Applied Research in Science and Technology 6(1): 10–18 2026

Contents lists available at openscie.com
E-ISSN: 2776-7205
Applied Research in Science and Technology
DOI: 10.33292/areste.v6i1.140
Journal homepage: https://areste.org/index.php/oai

Optimizing Plant Spacing and Mulching for Enhanced Weed Control and Cucumber Yield (*Cucumis sativus*) under Varied Sowing Conditions

Janet Oliver Orji[1], Martin Ikechukwu Nwufo[2], Oyibo Patricia Onyewuchi[2], Cyril Ifeanyi Duruigbo[2], Angus Onwudiwe Ikeh[1], Edward Onuawuchi Nze[2], and Alice Nnenna Amanze[3]

[1] Department of Crop Science, Faculty of Agriculture, University of Agriculture and Environmental Sciences, Umuagwo, Imo State, Nigeria
[2] Department of Crop Science and Technology, Federal University of Technology Owerri, Imo State, Nigeria
[3] Department of Agricultural Extension, Faculty of Agriculture, University of Agriculture and Environmental Sciences, Umuagwo, Imo State, Nigeria

*Correspondence: E-mail: janet.orji@uaes.edu.ng

ARTICLE INFO

Article History:
Received 6 December 2025
Revised 13 February 2026
Accepted 23 February 2026
Published 2 May 2026

Keywords:
Black,
Cucumber,
Mulching,
Polythene,
Transparent,
Wood shaving.

ABSTRACT

Background: Weeds pose a significant challenge to crop farming, particularly in cucumber production in Nigeria. They compete with cucumber plants for essential resources such as water, nutrients, and sunlight, which can lead to reduced crop yields. They harbor insects and disease organisms, serve as alternate host to pests, and compete with crops for nutrients, moisture, light, and space. Weeds cause damage to crops, reduce the yield and quality by competing with the crops, and cause harm to animals that feed on them. The production of cucumber has increased in Nigeria due to its importance, but it is still in short supply because of poor yield, which could be attributed to weed infestation.
Aims: This study was conducted to investigate the impact of spacing and mulching on weed control and fruit quality of cucumber (*Cucumis sativus*) at various sowing dates in humid ecology**.**
Methods: The experiment was carried out using a split-split plot arrangement layout in a Randomized Complete Block Design. The treatments consisted of three factors (time of planting, spacing, and mulching). The main plot was sowing dates (April, May, June, July, August and September), the sub plot was spacing (20cm x 50cm, 40cm x 50cm and 60cm x 50cm), sub-sub plot was mulching (no mulch, black plastic mulch, transparent plastic mulch, wood shaving) all were replicated 3 times.
Result: The sowing date had a significant effect ($p<0.05$) on weed dry weight at 4 and 6 weeks after emergence. Sowing in April recorded the lowest weed dry weight (0.31g at 4 WAE and 0.79g at 6 WAE) in 2015 and (3.84g at 4 WAE; 3.16g at 6 WAE) in 2016. Cucumbers that were spaced at 20 cm x 50 cm recorded the lowest weed dry weight (8.53g at 4WAE and 4.60g at 6WAE) in 2015 and also in 2016 (10.36g at 4WAE and 5.33g at 6WAE). Black polythene recorded the lowest weed dry weight (2.87g at 4WAE; 1.79g at 6WAE) in 2015 and (2.95g at 4WAE and 1.88g at 6WAE) in 2016.
Conclusion: The study revealed that effective weed control and high fruit quality were achieved by sowing early in April and May at closer spacing, combined with black polythene mulching. These practices recorded the lowest weed dry weight, while early sowing also produced better fruit quality. Therefore, the

study recommends sowing early in April and May at closer spacing and using black polythene mulch for optimal cucumber production.

To cite this article: Orji, J.O., Nwufo, M. I. Onyewuchi, O. P., Duruigbo, C. I., Ikeh, A.O., Nze, E. O., and Amanze, A. N. (2026). Optimizing plant spacing and mulching for enhanced weed control and cucumber yield (*Cucumis sativus*) under varied sowing conditions. *Applied Research in Science and Technology*, 6(1), 10–18.

