

## **EFFECT OF PRUNING ON GROWTH, FLOWERING AND FRUITING OF HINDI BISINNARA MANGO TREES**

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### **ABSTRACT**

The present investigation was carried out during 2000/2001 and 2001/2002 seasons to study the effect of time and pruning severity on growth, flowering and fruiting of Hindi Bisinnara mango trees. Three pruning treatments were used: pinching (removing the apical buds of terminal flushes), heading back (removing half length of terminal flushes) and removing the entirely terminal flushes of the tree, and the control which were left without pruning. Pruning was carried out monthly from the first week of October up to the first week of February. Results indicated that, all pruning treatments delayed flowering commencement by decreasing percentage of early flowering comparing to the control, except pinching in October which increased this percent. Pinching or heading back increased the number of panicles per shoot, yield as number or weight of fruits per tree at harvest while, decreased panicle length and fruit weight. On the other hand removing the entire terminal flushes slightly increased fruit weight, subsequently significantly decreased yield as number and weight of fruits per tree at harvest. In general pinching or heading back in December increased tree yield of mango Hindi Bisinnara cv.

**Keywords:** Mango-Hindi Bisinnara -Pruning- -Flowering-Yield.

### **INTRODUCTION**

Mango (*Mangifera indica* L.) production may be dramatically improved with improving cultural practices. There are many important commercial cultivars grown in Egypt Hindi Bisinnara one of them. However, early blooming or flowering during winter considered a problem that can be decrease the yield. As Hindi Bisinnara is apparently sensitive cultivar to this phenomenon and usually flowers earlier than the other cultivars. Warm periods during winter may allow early flowering to occur in all mango cvs, which may be damaged by subsequent cold temperature (Litz, 1997). Therefore pruning of mature trees before spring is used to induce synchronous flowering after danger of cold has passed. Winter pruning can be recommended as a measure to synchronize flowering of Sensation mango trees in the on year (Oosthuysen and Jacobs, 1997). Gil *et al.* (1998) increased flowering and fruit set of Haden mango trees was by pruning in the first week of December. Moreover, Lal *et al.* (2000) demonstrated that pruning severity influenced growth of emerging shoots on pruned branches. Furthermore, Sasaki *et al.* (2000) induced axillary panicles of mango cv. Irwin by pruning. Pruning is commonly used as a mean to control mango trees size and synchronize the vegetative and reproductive cycle of trees but may also be utilized to stimulate flowering and fruiting (Crane, 2004).

This work was aimed at studying the effect of pruning (time and severity) on lessening the early flowering phenomenon in mango Hindi Bisinnara cv which reduce the yield if occurred as well as studying the effect of pruning on growth, flowering and fruiting of this cultivar.

## **MATERIALS AND METHODS**

This experiment was conducted during two successive seasons of (2000/2001 and 2001/2002) on Hindi Bisinnara mango trees grown in a private orchard in Giza governorate. Trees were about 18 years old, grafted on seedling rootstocks, planted on sandy soil at 6x6 meters apart and received to the normal cultural practices used in the orchard. Trees were subjected to three pruning treatments: Pinching the terminal flushes of the tree (removing the apical buds of the terminal flushes), Heading back (removing half length of the terminal flushes) and Removing all the terminal flushes of the tree, and the control which were left without pruning. Pruning practices were done in five dates (October, November, December, January and February) consequently the experiment consisted of 16 treatments. For each treatment three trees were selected as replicates and the complete randomized block design was arranged with one tree for each replicate. On each tree thirty shoots were chosen randomly and tagged to determine the following traits, which comprised those treated by pruning and the control trees. Early flowered shoots (%) by using the following equation:

$$\text{Early flowered shoots (\%)} = \frac{\text{Number of flowered shoots before the second week of feb.} \times 100}{\text{Total numbers of pruned shoots}}$$

The second half of February was reported by Ammar (1995) to be the normal time for beginning blooming of Hindi Bisinnara mango trees under Giza governorate (the location of the experiment). Number of panicles per shoot and panicle length (cm) were determined By the end of flowering (in the first and second week of April for both seasons respectively). Number of fruits per tree were counted at harvest time (in the second and third week of July in both seasons respectively).

At harvest nine fruits were taken randomly from each replicate for determination fruit weight (g). Yield per tree in kg was also estimated by multiplying number of fruit per tree X average fruit weight at harvest. Number and length of emerged shoots (cm) as well as number of leaves per emerged shoots were measured at the end of November in both seasons (to make sure that no new flushes were emerged after November). The obtained data were tabulated and statistically analyzed according (Snedecor and Cochran, 1980) and Duncan's multiple range test was used to differentiate means (Duncan, 1955).

