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A Preliminary Study on Inducing Naomi Mango Trees to Produce an Additional Crop

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Abstract

The present study was conducted on 7 years old Naomi mango trees budded on Succary rootstock, grown under drip irrigation in sandy soil orchard at Wady EL-Natroon, EL-Behaira Governorate, Egypt during (2019-2020) and (2020-2021) seasons. Specific and interaction effects of shading with ceroon net, inflorescence thinning and their combinations were investigated. Most evaluated parameters responded specifically to shading application i.e., two yield measurements (No. & weight of fruits /tree), fruit weight, pulp%, TSS% and TSS/Acid ratio of shaded trees were significantly higher than those of non shaded ones. Meanwhile, total sugars and vitamin C did not respond considerably. Such trend was detected with both common and additional crops.

As for the specific effect of inflorescences thinning application both crops followed two conflicted trends. With the secondry (additional) crop thinning especially at 50% increased it obviously (10 times much more as control), while decreased its most fruit quality (fruit weight, pulp%, TSS%, total sugars% and vitamin C content). The revers was detected with the common crop parameters. Concerning interaction effect, specific effect of each factor reflected on their combinations, whereas the greatest yield values (No. & weight /tree) of the secondry crop was significantly coupled with the 50% thinned trees under shading application. While, good fruit quality was exhibited by the common crop of the nonthinned trees especially shaded ones.

Key wards: Mango, shading, thinning, additional crop.

Introduction

Mangoes (*Mangifera indica* L.) belong to family Anacardaceae, native to South Eastern Asia and considered one of the most important evergreen fruits of the tropical and sub-tropical countries. It is one of the most popular and favorite fruits because of its rich and delicious flavor (aroma &taste). It is considered to be the queen of fruits.

Mango trees were introduced to Egypt around 1825 year and ever since, its' cultivation has gradually expanded throughout the country and became one of the main fruits grown in Egypt, which recently ranking third after citrus and grape crops. The total cultivated area in Egypt reached to about 289288 feddans that produced about 1066404 tons (**Ministry of Agriculture and land reclamation, 2017**). The production areas are focused in Ismailia, Sharkia, Behira and Giza Governorates.

Naomi tree is medium-sized and fairly erect. Young leaves are reddish-brown. The flesh is yellow, fibreless, and has a mild flavor. The seed is monoembryonic. The fruit are medium sized, oval-oblong in shape, and turn a color at maturity. Naomi is a mid-season mango (**Tomer *et al.*, 1993**).

Many factors affecting mango cultivation the climate elements considered as important factor. Climate elements (sunlight, temperature and humidity) considered as crucial factors for cultivation especially for fruit trees such as mango which have specific environmental requirements.

Léchaudel *et al.*, (2013) showed that, exposing mango fruit to high temperature and intense light conditions during growth season may lead to metabolic and physiological disorders which may be reflected negatively on both yield and fruit quality.

Jutamanee and Onnom (2016) indicated that, shading mango trees can be considered as an effective technique to avoid undesirable effects of excess solar under hot climate.

In mango, the removal of the apical bud or inflorescence on terminal shoots just prior to or during the flowering period results in the development of normally inhibited auxiliary buds adjacent to the point of cuttings **(Reece *et al.*, 1946).** These buds usually develop as inflorescences, particularly if pruning is performed shortly before or after the start of normal bud development **(Issarakraisila *et al.*, 1991).**

Several practical advantages have been found in the induction of axillary panicles after panicle pruning of mango **(Shu, 1992).** Moreover, orchard owners in the central part of Taiwan have used this technique to produce off-season mango fruit **(Shu *et al.*, 1989).**

This study aimed to study possibility of producing an additional crop in Naomi mango trees through modifying its flowering nature through some horticultural practices identically shading and flowering thinning.

Materials and Methods

This study was carried out on young fruitful mango trees (7 years old) of Naomi Cv., budded on Succary mango rootstock, grown under drip irrigation system in sandy soil orchard at Wady EL-Natroon region, EL-Behaira Governorate, Egypt during two successive seasons through 2019, 2020 and 2021 years.

It was aimed to study the possibility of producing an additional crop of Naomi mango trees through some safety means as horticultural practices identically tree shading with ceroon net and inflorescence thinning. So, the response to trees shading combined with three thinning rates of inflorescences (removing 25%, 50% of the total panicles/tree and no thinning as control).

