

# Original Research Article

## EFFECT OF SEASONS, MULCHING MATERIALS, AND FRUIT QUALITY ON A CUCUMBER (*Cucumis sativus* L.) VARIETY

### Abstract

**Aims:** The experiment aimed to investigate the effect of seasons (early raining and late raining) and mulching materials (Black Polyethylene, White Polyethylene, Grass-mulch and Control) on marketable fruit yield of cucumber.

**Study Design:** The experimental design was a 4 x 4 factorial laid out in a randomized complete block design (RCBD) with three replications. Data were collected on plant morphology and fruit components; number of leave, vine length, branch number, tendril number, stem dieter; Number of fruits per plant, Fruit length, Fruit circumference, Fruit weight, Number of marketable fruits per plot and number of non-marketable fruit per plot and Fruit yield per hectare.

**Place and Duration of Study:** The present study was carried out at Teaching and Research Farm of Obafemi Awolowo University (OAU), Ile-Ife, Nigeria during the growing seasons of 2017 and 2018.

**Methodology:** The data collected were subjected to analysis of variance (ANOVA) using (SAS, 2003 version). Means of significant treatments were separated using Duncan's Multiple Range Test (DMRT).

**Results:** The obtained results revealed that seasons and mulching materials had significant effect on some of the parameters investigated. Late season significantly enhanced the fruit length, fruit weight and total fruit yield when compared with the early seasons. The mulching materials, Black polyethylene mulching materials significantly enhanced the morphology and some of fruit components; fruit length and fruit weight while white plastic mulch significantly improved the number of fruit per plant, fruit diameter and total yield of cucumber at both early and late seasons followed by grass-mulch. However, control consistently produced the highest number of non-marketable fruits when compared with other treatments investigated.

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29 **Conclusion:** Therefore, planting of Poinsett76 variety towards the ending of raining seasons with  
30 the application of white plastic mulching is highly recommended for the small holder farmers.

31 **Keywords:** mulching, Poinsett76 and Marketable, season.

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## 32 1.0 Introduction

33 Cucumber (*Cucumis sativus* L.) is one of the most important fruit vegetable grown in tropic and  
34 temperate region of the world. It belongs gourd family Cucurbitaceae, it is a thermophile crop  
35 that requires a stable warm temperature for good marketable yield. Cucumber is one of the oldest  
36 crop domesticated by man about 5,000 years ago [1], it is known to be originated from India,  
37 which has now spread all over the world. Cucumber is one of the most popular fruit vegetable  
38 cultivated in both Europe and Asia. China is the leading producer of cucumber with the fruit  
39 yield of 54.3 million tonnes per year followed by Turkey with 1.7 million tonnes per year. In  
40 Africa, Egypt is the leading producer with a fruit yield of 613 thousand tonnes per year of  
41 cucumber and it is ranked 9<sup>th</sup> while Cameroon ranked 21<sup>st</sup> with the fruit yield of 224 thousand  
42 tonnes per year in the world [2].

43 Cucumber belongs to annual crop and a climbing herb; the leaves are alternate, simple and  
44 triangular-ovate. Leaf-blades are 3-7 lobed and deeply cordate at base. The stems of the  
45 cucumber produce vines which are sparingly branched. The fruit is composed mostly of water  
46 and more than 96% of the edible unpeeled fruit is water [3].

47 Cucumber has been listed among the most important fruit vegetable for medicinal properties;  
48 vitamins and minerals like A, B6, C, K, potassium and also provides dietary fibres, pantothenic  
49 acid, magnesium, phosphorus, copper, and manganese [4]. It contains ascorbic and caffeic acid,  
50 both of which help to smoothen skin irritation and reduce swelling. Cucumber fruit skin contains  
51 chlorophyll and silica; two beneficial elements that are lost when the vegetables are peeled. Its