## **RESULTS AND DISCUSSION**

### **Effect of pruning on number of emerged shoots:**

Heading back or removing terminal flushes in October or November and December increased the number of emerged shoots, however the differences were insignificant comparing to the control. Pinching in November and December decreased the number of emerged shoots in the first season and gave similar result of the control in the second one. All pruning treatments in February significantly induced emergency of axillary vegetative

shoots comparing to the control Table (1). Removing terminal flushes recorded the highest significant increase in number of emerged shoots per pruned shoot followed by those resulted from heading back or pinching. Also the three pruning treatments in January significantly increased number of emerged shoots in the first season, since it gave similar trends which was noticed with removing terminal flushes or heading back in the second season meanwhile, pinching gave similar results of the control. In general increasing pruning severity tended to increase the number of emerged shoots. These results are in harmony with those of Kulkarni (1983) who reported that pruning of Alphonso mango trees in February resulted in immediate production of vegetative growth. Moreover Nunez-Elisea *et al* (1996) reported that removing apical buds of mango by pruning stimulated initiation of shoots from axillary buds.

**Effect of pruning on shoot length (cm):**

Length of emerged shoots increased with increasing pruning severity Table (1). Removing terminal flushes or heading back seemed to increase shoot length more than pinching. However the highest shoot length was noticed with removing terminal flushes in November in both seasons.

Furthermore heading back significantly increased shoot length for all dates of pruning especially in the first season, while it was significant only in November in the second season. Pinching in February decreased shoot length comparing to the control, this was noticed in both seasons of study.

From the above mentioned results the data reveal that removing terminal flushes was the best pruning treatment for increasing shoot length. These findings are in accordance with those mentioned by Lal *et al* (2000) who found that pruning influenced growth of Dashehari mango trees and increased length of emerging shoots on pruned branches.

**Effect of pruning on number of leaves per shoot:**

Pruning by removing terminal flushes in December and November proved to be effective in increasing number of leaves per emerged shoot comparing to the control and this trend was noticed in both seasons of study Table (1).

In addition heading back on the same dates resulted also in a significantly increase in number of leaves per emerged shoot. Pinching or heading back in the first season decreased number of leaves per shoot however, the differences were insignificant comparing to the control.

Concerning the second season all pruning treatments significantly increased number of leaves per shoot except pinching in October which significantly decreased this number. Therefore increasing pruning severity by removing terminal flushes proved to be the most effective treatment for increasing number of leaves per shoot. These results are in line with those of Oosthuysen and Jacobs (1995) who demonstrated that, tipping can be used to eliminate the problems associated with poor branching, where it increased number of terminal shoots and number of canopy leaves of sensation and kent mango trees.

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**Effect of pruning on percentage of early flowered shoots:**

All pruning treatments significantly decreased percentage of shoots that early flowered comparing to the control except pinching in October which increased this percentage Table (2). Increasing pruning severity caused a pronounced reduction in this percentage. Removing terminal flushes in February presented the lowest values in this regard. All dates of pruning by pinching recorded higher early flowering percent than heading back or removing terminal flushes. Time of pruning affected the percentage of early flowered shoots though, it was decreased gradually with delaying pruning from October to February. It could be concluded from the above mentioned results that pruning can be employed to reduce occurrence of early flowering for Hindi, Bisinnara mango trees. These results go in line with those reported by Oosthuysen (1993) who delayed flowering of Sensation mango trees by pruning. Similarly Walt *et al* (1996) concluded that pruning had a positive effect on delaying flowering and increasing its synchrony without affecting yield of Sensation mango trees. Also Wang *et al* (2000) reported that changing the pruning time from August to September delayed flowering of Aiwon mango trees.

**Effect of pruning on number of panicles:**

The highest number of panicles was recorded with pinching or heading back in October. Moreover pinching increased number of panicles than heading back or removing terminal flushes this was noticed with all pruning dates in both seasons Fig (1). However removing terminal flushes in December, January and February significantly decreased number of panicles comparing with the control in both seasons. Increasing number of panicles may be related to the effect of pruning on releasing apical dominance and inducing buds to produce axillary panicles. In this respect Oosthuysen and Jacobs (1997) reported that the increase flowering intensity by winter pruning could be due, to enhanced number of inflorescences developing per terminal shoot. Moreover Mohan *et al.* (2001) demonstrated that pruning of Dashehari mango trees in New Delhi during July, August and Dec. doubled number of panicle per pruned shoot.