This experiment was designed and devoted to investigate the effect of shading Naomi mango trees i. e., two shading states (shading application & no shading) combined with three thinning rates of panicles / inflorescences (removing 25%, 50% of the total panicles number and left without thinning). It aimed to stimulate possibility of producing additional crop of Naomi mango cv. for extending its marketable duration.

Accordingly, the possible combinations between three thinning rates applied on either the shaded trees or the unshaded ones of Naomi mango cv. were the evaluated 6 treatments in this experiment:

Experimental lay out:

The complete randomized block design with three replications was employed for arranging the differential treatments (combinations between two studied factors included in this experiment). Each replicate was represented by two trees. So, 36 trees were needed (2.0 shaded × 3.0 thinning × 3.0 replicate × 2.0 trees/each replicate) to study the specific and interaction effects of two studied factors and their combinations. On half of devoted trees (18 trees) were subjected to shading with ceroon net, while others were left without shading. Trees of each half (18) were divided into 3 categories according to their growth vigor (6 trees per each). Two trees of each category were random subjected to one of 3 thinning rates.

Whereas each replicate was also represented by two trees. Beside, 12.0 additional trees were also included, so reserve would be available. Meanwhile, at full bloom stage (mid April 2019 & 2020 years) inflorescence thinning was carried out by removing 25.0%, 50% of the total panicles or left without thinning. Since, one third of either the ceroon shaded trees or unshaded ones were randomly subjected to only one of the three thinning rates (25%, 50% and without thinning). The following measurements were investigated.

1- Productivity:

Productivity (yield) of the individual Naomi mango tree estimated either as number or weight (kg) of harvested mature fruits per each were recorded on late July – early August (2019 & 2020 years) and late March – early April (2020 & 2021 years) for the common (1st) and additional (2nd) crops during two (2019 & 2020) and (2020 & 2021) experimental seasons, respectively. Two productivity measurements i.e., (No. & weight of fruits per tree) were evaluated**.**

2. Fruit quality:

2.1. Fruit physical properties:

Fruit physical characteristics of Naomi mango trees were determined for both 1st and 2nd crops (separately).

3.2. Fruit chemical properties:

Four fruit chemical characteristics i.e., fruit juice (TSS%, TSS/ Acid ratio, total sugars% and vitamin C) contents, were determined according to **Dubaist *et al.*, (1956)** and **Hussein & Youssef (1972)**.

-Statistical Analysis:

Data obtained during both seasons were subjected to analysis of variance and significant differences among means were compared according to **(Snedecor and Cochran, 1977).** In addition, significant differences among means were differentiated according to the Duncan,s multiple test range **(Duncan, 1955)** where capital and small letters were used for distingusing between values of specific and interaction effects, respectively.

Results and Discussion

The response of Naomi mango trees to specific and interaction effects of two studied factors (shading with ceroon and inflorescence thinning rates) i.e., 6 combinations were evaluated through the differences exhibited in the following measurements:

1. Tree productivity (yield):

A. Specific effect:

Concerning the specific effect of tree shading with ceroon net, data obtained in **Table (1)** displayed that, two productivity parameters (No. & weight in kg of harvested fruits per tree) followed generally the same trend. Herein, shading application increased significantly the two yield parameters for both 1st and 2nd crops of Naomi mango trees during two experimental seasons. However, the rate of increase was relatively higher in the first crop than that in secondry crop in spite of differences were still significant even in the additional crop.

As for the specific effect of thinning application, it was quite clear that, two opposite trends were detected as the response of the 1st and 2nd crops was concerned. Anyhow, with the common crop (1st one) the unthinned trees showed the greatest values of two yield parameters followed statistically in a descending order by those subjected to 25.0 and 50 % thinned inflorescences. The reverse was true with the additional crop, whereas the 50.0 % thinned trees were statistically the superior while the unthinned ones were the inferior. Two trends of the specific effect of inflorescence thinning were true during both seasons, whereas each crop (1stand 2nd) followed its own trend, however rate of variance was more pronounced with the secondry crop for two yield parameters.

B. Interaction effect:

Data in **Table (1)** declared that, two opposite trends were detected as the responses of either 1st or 2nd crops to the interaction effect were

separately compared. Consequently, with the 1st crop both combinations of the nonthinned Naomi trees gave the higher values, while two combinations of 50% thinned panicles gave the lowest values (irrespective of shading was applied or not).

