

## **Effect of plant spacing and pruning on vegetative growth, yield and fruit quality of introduced mango cultivars**

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### **ABSTRACT**

Kitchener is the most extensively cultivated mango cultivar in the Sudan. However, this cultivar is not popular in export markets due to its high fiber content. Hence, internationally popular mango cultivars have been recently introduced to the Sudan from South Africa. They include Tommy Atkins, Kent, Keitt, Haden and Sensation. An experiment was conducted in Kamleen nursery, Gezira State, Sudan, during June 2008 to May 2011, to investigate the effects of plant spacing and pruning on vegetative growth, yield and fruit quality of these introduced mango cultivars compared to the local cultivar, Abusamaka. The trees were planted at a spacing of 5x5m and 10x10 m and subjected to three types of pruning, namely, pruning to two branches, three branches, tip pruning and control. Treatments were arranged in a split-plot design with three replicates. Plant spacing was assigned to the main plots and pruning treatments to the sub-plots. Results showed that the wider spacing resulted in significantly larger canopy diameter and larger number of fruits per tree than the closer spacing in all cultivars and seasons. However, the closer spacing resulted in significantly larger number of fruits/ha and higher total yield/ha than the wider spacing due to the larger number of trees/ha. Pruning of mango trees to three main branches resulted in significantly the highest yield components and total yield, followed by two branches, tipping and the lowest yield components were produced by the un-pruned control. The introduced mango cultivars had significantly more vigorous vegetative growth, earlier in flowering, higher yield components and total yield and better fruit quality than the local cultivar Abusamaka. It could be concluded that the introduced cultivars Tommy Atkins, Kent and Keitt are promising cultivars to be grown in the Sudan using the high density planting system and pruned annually for high production of good quality fruit.

### **INTRODUCTION**

The mango cultivar Kitchener is the most dominant cultivar in the Sudan and represents about 95% of the mango trees grown in orchards. It is not a good competitor in international markets due to its high fiber content (Elkashif *et al.*, 2003). Mango production in Sudan is challenged by a number of constraints such as low productivity, low fruit quality and high post-harvest losses during harvest of the tall trees (Abdelazim *et al.*, 2011; Elgozouli, 2011). Although more than 500 mango cultivars exist, only a few are important in the international trade. These include Tommy Atkins, Keitt, Kent, Haden, Irwin and Sensation. These cultivars are characterized by fruits with beautiful skin colours, less fibrous, firmer and more suited for long-distance transportation than other cultivars (Cecilia, 2010). Tommy Atkins and Keitt cultivars represent 50% of the commercial crop worldwide (Richard, 2000). Some of these internationally popular cultivars have been recently introduced from South Africa to the Sudan such as Tommy Atkins, Kent, Keitt and

Sensation. These cultivars were planted at a spacing of 5x 5m in Kamleen and Kassala nurseries.

High density planting method of mango trees is now very popular all-over the world. It involves planting trees which have been grafted on dwarfing rootstocks at a close spacing coupled with annual pruning to maintain a reasonable and constant canopy size (Ram *et al.*, 2006; Krishna *et al.*, 2009; Gunjate *et al.*, 2009). Krishna and Singh (2007) reported that great yield improvements were obtained with increased plant density due to the large number of trees per unit area of land.

Mango trees growing in tropical conditions often have excessive vegetative growth and large canopies which are difficult and expensive to manage (Oosthuysen, 1997). Individual tree yield will subsequently decrease due to shading of the terminal branches caused by adjacent trees growing into one another (Sharma *et al.*, 2006). Hence, there is a need for annual pruning to control tree size and achieve the maximum amount of marketable fruit yield. Therefore, the objective of this research was to determine the effects of plant spacing and pruning on vegetative growth, yield and fruit quality of some introduced mango cultivars.