52 juice is often recommended as a source of silicon to improve the complexion and health of the  
53 skin [5]. Pickling process removes or degrades much of the nutrient content, especially vitamin C  
54 [6]. Presently, cucumber is now becoming popular which could be as a result of high nutritional  
55 and medicinal values, as well as being a useful component ingredient in pharmaceutical and in  
56 the preparation of salad, liquor drink in homes and fruits drinks industries. Due to little quantity  
57 of sugar present in the fruits and it helps in the burning of excess fat in the body [7] makes it  
58 very good for diabetic patients. In spite of the above importance of the crop, cucumber is still  
59 produce by the few farmers who has little or no knowledge about the agronomical practices of  
60 the crop in order to produce high marketable and fruit quality of the crop. Moreover, the  
61 production of the cucumber fruit in Nigeria is very low due to some [8] constraints such as lack  
62 of production knowledge, poor vine management, low soil fertility and mulching materials  
63 technology [8, 9]. The problems are compounded by the farmers' practice of allowing the vines  
64 to trail on the ground leading to the production of low-quality fruits. The practice also promotes  
65 overcrowding of the vines with the subsequent attack by mould as a result of high canopy  
66 architecture [8].

67 The need to develop the appropriate agronomical technology required to produce marketable and  
68 fruit quality cucumber to meet the nutritional need of the ever growing population. The need to  
69 document the influence of mulching materials, effects of seasons on marketable fruit yield and  
70 nutritional quality of cucumber is the aim of this study.

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## 78 2.0 MATERIALS AND METHODS

79 The study was conducted during early and late (March – June and August – ~~October~~) seasons  
80 of 2017 and 2018 at the Teaching and Research Farms of the Obafemi Awolowo University, Ile-  
81 Ife, Nigeria-situated within the rain forest zone on latitude 7° 28'N and longitude 4° 33'E at an  
82 elevation of about 200 m above sea level. The region experiences approximately 7 months  
83 (April-October) of bimodal rainfall and 5 months (November – March) of dry season annually  
84 with slight irregularity in the rainfall distribution pattern occurring between April-October. Mean  
85 rainfall for 2017 and 2018 were 1683.7 mm and 1678.9 mm. The experimental plots were  
86 previously cropped to maize (*Zea mays* L.) and have been allowed to rest over four cropping  
87 seasons before the experiments. Pre planting soil samples were collected using an Auger to soil  
88 depth of about 15 cm and was analysed for physical and chemical analyses.

89 The soil is in the Iwo series derived from coarse grained granite gneiss parent rock and classified  
90 as Ultisol (low base status forest soils). It is well drained, grayish brown to brownish red with  
91 predominantly high low acidity clay-kaolinite [10]. The growing horizon was generally loamy,  
92 acidic, pH 6.50 to 6.60, and with K 0.02-2.06 C mol kg<sup>-1</sup>, N 0.06-0.09%, and available P 23.03-  
93 31.16 mgkg<sup>-1</sup>. Cucumber *Poinsett76* cultivar, was used, and obtained commercially from a local  
94 seed company. The experiment was laid in a 4 x 4 factorial arranged in a Randomized Complete  
95 Block Design (RCBD) with 3 replications. The treatments includes ~~four seasons (early and late)~~  
96 for two years and four mulching materials (Black Polyethylene mulch, Transparent Polyethylene

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97 mulch, dried plants straw and Control). The soil amendment used was inorganic fertilizer NPK  
98 15:15:15 at 200 kg/ha. Conventional tillage method was used to prepare the land. The land was  
99 ploughed twice using a tractor mounted disc plough after which it was harrowed. Planting was  
100 carried out on flat land. The land was divided into three blocks and thereafter subdivided into  
101 plots. Each plot was made into beds size of 2 X 2 m and 0.5 m were the pathway between the  
102 plots. The experimental field had three replications. The synthetic mulching materials (Black and  
103 white transparent Polyethylene 45µm) measured and cut to the bed sizes of 2 m x 2 m and  
104 thereafter perforated with the help of improvised jig (20 cm circumference) according to the  
105 planting spacing of 0.5 x 0.5 m. The perforated mulching materials were randomized on the  
106 beds. Thereafter, the seeds were sown at the rate of 2 seeds per hole giving a plant population of  
107 80,000 plants/ha. The mineral fertilizer were applied in a split applications at 2 and 4 Weeks  
108 After Sowing (WAS) using the ring method. Weed control was done manually. Insect pest and  
109 fungi were controlled when pest incidence were observed using Insecticide (*Cypermethrine*, a.i.)  
110 and Fungicide (*Mankozeb* 75% a.i) applied at the rate of 40 ml per 20 liters of water. The  
111 spraying started from 3, 4 and 5 weeks after sowing prior fruiting.