Meanwhile, with the additional crop the trend took the other way around, whereas the thinned trees at 50% especially those shaded produced significantly the greatest values of two yield parameters, while those neither thinned nor shaded ones that gave the lowest values.

Taking into consideration, that both combinations of 25 % thinned trees were significantly in between as both 1st & 2nd crops were concerned.

These results are in general agreement with the findings of **Chang and Leon (1987)** and **Shu (1992)** who found that, de blossoming of the terminal inflorescence of mango can lead to inflorescence development from axillary buds and consequently considered as a technique can be used to produce off-season fruits. However, findings of **Lechaudel *et al.*, (2013)** gave support to the specific effect of shading. They pointed out that, shading is an effective technique to avoid desirable effects of exposing mango to climate elements of high temperature, intense light conditions which certainly resulted in some physiological disorders as that usually reflect negatively on both yield and fruit quality.

Table 1. Yield as number and weight (kg) of fruits per Naomi mango tree in response to specific and interaction effects of tree shading with ceroon net and thinning rate during two successive (2019-2020) and (2020-2021) experimental seasons.

Treatments / Tree shading / Thinning rate	Common (1st) yield late July &early Aug. (2019)			Secondary (2ed) yield late March & early April (2020)		
Yield as number of fruits/tree						
1st (2019-2020) experimental season						
	No shading	**Shading**	**Mean***	**No shading**	**Shading**	**Mean***
T1– Control (no thinning)	62.17 a	66.51 a	**64.34 A**	1.99 d	2.58 d	**2.28 C**
T2- (25 %)	45.01 bc	50.44 b	**47.73 B**	15.33 c	17.22 c	**16.27 B**
T3- (50 %)	37.36 c	44.69 bc	**41.03 C**	25.09 b	27.39 a	**26.24 A**
Mean**	**48.18 B**	**53.88 A**		**14.14.B**	**15.37 A**	
2nd (2020-2021) experimental season						
	Common (1st) yield late July &early Aug. (2020)			**Secondary (2ed) yield late March & early April (2021)**		
T1– Control (no thinning)	68.53 a	68.89 a	**68.71 A**	1.72 d	2.04 d	**1.88 C**
T2- (25 %)	33.10 c	52.69 b	**42.90 B**	17.84 c	20.14 b	**18.99 B**
T3- (50 %)	37.60 c	35.23 c	**36.41 C**	26.16 a	25.92 a	**26.04 A**
Mean**	**46.41 B**	**52.27 A**		**15.24 B**	**16.03 A**	
Yield as weight of fruits (kg)/tree						
1st (2019-2020) experimental season						
	Common (1st) yield late July &early Aug. (2019)			**Secondary (2ed) yield late March & early April (2020)**		
	No shading	**Shading**	**Mean***	**No shading**	**Shading**	**Mean***
T1– Control (no thinning)	24.05 b	26.03 a	**25.11 A**	0.63 e	0.65 e	**0.64 C**
T2- (25 %)	18.07 d	20.60 c	**19.34 B**	4.42 d	5.08 c	**4.75 B**
T3- (50 %)	16.75 f	18.25 e	**17.50 C**	6.93 b	7.70 a	**7.32 A**
Mean**	**19.62 B**	**21.62 A**		**3.50 B**	**4.53 A**	
2nd (2020-2021) experimental season						
	Common (1st) yield late July &early Aug. (2020)			**Secondary (2ed) yield late March & early April (2021)**		
T1– Control (no thinning)	24.95 b	26.63 a	**25.81 A**	0.50 e	0.61 e	**0.55 C**
T2- (25 %)	17.52 d	21.12 c	**16.98 B**	4.60 d	5.29 c	**5.38 B**
T3- (50 %)	16.10 f	16.47 e	**16.24 C**	6.80 b	7.14 a	**6.84 A**
Mean**	**18.24 B**	**21.86 A**		**4.23 A**	**4.11 A**	

* &** refer to specific effect of thinning rate and tree shading application, respectively. Means of each investigated factor or their combinations followed by the same capital or small letter/s are not significant at 5% level.

2. Fruit quality:

2.1. Some fruit physical properties:

-Fruit weight:

The average fruit weight of Naomi mango fruits in response to specific and interaction effects of tree shading and panicle thinning were investigated.

