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Influence Of Poultry Manure on The Management of Cucumber Mosaic Virus Disease on Okra Varieties Under Screenhouse Condition

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ABSTRACT
This study was to assess the influence of poultry manure application on the management of Cucumber mosaic virus disease on okra varieties in Dutsin-Ma, Katsina State under screenhouse conditions. The trial was conducted in the 2024 dry season at the Nursery, Department of Agronomy, Faculty of Agriculture, Federal University Dutsin-Ma. Three okra varieties (Clemson spineless, 'Kahon Balewa' and 'Yar Balla') and poultry manure were arranged in a completely randomised design (CRD) with four replicates. Seedlings were inoculated with the virus at the three-leaf stage, and 2.0 t/ha of poultry manure (PM) was applied by placement method at one-week post-inoculation (WPI) in the PM-treated pots, while no manure was applied on the control pots. Data was collected on disease incidence and severity, number of leaves per plant, plant height (cm), numbers of branches per plant, number of days to 50% flowering, number of pods per plant were also recorded on plant growth and subjected to analysis of variance (ANOVA) using the general linear model (PROC GLM) procedure of SAS (2008). The study shows a significance in poultry manure application in CMV management among the three okra cultivars tested this is therefore recommended to ameliorate the menace in okra production. Although, from the study, PM should be incorporated into soil two weeks before seed sowing to allow proper mineralization. This study can also be tried in the field for large okra production.

Keywords:
Clemson spineless,
Cucumber mosaic virus,
Okra, low fertility,
Yields.

INTRODUCTION

Vegetables are crop species that are not only good sources of essential vitamins and minerals (Bakhru, 2003), but they are also widely used as a complement to starchy staple foods. In Africa, vegetables constitute the fourth largest group of commodities produced for various uses. Okra (*Abelmoschus esculentus* L. Moench) also known as lady's finger, is a member of the family Malvaceae (Walker, 2012). It is cultivated in several parts of tropical and sub-tropical Africa (Saifullah and Rabbani, 2009). Okra is grown on subsistence and large-scale farms in West Africa, Iran, Turkey, many Asian countries and the southern United States.

Farmers usually harvest fruits at edible maturity to sell in the fresh market or dry fruit and partially processed for the market. It is rich in calcium and phosphorus, it also contains protein, carbohydrate, fibre and vitamins (Ogungbenle and Omosola, 2015).

Okra contains carbohydrates and vitamins (Dilruba *et al*., 2009), and plays a vital role in human diet (Kahlon *et al*., 2007, Saifullah and Rabbani, 2009). Mainly, the immature leaves are sometimes used for soup making and flavouring or may be added to salads and stews. Consumption of young immature okra pods is important as fresh fruits, and it can be consumed in different forms (Ndunguru and Rajabu, 2004).

The major limiting factor for its cultivation is the incidence of viruses, *Cucumber mosaic virus* (CMV) which is transmitted by whitefly (Bemisia tabaci Gen.) (Balogun *et al*., 2007). This disease is caused by a complex consisting of the monopartite begomovirus, *Cucumber mosaic virus* (family: Geminiviridae) and a small satellite DNA β component (Ndunguru and Rajabu 2004). This disease and its insect vector cause heavy losses to okra by affecting the quality and yield of the fruits.

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Infection of 100% plants in a field is quite common and yield losses range from 50 to 94% depending on the stage of crop growth at which infection occurs (Sastry and Singh, 2022). The initial symptom on young leaves is a diffuse, mottled appearance. Older leaves have irregular yellow interveinal areas. Clearing of the small veins starts near the leaf margins, at various points, about 15 to 20 days after infection. Thereafter, the vein clearing develops into a vein chlorosis. As reported by Ndunguru and Rajabu (2004), the newly developed leaves exhibit an interwoven network of yellow vein, which enclose the green patches of the leaf. Fruits developing on infected plants have irregular yellow areas which follow a longitudinal alignment. Due to heavy infestation the fruits become malformed and reduced in size (Salaudeen, 2016) mostly yellow, small, tough and fibrous. If plants are infected within 20 days after germination, their growth is retarded; few leaves and fruits are formed (Sastry and Singh, 2022). The extent of damage declines with delay in infection of the pathogens. Plants infected 50 and 65 days after germination suffer a loss of 84 and 49%, respectively (Khan *et al.*, 2010).

