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Cucumber (*Cucumis sativus* L.) Evaluation at The Alcorn Experiment Station

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Abstract

A field experiment was used to evaluate seven cucumber lines (L-1 to L-7) for adaptation, vine growth, and yield potentials. Cucumber line adaptations were determined by the number of seeds germinated during the first 14 days from the date they were seeded in the field plots. Vine growth was a measure of such growth components as vine length, vine weight, plant vigor, and leaf area. Yield potentials were based on such yield components as fruit number, fruit weight, fruit size, fruit diameter, fruit length and fruit shape. Data on plant growth and yield and seed germination were analyzed by the analysis of variance and means were separated by the Least Significant Differences (LSD) test procedure. The relationships between cucumber fruit weights and plant growth and yield components were determined by their coefficient of correlation (T) values. The seed germination rate, vine growth and yield potentials varied with cucumber line. The relationship between cucumber weight and other growth and yield components was highly significant (d = 09615) for its relationship with fruit number, but nonsignificant for other parameters in this study. Differences in cucumber fruit sizes, cucumber diameter and cucumber length were not significant among the seven cucumber lines evaluated. Findings suggest that the cucumber lines will germinate in Memphis Silt Loam soil to grow to mature vines and marketable fruits.

Keywords: Cucumber lines, seed germination, vine growth, yield components, coefficients, correlation.

1.0 Introduction

Cucumber (*Cucumis sativus L.*) is a warm-season crop and susceptible to cold and frost damages. It is an important vegetable and one of the most popular members of the Cucurbitaceae family (Thoa, 1998). Extremely high temperatures may cause light green fruit color and bitterness in many cucumber varieties. It will grow well in any well-drained soil, and tolerant to a wide range of soil pH, especially at a soil pH range of 6.0 to 6.8 (Lynn *et al*., 2021). Conventional clean tillage methods can be used during soil preparation including deep ploughing, disking, and harrowing.

Cucumber is a widely cultivated plant for its fruits which are a rich source of minerals and vitamins, eaten fresh in salads as a supplement with other vegetables (Eifediyi and Remission, 2010). Production of condition need proper handling, especially when using organic manure (Peyvest *et al*., 2008 Abdelaziz, 2010). Fertile soils are used for the cultivation of cucumber since infertile soils result in bitter and misshapen fruits which are often rejected by consumers. Bush following has been an efficient, balanced, and efficient agricultural system for soil productivity and fertility in the tropics (Ayoola and Adeniran, 2006).

Inappropriate farming systems and poor agronomic management are responsible for low yield of cucumber. The quality/fertility status of soils is essential for growth and development for cucumber (Li *et al*., 2019). With good moisture and fertilizer management, optimum yield of cucumber might be attained. The conventiona

lirrigation methods including flooding irrigation, furrows irrigation and drip irrigation have been widely applied for a long time in cucumber cultivation because of their low cost or simple operation (Zhang *et al*., 2012., Fan *et al*., 2014). The integration application of inorganic and organic fertilizer or organic manures in cucumber production. (Zhang *et al*., 2014). An integrated pest management including pest monitoring, cultural method, host resistance, botanicals, biological control and judicious use of chemicals is recommended for cucumber pest control (Gerlin *et al*., 2001, Mahmood *et al*., 2010).

The immature cucumber fruits are used as salad and for pickling. The fruits and seeds possess cooling properties. It is very useful for natural diuretic and thus can serve as active drug for secreting and promoting the flow of urine. The fruit is used as an astringent and good for people suffering from constipation, jaundice, and indigestion, whereas the seed oil is used as antipyretic (Dawer *et al*.,2019). Even though cucumber is a rich source of important nutrients and bioactive compounds, it has been used not only as food but also in therapeutic medicine and beauty culture applications since ancient times (Dixit and Kar, 2010; Kapoor, 2001). Also cucumber is rich in moisture content and very low in calories (Mukherjee *et al*, 2013). Cucumber considered as vegetable crop is rich in polyphenolics and other phytochemicals (Uzuazokaro *et al*., 2018) that are known to possess multiple biological activities such as antioxidant, anti-carcinogenic, anti-hyaluroidase, anti-elastase, anti-diuretic, anti-microbial and analgesic activities (Nema *et al*., 2011).

Yields range from 1-3 pounds of fruit per plant per week during the peak harvest period. A normal harvest period of 12 weeks in a well-managed crop can yield a total of 20-25 pounds of fruit per plant (University of California, Davies, 2016). A healthy cucumber plant can be expected to produce 10 large cukes or 15 small ones within a harvest period of about three weeks (Barbara, 2016). Cucumber vine length, number of flowers, total number of fruits and number of nonmarketable fruits were in higher on the nonstaked treatment while staking results in a higher of marketable fruits, weight, length and diameter of fruits. The unpruned plants produced the highest total of fruits, marketable and nonmarketable fruits while the weight, length and diameter of fruits were highest on one stem pruning. Staking, pruning and their interaction had no significant effect on the number of days to 50% anthesis. (Ekwu and Utobo, 2010).