A. Specific effect:

With regard to the specific effect of tree shading with ceroon, data in **Table (2)** revealed that, the average fruit weight followed trend during both seasons which pointed out that, shading application increased it significantly for both common and secondry crops.

Concerning the specific effect of flowering thinning, it was quite clear that, 1st and 2nd crops followed two conflicted trends. Herein, 50.0 %, thinning rate was statistically the superior and 0.0 thinning rate (control) was the inferior with the 1st crop, while with secondry crop the opposite was true.

B. Interaction effect:

With the common crop the combinations of 50.0 % thinned trees especially shading construction ones having significantly the greatest values of fruit weight, while the reverse was found with non thinned trees. As for the secondry crop the opposite was detected. In addition, other combinations were in between.

- Percentage of three fruit components:

Percentage of fruit pulp, peel and seed were the three components investigated.

Data in **Tables (2 & 3)** revealed that, each parameter followed its own trend, whereas the fruit pulp % followed an opposite trend to that detected with both peel and seed%.

A- Specific effect:

With regard to the specific effect of tree shading application, data obtained declared that, shaded trees had statistically higher pulp%, while with both peel and seed% the reverse was detected. Such trend was true in both crops.

Meanwhile, the specific effect of thinning rate not only differed from one physical character to other, but also the response of the common crop was completely varied than that with the additional one.

However, the 1st (common) crop showed the highest fruit pulp% and the least peel and seed% were significantly in closed relationship with the severest thinning rate (50%). However, with the secondary crop the reverse was true.

B-interaction effect:

The shaded trees thinned at 50.0 % showed the highest pulp% from one hand and the lowest percentage of both fruit peel and seed from the other as the response of 1st crop was concerned. However, the revers was detected in the secondry crop, whereas, the shaded trees without thinning showed the highest pulp% and least values of both peel and seed%. In addition, other combinations were in between.

These results are in partial agreement with the findings of **Mthembu (2001)** and **Dayioglu & Hepaksoy (2016)** who showed that, black or white shading nets reduced sunburn of apple fruits without negative impact on fruit quality and maturation.

The findings **of Lechaual *et al.*, (2018)** and **Jutamanee and Onnom (2016),** gave support to our results all demonstrated that shading mango trees considered as an effective technique to avoid the undesirable effects of high temperature and intense high on fruit quality and preventing the metabolic and physiological disorders with could be certainly reflected negatively on both yield and fruit quality.

Horscroft and Sharples (1987) and Chaudhary *et al.*, (2020) reported that fruit thinning of mango improves fruit quality.

Table 2. Average fruit weight (g) and pulp% of Naomi mango cv. in response to specific and interaction effects of tree shading with ceroon net and thinning rate during two successive (2019-2020) and (2020-2021) experimental seasons.

Treatments	Average fruit weight (g)					
Tree shading	1st (2019-2020) experimental season					
	Common (1st) yield late July &early Aug. (2019)			Secondary (2ed) yield late March & early April (2020)		
Thinning rate	No shading	Shading	Mean*	No shading	Shading	Mean*
T1– Control (no thinning)	387.30 d	393.00 d	**390.20 C**	295.60 b	314.20 a	**304.90A**
T2- (25 %)	401.90 c	408.30 c	**405.10 B**	282.50 cd	288.80 bc	**285.60B**
T3- (50 %)	422.00 b	461.30 a	**441.70 A**	276.30 d	281.10 cd	**278.70B**
Mean**	**403.70 B**	**420.90 A**		**284.80 B**	**294.70 A**	
	2-ed (2020-2021) experimental season					
	Common (1st) yield late July &early Aug. (2020)			Secondary (2ed) yield late March & early April (2021)		
T1– Control (no thinning)	364.50 f	386.80 e	**375.70 C**	293.20 a	297.80 a	**295.50 A**
T2- (25 %)	390.90 d	400.70 c	**395.80 B**	282.20 a	284.60 a	**283.40 B**
T3- (50 %)	444.60 b	467.30 a	**455.95 A**	258.00 b	265.80 b	**262.80 C**
Mean**	**400.00 B**	**418.30A**		**277.80 A**	**282.70 A**	
Treatments	Fruit pulp%					
Tree shading	1st (2019-2020) experimental season					
	Common (1st) yield late July &early Aug. (2019)			Secondary (2ed) yield late March & early April (2020)		
Thinning rate	No shading	Shading	Mean*	No shading	Shading	Mean*
T1– Control (no thinning)	76.04 e	77.57 d	**76.81 C**	76.97 b	79.52 a	**78.24 A**
T2- (25 %)	78.30 c	78.43 c	**78.45 B**	74.89 d	75.96 c	**75.42 B**
T3- (50 %)	80.14 b	80.81 a	**80.48 A**	72.38 f	74.12 e	**73.25 C**
Mean**	**78.16 B**	**78.99 A**		**74.79 B**	**76.48 A**	
	2-ed (2020-2021) experimental season					
	Common (1st) yield late July &early Aug. (2020)			Secondary (2ed) yield late March & early April (2021)		
T1– Control (no thinning)	75.33 e	76.74 d	**76.04 C**	76.55 b	78.86 a	**77.70 A**
T2- (25 %)	76.53 d	78.09 c	**77.31 B**	75.00 b	75.71 c	**75.30 B**
T3- (50 %)	79.03 b	80.24 a	**79.65 A**	72.35 e	74.01 d	**73.18 C**
Mean**	**76.96 B**	**78.36 A**		**74.63 B**	**76.19 A**	

