**Performance of Cucumber (Cucumis spp*.)* as Influenced by Row Arrangement and Weeding Regime Grown in Intercrop with Okra (*Abelmoschus esculentus [L]*** [**Moench**](https://en.wikipedia.org/wiki/Conrad_Moench)***.)* in Sudan Savanna**

**ABSTRACT**

**Aims:** To evaluate the performance of cucumber in an okra-cucumber intercrop system under different row arrangements and weeding regimes in a Sudan Savanna region.

**Study Design:** The study employed a field experimental design.

**Place and Duration:** Field trials were conducted at the Teaching and Research Farm, Faculty of Agriculture, University of Maiduguri, Borno State, Nigeria, during the 2018 and 2019 rainy seasons.

**Methodology:** The experiment involved a factorial combination of three-row arrangements of okra and cucumber (1:1, 1:2, and 2:1) and four weeding regimes (W0, W1, W2, and WF), arranged in a split-plot design with three replications. Weeding regimes were assigned to the main plots, while row arrangements were allocated to the subplots. Cucumber performance was assessed based on parameters such as the number of fruits per plant, fruit length, fruit weight per plant, and fruit yield per hectare.

**Results:** The results showed that the number of fruits per plant, fruit weight per plant, and fruit yield per ha of cucumber were significantly greater at a 1:2 row arrangement than the other planting patterns used. Two weeding was found to be optimum for the number of fruits per plant, fruit length, fruit weight per plant, and fruit yield per ha of cucumber. The interaction combination of a 1:2 row arrangement combined with two weddings was optimum fruit yield per ha of cucumber.

**Conclusion:** Based on the results of the present study, a 1:2 row arrangement with two weddings should be adopted to produce cucumber in okra/cucumber intercrop in the Sudan Savanna agro-ecology

1. **INTRODUCTION**

Cucumber (*Cucumis spp.*) is believed to have originated in India, particularly at the southern foothills of the Himalayas, or possibly Burma, where the plant exhibits great variability in its vegetative and fruit characteristics. Cultivated for over 3,000 years, cucumber spread from India to China and was highly regarded by ancient Greeks and Romans. The Romans even used advanced cultivation methods to grow cucumbers year-round for Emperor Tiberius. Christopher Columbus introduced cucumbers to the New World, planting them in Haiti in 1494 and possibly on other Caribbean islands. Many modern cucumber varieties were already known by the 17th century, with current forms ranging from small, stubby fruits (7–10 cm) to the large English greenhouse varieties that can grow up to 60 cm long.

As of 2012, cucumber cultivation spanned approximately 2 million hectares worldwide, producing 36 million tons. Asia leads global production, with China alone accounting for over 60% of the total. In tropical Africa, cucumber is cultivated in all countries but on a relatively small scale. In 2002, Africa produced 507,000 tons on 25,000 hectares, contributing less than 1.5% of global production. Egypt is the largest producer in Africa, accounting for 360,000 tons. International trade in cucumbers in 2002 amounted to 1.5 million tons, with Mexico, the Netherlands, and Spain as the main exporters. African exports, however, remain modest and largely unrecorded.

Cucumber is rich in nutrients, containing potassium, vitamins K, C, and A, as well as phosphorus, manganese, magnesium, and pantothenic acid. It is low in sodium, cholesterol, and saturated fat. Consumed raw or cooked, cucumbers offer numerous health benefits, making them an essential part of both food and skincare diets. With over 90% water content, cucumbers act as a natural cooling agent. They help reduce swelling and dark circles under the eyes, soothe and soften the skin, and provide a refreshing, relaxing effect. Cucumbers are also an alternative to caffeine for combating fatigue, as they contain carbohydrates and B vitamins.

The high-water content gives cucumbers diuretic properties, aiding in the removal of waste materials and toxins from the body. They help eliminate uric acid, which benefits individuals with arthritis, and their fiber-rich skin, combined with potassium and magnesium, helps regulate blood pressure and supports overall nutrient functions. Magnesium in cucumbers also relaxes nerves and muscles, promoting healthy blood circulation. Additionally, cucumber juice contains a hormone that aids pancreatic cells in insulin production, offering potential benefits for diabetic patients. There should be references to similar trials on cucumber, okra interactions; and weed management. The introduction should also clearly state the aims and objectives of the work.