## MATERIALS AND METHODS

### Plant spacing experiment

This study was carried out in Kamleen nursery, Gezira State, Sudan. Mango cultivars Tommy Atkins, Kent, Keitt and Abusamaka were grown at a spacing of 5 x 5 m and 10 m X 10 m to study the effects of plant density and pruning on vegetative growth, yield components, total yield and fruit quality. Treatments were arranged in a split-plot design with three replicates. Plant spacing was assigned to the main plots and pruning treatments to the sub-plots. Cultural practices such as irrigation, fertilization and weed control were carried out as recommended (Richard, 2000) .

### Pruning experiment

Pruning treatments were:

1. Tip-pruning: Only a small piece of the tip-end of the shoots was removed (15-20 cm) branches to grow.
2. Two branches: Pruning of all branches of the tree leaving only two main branches to grow.
3. Three branches: Pruning of all branches leaving only three main branches to grow.
4. The control : Leaving the trees to grow freely without pruning.

### Vegetative growth and yield data

It consisted of tree height (m): measured from ground level to the top of the tree; stem length (m): measured from ground level to the point of branch intersection; stem thickness (cm): measured at 50 cm above ground level; number of branches per tree; canopy diameter (m); number of years to first flowering; date of flowering and number of days from fruit set to harvest. Yield data consisted of number of fruits per tree, number of fruits/ha, fruit weight (g) and total yield (ton/ ha).

### Fruit quality data

It consisted of fruit length (cm), measured from the base to the tip of the fruit using a vernier caliper, fruit width (cm), measured at the widest point using a vernier caliper, fruit weight (g) and rind thickness was determined using a vernier caliper (mm). Fruit shelf-life, which was the number of days from harvest till the fruit reached the full ripe stage, was recorded. Fruit taste was evaluated using a taste panel. The panelists were asked to rate mango fruit taste on a scale of 1 to 5 as follows:

1, excellent; 2, good; 3, fair; 4, poor and 5, very poor.

#### **Fruit chemical analysis:**

It consisted of total soluble solids (TSS), measured using a hand refractometer. Titratable acidity was measured by taking a sample of 5 ml of juice, diluted to 200 ml with distilled water and then titrated against 0.1 N NaOH to a phenolphthalein end point. Titratable acidity was expressed as g of citric acid/100 ml of juice and calculated as follows:

$$TA = \frac{\text{ml NaOH used} \times 0.064 \times 100 \times \text{normality of NaOH}}{\text{ml of juice}}$$

Ascorbic acid was determined using the indophenol method. A sample of 40 ml of mango fruit juice was taken and blended with a reasonable amount of 0.4% oxalic acid and made up to 500 ml. This was filtered through Whatman filter paper No. 4. An aliquot of 20 ml was taken and titrated against standardized 2-6 dichlorophenol-indophenol dye to a faint pink colour

$$\text{Ascorbic acid (mg/100 ml juice)} = \frac{\text{Titer} \times \text{strength of the dye}}{\text{Dilution factor}}$$

$$\text{Dilution factor} = \frac{40 \text{ ml of juice} \times 20 \text{ ml taken}}{500 \text{ (dilution)}} = 1.6$$

#### **Statistical analysis**

Data were analyzed using the standard analysis of variance procedures. Means were separated using Duncan's Multiple Range Test (DMRT).

## RESULTS AND DISCUSSION

### Effects of plant spacing on mango tree canopy and yield

Tables 1 and 2 show the effects of plant spacing of mango trees of the different cultivars on canopy diameter, yield components and total yield in both seasons. There were highly significant differences among treatments in all tested parameters. The wider spacing resulted in significantly larger canopy diameter and larger number of fruits per tree than the closer spacing in all cultivars in both seasons. However, the closer spacing resulted in significantly larger number of fruits/ha and higher total yield/ha than the wider spacing due to the larger number of trees/ha. The traditional plant spacing of 10 x10 m resulted in 100 trees/ha and the recommended intensive planting (5x5 m) resulted in 400 trees/ha. Similar results were reported by Krishna *et al.* (2009) who found that mango productivity increased by the adoption of high density planting system. Regardless of plant spacing, the introduced cultivars Tommy Atkins, Kent and Keitt resulted in the largest canopies, largest number of fruits per tree and highest total yield, however, Kent out-yielded all cultivars when grown at the closer spacing.