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112 Data were collected on 5 randomly tagged plants on rows 2 and 5 in each plot on the following  
113 parameters: number of branches, vine length, number of leaves/plant, and tendril length/plant.  
114 Fruit yield were harvested from plants in rows 3 and 4 for fruit yield and fruits parameter were  
115 taken on 10 randomly selected for Fruit length, Fruit circumference and number of fruits per  
116 plant. Fruit yield and yield parameters ha-1 was determined as described by Oloyede *et al.* [11].  
117 Marketable fruits were determined based on uniformity in color, size and shape, and undamaged  
118 by pests or disease. Data were subjected to analysis of variance (ANOVA) using SAS [12] and  
119 significant means were separated using Duncan Multiple Range Test.

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## RESULTS

From the results obtained from the soil analysis, the soils were slightly acidic, pH 6.4, 6.6 in water (CH<sub>2</sub>O) and pH 6.3, 6.1 in Calcium chloride (CaCl<sub>2</sub>), very low in organic carbon (0.96%), organic matter (1.76%, 1.52%) and total nitrogen 0.08, 0.09 (Table 1). The low nutrient content in these sites might be due to the effects of continuous cropping of sites to various arable crops which might have depleted soil nutrients through several process of denitrification [13]. Adepetu *et al.* [13] noted that some nutrients are temporarily immobilized by microorganisms which were responsible for organic matter decomposition. Available P were 22.01, 42.46 mgkg<sup>-1</sup> and was high when compared with the critical value of 10<sup>-16</sup> mg kg<sup>-1</sup> for southwestern Nigeria [14]. This is due to the mobile nature of P in soil [14]. The physical properties of both sites were similar (Sand soil 526.4, 535.7 g kg<sup>-1</sup>) respectively. While Silt, Clay and textural classes were comparable (Table 1).

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**Table 1: Pre cropping Soil chemical and physical properties of the experimental sites**

Chemical property	2017	2018
pH (H <sub>2</sub> O) (1:2)	6.4	6.6
pH (CaCl <sub>2</sub> )	6.3	6.1
Organic Carbon (%)	0.96	0.52
Organic matter (%)	1.76	1.52
Total N (%)	0.08	0.09
Available P ((mg kg <sup>-1</sup> ))	22.01	42.46
<b>Exchangeable cations (cmol kg<sup>-1</sup>)</b>		
K <sup>+</sup>	2.06	0.20
Ca <sup>2+</sup>	2.28	0.24
Mg <sup>+</sup>	0.27	0.11
Na <sup>-</sup>	0.29	0.008
<b>Physical Property</b>		
Sand g kg <sup>-1</sup>	526.4	535.7
Silt g kg <sup>-1</sup>	124.0	230.4
Clay g kg <sup>-1</sup>	243.2	307.9
Textural class	Sandy loam	Sandy loam

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164 The response of leaves number and vine length of cucumber as influenced by seasons and  
165 mulching materials at 4, 5, and 6 weeks after planting (WAP) varied (Table 2). Results shows  
166 that season and mulching materials had highly significant effects ( $p < 0.001$ ) on leave number and  
167 vine length however, the interaction between season x mulching materials were not significant at  
168 ( $p < 0.001$ ).

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169 The data presented in (Table 3) revealed that the cropping seasons and mulching materials  
170 significantly influenced ( $p < 0.001$ ) the leave number and vine length as the week increases, season

173 three significantly improved ( $p < 0.001$ ) the leave number as well as vine length across the weeks while  
 174 the black plastic mulched subsequently increases the number of leaves and vine length respectively.