**Effect of pruning on panicle length (cm):**

Generally the longest panicle was produced by the control in both seasons. On the contrary, all pruning treatments significantly decreased panicle length comparing to the control Table (2). Pinching seemed to be effective in decreasing panicle length than other pruning treatments. Heading back produced longer panicles than removing terminal flushes or pinching, this was clear with all pruning dates in both seasons. As a comparison between the three pruning treatments it was noticed that heading back in November and December recorded the longest panicles. Conversely pruning in February gave the lowest panicle length with the three pruning treatments in both seasons. The effect of pinching on reducing panicle length may be related to increasing in number of panicles per shoot. Moreover, decreasing panicle length with removing terminal flushes may be a result of inducing vegetative shoots especially with delaying pruning up to February. In this concern Mohan *et al* (2001) reported that pruning in September reduced panicle length of Dashehari mango trees under Indian conditions.

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**Effect of pruning on number of fruits per tree at harvest:**

Heading back or pinching in December recorded the highest number of fruits per tree in the first season. However, pinching in December or January was the most effective treatment for increasing this number in the second one. Both pinching and heading back treatments increased the number of fruits per tree comparing to the control Table (3). This trend was cleared with all pruning dates except October, which significantly decreased this number. Removing terminal flushes recorded a significant reduction in number of fruits per tree at harvest in both seasons. The increment in number of fruits with pinching or heading back treatments may be related to their effect on inducing axillary panicles on pruned shoots. Conversely, this number decreased with severe pruning may be attributed to its effect on decreasing number of axillary panicles and enhanced number of emerged shoots per pruned flushes. It could be achieved from the above result that light or moderate pruning can be used to increase number of fruits per tree at harvest. In this concern Shinde *et al* (2002) found that pruning recorded the highest fruit number per tree of mango cv. Alphonso.

**Effect of pruning on fruit weight:**

Results in Table (3) showed that removing terminal flushes in October significantly increased fruit weight in both seasons comparing to the control. In general all pruning treatments in October or November tended to increase fruit weight except pinching which decreased it. Fruit weight increased gradually with increasing pruning severity. This was noticed with all dates of pruning except in February in the first season, as heading back increased fruit weight than removing terminal flushes. The increase in fruit weight may be due to the low fruit number per tree resulted from early flowering by pruning in October or November this flowering produced low fruit set because of low temperature during this period. However decreasing fruit weight with pinching may be due to increasing number of panicles and consequently increasing number of fruits per pruned shoot which reduced fruit weight. Removing terminal flushes slightly increased fruit weight comparing to the control, this may be due to reducing number of fruits per tree at harvest. These results are in harmony with those reported by Fivaz *et al* (1997) who, reported that pruning after harvest and fruit set increased fruit size of Tommy Atkins and Sensation mango trees.

**Effect of pruning on tree yield (kg):**

Data in Table (3) indicated that all pruning treatments in October significantly decreased yield per tree comparing to the control. This may be due to increasing percentage of early flowering, which subsequently decreased yield. Also removing terminal flushes decreased yield per tree this was noticed with all dates of pruning. These results are in agreement with Medina (1995) who reported that, severe pruning reduced yield of Tommy Atkins mango trees. Regarding pruning treatments results indicated that heading back or pinching in December, January and February significantly enhanced tree yield comparing to the control. The same trend was noticed in November, however the differences between heading back and the control

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were insignificant. This increase in yield per tree may be attributed to increasing number of fruits per tree at harvest. These results are in line with Mohan *et al* (2001) who found that pruning increased fruit yield of Dashehari mango trees. Moreover, Crane (2004) stimulated fruit production of mango, lime and guava by using pruning.

**Conclusion:**

It could be concluded that the promising pruning treatment is pinching or heading back in December, since they increased number of axillary panicles, number of fruits and yield per tree at harvest, although they decreased panicle length and fruit weight.