Soil fertility influences the incidence and spread of many plant pathogens and can be manipulated to facilitate the control of some fungal, bacterial and viral diseases (Horst, 1990). The incidence of some fungal and bacterial diseases is considerably reduced by increased soil fertility, whereas for others it is increased (Khan *et al.*, 2010).). However, Alegbejo (2001) reported that the incidence and severity of viral diseases is enhanced by increased level of plant nutrition. Studies had shown that incidence of cassava mosaic virus disease (CMVD) which is caused by whitefly-borne virus can be managed by reduction in the application of nitrogen fertilizer and an increase of potassium (Ndunguru and Rajabu 2004). Also, Saifullah and Rabbani (2009) suggest the application of a balanced NPK fertilizer to okra varieties susceptible to Okra mosaic virus infected plants to ameliorate the disease.

In the Sudan savannah, it has been generally observed that areas (Southern and Eastern Katsina) mostly severely affected by viral diseases in the early year of the recent virus disease epidemic are generally characterized by soil of low fertility and consistently low rainfall (Alegbejo, 2001). It is not clear however whether this low soil fertility enhances the epidemic. Infection may be reduced through insecticide application to suppress aphid population but the most effective strategy is the cultivation of resistant or tolerant varieties. Results obtained from this study will be a source of guidance to large-scale okra producers, researchers and policy makers on how this menace can be identified and managed, also, it will guide producers on the appropriate cultural practices and okra cultivars to be adopted to improve productivity. The broad objective of the study was to assess the influence of poultry manure application on the management of Cucumber mosaic virus disease on okra varieties in Dutsin-Ma, Katsina State under screenhouse conditions.

MATERIALS AND METHODS

The trial was conducted in 2024 dry session at the Nursery, Department of Agronomy, Faculty of Agriculture, Federal University Dutsin-Ma (12°26'N and 07°29'E and 212 m above sea level), Nigeria. The vegetation of the area is the Sudan Savanna type which combines the characteristics of both the Guinea and Sahel Savanna (Abaje *et al*., 2014).

Sources of okra seeds and CMV isolates

Three okra varieties (Clemson spineless, ‘Kahon Balewa’ and ‘Yar Balla’) were obtained from a reputable Agro-based Shop at Dutsin-Ma, Katsina State, Nigeria and the CMV isolate was obtained from the stock at the Department of Crop Protection Laboratory, Federal University Dutsin Ma, Katsina State, Nigeria.

Treatments, Experimental Design, Sowing and Sap inoculation

The three okra varieties (Clemson spineless, ‘Kahon Balewa’ and ‘Yar Balla’) and poultry manure were arranged in completely randomised design (CRD) with four replicates. Seeds were sown in 23-cm-diameter polythene bags filled with heat-sterilized loamy soil. Uninoculated control plants of each cultivar was established.

At the time of inoculation, the virus was recovered from the dehydrated leaf tissue by grinding in extraction buffer, pH 7.2 (0.1M sodium phosphate dibasic, 0.1M potassium phosphate monobasic, 0.01M ethylene diamine tetra acetic acid and 0.001M L-cysteine per litre of distilled water). A drop of 2-mercapto ethanol (β- mercapto ethanol) was added to the buffer just before inoculation. Seedlings were inoculated with the virus at the three-leaf-stage (10 days after sowing) by rubbing the upper surface of Carborundum-dusted (600 mesh) leaves with the sap. Excess inoculum was washed off with distilled water and the plants were observed daily for symptoms expression. Plants were sprayed weekly with an insecticide (Cypermethrin 10% E.C.) to avoid re-infection. Application of 2.0 t/ha of poultry manure was done by placement method at one-week post inoculation (WPI) in the PM treated pots, while no fertilizer was applied on the control pots.

Data Collection

Disease severity was assessed as percentage of leaf area exhibiting virus symptoms according to the rating scale of Salaudeen, (2016), where: 1 = no symptoms (apparently healthy plant); 2 = slightly mosaic leaves (10 – 30 %); 3 = mosaic (31 – 50 %) and leaf distortion; 4 = severe mosaic (51 – 70 %), leaf distortion and stunting; 5

= severe mosaic (>70 %), stunting and death of plants while disease incidence was expressed as percentage of plants showing typical symptoms of infection and will be recorded for the first 2 WAI. Also, three plants were tagged for the collection of growth parameters such as number of leaves per plant, plant height (cm), numbers of branches per plant, number of days to 50% flowering, number of pods per plant. Data collected was subjected to analysis of variance (ANOVA) using the general linear model (PROC GLM) procedure of SAS (2008). Where *F* test is significant (p<0.05) means were separated using the Least Significant Difference (LSD).