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183 **Table 2. Mean Squares from the combine Analysis of Variance on leaf number and vine**  
 184 **length of Cucumber at 4, 5, and 6 Weeks after Planting (WAP)**

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Source of Variation	DF	Leaf Numbers			Vine Length (cm)		
		4	5	6	4	5	6
Rep	2	25.56	34.56	363.06	316.11	407.52	781.79
Season	3	1382.25**	3366.04**	1975.01**	33876.78**	138962.03**	79547.78**
Mulch	3	35.32*	206.37**	602.58**	372.05*	724.71	718.83
Season*Mulch	9	9.57	33.62	65.85	97.17	163.15	822.61
Error	30	10.61	37.99	73.75	129.35	482.45	847.42

185 **Key:** DF-degree of freedom, REP- replication

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**Table 3. Effect of Seasons and Mulching Materials on Morphological Parameters of Cucumber at 4, 5, and 6 WAP**

Treatment	Leaf Numbers			Vine Length (cm)		
	4	5	6	4	5	6
Season 1	5.41	7.77	14.79	15.08	38.64	75.65
Season 2	6.06	13.16	26.06	14.79	41.36	93.33
Season 3	16.56	27.4	28.27	68.50	148.66	167.60
Season 4	6.06	14.16	24.06	16.29	43.36	95.35
<b>LSD<sub>0.05</sub></b>	<b>1.31</b>	<b>2.49</b>	<b>3.46</b>	<b>4.59</b>	<b>8.87</b>	<b>11.75</b>
White	8.81	16.27	25.66	28.47	71.21	108.33
Black	9.58	18.20	28.37	30.87	70.89	113.21
Mulch	7.62	14.70	20.10	30.52	66.97	104.16
Control	8.08	13.39	23.04	24.80	62.95	106.30
<b>LSD<sub>0.05</sub></b>	<b>1.31</b>	<b>2.49</b>	<b>3.46</b>	<b>4.59</b>	<b>8.87</b>	<b>11.75</b>

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**Key:** Season 1-Early Raining Season 2017, Season 2 - Late Raining Season 2017, Season 3- Early Raining Season 2018 and Season 4 - Late Raining Season 2018. White - White polyethylene, Black Polyethylene, Mulch-Dried Plant Straw and Control – Un-mulched

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208 There were highly significant improvement ( $p < 0.001$ ) on number of branches and stem diameter as  
209 influenced by seasons and mulching materials throughout the period of the studies (Table 4). The  
210 results revealed that the number of branches were highly improved in season two at 4 and 5 weeks  
211 after planting but at 6 weeks after planting season three was better than the two previous weeks while  
212 black plastic mulched consistently increased the number of branches while white transparent plastic  
213 mulch, dried straw mulch and control followed in that order (Table 5). Season one was noticed to  
214 favored the stem diameter though it was not significantly different at ( $p < 0.001$ ) from season three  
215 while season two and four were not significantly different ( $p < 0.001$ ) from each other. The black  
216 plastic mulch influenced the stem diameter of cucumber at four weeks after planting at week 5 dried  
217 straw mulch perform better while at 6 weeks after planting control and black plastic mulch did not  
218 significantly different ( $p < 0.001$ ).

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**Table 4. Mean Squares from the combine Analysis of Treatments on branch number and stem diameter on Cucumber at 4, 5, and 6 Weeks after Planting (WAP)**

Source of Variation	DF	Branch Number			Stem Diameter (cm)		
		4	5	6	4	5	6
Rep	2	7.99	52.79	6.78	0.44	1.51	6.78
Season	3	84.17**	191.70**	31.58**	40.32**	28.23**	31.58**
Mulch	3	2.52*	97.37*	3.71*	0.40	1.68	3.71*
Season*Mulch	9	0.45	25.10	0.91	0.22	1.16	0.91
Error	30	0.970	29.06	1.23	0.27	1.14	1.23

**Key:** DF-degree of freedom, REP- replication

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**Table 5. Effect of Seasons, Mulch and Population Densities on Morphological Parameters (stem branch number and diameter) of Cucumber at 4, 5, and 6 WAP**

Treatment	Branch Number			Stem Diameter (cm)		
	4	5	6	4	5	6
Season 1	1.49	0.58	2.47	4.05	4.21	4.38
Season 2	3.06	4.14	5.00	2.37	2.79	2.88
Season 3	0.27	5.12	6.93	4.05	4.21	4.38
Season 4	0.27	4.14	5.00	2.57	2.99	3.08
<b>LSD<sub>0.05</sub></b>	<b>0.39</b>	<b>2.17</b>	<b>0.78</b>	<b>0.21</b>	<b>0.43</b>	<b>0.44</b>
White	1.34	3.20	4.81	3.22	3.49	3.47
Black	1.57	5.58	5.68	3.39	3.61	3.78
Mulch	1.09	2.77	4.00	3.26	3.77	3.44
Control	1.09	2.43	4.91	3.17	3.32	4.03
<b>LSD<sub>0.05</sub></b>	<b>0.39</b>	<b>2.17</b>	<b>0.78</b>	<b>0.21</b>	<b>0.43</b>	<b>0.44</b>