In the past decades, traditional breeding has played essential roles in cultivar innovation of cucumber. Some superior varieties with early maturity, high yield and high resistance have been developed through hybridization and mutagenesis (Feng et; 2020). This study was therefore designed to evaluate the growth and yield potential of seven cucumber lines in southwest Mississippi.

2.0 Materials and Methods

A field experiment was used to evaluate seven cucumber lines (L-1, L-2, L-3, L-4, L-5, L-6 and L-7) for germination, plant growth and yield potential at the Alcorn Experiment Station. Seeds from each line were seeded in separate rows 6.1m long and 1.1m wide at a within-row spacing of 30.48cm. The experimental cucumber lines were arranged in a Randomized Complete Block (RCB) experiment design with 4 replications (blocks) of each line. Two seeds were planted per hill, but were thinned to single plants per hill, one month after the initial seed germination. The data collections on seed germination were limited to the 14 days from the seeding date. The averages from the 4 replications were reported for each cucumber line evaluated.

Fertilizer application to 4 replications planted with each cucumber line was 0.91kg of 13N-13P-13K based on soil test result. Fertilizer was incorporated into the soil of row preparation. Moisture applications were by natural rainfall, and initial overheard sprinkler irrigation. Occasional hand weedings were for nutsedge control. Seed germination counts which began on April 9, 2008, were completed 14 days later and averages for each line reported. The growth

components evaluated included vine length, vine weight, plant vigor, leaf area, whereas the yield and yield components evaluated included fruit number, fruit weight, fruit size, fruit diameter, fruit length and fruit shape. The relationships between fruit weight and other growth and yield components were also determined. Data on growth and yield components were analyzed by the analysis variance and means separated by the Least Significance Difference (LSD) test, (Steele and Torrie, 1980). The coefficient of correlation (d) statistical procedure was used to determine the strength of the relationship between fruit weight with plant growth and yield components.

3.0 Results

The effects of agronomic practices on cucumber line seed germination, vine length, vine weight, plant vigor, and leaf area are reported in Table 1. In general, the average seed germination for each cucumber line was low. The average seed germination from seeding to the fourteenth day of final count was highest (6.0) for cucumber Line-6, and lowest (3.0) for cucumber Line-1, which was not significantly different from 3.3, and 4.0 reported for cucumber Line-7 and cucumber Line-2, respectively. Vine length was highest (225.0cm for cucumber line-5 but was not significantly different from 210.0 and 195.0 cm reported for cucumber Line-1, cucumber Line-2 and cucumber Line-3 respectively. The lowest length value (146.3 cm) was for cucumber Line-6, which was not significantly different from 176.8 cm reported for Line-7. Cucumber line weight was highest (0.68 kg) for cucumber Line-1, which was significantly different from 0.27 and 0.45 cm reported for cucumber line-6 and cucumber line-7 respectively. Usual ratings indicate that cucumber line-3 had excellent plant vigor, whereas others had very good plant vigor, except cucumber Line-7 with a good (3.0) plant vigor rating. The average leaf area per plant was highest (287.7 sq cm) for cucumber Line-1 but was not different from 279.5 sq cm reported for cucumber Line-4. The lowest leaf area value (249.6 sq cm) reported for cucumber line-5 was not different from 251.3, 254.5, and 257.5 sq cm were reported for cucumber Line-2, Line-7, and Line-6, respectively.

The effects of agronomic practices on cucumber fruit yield and yield components are reported in Table 2. The average number of cucumber fruits harvested from each replication for the two harvesting periods was highest (26.0) for cucumber Line-3, which was different from 25.8 and 23.3 reported for cucumber Line-1 and Line-6, respectively. Cucumber fruit weight was highest (7,360.44 Kg/A) for cucumber Line-1, which was different from 7049.61 Kg/A reported for cucumber Line-3. The lowest value (3,947.53 Kg/A) was for cucumber Line-7, which was different from 4090.52 Kg/A reported for cucumber Line-4. Fruit size was highest (0.46 Kg/fruit) for cucumber Line-1 but was not significantly different from the values reported for other cucumber line evaluated. The difference among values reported for fruit size, fruit diameter and fruit length for the cucumber lines evaluated were not significant. Visual fruit shape ratings showed the fruits were straight for cucumber L-6, L-7, L-1 and L-2, slightly curved for cucumber L-4 and highly curved for cucumber Line-5 and line-3.

The coefficient of correlation(r) between cucumber fruit weight and plant growth and yield components is reported in Table 3. These relationships were nonsignificantly positive except for the relationship with cucumber fruit number which was highly significant. (r = xx).