RESULTS AND DISCUSSION

Soils physical and chemical properties of the experimental sites

The result of physical and chemical analysis of the soil obtained from the experimental site (Table 1) revealed that the soil has a Sandy loam textural class that was slightly acidic in nature. It has a low Nitrogen content with moderate content of Organic carbon as well as available phosphorus. There was a low content of exchangeable bases that led to a low cation exchange capacity. Furthermore, it showed the result of poultry manure (PM) analysis carried out on the poultry droppings used during the course of this trial. It revealed that a high Nitrogen with a moderate phosphorus content as well as low amounts of exchangeable bases were obtained from the poultry manure used in this experiment.

Table 1: Physical and chemical properties of the soil and poultry manure at the experimental site during 2024 dry season

Soil depth (0-30cm)		
Location	**Soil**	**Poultry manure**
Soil Characteristic		
Particle Size Distribution (%)		
Sand (g/kg^{-1})	530	
Silt (g/kg^{-1})	270	
Clay (g/kg^{-1})	200	
Textural Class	Sandy loam	
Chemical Composition		
pH in H_2O (1:2.5)	6.52	
Organic Carbon (g kg^{-1})	17.80	
Total Nitrogen (g kg^{-1})	2.10	10.89
Available Phosphorous (ppm)	15.10	6.25
Calcium (Ca)	3.45	4.10
Magnesium (Mg)	0.76	3.18
Potassium (K)	0.35	4.29
Sodium (Na)	0.23	
CEC (Cmol kg^{-1})	5.09	

Influence of poultry manure application on disease incidence and severity on CMV infected okra cultivars at Dutsin ma during the 2024 dry season

Table 2 showed the influence of poultry manure application on disease incidence and severity on CMV infected okra cultivars at Dutsin ma during the 2024 dry season. The result displayed a significant difference among the PM-treated okra crops as compared to the untreated plants, it shows that disease incidence was significantly highest in the PM-untreated okra cultivars. Among the PM-treated cultivars, 'Kahon Balewa' recorded the lowest in disease incidence (30%) at 2 WPI whereas the highest in disease incidence was from 'Yar Balla' cultivar. Similar trend was observed at 6 WPI where same PM-treated 'Yar Balla' cultivar had the highest disease incidence of 50% and the lowest was found in PM-treated 'Kahon Balewa' (35%) whereas the untreated plants had a disease incidence at the range of 70 and 80%.

At 2WPI, there was significant difference among the PM-treated okra plants on disease severity where the untreated crops displayed highest severity within the range of 3.0

and 3.5 as compared to the PM-treated plants that ranges between 1.5 and 2.0 across the cultivars tested. Disease severity score was significantly highest in PM-treated Clemen spineless and 'Yar Balewa' cultivars whereas the least in disease severity was recorded from the 'Kahon Balewa' cultivar. At 6 WPI, plots which received PM had least disease severity while the untreated plants gave the highest. PM-treated 'Kahon Balewa' plants consistently had lowest disease severity scores as compared to all cultivars tested.

Table 2: Influence of poultry manure on disease incidence and severity on CMV infected okra cultivars at Dutsin ma during the 2024 dry season

		Disease Incidence				Disease severity		
		2 WPI	4 WPI	6 WPI		2 WPI	4 WPI	6 WPI
Clemson spineless	PM treated	45b	40b	40b		2.0b	2.5b	2.5b
	Untreated	60a	70a	80a		3.5a	4.0a	4.5a
	SE	0.231	0.091	0.212		0.210	0.127	0.018
Kahon Balewa'	PM treated	30b	30b	35b		1.5b	2.0b	2.0b
	Untreated	50a	60a	70a		3.0a	3.5a	4.0a
	SE	0.119	0.098	0.102		0.089	0.102	0.126
'Yar Balla'	PM treated	50b	55b	50b		2.0b	2.5b	2.5b
	Untreated	65a	70a	80a		3.5b	4.0a	4.0a
	SE	0.003	0.231	0.210		0.210	0.281	0.104