**Key:** Season 1-Early Raining Season 2017, Season 2 - Late Raining Season 2017, Season 3- Early Raining Season 2018 and Season 4 - Late Raining Season 2018. White - White polyethylene, Black Polyethylene, Mulch-Dried Plant Straw and Control – Un-mulched

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The effects of season significantly ( $p < 0.001$ ) affected tendril number and tendril length while the mulching materials did not affected the parameters significantly (Table 6). Season significantly affected ( $p < 0.001$ ) the both the number of tendril and tendril length (Table 7). Season three affected the number of tendril at 4 and 5 but at 6 weeks after planting season 4 improved the tendril number while tendril length was noticed to be improved by season three at 4 and 5 while at 6 WAP season 4 performed better when compared with others seasons. Mulching materials at 4 and 5 WAP were not improved the tendril number while at 6 WAP black mulch increased the number of tendril, the tendril length was significantly influenced ( $p < 0.001$ ) at early stage (4 WAP) but at 5 and 6 WAP mulching materials were not affected the tendril length.

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293 **Table 6. Mean Squares from the combine Analysis of Treatments on tendril number and**  
294 **tendril length on Cucumber at 4, 5, and 6 Weeks after Planting (WAP)**

Source of Variation	DF	Tendril number			Tendril length (cm)		
		4	5	6	4	5	6
Rep	2	33.39	85.89	120.02	9.38	145.39	243.97
Season	3	506.25*	3700.69*	365.06**	4010.77**	460.96*	84.53**
Mulch	3	9.27	29.13	148.79	20.74	46.24	7.95
Season*Mulch	9	2.15	11.19	32.32	15.65	6.41	10.99
Error	30	5.51	35.07	66.05	11.86	36.82	10.99

295 **Key:** DF-degree of freedom, REP- replication

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313 **Table 7. Effect of Seasons, Mulch and Population Densities on Morphological Parameters**  
314 **of Cucumber at 4, 5, and 6 WAP**

Treatment	Number of Tendril			Tendril Length (cm)		
	4	5	6	4	5	6
Season 1	5.72	18.37	13.29	0.68	10.92	11.21
Season 2	0.10	3.16	16.85	0.72	11.28	13.54
Season 3	5.72	18.37	13.29	18.99	17.35	12.83
Season 4	0.10	3.16	18.85	0.72	11.28	14.32
<b>LSD<sub>0.05</sub></b>	<b>0.94</b>	<b>2.39</b>	<b>3.28</b>	<b>1.39</b>	<b>2.45</b>	<b>1.33</b>
White	3.28	10.83	16.45	5.11	13.82	12.54
Black	3.37	11.83	17.58	5.99	12.91	13.50
Mulch	2.50	10.04	13.75	5.56	12.66	13.06
Control	2.58	10.37	14.50	4.45	11.44	12.80
<b>LSD<sub>0.05</sub></b>	<b>0.94</b>	<b>2.39</b>	<b>3.28</b>	<b>1.39</b>	<b>2.45</b>	<b>1.33</b>

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315 **Key:** Season 1-Early Raining Season 2017, Season 2 - Late Raining Season 2017, Season 3-  
316 Early Raining Season 2018 and Season 4 - Late Raining Season 2018. White - White  
317 polyethylene, Black Polyethylene, Mulch-Dried Plant Straw and Control – Un-mulched

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326 Season and mulching materials influenced the yield parameters of cucumber (Table 8). There is  
327 high influenced of season and mulching materials on all the yield parameters of cucumber  
328 measured. Effects of treatments is presented in (Table 9). The results indicates that season two  
329 and four significantly increased ( $p < 0.001$ ) the number of fruits, fruit Length, fruit diameter, fruit  
330 weight, marketable fruit and non- marketable and total yield respectively. All the mulching  
331 treatments used were significantly improved all the yield parameter measured when compared  
332 with control. White transparent plastic mulch, black plastic mulch, dried straw mulch were not  
333 significantly different from each other but white transparent plastic mulch gave the highest  
334 ton/ha.