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**تأثير التقليم على نمو و تزهر وإثمار أشجار المانجو هندی بسنارة**  
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اجرى هذا البحث خلال موسمي (٢٠٠٠/٢٠٠١ و ٢٠٠١/٢٠٠٢) لدراسة تأثير ميعاد وشدة التقليم على نمو وإزهار وإثمار أشجار المانجو هندی بسنارة. تم استخدام ثلاث معاملات من التقليم وهى: إزالة البرعم الطرفى لدورات النمو الطرفية، إزالة نصف طول دورة النمو الطرفية أو إزالة دورة النمو الطرفية بالإضافة إلى أشجار المقارنة التى تركت بدون تقليم. تم إجراء التقليم فى خمس مواعيد شهرية بداية من الأسبوع الأول من اكتوبر وحتى الأسبوع الأول من فبراير على خمس مجموعات من الأشجار.

أوضحت النتائج أن جميع معاملات التقليم أدت الى تأخير التزهير و خفض نسبة التزهير المبكر عن أشجار المقارنة ماعدا ازالة البرعم الطرفى فى اكتوبر التى أدت الى زيادة هذه النسبة. إزالة البرعم الطرفى أو نصف طول دورة النمو الطرفية أدى الى زيادة أعداد النورات المتكونة لكل فرع وكذلك المحصول كعدد أو وزن ثمار لكل شجرة عند الحصاد و ولكن قل طول النورة وانخفض وزن الثمرة. على الجانب الآخر فان إزالة دورة النمو الطرفية أدت الى زيادة طفيفة فى وزن الثمرة مع حدوث انخفاض معنوي فى المحصول كعدد أو وزن ثمار لكل شجرة عند الحصاد. بصفة عامة فان إزالة البرعم الطرفى أو نصف طول دورة النمو الطرفية فى ديسمبر من أفضل المعاملات لزيادة انتاجية أشجار المانجو هندی بسنارة

**Table (1):Effect of time and severity of pruning on vegetative growth of Hindi Bisinnara Mango trees in two seasons.**

Time of pruning	Pruning treatments (severity)	Season 2000/2001			Season 2001/2002		
		No. of emerged shoots	Shoot Length (cm)	No. of leaves per emerged shoot	No. of Emerged shoots	Shoot Length (cm)	No. of leaves per emerged shoot
October	Pinching	1.11 cd	17.41 hi	11.20 ef	1.16 f	17.20 e-h	10.50 h
	Heading back	1.44 cd	19.50 g	12.70 de	1.33 ef	19.20 ef	16.16 c
	Removing terminal flushes	1.55 cd	23.43 e	15.70 b	1.66 def	19.60 de	15.33 d
November	Pinching	0.88 d	11.07 m	11.00 f	1.00 f	18.20 fg	13.00 ef
	Heading back	1.38 cd	27.75 d	20.50 a	1.33 ef	28.00 bc	19.70 b
	Removing terminal flushes	1.66 c	40.76 a	20.60 a	1.33 ef	40.00 a	20.20 b
December	Pinching	1.00 cd	19.83 g	10.50 f	1.00 f	13.70 l	12.33 fg
	Heading back	1.66 c	17.83 h	11.20 ef	1.66 def	14.00 hi	13.33 e
	Removing terminal flushes	1.66 c	34.22 c	22.00 a	2.00 cde	31.00 b	21.16 a
January	Pinching	2.66 b	16.75 j	10.00 f	1.00 f	13.60 l	13.20 e
	Heading back	2.66 b	22.50 f	11.00 f	2.33 bcd	15.00 ghi	12.00 g
	Removing terminal flushes	3.66 a	36.83 b	15.00 bc	2.00 cde	23.00 d	20.20 b
February	Pinching	2.66 b	14.61 l	10.50 f	2.66 bc	13.50 l	12.81 ef
	Heading back	2.66 b	17.01 ij	11.00 f	3.00 a	16.00 fi	13.10 e
	Removing terminal flushes	2.66 b	27.67 d	14.00 cd	4.66 a	27.00 c	16.00 cd
Control		1.11 cd	15.56 k	11.55 ef	1.00 f	16.41 e-l	10.53 h

Values followed by the same letters in each column are not significantly different at 5% level.

Pinching: Removing apical buds of terminal flushes. Heading back: Removing half length of terminal flushes Removing terminal flushes: Removing all terminal flushes.