Means followed by same letter within the same column for each parameter are not significantly different according to Least Significant Difference (LSD) at *p*=0.05

Influence of poultry manure application on plant height and number of leaves on CMV infected okra cultivars at Dutsin ma during the 2024 dry season

The influence of PM application on plant height and number of leaves on CMV infected okra cultivars at Dutsin ma during the 2024 dry season is shown on Table 3. There was significant difference between the PM-treated and un-treated plants. Among the PM-treated okra crops 'Yar Balla' cultivar produced the tallest plants (28.3cm) whereas the least in plant height was recorded from the un-treated Clemen spineless cultivar at 2 WPI. Similarly, same 'Yar Balla' cultivar also produced the highest plant height, although similar to Clemson Spineless cultivar and the lowest was found in 'Kahon Balewa' at 6 WPI.

Result on number of leaves per plant shows a significant difference among the tested treatments on okra plants. Throughout the study period, number of leaves was significantly highest in the PM treated Clemen spineless cultivar, this was closely followed by 'Kahon Balewa' and the least was recorded from 'Yar Balla' cultivar

Table 3: Influence of poultry manure on plant height and number of leaves on CMV infected okra cultivars at Dutsin ma during the 2024 dry season

		Plant height (cm)				Number of leaves		
		2 WPI	4 WPI	6 WPI		2 WPI	4 WPI	6 WPI
Clemson spineless	PM treated	19.4a	22.5a	35.6a		6a	8a	15a
	Untreated	14.6b	16.3b	20.1b		4b	4b	6b
	SE	0.228	0.217	0.673		0.109	0.113	0.121
Kahon Balewa'	PM treated	18.2a	24.4a	33.4a		5a	7a	12.0b
	Untreated	13.2b	17.3b	22.9b		3b	4b11a	7b
	SE	0.126	0.210	0.182		0.211	0.112	0.107
'Yar Balla'	PM treated	28.3a	33.2a	35.6a		5	8a	10a
	Untreated	17.3b	20.3b	24.2b		4	6b	7b
	SE	0.172	0.18	0.210		0.111	0.101	0.114

Means followed by same letter within the same column for each parameter are not significantly different according to Least Significant Difference (LSD) at *p*=0.05

Influence of poultry manure application on yield components on CMV infected okra cultivars

The influence of poultry manure application on yield components of CMV infected okra cultivars at Dutsin ma during the 2024 dry season is shown in Table 4. There was significant difference among the PM-treated okra plant in number of branches produced as compared to the untreated okra plants. At 6 WPI, all the PM treated okra cultivars had similar number of branches whereas the untreated okra cultivars had no branches.

PM-treated okra crops had significant influence, where Clemenson spineless flowered early at 28 days, this was followed by Kahon Balewa' at 29 days after planting whereas the untreated cultivars had delayed flowering which ranged between 34 and 38 days after planting.

Same PM-treated Clemson spineless cultivar which flowered early produced the highest number of pods (12) followed by 'Yar Balla' (11) and the lowest was found in 'Kahon Balewa' (10) whereas their counterparts from the untreated plots had fewer pods ranging from 6 and 7. More so, a significant difference was recorded on okra pod yield between the PM-treated and untreated okra plants across the cultivars tested where the PM-treated plots gave the highest pod yield as compared to the untreated plots. Also, PM-treated Clemson spineless gave the highest yield of 1201.2 kg/ha, this was followed by 'Kahon Balewa' (1009.3 kg/ha) whereas the untreated cultivars had pod yields between 320.0 – 349.3kg/ha.

Table 4: Influence of poultry manure on yield components on CMV infected okra cultivars

		Number of branches				Days to	Number	Pod	
		2 WPI	4 WPI	6 WPI		50% flow.	Pods	yield (kg)	
Clemson spineless	PM treated	2a	2a	3a		28b	12a	1201.2a	
	Untreated	0b	0b	1b		34a	7b	349.3b	
	SE	0.028	0.017	0.009		0.19	0.091	0.21	
Kahon Balewa'	PM treated	2a	3a	3a		29b	10a	1009.3a	
	Untreated	0b	0b	0b		36a	4b	320.1b	
	SE	0.002	0.023	0.0148		0.021	0.21	0.118	
'Yar Balla'	PM treated	2a	2a	3a		32b	11a	972.4a	
	Untreated	0b	0b	1b		38a	4b	341.2b	
	SE	0.028	0.017	0.009		0.19	0.102	0.291	