335 Fig 1 shows the influence of mulching materials on the nutritional quality of cucumber fruit. The  
336 results revealed that calcium, magnesium, phosphorus, iron and potassium did not show  
337 significant different when compared with the different mulching materials, however, there is  
338 little effect of black plastic mulch on Potassium.

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352 Table 8. Combined Analysis of Variance Showing the Mean Squares of Treatments on Cucumber  
353 Yield parameters as influenced by season and and mulching materials.

Source of Variation	DF	Number of Fruit/plot	Fruit Length (cm)	Fruit Diameter (cm)	Fruit Weight (gram/kg)	Non-Mktable	Mktable	Total Yield (ton/h)
Rep	2	7.64	1.85	1.23	145.98	14.88	5.35	5.66
Season	3	388.00**	352.95**	196.12**	45308.86**	403.86**	4.31*	447.56**
Mulch	3	88.92**	4.79	5.98	8065.89	171.53**	11.17**	39.45**
Season*Mulch	9	14.76	3.28	7.35	7107.92	18.21**	4.83	6.44
Error	30	9.33	4.73	3.29	3835.07	7.12	1.54	6.13

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354 Key: DF-degree of freedom, REP- replication

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**Table 9. Effect of Seasons and Mulching Materials on Cucumber Yield Parameters**

Treatment	Number of Fruit/plot	Fruit Length (cm)	Fruit Diameter (cm)	Fruit Weight (gram/kg)	Mktable	Non-Mktable	Total Yield (ton/ha)
Season 1	4.31	15.42	13.17	101.81	3.00	1.35	1.31
Season 2	7.43	16.79	14.61	148.44	6.54	0.70	3.09
Season 3	3.97	18.91	15.50	230.21	2.89	1.10	2.45
Season 4	10.00	21.64	17.99	322.92	8.85	1.33	8.21
<b>LSD<sub>0.05</sub></b>	<b>1.23</b>	<b>0.87</b>	<b>0.73</b>	<b>25.01</b>	<b>1.07</b>	<b>0.50</b>	<b>1.00</b>
White	7.62	17.72	15.48	204.75	6.72	0.95	4.52
Black	6.93	18.41	15.41	206.98	6.18	0.75	4.07
Mulch	6.68	18.35	15.58	209.98	5.83	0.95	4.01
Control	4.47	18.28	14.80	181.67	2.54	1.83	2.45
<b>LSD<sub>0.05</sub></b>	<b>1.23</b>	<b>0.97</b>	<b>0.73</b>	<b>25.01</b>	<b>1.07</b>	<b>0.50</b>	<b>1.00</b>

**Key:** Season 1- Early raining Season 2017, Season 2 - Late Raining Season 2017, Season 3- Early Raining Season 2018 and Season 4 - Late Raining Season 2018. White - White polyethylene, Black Polyethylene, Mulch-Dried Plant Straw and Control – Un-mulched

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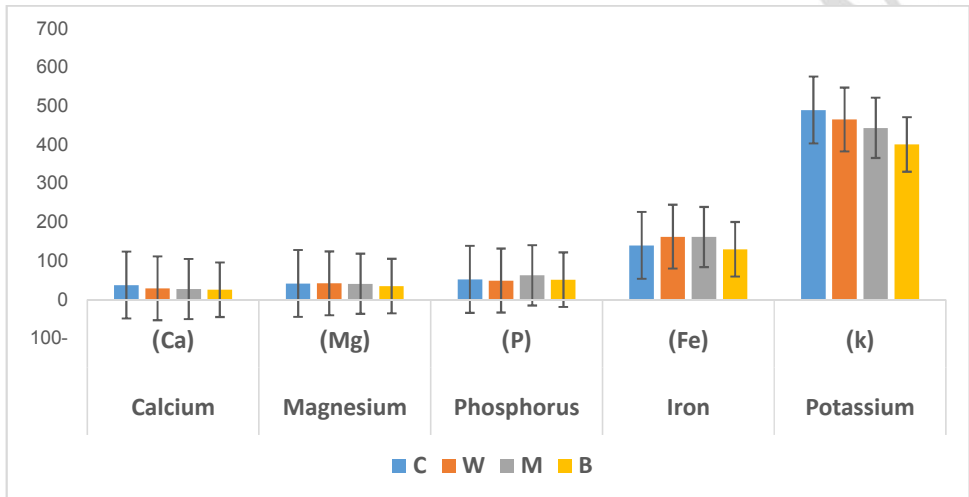
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**Table 10: Effects of season by mulching interactions on the marketable fruit**