The local cultivar Abusamaka resulted in the least vegetative growth and yield parameters in both seasons. Gunjate *et al.* (2009) found that high density planting of Tommy Atkins cultivar (600-800 trees/ha) produced 13.7 tons/ha and the fruit weight was 435 g. Similarly, Ram *et al.* (2006) found that high density of Dashehari cultivar yielded double the number of fruits/ha than that in normal density (68 trees/ha). Also, they mentioned that high density planting technology was most applied with dwarf trees and stated that poor yield of mango could be attributed to wide tree spacing. Krishna and Singh (2007) reported that the fruit yield was 4.4 tons/ha in normal density (69 trees/ha) while it reached 39.8 tons/ha in high density (666 trees/ha) in the 19<sup>th</sup> year. Similar results were found by Krishna *et al.* (2009) who found that Totapuri yielded 13 tons/ha in high density planting (666-833 trees/ha) compared to 6.5 tons/ha in wider spacing.

Table 1. Interaction effects of mango cultivars and plant spacing on tree canopy and fruit yield ( season 2008).

Cultivar	Tree spacing (m)	Canopy diameter (m)	No. of fruits/tree	N. of fruits/ha	Fruit weight (g)	Yield (ton/ha)
Tommy	10 x 10	4.0 a	180 a	18000 c	430 d	7.7 d
Atkins	5 x 5	2.5 c	67d	26800 a	395 e	10.6 b
Kent	10 x 10	4.3 a	126 b	13000 d	566 b	7.4 d
	5 x 5	2.3 c	53 e	21000 b	632 a	13.3 a
Keitt	10 x 10	3.2 b	112 c	11200 e	400 e	4.5 f
	5 x 5	2.0 c	55 e	22000 b	497 c	10.9 b

Abusamaka	10 x 10	2.1 c	125 b	12500 a	500 c	6.3 e
	5 x 5	1.7 d	43 f	17200 c	550 b	9.5 c
Sig. level		**	***	***	***	***
SE $\pm$		0.31	0.37	0.28	0.35	0.21
C.V (%)		11.6	12.1	14.2	12.6	8.4

Means in columns having the same letter(s) are not significantly different at  $P \leq 0.05$  level according to Duncan's Multiple Range Test.

\*\* and \*\*\* indicate significance at  $P \leq 0.01$  and  $0.001$ , respectively.

Table 2. Interaction effects of mango cultivars and plant spacing on tree canopy and fruit yield (season 2009).

Cultivar	Tree spacing (m)	Canopy diameter (m)	No. of fruits/tree	No. of fruits/ha	Fruit weight (g)	Yield (ton/ha)
Tommy Atkins	10 x 10	6.3 a	207 a	20700 e	412 d	8.5 d
	5 x 5	3.8 c	160 b	64000 a	362 e	23.2 b
Kent	10 x 10	5.5 a	156 b	15600 f	543 b	8.5 d
	5 x 5	3.5 c	103 e	41200 c	621 a	25.6 a
Keitt	10 x 10	4.6 b	143 c	14300 f	392 e	5.6 f
	5 x 5	3.2 d	121 d	48400 b	490 c	23.7 b
Abusamaka	10 x 10	3.3 d	155 b	15500 f	492 c	7.6 e
	5 x 5	2.3 e	87 f	34800 d	527 b	18.3 c
Sig. level		***	***	***	***	***
SE $\pm$		0.24	0.31	0.33	0.34	0.24
C.V (%)		11.6	9.6	12.4	12.3	7.4

Means in columns having the same letter(s) are not significantly different at  $P \leq 0.05$  level according to Duncan's Multiple Range Test.

\*\*\* indicate significance at  $P \leq 0.001$ .