Means followed by same letter within the same column for each parameter are not significantly different according to Least Significant Difference (LSD) at *p*=0.05

Cucumber mosaic virus is one of the major viruses limiting the productivity majorly cultivated annual crops in the tropics including okra, although the adoption of resistant cultivars has been recommended as the best option (Salaudeen, 2016). Because of the economic importance of okra, research has been intensified to ensure adequate plant protection and maximum yield. The inability of all CMV-infected okra plants to prevent symptom expression indicated that none of them was immune to the virus. Host plant immunity is the highest level of resistance which is recognized as the absence of symptoms after inoculation. However, the fact that the intensity of symptoms differed significantly among the infected okra plants revealed that the pathogenicity of the virus was cultivar dependent (Alegbejo, 2001). The Clemson spineless cultivar in which symptom expression was mildest probably contained CMV-resistant gene (s) and the same reason may hold for 'Kahon Barewa' which exhibited moderate level of resistance. Moreover, the results obtained revealed that even though the CMV-inoculated plants permitted systemic spread of the virus multiplication and symptom severity was suppressed (Ahmed *et al*., 2022), suggesting that resistance to CMV was under the influence of two or more genes.

The susceptible cultivar was the most vulnerable possibly due to absence of CMV resistant genes. Growth and yield attributes decreased drastically in CMV-infected okra cultivars owing to their poor genetic architectural (Apalowo *et al*, 2022). The magnitude of reductions in such okra cultivars revealed the level of CMV pathogenicity on them. This corroborates the findings of Fajinmi, and Fajinm (2010) when some cowpea varieties were infected with CMV. Some of the severely infected plants were stunted as a result of short internodes induced by the virus. This is consistent with the findings of Ahmed *et al*. (2022). Although none of the cultivars exhibited consistent low reduction in the evaluated parameters, PM-treated Clemson spineless which produced the highest pod numbers could be described as the most promising. Pod numbers, are an important yield component because of its direct relationship with the total output. Reduction in pod numbers, was the highest in diseased plants of 'Yar Balla' probably due to the carryover effects of high reductions in number of branches per plant.

A general increase in plant attributes was observed during its growth with poultry manure application as compared to the untreated plots. Many studies conducted elsewhere using different plants have reported similar results. According to Zhang *et al*. (2012), organic manure such as animal droppings improves the soil chemical, physical and biological properties that improves the infected crops immunity, which probably occurred in the present study, the author also reported poultry manure to improve soil physical properties such as aggregation, aeration, bulk density, water retention, and plant nutrients. More so, the significant increases observed on pod yield per plant could be attributed to the ability of the poultry manure to increase the organic matter (OM) content of the soil and in turn releases the plant nutrients in an available form for the use of the crop. Furthermore, this could also be attributed to the ability of the animal manure in building better soil structure because of its high organic matter and hence, more moisture retention.

To manage this disease, include useful techniques that vegetable producers are urged to follow. Crop rotation is one simple and effective technique that is highly recommended simply because it provides a mechanism that separates viable spores in crop residue from the newly emerging seedlings. A second technique that okra producers are urged to consider is to fertilize each of the different cultivars properly through appropriate organic manure. Overuse of nitrogen fertilizer, by farmers in the study area increases the amount of viral pathogens in their fields while often failing to significantly increase yields (Akintoye *et al.*, 2011). Finally, using high-quality and disease-free seed is always highly recommended because infested seeds left on the soil surface provide inoculum from which epidemics develop (Agrios, 2005).

CONCLUSION

Plant nutrition is a critical component of virus disease management for optimal yields in okra cultivation. The study shows a significance in poultry manure application in CMV management among the three okra cultivars tested, this is therefore recommended to ameliorate the menace in okra production. Although, from the study, it should be incorporated in soil two weeks before seed sowing to allow proper decay. Proper farm sanitation is also recommended. This study can also be tried in the field for large okra production on varying poultry manure application rates.

REFERENCE

Abaje, I. B., Sawa, B. A. and Ati, O. F. (2014). Climate Variability and Change, Impacts and Adaptation Strategies in Dutsin-Ma Local Government Area of Katsina State, Nigeria. *Journal of Geography and Geology*. 6, (2) 103-112.

Agrios, G.N. (2005). Plant Pathology, Fifth Edition. Elsevier Academic Publishers. Amsterdam.