<b>MULCHING MATERIALS</b>					
<b>season</b>	<b>White</b>	<b>Black</b>	<b>Mulch</b>	<b>Control</b>	<b>LSD<sub>0.05</sub></b>
<b>1</b>	7.00	4.66	5.33	1.66	<b>5.27</b>
<b>2</b>	13.66	9.33	9.33	3.66	<b>8.52</b>
<b>3</b>	5.00	2.33	4.00	3.33	<b>1.76</b>
<b>4</b>	5.33	12.66	10.00	3.00	<b>4.52</b>
<b>LSD<sub>0.05</sub></b>	<b>4.67</b>	<b>2.95</b>	<b>6.48</b>	<b>4.45</b>	

**Key:** Season 1-Raining Season 2017, Season 2 - Late Raining Season 2017, Season 3- Raining Season 2018 and Season 4 - Late Raining Season 2018. White - White polyethylene, Black Polyethylene, Mulch-Dried Plant Straw and Control – Un-mulched.

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Key: C- control, W- white transparent plastic mulch, M- dried straw mulch and B- black plastic mulch

Fig. 1: influence of mulching materials on the nutritional quality of cucumber fruit.

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#### 427 4.0 DISCUSSION

428 The data recorded on plant growth characteristics expressed as leaf number, vine length, branch  
429 number, stem diameters, number of tendril and tendril length clearly revealed the influence of  
430 season and mulching materials on the cucumber crop. Season one (early raining seasons in both  
431 years) significantly improved the growth and development of the crop compared to season 2 and  
432 4 (late raining season) which indicates the importance of abundance of soil moisture availability  
433 in the soil for proper usage of available soil mineral nutrients compared with when there is little  
434 or shortage of water in the soil for plant to make use. Mulching materials showed a unique  
435 improvement on the agronomical parameters investigated. Black plastic mulch influenced the  
436 growth and development of cucumber parameters investigated; leave number, vine length, and  
437 number of branches, stem diameter, number of tendril, and tendril length were highly improved.  
438 This could be as a result of suppression of weed competition and high use water efficiency [15,  
439 16]. Also, black plastic mulch is capable of maintaining a high soil water contents compared to  
440 the control (no mulch) treatments [17]. Improvement of the water use efficiency by better  
441 utilization of soil water appears to be the best way to increase fruit and vegetable yield [18]. As  
442 well as reducing soil water evaporation and exploiting deep soil water so as to support shoot  
443 biomass accumulation and optimize the dry matter [17]. The continuous influence of the effect of  
444 black plastic mulch could be linked with the decomposition of organic residues under plastic  
445 mulch which in turns add more nutrients and as well resulting to low soil pH, which may  
446 increases the bioavailability of trace elements. Arora *et al.* [19] reported that Black polyethylene  
447 mulch significantly improved plant height, number of branches, flower size and yield. However,

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448 white transparent plastic mulch and plant straw mulch were significantly better than the control  
449 and were not significantly different from each other on leaf number at 4 and 5 WAP, branch  
450 number at 4 and 5 WAP, stem diameter at 4 and 6 WAP, number of tendril at 4, 5, and 6 WAP,  
451 and as well as tendril length at 4, 5 and 6 WAP respectively. This may be as a result of the good  
452 environment modulation potentials of mulching technology. Stable moisture content and well  
453 textured soil leading to unrestricted expanded root growth and subsequent increase in nutrient  
454 absorption, it might also, due to the fact that mulch has been reported to be beneficial in fruit  
455 vegetable production in providing favourable conditions for the plant growth, prevent nutrient  
456 leaching, wind and soil erosion and as well as reduction in evapotranspiration. In all the  
457 mulching materials used in this study (white transparent plastic mulch, black plastic mulch, dried  
458 plants straw and bare soil-control) were significantly different from each other and control was  
459 noticed to be the least among the treatments. This could be as a result of allowing the plant to  
460 grow on a bare soil where it is exposed to soil borne pathogens, insect pest and diseases which  
461 will invariably hinder the growth and development of the plant. This observation confirms the  
462 report of Ba [20] who found that the non- mulched plots produced cucumber plants with the least  
463 plant height, number of branches, flowers, and fruits.