1. **MATERIALS AND METHODS**

Field experiments were conducted during the wet season of 2018 and 2019 at the Teaching and Research Farm, Department of Crop Production, Faculty of Agriculture, University of Maiduguri (Longitude 13°12' 36.02'' E and Latitude 11°48' 2.32'' N and on an altitude of 354 m above sea level). Maiduguri is in the Sudan Savannah region of Borno State, Nigeria under a semi-arid environment characterized by sparse vegetation with an average annual rainfall of 650mm, spanning 4-5 months (May – September). The average temperature is 28.50 C with relatively low humidity during the dry season and high humidity during the wet season. The soils are generally sandy loam. (Geographical Information System Laboratory “GIS Lab” Department of Geography, Faculty of Social and Management Science, University of Maiduguri).

The experiment consists of three (3) row arrangements (1:1, 1:2, 2:1) and four (4) weeding regimes (weedy check, hoe weeding once at 3 WAS, hoe weeding twice at 3 and 6 WAS, and weed-free). The sole crops of okra and cucumber were also included for the purpose of calculating land equivalent ratio (LER). The weeding regimes allocated to the main plots while the raw arrangements was allocated to the sub plots. The treatments were factorially combined and laid out in a Split Plot Design and replicated three times. There were total of 36 plots and each measuring 3.0 m x 4.5m (gross size of 13.5m2) while the net plots consist of the three (3) most central rows in each gross plot excluding boarder rows (6.75m2). Within the replicate block, rows were separated using 1m apart and 2m between each replicate block. The estimated land area used for the experiment was 0.11ha.

1. **RESULTS AND DISCUSSION**

The results of the analysis of soil samples taken from the experime3ntal sites are presented in Table The soil of the research site was coarsely textured and well-drained sandy loam at 0-15cm and 15-30cm depth, slightly acidic and low in organic carbon. The soil also has a low cation exchange capacity. Similarly, available phosphorus and Nitrogen were also low. This is in agreement with Rayer who reported that the Sudan savanna soils are low in nutrient status.

The effects of row arrangements and weeding regimes on number of fruits/plant of cucumber in 2018, 2019 and combined mean is presented in Table 2. There was significant effect of row arrangements on number of fruits/plant of cucumber in 2018, 2019 and combined mean. Throughout the period of observations in both the years and combined mean, 1:2 row arrangements produced significantly the highest number of fruits/plant while 2:1 row arrangements produced the least number of fruits/plant. Similarly, there was significant effect of weeding regimes on number of fruits/plant of cucumber in both the years and combined mean. The two weeding and weed free gave significantly higher number of fruits/plant in both years and combined mean than the other weeding regimes. However, two weeding was optimum for the number of fruits/plant.

There was significant interaction between row arrangements and weeding regimes on number of fruits/plant of cucumber in both years and combined means. In both years and combined mean, the 1:2 row arrangements with two weeding was optimum for number of fruits/plant of cucumber while 1:1 and 2:1 row arrangements with weedy check produced the least number of fruits/plant (Tables 3).

The effects of row arrangements and weeding regimes on fruits weight/plant of cucumber in 2018, 2019 and combined mean is presented in (Table 4). There was significant effect of row arrangements on fruits weight/plant of cucumber in both the years and combined mean. The 1:2 row arrangements produced the best fruits weight/plant of cucumber and the least fruits weight/plant was observed in 2:1 row arrangements in both the years and combined mean. There was significant effect of weeding regimes on fruits weight/plant of cucumber in both years and combined mean. Two weeding and Weed free produced the best fruits weight/plant. However, two weeding was optimum for fruits weight/plant of cucumber and the least was observed in weedy check.

The interaction between row arrangements and weeding regimes on fruits weight/plant of cucumber in 2018, 2019 and combined mean is shown in (Table 4). There was significant interaction between row arrangements and weeding regimes on fruits weight/plant of cucumber in both years and combined mean. Generally, the 1:2 row arrangements with two weeding and weed free produce the best fruit weight. Essentially, 1:2 with two weeding was optimum for fruit weight of cucumber. The least was observed in 2:1 row arrangements with weedy check (Tables 5).