**Table (2): Effect of time and severity of pruning on early flowering (%), number of panicles per pruned shoot and Panicle length (cm) of Hindi Bisinnara Mango trees in two seasons.**

Time of pruning	Pruning treatments (severity)	Season 2000/2001			Season 2001/2002		
		Early Flowering (%)	No. of panicles per pruned shoot	Panicle Length (cm)	Early Flowering (%)	No. of panicles per pruned shoot	Panicle Length (cm)
October	Pinching	67.77 a	6.33 a	12.80 hi	63.33 a	6.16 a	12.40 l
	Heading back	54.44 b	5.10 b	16.40 d	38.88 b	5.16 b	18.40 d
	Removing terminal flushes	33.33 c	2.83 d	13.20 gh	27.77 c	1.83 ef	13.60 h
November	Pinching	35.55 c	3.33 c	13.60 g	42.22 b	4.16 c	14.30 g
	Heading back	21.11 de	1.33 f	17.40 c	17.77 e	2.00 e	20.50 b
	Removing terminal flushes	20.00 def	0.88 f	15.60 e	13.33 ef	1.33 g	16.33 f
December	Pinching	28.88 cd	3.77 c	14.10 f	27.22 cd	3.83 d	14.60 g
	Heading back	16.66 efg	1.00 f	18.10 b	8.88 fg	1.66 f	19.80 c
	Removing terminal flushes	10.00 f-i	0.33 g	15.70 e	4.44 gh	0.83 l	16.90 e
January	Pinching	17.77 ef	2.00 e	12.80 hi	20.00de	1.83 ef	11.90 j
	Heading back	10.00 f-i	0.99 f	17.30 c	5.55 gh	1.16 gh	16.50 f
	Removing terminal flushes	4.44 hi	0.22 g	15.80 e	2.22 gh	0.49 j	14.50 g
February	Pinching	12.22 e-h	1.33 f	11.40 j	16.66 e	1.33 g	10.50 l
	Heading back	6.66 ghi	0.88 f	13.60 g	3.33 gh	0.99 hi	12.20 ij
	Removing terminal flushes	00.00 l	0.11 g	12.40 l	00.00 h	0.33 j	11.40 k
Control		65.55 a	1.06 f	22.30 a	62.22 a	1.11 gh	24.60 a

Values followed by the same letters in each column are not significantly different at 5% level.

Pinching: Removing apical buds of terminal flushes. Heading back: Removing half length of terminal flushes Removing terminal flushes: Removing all terminal flushes.

**Table (3): Effect of time and severity of pruning on fruit weight (g), number of fruit per tree at harvest and tree Yield (Kg) of Hindi Bisinnara Mango trees in two seasons.**

Time of pruning	Pruning treatments (severity)	Season 2000/2001			Season 2001/2002		
		Number of fruits / tree	Fruit weight (g)	Tree yield ( Kg)	Number of fruits / tree	Fruit weight (g)	Tree yield ( Kg)
October	Pinching	96 g	239.4 cd	22.98 f	75 h	252.2 a	18.91 g
	Heading back	49 h	244.9 bc	12.00 g	75 h	252.1 a	18.88 g
	Removing terminal flushes	20 l	256.8 a	5.14 h	25 l	255.3 a	6.38 h
November	Pinching	247 e	222.2 fgh	54.88 d	247 f	211.2 d	52.25 e
	Heading back	162 f	233.1 de	36.76 e	165 g	245.9 abc	40.57 f
	Removing terminal flushes	25 l	248.6 ab	6.21 h	37 l	246.1 ab	9.10 h
December	Pinching	412 a	215.5 hi	88.78 a	476 a	209.0 d	99.48 a
	Heading back	416 a	224.2 fg	93.26 a	330 d	234.0 c	77.88 b
	Removing terminal flushes	113 g	223.8 fgh	25.28 f	80.33 h	243.5 abc	18.23 g
January	Pinching	340 c	208.9 ij	71.02 c	387 b	190.8 e	73.83 b
	Heading back	411 a	215.8 ghi	88.69 a	290 e	236.2 bc	68.49 cd
	Removing terminal flushes	110 g	216.1 ghi	23.77 f	80 h	235.8 bc	18.86 g
February	Pinching	318 d	180.5 k	57.39 d	360 c	184.0 e	66.24 d
	Heading back	364 b	223.6 fgh	81.39 b	280 e	189.2 e	52.97 e
	Removing terminal flushes	55 h	206.7 j	11.36 g	82.66 h	203.3 d	16.80 g
Control		162 f	228.9 ef	37.08 e	165 g	236.1 bc	38.95 f

Values followed by the same letters in each column are not significantly different at 5% level.

Pinching: Removing apical buds of terminal flushes. Heading back: Removing half length of terminal flushes Removing terminal flushes: Removing all terminal flushes.

