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Original Research Article

Comparative Study of the Germination and Morphological Characteristics of Four Cucumber (*Cucumis sativus* L.) Genotypes in Keffi, Nasarawa State, Nigeria

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A b s t r a c t

A field trial for the evaluation of the rates of germination and morphological characteristics of four cucumber (*Cucumis sativus* L.) genotypes was conducted at Botanical Garden of the Department of Biological Sciences, Nasarawa State University, Keffi. Four cucumber genotypes were planted in a randomized complete block design (RCBD) with four replications. The germination percentage at 4 and 6 days after planting (DAP) were compared. There was no statistical difference ($p< 0.05$) between the rate of germination and the total fruit yield per pickling in all the treatments. Results revealed that variation in morphological traits did exist among genotypes, such as total fruit yield per pickling ranged from 385.7g in Nandini 732 F_1 to 190.5g in Marketmore, Nandini 732 F_1 had the highest total fruit yield per pickling and there was a significant difference ($p< 0.01$) in the percentage marketable fruit yield among the genotypes. Leaf area, fruit length (FL) fruit diameter (FD), and fruit number per node (FNN) have been identified as the main morphological traits for selecting best genotypes.

K e y w o r d s

Cucumber

Genotypes

Germination

Marketmore

Morphological characters

Nandini 732 F_1

Introduction

Seed germination has been defined as the sequences of complex processes that lead to the initiation of growth in the quiescent embryo in the seeds (Bewley, 1997). Hence the process incorporates those events that begin with the uptake of water by the quiescent dry seed and terminate with the elongation of the embryonic axis (Bewley and Black, 1994).

Cucumber (*Cucumis sativus* L.) belongs to the family Cucurbitaceae (Dutta, 1964), its production is still in the hands of peasant farmers in west Africa. In Nigeria, cucumber is mainly cultivated in the Northern parts of the country. Cucumber is stored to be one of the oldest vegetable crops, being grown for at least five thousand years (Shetty and Whener, 2002). It is the fourth most important vegetable crop after tomato, cabbage and onion. As a vegetable crop, *Cucumis sativus* has great economic importance (Plader et al., 2007).

Cucumbers have wide range of consumption uses cross–culturally. They are generally eaten fresh or picked and are particular important in the diet of the people living in Russia and east, and south east Asia, where they may also be served as fresh or cooked vegetables. When mature, the cucumber fruit is 90% water, its flavor and texture have made it popular for

use as a fresh addition to salads, as well as pickled and prepared in relishes (Thompson and Kelly, 1959). In India, the fruits are used in the preparation of chutney and curries. Cucumbers are also used in skin tonics and other beauty aids (Whitaker and Davis, 1962). Cucumber is good for diabetic patients as it contains low sugar and help in the burning of excess fat in the body (Wehner and Gunner, 2004).

The outer covering, that is, melanin or the epicarp of cucumber is used or mixed with pomade or cream to control oily or fatty face. It has been used in the production of large variety of cosmetics including fragrance, body lotions, shampoos and soaps (Wehner and Gunner, 2004). Cucumber is a thermophilic and frost susceptible horticultural crop usually cultivated in fields during spring – summer period (Bacci et al., 2006) or in green house in different seasons. The optimum temperature for germination of seeds is 26-28^{o}C, during growth and fructification, 18-30^{o}C, if the temperature is less than 20^{o}C. All stages of development are strongly decelerated, at temperatures less than 10^{o}C growth stops, and at 0^{o}C all plants perish.

Growth response can be expressed in various parameters of plant growth measurements. Some of these growth measurements parameters are the increment of the plant height, leaf area, branch length, shoot diameter. Moreover, parameters associated with yield include: leaf area, fruit number per node (FNN), fruit diameter (FD) and fruit length (FL). Leaf is an important plant organ that is associated with photosynthesis and evapotranspiration. Leaf area is an indicator of crop growth and productivity (Pyneet al., 2005). As a result of this, it has a great influence in final crop yield in productivity and total growth of the plant. For this reason better growth and larger yields in productivity of many plant species obtained was due to the existence of optimal leaf area that attached earlier in the season (Pyne et al., 2005).

Materials and methods

Experimental site

A field trial was conducted at the research farm of Plant Science and Biotechnology Unit, Department of Biological Sciences, Nasarawa State University, Keffi. Keffi is located on latitude 08° 50'N and longitude 07^{o} 52'E in the guinea savanna belt of Nigeria.

Experimental materials and design

Four cucumber genotypes (Table 1) were planted on the 20th May 2012. The experiment was carried out on a field with 82m × 96m (i.e., 7872 m^{2}) on a plot size of 3m × 3m of thirty-two (32) plants in each plot, which gave a total of one hundred and twenty-eight (128) plants. The experiment was laid out in a randomized complete block design (RCBD) with four replications. Weeding was done manually at four weeks after planting (WAP).

Table 1. Cucumber genotypes evaluated at Keffi, Nasarawa State, Nigeria.

Origin	Genotypes	Seeds colour
France	Marketer	Blue
France	Poinsett 76	Green
Italy	Nandini 732F$_1$,	Orange
Thailand	Marketmore	White

Data were collected on the following parameters; days to emergence, plant height, length of branch, branch number, shoot diameter, leaf length, leaf width, fruit diameter, fruit number per plant, fruit number per node, distance between internodes, fruit length, marketable and non-marketable genotypes.

