10g).Bitter leaf extract also produced the tallest plants followed by moringa extract. While leaf area of the tested crops were significantly improved by the extracts, leaf number seemed to be controlled genetically. Plant extracts contain bio stimulants, bio pesticides, hormones, vitamins and minerals that can promote plant growth and increase plant response on stress .Generally, these plant extracts are readily available, cheap and easy to prepare and apply. We therefore recommend the use of these extracts in raising nursery crops and growing crops in the field especially bitter leaf and moringa extracts which are environmentally friendly and sustainable.

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INTRODUCTION

The Solanaceae family is a monophyletic dicot group, which contains widely cultivated crops with individual species serving as a food source, as a source of bioactive molecules or as ornamentals (Gebhardt,2016).Species belonging to this family, such as the African garden (*Solanum macrocapon* L) egg potato (*Solanum tuberosum*), tomato (*Solanum lycopersicum*), pepper (*Caspicum annuum*) or tobacco (*Nicotiana tabacum*), are grown on all continents with temperate or tropical climates and are commonly found in many households worldwide. They are grown mainly as vegetables which are important components of daily diets in Africa and important sources of income, especially in urban and sub-urban areas. Garden egg, also known as African eggplant (*Solanum melongena*), is one of the most important vegetable crops in Nigeria and in West Africa (Onwusah-Ansah *et al*, 2001). Garden egg is not only consumed almost on daily basis by rural and urban families but it also represents the main source of income for many rural households in the forest zone of the country, (Danquah-Jories, 2001).The crop is grown for either the immature fruits or leaves depending on the locality. The immature fruits are either eaten raw or cooked. Tomato is a very widely used and important vegetable in Nigeria, about 25,000 tones of fresh tomato are produced annually. It is grown for its fruit and is used in varieties of ways for the production of puree pastes, juices, and canned fruit or mixed in chilli sauces. Pepper is a vital commercial crop, cultivated for vegetable, spice, and value-added processed products (Onwusah –Ansah *et al*, 2001). Besides vitamins A and C, the fruits contain mixtures of antioxidants notably carotenoids, ascorbic acid, flavanoids and polyphenols (Okolie *et al*., 2022). This makes it a very important constituent of many foods, adding flavour, colour and pungency and, hence, an important source of nutrition for humans. Peppers can be used whole, chopped or in various processed forms such as fresh, dried and ground into powder (with or without the seeds), or as an extract .

Solanaceae family crops like pepper, garden egg and tomato are normally raised in nursery due to the small size of their seeds which produce weak seedlings when they germinate. A nursery is a place where young plants are raised under intensive management for later transplanting into the field (Onwusah –Ansah *et al*, 2001).. Many horticultural crops can be grown in-situ but, experience has shown that raising seedlings in the nursery has a number of advantages especially Economy of propagules, (Peter, 2007). Nursery practices also enable intensive care for the seedlings – protection against animals, diseases, insects and rodents, regular maintenance

practices, watering / irrigation and manuring. The dependency on the use of inorganic fertiliziers as a source of plant nutrients by farmers and their high cost is further associated with land and soil degradation and environmental pollution calls for alternative safe natural sources of plant nutrients (Onwusah –Ansah *et al*, 2001).. Also the application of fertilizer in nursery crops always pose some toxicity challenges. (Du Jardin, 2012). This is why this research work focused on the use of plant extracts which modern researchers have discovered to possess bio-stimulant, bio-fertilizer and bio-pesticide abilities. *Moringa oleifera, Chromoleana odorata and Vernonia amagdalina*extracts were used for the experiment as sources of nutrients.

MATERIALS AND METHODS

Experimental Materials:The Horticultural seeds (pepper seeds(NIHORT 47-4),garden egg seeds(Local best) and tomato seeds(Platinium)were bought from Rumuodomaya market in Obio/Akpo LGA of Rivers State.The plant extracts from (*Vernonia amygdalina* (Bitter leaf*), Chromolaena odorata (*Siam) *and Moringa oleifera (*Moringa)) were collected from nearby farms in Nnamdi Azikiwe University, Awka,

Experimental Materials Preparation: About 60 grams of bitter leaf ,moringa and siam leaves were each macerated in 120 ml of clean water and the crude extract was filtered and applied at equivalent of $10m/m^2$ (Fabunmi and Awe,2019).The extracts served as sources of plant nutrients, growth hormones and biostimulants (phytochemicals). Except for the control plots, the extracts were applied in the Nursery trays soil a day before planting in order to check their impact on seed germination and emergence. Nursery trays were used for planting and river sand as planting medium.