* &** refer to specific effect of thinning rate and tree shading application, respectively. Means of each investigated factor or their combinations followed by the same capital or small letter/s are not significant at 5% level.

Table 3. Fruit peel and seed percentages of Naomi mango cv. in response to specific and interaction effects of tree shading with ceroon net and thinning rate during two successive (2019-2020) and (2020-2021) experimental seasons.

Treatments / Tree shading / Thinning rate	Fruit peel %					
	1st (2019-2020) experimental season					
	Common (1st) yield late July &early Aug. (2019)			Secondary (2ed) yield late March & early April (2020)		
	No shading	Shading	Mean*	No shading	Shading	Mean*
T1– Control (no thinning)	14.91 a	13.47 b	**14.19 A**	15.15 e	12.83 f	**13.99 C**
T2- (25 %)	13.15 c	13.05 c	**13.10 B**	17.06 c	16.11 d	**16.59 B**
T3- (50 %)	11.84 d	11.17 e	**11.50 C**	19.20 a	17.80 b	**18.50 A**
Mean**	**13.30 A**	**12.56 B**		**17.14 A**	**15.58 B**	
	2-ed (2020-2021) experimental season					
	Common (1st) yield late July &early Aug. (2020)			Secondary (2ed) yield late March & early April (2021)		
T1– Control (no thinning)	15.40 a	14.54 b	**14.97 A**	15.62 d	13.56 e	**14.59 C**
T2- (25 %)	14.91 ab	13.59 c	**14.25 B**	16.49 c	16.97 c	**16.73 B**
T3- (50 %)	13.00 d	11.86 e	**12.43 C**	19.39 a	17.85 b	**18.62 A**
Mean**	**14.44 A**	**13.33 B**		**17.17 A**	**16.12 B**	
Treatments / Tree shading / Thinning rate	Fruit seed %					
	1st (2019-2020) experimental season					
	Common (1st) yield late July &early Aug. (2019)			Secondary (2ed) yield late March & early April (2020)		
	No shading	Shading	Mean*	No shading	Shading	Mean*
T1– Control (no thinning)	9.05 a	8.96 a	**9.01 A**	7.88 bc	7.65 c	**7.77 C**
T2- (25 %)	8.55 b	8.35 b	**8.45 B**	8.05 b	7.93 b	**7.99 B**
T3- (50 %)	8.02 c	8.02 c	**8.02 C**	8.28 a	8.22 a	**8.25 A**
Mean**	**8.54 A**	**8.45 B**		**8.07 A**	**7.93 B**	
	2-ed (2020-2021) experimental season					
	Common (1st) yield late July &early Aug. (2020)			Secondary (2ed) yield late March & early April (2021)		
T1– Control (no thinning)	9.03 a	8.94 a	**8.99 A**	7.83 d	7.58 e	**7.71 C**
T2- (25 %)	8.56 b	8.32 c	**8.44 B**	7.99 bc	7.95 cd	**7.97 B**
T3- (50 %)	7.99 d	7.90 d	**7.92 C**	8.25 a	8.15 ab	**8.20 A**
Mean**	**8.60 A**	**8.31 B**		**9.03 A**	**7.89 B**	

* &** refer to specific effect of thinning rate and tree shading application, respectively. Means of each investigated factor or their combinations followed by the same capital or small letter/s are not significant at 5% level.