Leaf area measurement

- **Method A** Non-destructive (indirect) method of measuring leaf area was estimated by measuring the width or length of plant parts (i.e. leaf width, length, number, branch length, branch number and branch height), width, length, number, branch length, branch number and branch height from each plot were separated into four different categories without cutting the plant and the mean was calculated for each plot (Pyne et al., 2005).
- **Method B** Destructive (direct) methods for measuring leaf area were restricted to the use of an automatic area integrating meter, which is classified as destructive (Pyne et al., 2005)
- **Method C** Percentage (marketable) yield (by weight). Each plot was harvested daily, if there was marketable fruit size in each plant, than the number and the weight of total fruit yield in each plot were calculated and recorded.

This was done for only the marketable fruits. Of all the methods described by Pyne et al. (2005), methods A and C were the most rapid. Method A was undertaken without cutting the plants and has been successfully

applied for various crops such as sorguhm, millet and sunflower (Pyne et al., 2005).

Data analysis

Analysis of variance (ANOVA) was done using statistical Analysis system program (SAS Institute, 1999). Morphological variations were conducted using the fisher's least significant Difference (FLSD).

Results and discussion

The germination percentage 4 and 6 days after planting (DAP) is presented in Table 2. It revealed that Nandini 732 F_1 had the lowest germination percentage (27.1%) 4 days after planting. Marketmore, Poinsett 76 and Marketer had 45.8%, 54.2% and 64.6% respectively. At 6 days after planting, Nandini 732F_1 had the lowest value (56.3%). The germination percentage of the other genotypes ranged from 72.9 to 81.3%.

Table 2. Means of germination percentage at 4 and 6 days after planting (DAP).

Genotype	4 DAP	6 DAP	Mean
Poinsett 76	54.2	81.3	67.75
Marketer	64.4	81.3	72.85
Marketmore	45.8	72.9	59.35
Nandini 732F_1	27.1	56.3	41.7

Nandini732 F_1 had the best yield with the total weight of 358.7g in all the harvest, followed by Poinsett 76 and Marketer with the total weight of 268.8g and 244.1g, whereas Marketmore had the least with the total weight of 190.5g (Table 3). Nandini732F_1, had the highest marketable fruits in all the harvest with the total weight of 89.7g marketable fruits, followed by Poinsett76 with 67.2g, Marketer had 61.0g and then Marketmore with 47.6g. The result of this research showed that there was no uniform germination and seedling establishment among the genotypes. This corroborates the findings of Adams et al. (1992).

Table 3. Morphological Characteristics of cucumber (*Cucumis sativus* L.) genotypes.

Genotype	Total fruit yield pickling (TFY) (g)	Fruit no. per picking (FNP)	Branch no. (PH) per plant (cm) (BP)	Plant height (cm) (PH)	Length of branch (cm) (LB)	Shoot diameter (SHD) (cm)	Leaf Length (LL) (cm)	Leaf width (LW) (cm)	Fruit diameter (FD) (cm)	Fruit no. per node (FNN)	Distance between internode (DN) (cm)	Fruit length (FL) (cm)
Poinsett 76	268.8	6.05	6.84	142.5	13.5	1.56	7.6	10.1	16.36	6.65	105.5	18.48
Marketer	244.1	4.21	3.71	107.0	11.2	1.22	5.7	9.5	16.46	4.21	98.40	18.35
Marketmore	190.5	3.48	2.91	68.5	5.5	1.16	5.1	7.5	16.15	3.48	78.25	16.70
Nandini732F_1	358.7	6.73	5.41	150	12.3	1.99	7.9	9.5	19.05	7.73	100.5	22.96
FLSD (0.05)	6.23	0.01	0.50	10.0	2.70	0.03	0.10	2.0	1.20	0.08	5.76	3.1

The results also revealed that Poinsett 76, Marketer and Marketmore had the high germination percentages but yet the total yield of their fruits were average whereas Nandini 732 F_1, that had the lowest germination percentage at both 4 and 6 days after planting (DAP) had the highest total fruit yield. The low germination percentage of Nandini 732 F_1 could have been as a result of environmental factors affecting the germination of seeds such as temperature, oxygen, water, seed dormancy and seed viability (Bell et al., 1995).

There was a slight variation for fruit number per pickling (FNP) among the genotypes. Genotypes with high total fruit yield (TFY) also showed high fruit number per pickling (FNP) with the exception of Marketmore, with low total fruit yield (TFY). With respect to the leaf area (leaf length and width) which is an indicator of crop growth and productivity, it was low in Marketmore as well as other parameters such as fruit length, fruit diameter and fruit number per node. Thus, germination had no effect on yield.

Conclusion

Growth is applied to quantitative changes that occur during development, and also seen as an irreversible change in the size of cell, organ, or whole plant. It is clear that traits such as fruit number per plant and fruit number per node are more important, than traits related to vegetative growth. However, the results did indicate that fruit number per plant (FNP) and fruit number per node (FNN) were the most important components of total

fruit yield (TFY) in cucumber. Distance of internodes had a broad variation that ranged from 105.5(cm) in Poinsett76 to 78.25 (cm) in Marketmore. Nandini732F_1 and Poinsett76 had the highest value of FNP and FNN, respectively. However, this study was carried out during the 2012 rainy season. It is necessarily that a similar study be conducted during dry season under irrigation in order to compare the results obtained during the different seasons.

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