Experimental Layout: The 3x3 complete randomized design experiments was replicated 3 times. Each seed tray contained 10x20 (200) holes and was divided into 3 partitions for the three test crops and 2 seeds were planted in each hole.

Data Collection Techniques: Percentage emergence was taking at 5,6 and 7 DAP(Days After Planting),plant height(cm) and leaf area(cm^2) were taking at 12,16,20,24 and 28 DAP with a flexible meter rule. Leaf area were estimated for the three crops(Mohammed and Krishnamurthy,2001).Number of leaves were counted manually while biomass were taking with Electronic weighing machine at the end of 32DAP.

Data Analysis: Data collected were subjected to statistical analysis using Genstat 12 editon. Data were subjected to ANOVA test and differences between means were determined at the 5% level of probability using Duncan's multiple range test.

RESULTS

Impact of plant extracts on the crops seed emergence (%)

Moringa leaf extract enhanced 50% emergence at 5 DAP. Emergence started from 6 DAPS in other extracts, on 7DAP virtually all the seeds have emerged in all the treatments (Table 1).

Table 1. Impact of plant extracts on the crops seed emergence (%)

	Days After Planting								
	5			**6**			**7**		
Plant extract	**tomato**	**Garden egg**	**pepper**	**Tomato**	**Garden egg**	**pepper**	**tomato**	**Garden egg**	**pepper**
Control	0	0	0	75	80	0	90	85	90
Siam	0	0	0	80	85	80	90	90	90
Moringa	50	50	30	90	90	85	95	95	95
Bitter leaf	0	0	0	85	85	85	95	90	95

Impact of plant extracts on nursery tomato plant height (cm)

Bitter leaf extract produced the highest plant height up till 20 DAP after planting, while moringa leaf extract took over from 24 to 28 DAP. The control had the least height. (Table 2).

Table.2. Impact of plant extracts on nursery tomato plant height (cm)

.Extracts	**12 DAP**	**16 DAP**	**20 DAP**	**24 DAP**	**28 DAP**
Control	2.067a	2.067a	2.50a	2.80a	3.0a
Siam	2.033a	2.033a	2.60a	3.70b	4.03b
Moringa	2.667b	2.607b	3.367b	4.60d	4.967d
Bitter leaf	2.867c	2.867b	3.40b	4.10c	4.40c
LSD	0.27	0.2766	0.22	0.35	0.354

Impact of plant extracts on nursery tomato plant height (cm).

Moringa leaf extract produced the tallest plant height at 28 DAP(4.9cm), followed by bitter leaf leaf extract (4.36cm). The control had the least height. (Table 3)

Table.3. Impact of plant extracts on garden egg nursery plant height (cm)

Extracts	12 DAP	16 DAP	20 DAP	24 DAP	8 DAP
Control	1.63a	2.50a	2.67a	2.83a	3.13a
Siam	2.30b	2.63a	3.30b	3.70b	4.03b
Moringa	2.27b	3.50b	3.670c	4.53d	4.96d
Bitter leaf	2.23b	3.40b	3.90b	4.13c	4.36c
LSD	0.764	0.22	0.448	0.41	0.50

Impact of plant extracts on nursery pepper plant height (cm).

Bitter leaf extract produced the highest plant height up till 28 DAP(3.5cm), followed by moringa leaf extract (3.4cm). The control had the least height. (Table 4.)

Table 4. Impact of plant extracts on nursery pepper plant height (cm)

Extracts	12 DAP	16 DAP	20 DAP	24 DAP	28 DAP
Control	0.967a	1.13a	1.60a	1.83a	2.16a
Siam	1.633a	2.033a	2.20a	3.00b	3.16b
Moringa	1.07b	1.53b	2.50b	3.20d	3.40d
Bitter leaf	1.86c	2.06b	2.53b	3.33c	3.50c
LSD	0.33	0.163	0.326	0.40	0.34

Impact of plant extracts on nursery tomato number of leaves.