1. Introduction

Cucumber is an important vegetable in the tropics because of its nutritional value and health benefit; hence, it is in high demand all year round (Ikeh *et al,* 2012; Ikeh *et al,* 2025). The production of cucumber and other fruits and vegetables such as okra and tomatoes has increased in Nigeria due to its importance but it is still in short supply because of poor yield and the major factor that limits yield in cucumber production is weed infestation. Weed interference is a major problem in cucumber farming, leading to yield reductions of 45–95%. To avoid such losses, farmers predominantly rely on hand weeding and herbicide application. However, each of these weed control methods has its own limitations (Daramola, 2021).

Weeds are among the most significant pests that reduce crop productivity. Both weeds and crop plants require similar resources for growth and development: carbon dioxide and nitrogen from the atmosphere, water and minerals from the soil, and light from the sun. When weeds compete for these limited resources, they restrict crop growth and development, resulting in substantial yield losses (Esang *et al,* 2019). The extent of damage depends on factors such as weed type, population density, and the duration of weed crop interference (Daramola *et al.,* 2021).

Every crop has a critical period for weeding. The critical period of weed control (CPWC) in cucumber refers to the stage in the crop growth cycle during which weeds must be controlled to prevent quantitative and qualitative yield losses (Tursun *et al.,* 2015). It is the period when the crop is most sensitive to weed competition, making it essential to maintain weed-free conditions to avoid unacceptable reductions in potential yield (Daramola *et al.,* 2021). From a practical standpoint, yield losses caused by weed interference before or after the CPWC are of limited concern. In other words, weeds present before or emerging after the CPWC do not significantly affect yield (Knezevic *et al.,* 2013).

Studies on cucumber have shown that weed infestation during the CPWC causes irreversible yield losses, while weed control before or after this period does not improve fruit yield compared with crops kept weed-free only during the CPWC (Alkhaatib *et al.,* 2015). Consequently, weed control recommendations in cucumber are based on the CPWC, as it represents the optimum timing for weed removal. This approach ensures effective yield protection while reducing production costs (Daramola *et al.,* 2021).

Weed control, whether chemical, mechanical, or manual, places a significant burden on farmers (Jenni *et al.,* 2004). Manual or mechanical methods, such as hoeing, are time-consuming and can damage sensitive crops like cucumber due to their tender vines. Chemical weed control is effective, but farmers often struggle with its high cost and the negative impact it has on the environment.

This situation underscores the need for alternative weed control methods that are both environmentally friendly and cost-effective. Plant spacing and mulching have been reported to significantly reduce weed pressure, and integrating both practices could yield better results in sustainable weed management (Ikeh *et al.,* 2019; Mnzughul *et al.,* 2023).

The presence of weeds in the growing areas is often a major contributor to the low yields of many vegetable crops, including cucumbers, leading to reduced productivity and profitability. Spacing is an important cultural practice that can be employed to control weeds in cucumber production. The rapid closing of canopy and improved radiation interception from closely spaced plants or higher population

densities can boost crop growth rates and yields (Yadav & Devi, 2025). Ansa & Garjila (2019) also reported that close spacing allows less competition from weeds. This suggests that farmers could employ close spacing in cucumber production to control weeds by achieving ground cover due to the early formation of close canopy, thus mitigating the impact of weeds on crop performance.

The presence of weeds in cultivation areas often significantly contributes to the low yields observed in various vegetable crops, including cucumbers, ultimately leading to reduced productivity and profitability. An effective cultural practice for managing weeds in cucumber production is proper spacing. The rapid closure of the canopy, along with improved light interception from closely spaced plants or higher population densities, can enhance crop growth rates and yields (Yadav & Devi, 2025) while simultaneously suppressing weed growth and competition (Udoh & Ndon, 2016). This indicates that farmers could adopt closer spacing in cucumber production as a strategy to manage weeds by achieving ground cover through the early formation of a dense canopy, thereby lessening the impact of weeds on crop performance.

The primary goal of mulching for weed control is to block light from reaching weeds, thereby inhibiting their growth (Yeganehpoor *et al.,* 2005; Ikeh *et al.,* 2019). Bobby *et al.* (2017) reported that plastic mulches (black-black, black-silver, black-white) were far more effective in controlling weeds in greenhouse cucumber seedlings compared to organic mulches such as paddy straw, paddy husk, and groundnut shells. The findings of Ikeh & Akpan (2018) indicated significant fruit yields of 22.05 and 22.62 t/ha from the application of 15 t/ha sawdust mulching. Similarly, Parmar *et al.* (2013) reported superior yield and quality of watermelon grown using polyethylene black film. Furthermore, studies by Ikeh *et al.* (2019) showed that mulching significantly reduces weed density while improving fruit yield, with sawdust and grass mulching producing the highest number of fruits per plant.