**Table 1: Physico-chemical properties of the surface (0-15) and sub-surface (15-30) soil at the experimental site in Maiduguri during the 2018 and 2019 rainy season.**

**Soil properties 2018 2019**

**Particle size Distribution 0-15 15-30 0-15 15-30**

Sand g/kg 76.00 76.00 76.00 76.00

Silt g/kg 10.00 12.00 10.00 12.50

Clay g/kg 14.00 11.50 16.00 11.00

Textural class Sandy loam Sandy loam Sandy loam Sandy loam

**Chemical composition**

PH in water 6.27 6.27 6.28 6.26

Organic carbon 0.43 0.23 0.42 0.22

Total nitrogen 0.13 0.06 0.13 0.06

Available phosphorus (mg/kg) 3.15 4.90 3.15 3.14

Exchangeable cation (mg/kg)

K 0.61 0.47 0.61 0.46

Mg 0.60 0.40 0.60 0.41

Ca 1.20 1.00 1.20 1.01

Na 0.13 0.05 0.13 0.06

CEC 2.54 1.92 2.52 1.91

*Mg kg = Milligram per kilogram CEC = Cation Exchange Capacity*

**Table 2: Effect of row arrangements and weeding regimes on number of fruits/plant of cucumber in Maiduguri during 2018, 2019 rainy season and combine mean**

**Number of fruits/plants**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Treatment 2018 2019 Combined mean**

**Row arrangements (A)**

1:1 11.93b 11.65b 11.79b

1:2 13.27a 13.00a 13.14a

2:1 10.74c 10.38c 10.56c

SE ± 0.38 0.40 0.26

**Weeding regimes (B)**

Weedy Check 8.83c  8.40c  8.61c

1W 10.43b 9.91b  10.17b

2W 14.13a  13.84a 13.98a

WF 14.53a 14.57a  14.55a

SE ± 0.44 0.46 0.30

**Interaction**

**A X B** \* \* \*

Means followed by the same letter (s) in a column are not significantly different at P=0.05 level of probability using DMRT.

**Table 3: Interaction between row arrangements and weeding regimes on number of fruits/plant of cucumber in Maiduguri during 2018, 2019 rainy seasons and combined mean**

**Weeding regimes**

**Weedy Check 1W 2W WF**

**2018**

**Row arrangements**

**1:1** 8.00e9.00de 11.50c 14.63b

**1:2** 9.46de 10.13cd 17.63ab 18.63a

**2:1** 9.03de 9.16de 13.13b 13.63b

**SE ±** 0.77

**2019**

**Row arrangements**

**1:1** 8.03e8.30de 11.93c 13.80b

**1:2** 8.90de 9.96d 17.20ab 18.50a

**2:1** 8.26e 9.50de 12.73bc 13.06b

**SE ±** 0.80

**Combined Mean**

**Row arrangements**

**1:1** 8.01h8.65gh 12.53d 14.21c

**1:2** 9.18fg 10.05f 17.33ab 18.56a

**2:1** 8.65gh 9.33fg 12.11d 13.35cd

**SE ±** 0.53

Means having the same letters(s) are not statistically different at p =0.05 (DMRT)

The meaning of 1W, 2W and WF should be clearly stated by asterisk**.** They are not highlighted in the materials and methods and discussion of the manuscript.

**Table 4: Effect of row arrangements and weeding regimes on fruits weight/plants of cucumber in Maiduguri during 2018, 2019 rainy season and combine mean**

**Fruits weight/plants (kg)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Treatment 2018 2019 Combined mean**

**Row arrangements (A)**

1:1 2.93b  2.87b 2.90b

1:2 3.83a 3.67a 3.75a

2:1 2.23c 2.85c 2.54c

SE ± 0.49 0.68 0.53

**Weeding regimes (B)**

Weedy Check 1.86d 1.40d 1.63c

1W 2.66c 2.51c 2.58b

2W 4.89a 4.93a 4.91a

WF 4.95a 4.97a 4.96a

SE ± 0.11 0.14 0.12

**Interaction**

**A X B**  \* \* \*

Means followed by the same letter (s) in a column are not significantly different at P=0.05 level of probability using DMRT.