Table 5. showed that the extracts had no effect on 16 DAP, moringa extract produced the highest number of leaves on 20,24 and 28 DAP followed by bitter leaf.

Table 5. Impact of plant extracts on nursery tomato number of leaves.

Extracts	16 DAP	20 DAP	24 DAP	28 DAP
Control	3	3a	4a	4.33a
Siam	3	3a	6c	6.0b
Moringa	3	4b	8d	8.0c
Bitter leaf	3	3.3a	5.33b	7.67c
LSD	-	0.57	0.57	0.75

Impact of plant extracts on nursery pepper number of leaves

Table 6. showed that the extracts had no effect on the tested crops leaf number till 24DAP,whensiam extract had the highest (3.67) At 28 DAP all the extracts had the same number of leaves except in control.

Table 6 Impact of plant extracts on garden egg nursery number of leaves.

Extract	16 DAP	20 DAP	24 DAP	28 DAP
Control	1.63a	3a	3a	3a
Siam	2.3a	3a	3.67b	4b
Moringa	2.27a	3a	3.33a	4b
Bitter leaf	2.23a	3a	3.0a	4b
LSD	-	-	0.3	0.3

Impact of plant extracts on nursery pepper number of leaves

Table 7 showed that the extracts had no effect on 16 DAP, moringa extract produced the highest number of leaves in 20,24 and 28 DAP followed by bitter leaf. Control was the least followed by siam extract.

Table 7. Impact of plant extracts on nursery pepper number of leaves

Extract	16 DAP	20 DAP	24 DAP	28 DAP
Control	3	3a	4a	4.33a
Siam	3	3a	6c	6.0b
Moringa	3	4b	8d	8.0c
Bitter leaf	3	3.3a	5.33b	7.67c
LSD	-	0.57	0.57	0.75

Impact of plant extracts on nursery tomato leaf area (cm^2)

Other than control, the extracts had the same significant effect on tomato leaf area on 16 DAP. On 28DAP moringa(8.0 cm^2) had the highest followed by bitter leaf (7.67 cm^2)and control (4.33 cm^2)was the least in Table 8.

Table 8. Impact of plant extracts on nursery tomato leaf area (cm^2)

Extract	16 DAP	20 DAP	24 DAP	28 DAP
Control	0.68a	0.757a	0.88a	4.33a
Siam	0.91b	0.95b	1.63c	6.0b
Moringa	0.86b	1.10c	1.55b	8.0d
Bitter leaf	0.86b	1.28d	2.06d	7.67c
LSD	0.048	0.0415	0.0268	0.75

Impact of plant extracts on garden egg nursery leaf area (cm^2).

The siam leaf extract produced the largest leaf area throughout the course of the work followed by moringa extract while the control was the least inTable 9.

Table 9. Impact of plant extracts on garden egg nursery leaf area (cm^2)

Extract	16 DAP	20 DAP	24 DAP	28 DAP
Control	1.54a	1.59a	1.63a	1.65a
Siam	1.54a	1.87b	2.75c	2.78d
Moringa	1.64a	1.75c	2.28b	2.44c
Bitter leaf	1.54	1.64d	1.87d	1.99b
LSD	0.011	0.017	0.045	0.012

Impact of plant extracts on nursery pepper leaf area (cm^2)

The bitter leaf extract produced the largest leaf area throughout the course of the work followed by siam extract while the control was the least.Table.10.

Table10. Impact of plant extracts on nursery pepper leaf area (cm^2)

Extract	16 DAP	20 DAP	24 DAP	28 DAP
Control	0.24a	0.45a	0.75a	0.98a
Siam	0.35b	0.93b	1.17c	1.38b
Moringa	0.40b	0.79c	1.04b	1.35d
Bitter leaf	0.44c	0.98d	1.31d	1.41c
LSD	0.048	0.028	0.0368	0.228

Impact of plant extracts on crops biomass (g).