The novelty of this study lies in the integrated assessment of sowing date, plant spacing, and mulching interactions as a combined cultural strategy for optimizing weed suppression and fruit quality in cucumber production under humid tropical conditions.

2. Methods

2.1 Experimental Location

The experiment was conducted in April, May, June, July, August and September in 2015 and 2016 cropping seasons at the Teaching and Research Farm, School of Agriculture and Agricultural Technology, Federal University of Technology Owerri, Imo state, Nigeria.

2.2 Experimental Design and Treatments

The experiment was carried out using a split-split plot arrangement fitted into a Randomized Complete Block Design. The treatments consisted of three factors (planting months, spacing and mulching). The main plot was planting months (April, May, June, July, August, and September), the sub plot was spacing (20cm x 50cm, 40cm x 50cm and 60cm x 50cm) and sub-sub plot was mulching (no mulch, black polythene, transparent polythene and wood shaving) all were replicated three times.

2.3 Land Preparation

The land was manually cleared. The vegetation was cleared using machetes and cutlasses. Stumps and roots were removed with hoes and spades to provide a clean surface. The soil was then tilled manually with hoes and spades. The seedbeds were raised and demarcated with 0.5 m paths, while replicates were separated by 1 m paths to allow accessibility and minimize interference between treatments.

2.4 Field Layout

The entire field measured 42 m × 10 m, giving a total area of 420 m². Each plot measured 4 m × 1 m (4 m²). Seedbeds were separated by 0.5 m paths, while replications were demarcated with 1 m paths. Each replicate contained 12 plots, resulting in a total of 36 plots for the three replications.

2.5 Planting

The Seeds of a popular cucumber cultivar (cu999) were sown on the plots at the rate of 2 seeds / stand according to treatment, and at a depth of 2 cm, seedlings were later thinned to 1 seedling/stand. Planting was done in the months of April, May, June, July, August and September in 2015.

2.5 Data Collection and Analysis

i) Weed fresh weight (g): At 4 and 6 weeks after emergence, weed fresh weight was obtained by using 1m x 1m quadrant, which was dropped at random, and the weeds within the quadrant were harvested and weighed fresh.

ii) Fruit length (cm): Fruit length (cm) was assessed by using a flexible tape rule; the tape was placed from the proximal to the distal end.

iii) Fruit girth (cm): The fruit girth was determined with the aid of a veneer caliper. The measurement was taken from three portions

All data collected were subjected to analysis of variance and mean separation using Genstat Discovery Edition 3 (Genstat, 2012) software.

3. Results

3.1 Effect of Different Cultural Practices on Weed Fresh Weight at (g) 4 WAE

All interactions had a significant effect on WFW at 4 weeks after emergence (WAE), as shown in Table 1. April planting recorded the lowest WFW in 2015 and 2016 at 20 cm × 50 cm spacing on plots treated with black polythene, with mean values of 0.34 g and 8.91 g, respectively.

For the main effects, April planting recorded the lowest WFW in 2015 and 2016, with mean values of 1.31 g and 18.79 g, respectively. A spacing of 20 cm × 50 cm produced the lowest WFW in 2015 (39.36 g) and 2016 (47.98 g). Plots treated with black polythene also recorded the lowest WFW, with values of 13.23 g in 2015 and 13.63 g in 2016.

Table 1. Effect of different cultural practices on weed fresh weight at (g) 4WAE in 2015 and 2016 for interaction and main effect.