Same observation as in table 3

**Table 5: Interaction effect of row arrangements and weeding regimes on fruit weight/plants (kg) of cucumber in Maiduguri during 2018, 2019 rainy seasons and combined mean**

**Weeding regimes**

**Weedy Check 1W 2W WF**

**2018**

**Row arrangements**

**1:1** 1.7e 2.6d 3.0c 4.5ab

**1:2** 1.6e 2.4d 4.9ab 5.1a

**2:1** 1.1e 2.0d 3.3c 3.9b

**SE ±** 0.98

**2019**

**Row arrangements**

**1:1** 1.4e 2.4d 3.2c 4.6ab

**1:2** 1.6e 2.6d 4.4ab 4.9a

**2:1** 0.9e 2.2d 3.0c 3.9b

**SE ±** 0.88

**Combined Mean**

**Row arrangements**

**1:1** 1.5e 2.5d 3.1c 4.5ab

**1:2** 1.6e 2.5d 4.6ab 5.0a

**2:1** 1.0e 2.1d 3.3c 3.9b

**SE ±**  0.88

Means having the same letters(s) are not statistically different at p =0.05 (DMRT)

**Table 6: Effect of row arrangements and weeding regimes on fruits yield of cucumber in Maiduguri during 2018, 2019 rainy season and combine mean**

**Fruit yield (t/ha)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Treatment 2018 2019 Combined mean**

**Row arrangements (A)**

1:1 8.75b 9.32ab 9.03ab

1:2 9.38a 9.71a 9.54a

2:1 8.56b 8.39b 8.47b

SE ± 0.15 0.17 0.16

**Weeding regimes (B)**

Weedy Check 4.91d 5.52d 5.21d

1W 8.30c 7.60c  7.95c

2W 10.07a 10.51ab 10.29a

WF 10.31a 11.34a 10.82a

SE ± 0.17 0.19 0.18

**Interaction**

**AXB** \* \* \*

Means followed by the same letter (s) in a column are not significantly different at P=0.05 level of probability using DMRT

Same observation as in table 3

**Table 7: Interaction effect of row arrangements and weeding regimes on fruit yield (t/ha) of cucumber in Maiduguri during 2018, 2019 rainy season and combined mean**

**Weeding regimes**

**Weedy Check 1W 2W WF**

**2018**

**Row arrangements**

**1:1** 6.75ef7.56de 9.61b 10.30ab

**1:2** 7.07ef9.31c 10.21ab 11.21a

**2:1** 6.41f8.23d 9.94b 9.96b

**SE ±** 0.31

**2019**

**Row arrangements**

**1:1** 7.32de7.90d 9.63c 11.38ab

**1:2** 7.82de7.97d 11.38ab 12.16a

**2:1** 6.78e7.57de 10.47b 10.51b

**SE ±** 0.34

**Combined Mean**

**Row arrangements**

**1:1** 7.36de8.07d 10.38b 10.66ab

**1:2** 7.69d8.59d 11.06a 11.29a

**2:1** 6.60e7.20de 9.47b 10.46ab

**SE ±** 0.32

Means having the same letters(s) are not statistically different at p =0.05 (DMRT)

Same observation as in table 3

The effects of row arrangements and weeding regimes on fruit yield of cucumber in 2018, 2019 and combined mean is presented in (Table 6). There was significant effect of row arrangements on fruits yield of cucumber in 2018, 2019 and combined mean. Generally, 1:2 row arrangements produced significantly higher fruits yield than the other row arrangements in both years and combined mean. There was significant effect of weeding regimes on fruit yield in 2018, 2019 and combined mean. Weed free produced significantly higher fruit yield/ha and the least fruits yield was observed in weedy check. However, two weeding was optimum for the fruits yield/ha of cucumber in both the years and combined mean.

There was significant interaction between row arrangements and weeding regimes on fruits yield of cucumber in both years and combine mean (Table 6). In both the years and combined mean, the 1:2 row arrangements with two weeding and weed free produced the best fruits yield of cucumber. Essentially, 1:2 row arrangements with two weeding was optimum for yield of cucumber and the least fruits yield was observed in 2:1 row arrangements with weedy check (Tables 7).

**Conclusion**

Generally, from the result of the present study, the growing of okra and cucumber in mixture at the planting pattern of 1:2 row arrangements with two weeding appeared more advantageous. However, if a farmer is more interested in cucumber yield for maximum profit, he can maintain 1:2 row arrangements with two weeding.

We therefore, recommend the planting pattern of ratio 1:2 of a cucumber/okra intercrop and two weeding regime for optimum cucumber production in Sudan savanna region.

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