Bitter leaf extract had the highest biomass (28.13g) on tomato plants, while siam leaf extract and moringa leaf extract had same biomass but significantly higher than control which was the least. The dry weight followed the same trend(Table 11).Bitter leaf extract also had the highest biomass(84.10g) on pepper plant, while siam leaf extract and moringa leaf extract had same biomass but significantly higher than control (14.10g)which was the least. The dry weight followed the same trend.Bitter leaf extract still had the

highest biomass (50.10g) on garden egg plants, followed by moringa leaf extract. The control (20.10g) was the least. The dry weight followed the same trend (Table.11).

Table 11.The Impact of plant extracts on crops biomass (g).

		Weight wet			Dry weight	
Plant extract	**Tomato (40seedlings**	**Garden egg (50 seedlings)**	**Pepper (70 seedlings)**	**Tomato (40 seedlings)**	**Garden egg (50 seedlings)**	**(pepper) (70 seedlings)**
Control	8.10[a]	20.10[a]	14.10[a]	0.97a	2.417a	1.69a
Siam	24.10b	45.10b	49.10b	2.89a	5.317b	5.68a
Moringa	24.10b	46.267c	50.10b	2.87a	5.423c	5.88a
Bitter leaf	28.13c	50.10d	84.10c	3.37d	6.10d	10.06d
LSD	0.0576	0.28	0.006	0.0057	0.0835	0.11

DISCUSSION

The Impacts of three crude plant extracts from moringa,siam and bitter leaf were tested on the growth parameters of three solanacea nurserycrops viz pepper,garden egg and tomato. Moringa leaves are potential source of vitamin A and C, iron, calcium, riboflavin, b-carotene, phenolics (Brown and Saa,2015) The effect of moringa leaf extract is analogous to synthetic hormonal effect because the extract contains zeatin, a purine adenine derivative of plant hormone group cytokines (Brown and Saa,2015).This hormones and other bio stimulants aid in seed germination and emergence. This result is in accordance with the work of Ana and Chaves (2019).

Throughout the course of the work bitter leaf extract poduced the biggest wet and dry bio masses, for tomato(28.13g and 3.37g),for pepper(84.10g and 10,0g) for garden egg(50.10g and 6.10g).Bitter leaf extract also produced the tallest plants followed by moringa extract.While leaf of the tested crops were significantly improved by the extracts leaf number seemed to be controlled genetically.Moringa leaves sampled from various parts of the world were found to have high zeatin concentrations of between 5 µg and 200 µg/g of leaves (Fuglie, 2000). Moringa leaf extract when sprayed onto leaves of onions, bell pepper, soyabeans, sorghum, coffee, tea, chilli, melon and maize was shown to increase yields of these crops (,Abd El-Mageed,*et al*.,2017). Phytochemical screening of siam (Usunobun and Okolie, 2016) showed the presence of flavonoids, saponins, alkaloids, tannins etc. Mineral analysis showed the richness of *Chromolaena odorata* leaves in calcium (487.40mg/100g), sodium (44.22mg/100g), potassium (96.91mg/100g), magnesium (116.70mg/100g), zinc (3.77mg/100g), iron (67.71mg/100g), phosphate (143.15mg/100g), (Usunobun and Okolie,2016). Bitter leaf contains different bioactive compounds including; flavonoids, saponins, alkaloids, tannins, phenolics, terpenes, steroidal glycosides, triterpenoids, and hormones [Quasie *et al*., 2016; Luo *et al*., 2017] and is also rich in Vitamin A, Vitamin C, Vitamin E, Vitamin B_1, and Vitamin B_2 and minerals (Okolie,*et al*.,2022).Plant extracts contain biostimulants, biopesticides, homones, vitamins and minerals that can promote plant growth (Adenuga *et al*.,2010)and increase plant response on stress (Du Jardin, 2012),.Generally,,these plant extracts are readily available, cheap and easy to prepare and apply. We therefore recommend the use of these extracts in raising nursery crops and growing crops in the field especially bitter leaf and moringa extracts which are environmentally friendly and sustainable.

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