### Effects of pruning on mango tree canopy and yield

Table 3 shows the interaction effects of mango cultivars and pruning on tree canopy, yield components and total yield. Pruning had highly significant effects on all measured parameters. Although pruning reduced canopy diameter, yet it resulted in significantly higher yield components and total yield in all cultivars. Baley *et al.* (2009) found that removing branches by pruning reduced the tree's capacity to produce carbohydrates temporarily but the new flushes of growth produced significant amounts of assimilates. Sharma *et al.* (2006) suggested that pruning facilitated light penetration in the canopy, so that photosynthesis during growth was augmented and hence increased yield. These results confirmed those found by Richard (2000) who showed that pruning increased the efficiency of light interception by orchard canopies, which was critical for maximum yield and best fruit quality. However, reduction in yield components and total yield in unpruned trees was most probably due to shading of terminal branches caused by adjacent trees growing into each other.

Table 3. Interaction effects of mango cultivars and pruning on tree canopy, yield components and total yield (average of two seasons).

Mango Cultivar	Pruning Treatment	Canopy Diameter (m)	No. of fruits/tree	No. of fruits/ha	Fruit wt (g)	Yield (ton/ha)
Tommy	P	2.3 c	83.4 a	33360 a	355 b	11.8 a
Atkins	UP	4.0 a	61.9 d	24760 d	302 d	7.5 c
Kent	P	2.0 c	77.8 b	31120 b	362 a	11.3 a
	UP	3.2 b	60.3 d	24000 d	350 b	8.4 c
Keitt	P	2.0 c	70.6 c	28240 c	360 a	10.2 b
	UP	3.0 b	63.0 d	25200 d	332 c	8.4 c
Abusamaka	P	1.5 d	67.7 c	27080 c	332 c	8.9 c
	UP	2.0 c	60.3 d	24120 d	300 d	7.2 c
Sig. level		**	***	***	**	***
SE ±		0.1	0.6	0.4	0.3	0.4
C.V (%)		9.3	11.6	7.8	6.5	4.8

Means in columns having the same letter(s) are not significantly different at  $P \leq 0.05$  level according to Duncan's Multiple Range Test.

P and UP indicate pruned and unpruned, respectively.

\*\* and \*\*\* indicate significance at  $P \leq 0.01$  and  $0.001$ , respectively.

### Effects of type of pruning on yield components and total yield

Table 4 shows significant effects of type of pruning on yield components and total yield. Pruning of mango trees to three main branches resulted in the highest yield components and total yield, followed by two branches, tipping and the least yield parameters were produced by the unpruned control. This was probably due to the fact that three branches pruning facilitated more light interception which increased photosynthetic efficiency and hence increased yield. However, tip pruning and the unpruned control resulted in the lowest yield components and total yield because they prevented the penetration of light into the inner parts of the trees.

Table 4. Effects of type of pruning on yield components and total yield.

Type of pruning	No. of fruits/tree	No. of fruits/ha	Fruit weight (g)	Total yield (ton/ha)
Two branches	68.3 b	27320 b	350 b	9.6 b
Three branches	74.5 a	29800 a	388 a	11.5 a
Tipping	61.2 b	24480 c	312 c	7.3 c
Control	54.0 c	21600 d	280 d	6.0 c
Sig. level	***	***	**	**
SE+	0.63	0.83	0.32	0.42
C.V. (%)	9.6	12.7	12.6	11.8

Means in the same column having different letters are significantly different according to DMRT.

\*\* and \*\*\* indicate significance at 1% and 0.1% probability levels, respectively.

### Vegetative growth of the introduced mango cultivars compared to the local cultivar Abusamaka

Table 5 shows the vegetative growth of the introduced mango cultivars compared to the local cultivar Abusamaka. Tommy Atkins, Keitt and Kent cultivars had the longest main stems and Abusamaka had the shortest. Kent cultivar was the tallest, had the thickest stem, the largest number of branches and the largest canopy, while Abusamaka had the thinnest stem, the smallest number of branches and the smallest canopy. These results indicated that Kent cultivar had the most vigorous vegetative growth, followed by Tommy Atkins and Keitt, while Abusamaka had the least vegetative growth. The vigorous vegetative growth of the introduced cultivars was probably due to genetic factors or types of rootstocks. These results confirmed the findings of Pinto *et al.* (2000) who found that Sabre and Amrapali mango cultivars had dwarfing effects when used as

rootstocks. Tommy Atkins and Keitt had smaller canopy diameters than Kent, however, Abusamaka had the smallest.

