

Research Paper

Responses of Agronomic Parameters of Tomato Seedlings to pH Level and Shade

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This study was carried out to evaluate responses of tomato (*Lycopersicon esculentus*) seedlings to shade and different pH levels. The experiment was arranged in completely randomized design (CRD) of 4 replicates per treatment. Agronomic data such as plant height, number of leaf, stem girth, leaf area, fresh and dry weight of roots, shoots and chlorophyll contents of the tomatoes were determined. The data were subjected to analysis of variance (ANOVA) of statistical analysis system (SAS) Institute, 1999. Means

were separated by Duncan's Multiple Range test (DMRT) at $P < 0.05$. Results of the study revealed that highest tomato height (21.50 cm), number of leaf (24.52) and leaf area (3.59 cm²), fresh weight (5.67 kg), root dry weight (0.74 kg) and chlorophyll content (0.19) were recorded in tomato treated with pH 9 and shade.

Key words: Agronomic parameters, chlorophyll, pH level, tomato seedlings and shade.

INTRODUCTION

Tomato (*Lycopersicon esculentum*) is a fleshy vegetable used as daily diet of Nigerians. It is rich in nutritional constituents such as vitamins and minerals (Ojeniyi *et al.*, 2009; Babajide and Salami, 2012). Also, according to FAO 2002, Syed Ishtiaq *et al.*, 2015, tomato has a main role in human nutrition because of its rich source of lycopene, minerals and vitamins such as ascorbic acid and b-carotene which are anti-oxidants and promote good health (Wilcox *et al.*, 2013).

Tomato (*Lycopersicon esculentum*) has been reported useful in diverse aspects such medicine, food, cosmetics (Debjit *et al.*, 2012). Its consumption has recently been demonstrated to be beneficial to human health due to the presence of phytochemicals, powerful natural antioxidants and many other nutritional components needed for wellbeing of humans (Periago *et al.*, 2008; Palop *et al.*, 2010). The cultivation of tomatoes requires nutrients for growth and proper development of both the vegetative part and yields, few of those factors

are phosphorus, potassium, phosphorus and potassium and soil pH and environmental factors such as temperature, water, oxygen and sometimes light or darkness, viability of the seeds, seed variety and ecological condition of natural soil where the seeds are sown (Ojeniyi *et al.*, 2009). In order to increase the yield of the plant, promote food security, various factors affecting plant growth such as pH, shading and other abiotic characteristics and their various effects on plant growth need to be studied. However, this study was carried out to evaluate the effect of pH and shading on vegetative characteristics of *Lycopersicon esculentum* seedlings.

MATERIALS AND METHODS

Tomato (*Lycopersicon esculentum*) seeds were bought at Osiele market, Abeokuta, Ogun state, Nigeria. The

Table 1. Agronomic parameters of tomatoes plants under different pH levels

Treatments	Agronomic parameters			
	Plant height	Number of leaf	Stem girth	Leaf area
PH 3+ shade	10.96 ±0.014 ^e	13.53±0.09 ^d	0.33±.01 ^c	2.22±0.02 ^e
pH 5 + shade	15.17± 0.01 ^d	18.67±0.167 ^c	0.37±.01 ^c	2.43±0.01 ^d
pH 7 + shade	15.25± 0.12 ^c	18.51±0.25 ^c	0.40±.08 ^b	2.85±0.02 ^c
pH 9 +shade	21.50±0.08 ^a	24.52±0.08 ^a	0.58±0.01 ^a	3.59±0.01 ^a
Distilled water+ sun exposure (Control)	17.49±0.05 ^b	21.86±0.07 ^b	0.55±0.09 ^a	3.29±0.08 ^b

Means (±standard error) followed by the different superscripts (s) across columns are significantly different at ($p < 0.050$ level of probability using Duncan Multiple Range test (DMRT).

experiment was carried out in green house of Department Pure and Applied Botany, Federal University of Agriculture, Abeokuta.

Collection of soil sample

Loamy soil was collected from the fallowed *Tectonia grandis* plot, Federal University of Agriculture, Abeokuta. 5 g of the soil was weighed in to four beakers and the pH of the soil was determined using pH meter after which the pH was adjusted to pH 3, pH 5, pH 7 and pH 9. 20 ml distilled water was added, stirred and the pH meter was checked and adjusted using sodium hydroxide (NaOH) and diluted hydrochloric acid (HCl) until the desired pH was determined. Soil pH was poured into the soil packed into four buckets, mixed thoroughly and watered for five days.

The soil was begged into the polythene pots watered for 2 days and tomato seeds were planted in situ using 37 cm by 31 cm perforated black polythene bags filled with soil and watered.

After germination, the polythene bags were arranged in completely randomized design (CRD) of 4 replicates while the controls were treated with distilled water and paced under sun.