		2015						2016					
		Months						Months					
Mulching	Spacing	April	May	June	July	Aug	Sept	April	May	June	July	Aug	Sept
NM	20x50	2.64	42.47	86.20	163.75	94.81	128.21	24.82	111.93	142.13	128.52	101.87	156.04
	40x50	3.23	53.70	170.26	175.73	144.58	139.82	29.20	107.64	165.93	101.10	184.66	163.06
	60x50	2.09	54.75	163.54	190.13	189.11	129.92	33.24	134.25	181.73	158.58	171.32	181.46
BP	20x50	0.34	5.14	14.64	10.98	14.79	15.26	8.91	18.21	14.07	8.64	15.04	14.86
	40x50	0.76	7.77	15.02	12.07	15.93	51.20	12.94	12.89	12.44	13.35	16.16	13.36
	60x50	0.70	4.55	14.73	17.27	18.30	18.71	9.84	15.99	14.61	17.32	11.11	15.92
TP	20x50	0.73	10.93	17.22	37.28	42.09	42.93	15.42	20.74	21.15	38.22	33.46	38.09
	40x50	0.70	11.29	19.40	47.28	37.04	40.27	22.50	21.77	19.77	36.90	21.27	46.11
	60x50	0.47	12.49	22.85	24.26	34.36	38.73	9.34	21.51	53.35	42.89	38.74	40.00
WS	20x50	0.86	9.34	42.86	55.08	46.86	59.23	17.33	18.26	25.97	58.68	55.79	63.01
	40x50	1.25	9.09	33.04	60.86	62.47	70.17	22.95	25.96	40.07	61.12	54.21	60.38
	60x50	1.90	10.41	51.64	68.92	96.08	64.93	19.07	30.25	93.58	83.16	76.96	72.25

	LSD $_{0.05}$ (Month x Spacing x Mulching) = 21.11						*9.67*					
Month	April	May	June	July	Aug	Sept	April	May	June	July	Aug	Sept
	1.31	19.39	54.20	71.94	66.37	66.02	18.79	44.97	65.38	62.37	65.05	72.05
	LSD $_{0.05}$ (Month) = 7.62						*3.51*					
Spacing	20x50	40x50	60x50				20x50	40x50	60x50			
	39.36	49.27	51.28				47.98	52.74	63.60			
	LSD $_{0.05}$ (Spacing) = 2.97									*2.21*		
Mulching	NM	BP	TP	WS			NM	BP	TP	WS		
	107.50	13.23	24.45	41.38			126.53	13.63	30.07	48.85		
	LSD $_{0.05}$ (Mulching) = 5.23						*2.21*					

Key: NM : No mulch
BP : Black polythene
TP :Transparent polythene
WS :Wood shaving

3.2 Effect of Different Cultural Practices on Weed Fresh Weight (g) at 6WAE

Month × spacing × mulching interactions significantly suppressed weeds in 2015 and 2016, as shown in Table 2. In 2015, April planting recorded the lowest WFW (1.14 g) at 20 cm × 50 cm spacing on plots treated with black polythene. In 2016, May planting recorded the lowest WFW (3.72 g) at 20 cm × 50 cm spacing on plots treated with black polythene.

For the main effects, April planting had the lowest WFW in 2015 and 2016, with mean values of 3.79 g and 14.28 g, respectively. In 2015, a spacing of 40 cm × 50 cm recorded the lowest WFW (21.24 g), while in 2016, the spacing of 20 cm × 50 cm recorded the lowest WFW (24.80 g). Plots treated with black polythene recorded the lowest WFW in both years, with 1.49 g in 2015 and 9.32 g in 2016.

Table 2. Effect of different cultural practices on weed fresh weight (g) at 6WAE in 2015 and 2016 for interaction and main effect