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464 Concerning the effects of seasons on the fruits yield component of cucumber, the results revealed  
465 that seasons significantly improved all the parameters measured (fruit number, fruit length, fruit  
466 diameters, fruit weight, marketable fruits, non-marketable fruits, and total yield). It is noticed  
467 that season 2 and 4 (late raining seasons) in two years of the studies consistently increased all the  
468 cucumber yield parameters measured (fruit number, fruit length, fruit diameters, fruit weight,  
469 marketable fruits, and total yield except non-marketable fruits, and) when compared with raining  
470 seasons (1 and 3). There was a reduction in number of fruits, marketable fruits, total yield and an

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471 increased in nonmarketable fruits during the raining season due to incessant heavy rainfall  
472 experienced in the location thereby favours the insect pest, disease build up and disruption of  
473 insecticide application to control the pest and diseases. In addition, there is a little sunlight for  
474 the plant to photosynthesize which will leads to dropping in temperature as against the plant  
475 growth requirements. As it is reported by Cobeil and Gosselin, [21] that cucumber is a  
476 thermophile plant that requires a stable warm temperature for good yield. The improvement seen  
477 in the season 2 and 4 was as a result of adequate temperature and sunlight, moderate rainfall and  
478 little pest and disease infestation. Furthermore, the flowers were well pollinated with active  
479 insect pollinator without been affected by incessant rainfall.

480 Mulching materials significantly promoted the fruit yield component of cucumber over the  
481 control except nonmarketable fruits. There was no significant different among the mulching  
482 materials (White transparent plastic mulch, black plastic mulch, and dried-plants straw mulch) on  
483 number of fruits, fruit length , fruit diameter, fruit weight, marketable fruits, nonmarketable fruits  
484 and total yield but had highly significant different from control. This study confirmed the report  
485 of Ajibola and Amujoyegbe [8], who reported that higher yield was obtained from the late season  
486 production of cucumber. The consistent increment noticed on all the yield component confirmed  
487 the report of Liu *et al.* [22], Khurshid *et al.* [23 ], and Muhammad *et al.* [24 ] agreed that  
488 mulching improves the ecological environment of the soil, increases soil water contents, reduces  
489 infiltration rate, increases the total intake of water due to formation of loose soil surface, reduces  
490 sealing of soil particle pores, reduces wind and water erosion and weed problems, decomposed  
491 crop residue improves soil aggregation, fertility and increases crop yields [25; 26;27; 28;29; 30;  
492 31; 32 and 33]

493 The interaction effect of seasons x mulching materials on marketable fruits of cucumber revealed  
494 that white transparent plastic mulching materials produced higher number of marketable fruits  
495 when planted in season 2 and 4 which could be as a result of beneficial characteristics of  
496 transparent polyethylene mulch as it repel and reduces the whitefly populations which helped in  
497 catching aphids in yellow traps and reduced virus diseases incidence, in comparison to bare soil.  
498 Transparent polyethylene mulch has a repellent effect on pest and vector insects, such as aphids  
499 [34, 35; 36].

500 The influence of mulching materials on the mineral elements of cucumber fruit results showed  
501 that the mineral element did not affected by the applications of mulching materials irrespective  
502 of the color or source (Ca, Mg, K, P, Fe) however, there was a little drop from the result of  
503 potassium produced with black plastic mulching materials

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## 505 **5.0 CONCLUSION**

506 The results from the study showed that seasons and mulching materials significantly improved  
507 the growth and fruit yield of cucumber produced in this ecological zone. Raining seasons favors  
508 the agronomical parameters while the late raining season improved the fruit yield and yield  
509 components of cucumber. All the mulching materials used significantly improved the growth and  
510 fruit yield components of cucumber. In addition, the interaction of white transparent plastic  
511 mulch in late raining season production significantly produced the highest yield when compared  
512 with other seasons and mulching materials used.

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