2.2. Fruit chemical properties:

The fruit juice TSS%, TSS/acid ratio, total sugars% and vitamin C contents were the investigated chemical characteristics of Naomi mango cv. as influenced by shading with ceroon and flowering thinning rate.

A. Specific effect:

With regard to specific effect of shading with ceroon net, data obtained as shown in **Tables (4 & 5)** displayed that, the response was too slight to be taken into consideration as the responses of the four evaluated fruit chemical properties were concerned. Such trend was true except with TSS % and TSS/ acid ratio of the secondry (2nd) crop, whereas shading increased them significantly.

As for the specific effect of flowering thinning, it is quite clear that, fruit juice vitamin C content in 1st crop only did not significantly influenced. However, other characteristics showed two conflicted trends.

Herein, two thinning rates 50.0 % and 25% increased significantly fruit juice TSS%, TSS/Acid ratio and total sugar % of 1st crop, whereas the severest thinning rate was more effective. On the contrary, with the secondry crop the control (no thinning) recorded the highest values for TSS%, TSS/Acid ratio; total sugar % and vitamin C content.

B-interaction effect:

Two opposite trends were detected as the interaction effect on these fruit chemical characteristics of 1st and 2nd crops were concerned. Anyhow, with 1st crop the shaded trees especially those thinned at 50% level had significantly the richest fruit TSS%, TSS/Acid ratio, total sugar % and vitamin c, and the reverse was observed by the

neither thinned nor shaded trees. However, with the secondry crop an opposite trend to that previously detected with the common crop was found.

These results are in general agreement with those previously found by **Horscroft and Sharples (1987); Yeshitela (2004); Mustafa *et al.*, (2018);**

Table 4. Fruit juice TSS % and TSS/Acid ratio of Naomi mango cv. in response to specific and interaction effects of tree shading with ceroon net and thinning rate during two successive (2019-2020) and (2020-2021) experimental seasons**.**

Treatments	**Fruit juice TSS %**					
Tree shading	**1st (2019-2020) experimental season**					
	Common (1st) yield late July &early Aug. (2019)			**Secondary (2ed) yield late March & early April (2020)**		
Thinning rate	**No shading**	**Shading**	**Mean***	**No shading**	**Shading**	**Mean***
T1– Control (no thinning)	13.96 e	14.02 e	**13.99 C**	12.97 b	13.57 a	**13.27 A**
T2- (25 %)	14.22 d	14.49 c	**14.36 B**	11.82 c	11.90 c	**11.86 B**
T3- (50 %)	15.22 b	15.43 a	**15.32 A**	11.40 e	11.57 d	**11.48 C**
Mean**	**14.46 A**	**14.65 A**		**12.06 B**	**12.35 A**	
	2-ed (2020-2021) experimental season					
	Common (1st) yield late July &early Aug. (2020)			**Secondary (2ed) yield late March & early April (2021)**		
T1– Control (no thinning)	13.75 d	14.16 c	**13.96 C**	13.26 b	13.68 a	**13.47 A**
T2- (25 %)	14.28 c	14.52 b	**14.40 B**	11.89 c	12.01 c	**11.95 B**
T3- (50 %)	15.30 a	15.37 a	**15.33 A**	11.69 d	11.61 d	**11.65 C**
Mean**	**14.44 A**	**14.68 A**		**12.28 B**	**12.44 A**	
Treatments	**Fruit juice TSS/ acidity ratio**					
Tree shading	**1st (2019-2020) experimental season**					
	Common (1st) yield late July &early Aug. (2019)			**Secondary (2ed) yield late March & early April (2020)**		
Thinning rate	**No shading**	**Shading**	**Mean***	**No shading**	**Shading**	**Mean***
T1– Control (no thinning)	27.59 d	28.15 c	**27.87 C**	28.19 a	29.06 a	**28.60 A**
T2- (25 %)	29.02 b	29.51 b	**29.25 B**	23.36 c	24.43 b	**23.96 B**
T3- (50 %)	33.02 a	32.15 a	**32.53 A**	24.68 b	23.37 c	**23.05 B**
Mean**	**29.75 A**	**29.89 A**		**24.66 B**	**25.57 A**	
	2-ed (2020-2021) experimental season					
	Common (1st) yield late July &early Aug. (2020)			**Secondary (2ed) yield late March & early April (2021)**		
T1– Control (no thinning)	27.34 e	28.43 d	**27.98 C**	29.08 a	29.29 a	**29.35 A**
T2- (25 %)	29.14 c	29.69 c	**29.45 B**	24.36 b	24.36 b	**24.59 B**
T3- (50 %)	33.26 a	32.49 b	**32.83 A**	23.47 c	23.08 b	**23.27 C**
Mean**	**29.83 A**	**30.21 A**		**25.53 B**	**25.97 A**	