		2015						2016					
		Months						Months					
Mulching	Spacing	April	May	June	July	Aug	Sept	April	May	June	July	Aug	Sept
NM	20x50	3.92	16.93	108.61	36.67	52.24	38.73	15.44	39.57	83.70	99.73	67.20	51.78
	40x50	9.03	18.91	78.27	39.40	50.40	45.89	19.98	106.21	101.77	90.39	78.00	71.42
	60x50	7.26	25.60	164.42	52.97	78.35	70.67	27.59	95.45	84.81	100.17	73.36	80.30
BP	20x50	1.14	4.64	5.35	5.48	5.10	29.60	6.03	3.72	7.50	6.10	6.89	8.27
	40x50	1.91	5.55	9.19	6.38	5.47	11.65	9.35	9.21	6.72	9.76	10.95	8.97
	60x50	1.41	6.94	13.70	11.76	9.49	9.02	2.70	10.55	10.67	8.50	30.50	7.38
TP	20x50	3.31	4.69	25.64	11.08	18.89	14.01	10.21	9.73	18.80	13.27	20.89	16.05
	40x50	3.85	8.73	29.88	11.97	19.55	21.22	17.98	9.38	13.69	18.96	21.54	13.01
	60x50	1.42	8.84	14.77	23.21	33.94	19.29	10.17	11.66	19.91	20.75	28.19	20.31
WS	20x50	3.09	4.96	27.20	18.83	84.55	19.03	15.70	9.29	15.81	20.44	20.71	28.24
	40x50	4.20	6.42	47.76	18.63	30.56	19.93	17.63	12.63	27.16	30.65	49.08	32.10
	60x50	4.94	8.64	51.61	17.78	22.62	29.88	14.58	34.49	49.48	60.36	53.47	50.49
	LSD $_{0.05}$ (Month x Spacing x Mulching) = 27.98							*16.89*					
Month	April	May	June	July	Aug	Sept		April	May	June	July	Aug	Sept
	3.79	10.07	48.03	21.18	34.68	27.41		14.28	28.49	36.67	39.92	38.40	32.36
	LSD $_{0.05}$ (Month) = 10.55							*4.10*					
Spacing	20x50	40x50	60x50					20x50	40x50	60x50			
	22.65	21.24	28.69					24.80	32.78	37.49			
	LSD $_{0.05}$ (Spacing) = 5.69							*3.92*					
Mulching	NM	BP	TP	WS				NM	BP	TP	WS		
	49.90	8.26	15.24	23.37				71.49	9.32	16.36	29.57		
	LSD $_{0.05}$ (Mulching) = 6.55							*4.01*					

Key: NM : No mulch
BP : Black polythene
TP : Transparent polythene
WS : Wood shaving

3.3 Fruit length

As shown in Table 3, the interaction of month × spacing × mulching did not significantly affect fruit length in 2015 but was significant in 2016. The highest fruit length (29.80 cm) was recorded in July planting at 20 cm × 50 cm spacing on plots treated with black polythene.

For the main effects, the highest fruit length (24.01 cm) was recorded in May planting in 2015, while in 2016, the highest fruit length (22.48 cm) was recorded in April planting. Cucumbers spaced at 20 cm × 50 cm produced the longest fruits in both years, with mean values of 21.18 cm in 2015 and 22.53 cm in 2016. In 2015, plots treated with black polythene produced the longest fruits (23.14 cm), followed by transparent polythene (21.79 cm). Similarly, in 2016, plots treated with black polythene recorded the longest fruits (23.91 cm), followed by transparent polythene (21.96 cm).

Table 3. Effect of different cultural practices on cucumber fruit length

		2015						2016					
		Months						Months					
Mulching	Spacing	April	May	June	July	Aug	Sept	April	May	June	July	Aug	Sept
NM	20x50	15.83	19.70	12.53	15.33	14.20	28.07	18.70	19.00	13.37	15.73	15.37	15.67
	40x50	15.27	18.87	12.20	15.33	14.60	14.20	18.67	17.27	14.63	15.23	13.90	13.83
	60x50	13.20	18.63	11.23	14.83	13.87	12.90	14.67	17.27	13.00	13.23	12.57	12.77
BP	20x50	20.63	30.40	23.93	24.33	20.90	23.57	29.19	25.10	27.17	29.80	24.13	28.37
	40x50	19.33	23.13	23.03	23.23	24.20	24.13	26.07	23.63	20.53	22.47	22.87	24.00
	60x50	18.67	26.83	22.37	21.87	20.67	20.23	23.90	24.73	24.83	14.03	19.77	19.80
TP	20x50	22.00	27.50	21.53	22.43	21.23	23.67	27.10	21.37	22.87	22.53	22.23	24.47
	40x50	21.73	25.23	21.27	21.67	21.93	20.07	23.77	22.93	23.33	17.63	20.10	22.10
	60x50	18.67	24.70	18.40	20.03	21.13	18.97	20.90	20.60	22.67	21.40	19.53	19.67
WS	20x50	20.20	24.07	17.87	23.37	17.60	17.10	25.37	23.27	21.33	20.07	16.80	16.87
	40x50	20.23	22.33	19.40	18.40	18.93	19.40	22.40	21.73	18.30	19.83	15.20	17.03
	60x50	17.63	21.70	5.80	15.87	16.20	17.40	19.00	21.77	17.00	17.83	16.40	14.90
	LSD $_{0.05}$ (Month x Spacing x Mulching) = NS							*3.96*					
Month	April	May	June	July	Aug	Sept		April	May	June	July	Aug	Sept
	18.57	24.01	18.30	19.76	18.79	19.97		22.48	21.56	19.92	19.15	18.24	19.12
	LSD $_{0.05}$ (Month) = 1.29							*1.14*					
Spacing	20x50	40x50	60x50					20x50	40x50	60x50			
	21.18	20.14	18.38					22.53	20.48	18.90			
	LSD $_{0.05}$ (Spacing) = 1.22							*0.81*					
Mulching	NM	BP	TP	WS				NM	BP	TP	WS		
	15.62	23.14	21.79	19.05				15.67	23.91	21.96	19.17		
	LSD $_{0.05}$ (Mulching) = 1.20							*0.93*					