Table 5. Vegetative growth of the introduced mango cultivars and the local cultivar Abusamaka grown at a spacing of 5 x 5m at four years of age (average of two seasons).

Cultivar	Tree height (m)	Stem length (m)	Stem thickness (cm)	Number of branches	Canopy diameter (m)
Tommy Atkins	3.5 b	0.9 a	29.6 c	27.3 b	6.1 b
Kent	4.2 a	0.9 a	40.3 a	36.1 a	8.4 a
Keitt	3.4 b	1.0 a	31.5 b	19.8 c	6.7 b
Abusamaka	1.4 c	0.4 b	15.4 d	9.5 d	3.1 c
Sig. level	***	***	***	***	***
SE+	0.82	0.73	0.95	0.57	0.46
C.V. (%)	8.7	6.7	7.8	9.2	6.3

Means in columns having different letters are significantly different according to DMRT.

\*\*\* indicates significance at 0.1% probability level.

### Flowering and yield

Table 6 shows flowering, yield components and total yield of the introduced mango cultivars and the local cultivar Abusamaka. Tommy Atkins, Kent and Keitt had the same number of years to first flowering. However, Abusamaka took a longer time to flowering (4 years) than the introduced cultivars. The early flowering of the introduced cultivars has a great economic advantage. With respect to date of flowering, Tommy Atkins cultivar was the earliest to flower, followed by Kent and Keitt and the latest cultivar was Abusamaka. Considering the number of days from fruit set to harvest, the earliest cultivar was Tommy Atkins, followed by Kent and Keitt. However, the local cultivar Abusamaka took the longest time to maturity. This could be an undesirable characteristic in Sudan because the fruits will be subjected to infestation by fruit flies. However, the late maturity of Abusamaka cultivar could be of great economic advantage and will fetch higher prices, whether in the local market or international markets, because it will be available at the time of mango scarcity. Nevertheless, the introduced cultivars are attractive

because of their beautiful colours, good eating quality, high productivity and good storability. With regard to fruit yield, Tommy Atkins had the highest total yield/ha followed by Kent while Keitt and Abusamaka had the lowest total yields.

Table 6. Time to flowering, yield components and total yield of the Introduced Mango cultivars and the local cultivar Abusamaka (average of two seasons).

Cultivar	YFF	DF	DFH	Fruit wt. (g)	Total yield (ton/ha)
Tommy Atkins	2.1 b	Oct-Nov	153.6 d	336.7 c	14.3 a
Kent	2.3 b	December	165.0 c	638.9 a	11.5 b
Keitt	2.0 b	December	172.3 b	497.5 b	8.4 c
Abusamaka	4.3 a	January	180.0 a	550.0 b	8.5 c
Sig. level	***		***	***	***
SE+	0.13		0.14	0.87	0.97
C.V. (%)	15.94		15.05	14.34	12.97

Means in the same column having different letters are significantly different according to DMRT.

\*\*\* indicate significance at 0.1% probability level.

YFF=number of years to first flowering, DF=date of flowering, DFH=number of days from fruit set to harvest.

### Physical characteristics of mango fruits

Table 7 shows the physical characteristics of mango fruits of the introduced cultivars Tommy Atkins, Kent and Keitt compared to the local cultivar, Abusamaka. The longest fruits were those of Abusamaka cultivar followed by those of Kent, while Keitt and Tommy Atkins cultivars had similar fruit lengths. There were no significant differences in fruit length between Keitt and Tommy Atkins. Elgozouli (2011) found similar results and reported that Abusamaka fruit length exceeded that of Tommy Atkins. Kent and Keitt cultivars had the widest fruits followed by those of Tommy Atkins and Abusamaka which had similar fruit width. Abourayya *et al.* (2011) reported that Keitt cultivar had the widest fruits (10.4 cm) followed by those of Kent and Tommy Atkins. With respect to fruit weight, Kent and Abusamaka cultivars had the heaviest fruits followed by Tommy Atkins and Keitt. These results confirmed the findings of Cecilia (2010) who reported that fruits of Kent cultivar were heavier than those of Keitt. Similar results