Each treatment was separated from the next by 0.5 m row spacing. The seedlings were thinned to four per polythene bag after emergence. The treated and control tomato seedlings were sampled at 4th week after planting. Agronomic parameters such as plant heights (cm), stem height (cm), leaf length (cm) were measured using meter rule while number of leaves of the treated and control plants were counted and girths of the tomatoes were measured using thread according to the method of (Nwaoguikpe, 2011). Also, dry and fresh weight of shoot and root and the chlorophyll content were also determined at the 8 week after planting according to the method of (Witham *et al.*, 1971) cited in Kadiri *et al* (2015).

Statistical Analysis

Data was subjected to analysis of variance (ANOVA) of SAS Institute, 1999 and separation of means by

Duncan's multiple ranges Test (DMRT) at $P < 0.05$. Results were represented in tables.

RESULTS AND DISCUSSION

Table 1 showed the responses of tomatoes to shade and different pH levels. Agronomic parameters such as plant height, number of leaf, stem girth and leaf area showed significant difference ($p < 0.05$) across the tomatoes treated with pH 3, pH 5, pH 7, pH 9 and control (pH 7 grown under sun).

Results revealed that at 4th week after planting tomato plants treated with pH 9 produced highest plant height (21.50 cm), number of leaf (24.52) and leaf area (3.59 cm²). This observation may suggest that tomato morphological parameters are influenced by pH 9 and that the tomato is a shade-loving plant. Hossein *et al.* (2011) and Craita and Tom, 2013 opined that salinity reduced tomato height and dry weight while increase in salinity and pH increased supply Na⁺ in tomato leaf. The observation that pH 9 produced significant effects on the tomato growth could be that the pH influenced the availability of nutrients to the plants. The ratio in uptake of anions and cations by plants may be responsible for the substantial observation recorded in tomato treated with pH 9 (Hossein *et al.*, 2011; Shahid and Moazzam, 2008; Nagarajan *et al.*, 2010; Scafaro *et al.*, 2010).

Also, the root fresh weight, root dry weight, shoot fresh weight, shoot dry weight and chlorophyll content varied significantly across the different levels of pH and shade under consideration (Table 2). Highest fresh weight (5.67 kg), root dry weight (0.74 kg) and chlorophyll content (0.19) were recorded at pH 9 while 1.15 kg and 0.43 kg were recorded in shoot fresh and dry weight of tomato treated with pH 7 raised under sun (control). This could be a clear indication that the agronomic parameters are influenced most by pH 9 followed by control. However, cultivation of the plant under shade with PH 9 is highly recommended. This observation concurs with the studies of Moniruzzaman *et al.* (2009); Govindaras and Lakshmanan, (2013) who postulated that Bangladhonia performed better in terms of fresh yield and quality under 25-50% shade condition. Also, findings on the effect of partial shade on growth and yield of tomato cultivars by

Table 2. Agronomic parameters of tomatoes plants grown of different pH levels four weeks after planting

Treatments	Agronomic parameters				
	Root FW (kg)	Root DW (kg)	Shoot FW (kg)	Shoot DW (kg)	Chlorophyll (milligram)
PH 3+ shade	0.89±0.01 ^e	0.69±.01 ^b	0.18±.02 ^e	0.13±0.011 ^c	0.13±0.07 ^b
pH 5 + shade	1.64±.02 ^c	0.15±.015 ^d	0.25±.012 ^c	0.18±0.057 ^b	0.14±0.04 ^b
pH 7 + shade	1.43±0.01 ^d	0.12±.08 ^d	0.22±.05 ^d	0.18±0.07 ^b	0.18±0.05 ^a
pH 9 +shade	5.67±0.03 ^a	0.74±0.07 ^a	1.15±0.02 ^a	0.43±0.02 ^a	0.19±0.02 ^a
Distilled water+ sun exposure (Control)	3.42±.01 ^b	0.46±0.01 ^c	0.79±0.08 ^b	0.20±0.08 ^b	0.13±0.08 ^b

Means (±standard error) followed by the different superscripts (s) across columns are significantly different at (p< 0.050 level of probability using Duncan Multiple Range test (DMRT).

Bushra *et al.*, 2012 and Nangare *et al.* (2015) revealed that partial shade produced maximum increase in plant height (101 cm) and average yield of (3.49 kg/plant) respectively.

Conclusion

The agronomic characters of tomato seedlings treated with pH 9 and shade performed better than others treatments therefore it is affirmed that pH 9 and shade influenced the growth of tomatoes better than other treatments hence the pH 9 and shady environment are recommended for cultivation of tomatoes.

AUTHORS` DECLARATION

We declare that this study is an original research by our research team and we agree to publish it in the Journal.

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