Key: NM : No mulch
BP : Black polythene
TP : Transparent polythene
WS : Wood shaving

3.4 Effect of Different Cultural Practices on Cucumber Fruit Girth

All levels of interaction significantly affected fruit girth in 2015, while in 2016, the month × spacing × mulching interaction had no significant effect, as shown in Table 4. In 2015, the highest fruit girth (20.60 cm) was recorded in July planting at 20 cm × 50 cm spacing on plots treated with transparent polythene.

For the main effects, May planting recorded the highest fruit girth (16.23 cm) in 2015, while in 2016, April planting recorded the highest fruit girth (16.06 cm), followed by May (15.47 cm). In both years, cucumbers spaced at 20 cm × 50 cm recorded the highest fruit girth (15.57 cm in 2015 and 15.44 cm in 2016), followed by 40 cm × 50 cm spacing. Black polythene mulch produced the highest fruit girth in 2015 and 2016, with mean values of 16.73 cm and 16.24 cm, respectively. This was followed by transparent polythene mulch, which recorded mean values of 16.01 cm in 2015 and 15.49 cm in 2016.

Table 4. Effect of Different Cultural Practices on Fruit Girth (cm) in 2015 and 2016 for Interaction and Main Effect

		2015						2016					
		Months						Months					
Mulching	Spacing	April	May	June	July	Aug	Sept	April	May	June	July	Aug	Sept
NM	20x50	12.83	14.77	12.70	13.40	14.63	13.63	14.60	15.27	13.97	14.33	11.37	13.10
	40x50	12.23	14.83	12.73	13.67	13.27	13.40	13.43	13.07	14.17	13.20	13.17	15.80
	60x50	12.17	12.73	11.53	14.33	13.17	14.17	11.73	14.30	15.63	12.37	11.30	12.07
BP	20x50	14.73	19.53	16.53	17.00	17.97	17.40	18.07	18.43	19.00	18.07	16.53	14.93
	40x50	13.37	17.90	15.90	20.10	17.47	17.40	18.00	15.70	16.67	15.70	16.60	14.60
	60x50	13.37	17.60	15.37	18.50	15.77	15.27	16.77	14.39	15.47	14.37	13.30	15.30
TP	20x50	16.23	18.30	17.50	20.60	16.60	15.60	17.97	16.80	16.07	17.13	15.47	15.23
	40x50	14.83	15.77	14.63	18.23	15.87	15.43	14.70	14.30	14.80	14.33	14.80	16.50
	60x50	13.47	15.50	14.50	13.87	15.47	15.77	15.70	17.07	14.80	13.60	14.93	14.53
WS	20x50	14.60	17.23	14.20	14.60	16.27	16.40	17.99	14.33	12.73	13.50	14.97	10.55
	40x50	13.50	16.13	14.87	15.70	15.00	15.40	17.17	14.67	13.60	13.47	15.40	14.90
	60x50	14.50	17.40	13.00	13.83	15.03	15.30	16.60	16.73	13.67	13.20	13.93	14.83
	$LSD_{0.05}$ (Month x Spacing x Mulching) = 2.22							NS					
Month	April	May	June	July	Aug	Sept		April	May	June	July	Aug	Sept
	13.82	16.23	14.45	16.15	15.54	15.43		16.06	15.47	15.05	14.44	13.31	14.36
	$LSD_{0.05}$ (Month) = 0.64							0.61					
Spacing	20x50	40x50	60x50					20x50	40x50	60x50			
	15.57	15.31	14.65					15.44	14.95	14.46			
	$LSD_{0.05}$ (Spacing) = 0.51							0.54					
Mulching	NM	BP	TP	WS				NM	BP	TP	WS		
	13.34	16.73	16.01	15.17				13.49	16.24	15.49	14.56		
	$LSD_{0.05}$ (Mulching) = 0.52							0.72					