were obtained by Elgozouli (2011) and Abourayya *et al.* (2011) who reported that Kent had the highest fruit weight followed by Keitt and Tommy Atkins, however, Abusamaka had a higher fruit weight than Tommy Atkins. Abusamaka and Keitt fruits had the thickest rinds, however, Kent had the thinnest. Similar results were reported by Elgozouli (2011) who found that Abusamaka fruits had a thicker rind compared to that of Tommy Atkins. Mango fruits with thick rinds are more resistant to fruit flies than thin-rinded fruits.

Table 7. Physical characteristics of fruits from introduced and local cultivar (average of two seasons).

Cultivar	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)	Rind thickness (mm)
Kent	13.3 b	9.7 a	632.0 a	1.7 c
Keitt	12.4 c	9.7 a	483.6 c	3.0 a
Tommy Atkins	12.4 c	9.1 b	600.0 b	2.0 b
Abusamaka	17.3 a	9.1 b	623.0 a	3.0 a
Sig. level	***	**	**	**
SE <sub>±</sub>	0.39	0.37	0.54	0.26
C.V.(%)	5.24	7.16	6.78	4.97

Means in columns having different letters are significantly different according to Duncan's Multiple Range Test.

\*\* and \*\*\* indicate significance at 1% and 0.1% probability levels, respectively.

### Chemical characteristics of mango fruits

Table 8 shows significant differences among cultivars on chemical characteristics, shelf life and taste of fruits. Fruits of Tommy Atkins cultivar had the highest total soluble solids (TSS) content followed by those of Kent and Abusamaka, however, Keitt fruits had the lowest TSS. Abdelazim *et al.* (2011) reported that Abusamaka fruits had the lowest total soluble solids compared to other local cultivars in the Sudan. Similar results were reported by Elkashif *et al.* (2003) who found that Abusamaka fruits had a TSS content of 12.81%. Abourayya *et al.* (2011) reported that fruits of Kent cultivar had the highest total soluble solids followed by those of Keitt, however, they were relatively low in fruits of Tommy Atkins. Similar results were reported by Gunjate *et al.* (2009) who found that fruits of Tommy Atkins were less sweet than those of other cultivars.

Titrateable acidity was highest in Abusamaka fruits followed by those of Keitt and Kent, however, fruits of Tommy Atkins had the lowest titrateable acidity. Abourayya *et al.* (2011) reported close acidity values and concluded that acidity depended on cultivar and stage of ripening.

Fruits of Abusamaka cultivar had the highest ascorbic acid content followed by those of Keitt, however, fruits of Kent and Tommy Atkins had the lowest values. Under Sudan conditions, the local cultivar Abusamaka had higher ascorbic acid content than the introduced cultivars. However, Abdelazim *et al.* (2011) found that Abusamaka fruits contained lower values of ascorbic acid compared to those of Galbatour cultivar. John and Veazie (2009) stated that ascorbic acid content varied with cultivar and location.

Table 8 shows that fruits of Keitt cultivar had the longest shelf-life followed by Kent while Tommy Atkins and Abu Samaka had the shortest. Araiza *et al.* (2005) reported that fruits of Tommy Atkins and Kent had longer shelf-lives compared to those of Ataulfo, Gouveia and Osteen mango cultivars in Mexico. This might be due to the high firmness of Tommy Atkins cultivar. This was in agreement with the findings of Pinto *et al.* (2000) who mentioned that the extension of post-harvest life of mango fruits is important to permit transport, distribution and commercialization to distant export markets.