4.0 Discussions

The generally low seed germination values reported in this study could be due to unusually low soil temperature during the 1st two weeks in April when the daily germination counts were taken. The seeds were subjected to very low night temperatures during the two weeks when seed counts were taken. Lynn *et al*., (2021) suggested that cucumber planting in field plots should wait until soil temperatures are 60^0F or higher, regardless of the cultivar. The cucumber line vine weights were related to their lengths (210.0, 195.0, 190.0, 225.0, 146.3 and 176.3 cm) which were lower than 290.92, 415.28, and 553.3cm recorded with 220N:129P:125K fertilizer treatments (Dawer *et al*., 2019). The inappro-

Table 1. Cucumber Seed Germination and Plant Growth Components

Cucumber Line (L)	Seed Germination (No./Row)	Growth Components Vine Length (cm)	Vine Weight (key/Plant)	Plant Vigor (Visual)	Leaf Area (sq cm)
L-1	3.0[V]	210.0[W]	0.68[X]	2.0[Y]	287.7[Z]
L-2	4.0	195.0	0.54	2.5	251.3
L-3	4.5	195.0	0.59	1.8	266.8
L-4	4.5	190.0	0.59	2.3	279.5
L-5	4.5	225.0	0.64	2.5	249.6
L-6	6.0	146.3	0.27	2.0	257.5
L-7	3.3	176.8	0.45	3.0	254.5
Mean	**4.3**	**191.1**	**0.54**	**2.3**	**263.8**
L. S. D. 5%	**1.0**	**30.4**	**0.4**	**0.4**	**15.1**

[V]Average daily seed germinations, 14 days after seeding. [W]Average vine length per plant of 2nd harvest. [X]Average vine weight per plant at 2nd harvest. [Y]Plant visual ratings, where 1=excellent; 2=very good; 3=Good. [X]Average leaf area for each line at 2nd harvest.

Table 2. Cucumber Yield and Yield Components.

Cucumber Line (L)	Fruit Yield Per Block: Fruit Number	Fruit Weight (Kg/A)	Fruit Yield Component: Fruit Size Weight/Fruit (Kg/Fruit)	Fruit Diameter (cm)	Fruit Length (cm)	Fruit Shape (VR)
L-1	25.8	7360.44	0.46	5.6	21.9	2.0
L-2	19.8	4283.23	0.34	5.0	21.0	2.0
L-3	26.0	7049.61	0.38	5.4	23.9	5.0
L-4	17.3	4090.52	0.42	5.4	22.0	3.8
L-5	21.5	5582.50	0.45	5.6	23.1	5.0
L-6	23.3	6570.93	0.42	5.3	21.2	1.0
L-7	15.3	3947.53	0.45	5.8	22.5	1.0
Mean	21.3	5554.96	0.42	5.4	22.2	2.8
LSD, 5%	3.3	3108.29	NS	NS	NS	2.0

[U]Average fruit number per replication for 2 harvests. [V]Average fruit weight per replication for 2 harvests. [W]Average individual fruit weight for each cucumber line. [X]Average fruit girth for the 2 harvesting period. [Y]Plant fruit length per replication for 2 harvests. [Z]Visual fruit shape rating, where 1=straight; 3=slightly curved and 5=good.

Table 3. Coefficient of correlation (d) for cucumber yield (Fruit Weight) with plant growth and yield components

Yield And Growth Components	Correlation Values (T)	Significance[Y]
Seed Germination	0.6352	NS
Vine Length	0.0686	NS
Vine Weight	0.0987	NS
Fruit Size	0.0750	NS
Fruit Number	0.9615	**
Fruit Diameter	0.0571	NS

Y=Significance where NS=Nonsignificant, **=Highly Significant relationships between the variables.

priate study initiation time could be responsible for the generally lower vine and fruit productions compared to earlier studies by (Lynn *et al*., 2021) and (Dawer *et al*., 2019). They indicated that conventional clean tillage methods such as deep-plowing, disking, and harrowing used in soil preparation can enhance plant growth quality and fruity yield. The yield data indicates that the weights of harvested cucumber fruits depended on the number of cucumber fruits depended on the number of cucumber fruits harvested from each vine. This relationship had a highly significant correlation (d =0.9615). a normal harvest period of 12 weeks in a well-managed cucumber farm can yield a total of 20-25 lbs. of fruits per plant (UC, Davis. 2016). A healthy

cucumber plant can produce 10 large cukes or 15 small ones within a harvest period of about 3 weeks (Barbara, 2016) which are higher than the yield reported in this study.

5.0 Conclusion and Recommendations

Cucumber (Cucumis sativus. L.) through cucumber line (L-7) evaluated in this study can be grown in Memphis silt loam soil (Typic Hapludalf, silty, mixed, thermic) in Southwest Mississippi. However, the effects of agronomic practices used in their productions will vary in their seed germination, plant growth, plant yield and yield components. Since seed germination was low during the first two weeks in April, due to possible low soil temperatures at the time of seeding, delaying seeding until 4th week in April or 1st week in May is suggested for cucumber growers in Southwest Mississippi. The highly significant coefficient of correlation (d) between the fruit number and fruit weight (d = 0.9615), suggests that production of quality marketable fruits from each cucumber line will depend on the number of quality fruits produced. Cucumber Line-1, Line-3, and Line-6 which had highest values for fruit number and weight, highest for fruit length and curvature, and highest values for fruit size and diameter, respectively, are recommended for production in Southwest Mississippi compared Line-2, Line-4, Line-5, and Line-7, evaluated in this study.

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