Key: NM : No mulch
BP : Black polythene
TP : Transparent polythene
WS : Wood shaving

4. Discussion

All treatments interacted significantly at all levels to affect weed fresh weight. The lowest weed fresh weights were recorded in April and May during both 2015 and 2016. This reduction could be attributed to the low rainfall experienced in those months, which was unexpected and may be linked to climate change. Cucumber, being a member of the Cucurbitaceae family, is particularly sensitive to water availability.

Water is a critical factor for plant growth; therefore, water stress can result in poor emergence and growth of weeds. Interestingly, this condition favoured cucumber growth and yield, as the longest fruits and highest girths were recorded in May and April plantings in 2015 and 2016, respectively. Spacing of 20 cm × 50 cm and 40 cm × 50 cm consistently produced the lowest weed fresh weights at 4 and 6 weeks after emergence in both cropping seasons. This can be attributed to the fact that closer spacing enables rapid canopy formation, which suppresses weed growth. These findings agree with Mark (2011), who reported that cucumbers and other cucurbits act as effective live mulch, controlling weeds early in the season. This canopy effect also contributed to the highest fruit length and girth recorded at 20 cm × 50 cm and 40 cm × 50 cm spacing in both years. This agreed with the findings of Yadav & Devi (2025) that both mulching materials and plant spacing exerted a significant influence on vine growth, phenological development, and yield-related attributes of the crop during the two consecutive years

Black polythene mulch consistently recorded the lowest weed fresh weight and the highest fruit length and girth. This is because black polythene prevents weed growth by blocking sunlight, which is essential for photosynthesis. These results align with Tarara (2000), who reported that black mulch effectively suppressed weed growth by intercepting nearly all incoming radiation.

The interaction of month × spacing × mulching recorded the lowest weed fresh weight in April and May at 20 cm × 50 cm spacing on plots treated with black polythene. However, the highest fruit length was recorded in July planting at 20 cm × 50 cm spacing on plots treated with black polythene in 2016. Similarly, the highest fruit girth was recorded in July planting at 20 cm × 50 cm spacing on plots treated with transparent polythene. This outcome could be attributed to the heavy rains during July, which ensured constant water availability during cucumber fruiting. One may therefore conclude that water stress has a significant effect on cucumber fruit size.

5. Conclusion

The implementation of early planting, close spacing, and the use of black polythene mulch has shown a significant potential to enhance cucumber yield. By effectively controlling weed growth and promoting optimal fruit development, these strategies can lead to increased fruit size and girth, ultimately providing greater returns for farmers. Adopting these practices can contribute to more productive and sustainable cucumber cultivation. Despite the promising outcomes of these strategies, there are several limitations to consider. First, the effectiveness of these techniques may vary depending on local environmental conditions, soil types, and pest pressures. Additionally, the initial costs of mulching materials and the labor required for close planting may pose challenges for some farmers. Furthermore, prolonged use of plastic mulch can lead to soil health issues and environmental concerns if not managed properly. Ongoing research and tailored agricultural practices will be crucial in addressing these limitations and ensuring the sustainable adoption of these strategies.

6. Authors Note

The authors declare that there is no conflict of interest regarding to the publication of this article. Authors confirmed that the paper was free of plagiarism.

7. References

Akpan, E. A., & Ikeh, A. O. (2018). Growth and yield response of cassava (*Manihot esculenta* Crantz) varieties to different spacing in Uyo, Southeastern Nigeria. *Journal of Agricultural and Crop Research, 6*(2), 19–27.

Al-Khatib, K., Kadir, S., & Libbey, C. (1995). Broadleaf weed control with clomazone in pickling cucumber (*Cucumis sativus*). *Weed Technology, 9*(1), 166–172. https://doi.org/10.1017/S0890037X00023125.

Ansa, J. E. O., & Garjila, Y. A. (2019). Growth and yield response of cucumber (*Cucumis sativus*) to spacing in the southern rainforest of Rivers State, Nigeria. *International Journal of Novel Research in Interdisciplinary Studies, 6*(5), 26–29.