The best fruit taste was recorded in fruits of Tommy Atkins and Kent, however, the worst fruit taste was recorded in Keitt and Abusamaka. This could probably be due to the low TSS and high acidity of Abusamaka fruits. Elkashif *et al.* (2003) evaluated different local mango cultivars and found that fruits of Abusamaka cultivar had the least acceptable taste.

It could be concluded that the introduced cultivars Tommy Atkins, Kent and Keitt are promising cultivars to be grown in the Sudan using the high density planting system and pruned annually for high production of good quality fruit.

Table 8. Chemical characteristics, shelf life and fruit taste of introduced and local mango cultivar (average of two seasons).

Cultivar	TSS (%)	TA	Ascorbic acid (mg/100 ml)	Shelf life (days)	Fruit taste
Kent	15.0 b	0.19 bc	12.4 c	29 b	2.1 a
Keitt	11.0 d	0.28 b	23.3 b	37 a	3.8 b
Tommy Atkins	16.0 a	0.14 c	12.0 c	22 c	1.9 a
Abusamaka	14.0 c	0.88 a	45.2 a	22 c	3.6 b
Sig. level	***	**	***	**	**
SE $\pm$	0.57	0.37	0.76	0.66	0.58
C.V.(%)	6.41	7.64	5.51	4.52	7.46

Means in columns having different letters are significantly different according to Duncan's Multiple Range Test.

\*\* and \*\*\* indicate significance at 1% and 0.1% probability levels, respectively.

TSS = total soluble solids.

TA = titratable acidity.

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تأثير التقليم ومسافات الزراعة على النمو الخضري و الإنتاجية وجودة الثمار لبعض أصناف المانجو المستوردة  
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#### الخلاصة

يعتبر الصنف كتشنر أكثر أصناف المانجو انتشاراً في السودان ولكنه غير مرغوب في أسواق الصادر نسبة لاحتوائه على نسبة عالية من الألياف. لذلك فقد تم استجلاب بعض الأصناف المرغوبة عالمياً من جنوب أفريقيا ، وقد شملت هذه الأصناف تومي أتكنز ، كنت ، كيبب ، هادن وسنسيشن. أجريت التجربة بمشتل الكاملين ، ولاية الجزيرة ، خلال الفترة من يونيو 2008 حتى مايو 2011م لمعرفة تأثير أبعاد الزراعة والتقليم على النمو الخضري ومكونات الانتاج والانتاجية ونوعية الثمار لهذه الأصناف المستوردة مقارنة بالصنف المحلي أبوسمكة. زرعت الأشجار على مسافات 5x5 م و 10 x 10 م وتم تقليمها بثلاثة طرق للتقليم على النحو التالي : تقليم على فرعين وتقليم على ثلاثة أفرع وتقليم القمم النامية للأفرع وغير مقلمة للمقارنة. استخدم تصميم القطع المنشقة بثلاث مكررات، حيث اسندت القطع الرئيسية لأبعاد الزراعة والقطع الفرعية لطرق التقليم. اظهرت النتائج أن مسافات الزراعة 10x10م اعطت معنوياً أفضل نمو خضري وأكبر عدد الثمار للشجرة الواحدة بالمقارنة مع 5x5م في كل المواسم. أبعاد الزراعة 5x5 م اعطت معنوياً أعلى عدد للثمار وأعلى انتاجية للهكتار نسبة للعدد الكبير من الاشجار في الهكتار. تقليم أشجار المانجو لثلاثة أفرع أعطى معنوياً أعلى انتاج يليه التقليم لفرعين ثم تقليم القمة وأدنى انتاجية كانت في الاشجار غير المقلمة. الأصناف المستوردة اعطت معنوياً أفضل نمو خضري وأعلى انتاجية وأفضل نوعية للثمار بالمقارنة مع الصنف المحلي أبوسمكة. خلصت الدراسة إلى أنّ الاصناف المستوردة تومي اتكنز وكنت وكيت هي أصناف واعدة يمكن زراعتها في السودان بطريقة الزراعة المكثفة وتقليمها سنوياً للحصول على أعلى انتاج من الثمار عالية الجودة.