Ahmed, A. A., Ladan M. K. and Mohammed A. G. (2022). Effect of yellow vein mosaic virus disease of okra on growth and proximate analysis of some okra cultivars in Dutsin-ma. FUDMA Journal of Agriculture and Agricultural Technology. 8(1) 244-250.

Akintoye, H. A., Adebayo, A. G., and Aina, O. O. (2011). Growth and yield response of okra intercropped with live mulches. Asian Journals of Agricultural Research 5: 146-153.

Alegbejo, M. D, (2001). Reaction of okra cultivars screened for resistance to okra mosaic virus in Samaru, Northern Guinea Savanna, Nigeria. *J. Sustain. Agric. Environ*. 3:315-320.

Apalowo, O.A., Adediji, A.O., Balogun, O.S., Fakolujo, T.I., Archibong, J.M., Izuogu, N.B., Abdelgawad, M.A., Ghonei, M.M., Mustapha, S., Mostafa-Hedeab, G., Batiha, G.E., and Atiri, G.I. (2022). Genetic structure of cucumber mosaic virus from natural hosts in Nigeria reveals high diversity and occurrence of putative recombinant strains. *Frontiers in Microbiology,* 13: 753054.

Bakhru H.K. (2003). *Foods that heal. The natural way to good health.* Orient Paperbacks, Delhi, pp 82-90 Central Bank of Nigeria (CBN) (1996) Annual report and statement of account, Nigeria

Balogun, O. S., Bakare, R. A. and Babatola, J. O. (2007). Evaluation of the pathogenic responses of some okra lines to Cucumber mosaic virus. *Journal of Agricultural Research and Development,* 6: 63-73.

Dilruba, S., Hasanuzzaman, M., Karim, R., and Nahar, K. (2009). Yield response of okra to different sowing time and application of growth hormones. *J. Horticultural Science and Ornamental Plants* 1: 10-14.

Fajinmi, A. A, Fajinmi, O. B. (2010). Incidence of okra mosaic virus at different growth stages of okra plants (Abelmoschus esculentus L. Moench) under tropical condition. *Journal of General and Molecular Virology*. 2(1):028-031.

Kahlon, T. S., Chapman, M. H., and Smith, G. E. (2007). In vitro binding of bile acids by okra, beets, asparagus, eggplant, turnips, green beans, carrot and cauliflower. Food Chemistry. 103:676–80.

Khah, E.M., Petropoulos, S.A. and Passou, H.C. (2010). Okra seed production and quality in relation to pod maturity at harvest. http://www.ihc2010.org/eposters/posters/Poster_705.swf

Ndunguru, J., and Rajabu, AC. (2004). Effect of okra mosaic virus disease on the above-ground morphological yield components of okra in Tanzania. *Scienta Horticulturae*, 99: 225-235.

Ogungbenle H. N., Omosola S. M. (2015). The Comparative Assessment of Nutritive Values of Dry Nigerian Okra (Abelmoschus esculentus) Fruit and Oil. International *Journal of Food Science Engineering and Nutrition.* 5(1): 8-14

Saifullah, M. and Rabbani, M. G. (2014). Evaluation and Characterization of *Okra (Abelmoschus esculentus L. Moench*.) Genotypes. *SAARC J. Agri*., 7 (1), 92-99.

Salaudeen, M.T., Oluwatosin, O., and Gana, A.S. (2018). Reactions of commercial cultivars of okra, pepper, and tomato to cucumber mosaic virus disease. Agro-Science *Journal of Tropical Agriculture, Food, Environment and Extension*, 17(2): 27-36.

Salaudeen M.T. (2016). Growth and yield responses of some cowpea accessions to Cucumber mosaic virus infection. *Achieves of Agronomy and Soil Science*, 62, 289 – 298

Sastry, K. S, Singh, S. J. (1974). Effect of yellow vein mosaic virus infection on growth and yield of okra crop. *Indian Phytopathology*. 27: 295-297.

SAS (Statistical Analysis System) (2008). Statistical Analysis System SAS/STAT User's guide, ver. 9.2. SAS Institute Inc., Cary, N.C. Walker S.S. (2012). Okra gumbo and rice: The NewsCourier.http://portal.unesco.org/en/ev.php URL_ID=238&URL_DO=DO_TOPIC&URL_SECTION=201.html). Accessed on May 15, 2016