Bobby, A., Prashanth, N., Seenivasan, N., & Mishra, P. (2017). Effect of different mulch materials on weeds in cucumber (*Cucumis sativus* L.) hybrid "Multistar" under shade net condition. *International Journal of Pure and Applied Biosciences, 5*(5), 1246–1251.

Daramola, O. S., Adigun, J. A., & Adeyemi, O. R. (2021). Efficacy and economics of integrated weed management in chilli pepper. *Journal of Crop Improvement, 35*(1), 38–50. https://doi.org/10.1080/15427528.2020.1795770

Daramola, S. D. (2021). *Weed interference and management in cucumber (Cucumis sativus L.)*. IntechOpen. https://doi.org/10.5772/intechopen.99564

Genstat. (2007). *GenStat for Windows, Discovery* (3rd ed.). Lawes Agricultural Trust, Rothamsted Experimental Station.

Ikeh, A. O., & Akpan, E. A. (2018). Response of dry season garden egg (*Solanum melongena*) to watering regime and organic mulching levels in Okigwe, Southeastern Nigeria. *Journal of Agricultural and Crop Research, 6*(2), 38–46.

Ikeh, A. O., Sampson, H. U., Ukabiala, M. E., Anonaba, N. K., Okamigbo, J. N., & Akuwueze, C. G. (2025). Effect of soil ameliorations on cucumber (*Cucumis sativus* L.) yield and soil physico-chemical properties in an ultisol of Southeastern Nigeria. *Open Science and Technology, 5*(1), 1–9. https://doi.org/10.33292/ost.vol5no1.2025.146

Ikeh, A. O., Udoh, E. I., & Opara, A. C. (2019). Effect of mulching on weed, fruit yield, and economic returns of garden egg (*Solanum melongena*) in Okigwe, Southeastern Nigeria. *Journal of Research in Weed Science, 2*(1), 52–64. https://doi.org/10.26655/jrweedsci.2019.1

Jenni, S., Brault, D., & Stewart, K. A. (2004). Degradable mulch as an alternative for weed control in lettuce produced on organic soils. *Acta Horticulturae, 638*, 111–118. https://doi.org/10.17660/actahortic.2004.638.

Mark, S. (2011). *Weed management strategies for organic cucurbit crops in the Southern United States*. eXtension, American Research-based Learning Network.

Mnzughul, N. S., Esang, D. M., & Ikeh, A. O. (2023). Variability of elite maize (*Zea mays* L.) varieties at different row spacing in Guinea Savannah Region of Nigeria. *Open Global Scientific Journal, 2*(2), 81–93. https://doi.org/10.70110/ogsj.v2i2.20

Parmar, H. N., Polara, N. D., & Viradiya, R. R. (2013). Effect of mulching material on growth, yield, and quality of watermelon (*Citrullus lanatus* Thunb) cv. Kiran. *Universal Journal of Agricultural Research, 1*(2), 30–37. https://doi.org/10.13189/ujar.2013.010203

Tarara, J. M. (2000). Microclimate modification with plastic mulch. *HortScience, 35*(2), 169–180. https://doi.org/10.21273/HORTSCI.35.2.169.

Tursun, N., Akinci, M. S., & Uludag, A. (2015). Estimating time of weed emergence in cucumber (*Cucumis sativus* L.). *Turkish Journal of Agriculture – Food Science and Technology, 3*(5), 271–278. https://doi.org/10.24925/turjaf.v3i5.271-278.268.

Udoh, D. J., & Ndon, B. A. (2016). *Crop production techniques for the tropics*. Concept Publication.

Yadav, S., & Devi, S. (2025). Varying intra-row spacing and mulching effect on growth and yield of parthenocarpic cucumber (*Cucumis sativus* L.) under protected conditions. *Journal of Advances in Biology & Biotechnology, 28*(8), 234–241. https://doi.org/10.9734/jabb/2025/v28i82700

Yeganehpoor, F., Salmasi, S. Z., Abedi, G., Samadiyan, F., & Beyginiya, V. (2015). Effects of cover crops and weed management on corn yield. *Journal of the Saudi Society of Agricultural Sciences, 14*(2), 178–181. https://doi.org/10.1016/j.jssas.2014.03.002