* &** refer to specific effect of thinning rate and tree shading application, respectively. Means of each investigated factor or their combinations followed by the same capital or small letter/s are not significant at 5% level.

Table 5. Fruit juice total sugars% and vitamin c (mg/100g pulp) of Naomi mango cv. in response to specific and interaction effects of tree shading with ceroon net and thinning rate during two successive (2019-2020) and (2020-2021) experimental seasons**.**

Treatments	Fruit juice total sugars %					
Tree shading	1st (2019-2020) experimental season					
	Common (1st) yield late July &early Aug. (2019)			Secondary (2ed) yield late March & early April (2020)		
Thinning rate	No shading	Shading	Mean*	No shading	Shading	Mean*
T1– Control (no thinning)	11.56 c	11.73 c	**11.65 B**	10.54 bc	10.66 b	**10.77 A**
T2- (25 %)	12.93 b	12.69 b	**12.81 B**	10.86 a	10.67 b	**10.60 B**
T3- (50 %)	13.09 a	13.06 a	**13.07 A**	10.34 d	10.47 c	**10.41 C**
Mean**	**12.53 A**	**12.49 A**		**10.58 A**	**9.60 A**	
	2ed (2020-2021) experimental season					
	Common (1st) yield late July &early Aug. (2020)			Secondary (2ed) yield late March & early April (2021)		
T1– Control (no thinning)	11.57 c	11.73 c	**11.65 B**	10.44 b	10.54 b	**10.59 A**
T2- (25 %)	12.81 b	12.63 b	**12.72 B**	10.67 a	10.51 b	**10.49 B**
T3- (50 %)	13.12 a	12.90 b	**13.01 A**	10.25 c	10.40 b	**10.33 B**
Mean**	**12.50 A**	**12.42 A**		**7.46 A**	**7.48 A**	
Treatments	Fruit juice vitamin C content					
Tree shading	1st (2019-2020) experimental season					
	Common (1st) yield late July &early Aug. (2019)			Secondary (2ed) yield late March & early April (2020)		
Thinning rate	No shading	Shading	Mean*	No shading	Shading	Mean*
T1– Control (no thinning)	41.64 a	42.80 a	**42.22 A**	39.32 ab	40.70 a	**40.80 A**
T2- (25 %)	43.16 a	42.64 a	**42.90 A**	42.28 a	37.00 b	**40.15 A**
T3- (50 %)	43.51 a	43.47 a	**43.49 A**	36.70 b	36.86 b	**34.90 B**
Mean**	**42.77 A**	**42.97 A**		**36.31 A**	**39.95 A**	
	2ed (2020-2021) experimental season					
	Common (1st) yield late July &early Aug. (2020)			Secondary (2ed) yield late March & early April (2021)		
T1– Control (no thinning)	40.91 a	41.97 a	**41.44 A**	38.38 a	40.09 a	**39.24 A**
T2- (25 %)	43.70 a	43.76 a	**43.73 A**	35.34 b	37.22 ab	**36.28 B**
T3- (50 %)	43.27 a	43.57 a	**43.42 A**	31.94 c	32.26 c	**32.10 C**
Mean**	**42.18 A**	**42.88 A**		**35.22 A**	**36.52 A**	

* &** refer to specific effect of thinning rate and tree shading application, respectively. Means of each investigated factor or their combinations followed by the same capital or small letter/s are not significant at 5% level.

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دراسة مبدئية علي دفع اشجار المانجو ناعومى لإنتاج محصول إضافى

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أجريت هذه الدراسة على أشجار مثمرة حديثة (7 سنوات) لصنف المانجو ناعومى مطعومة على الأصل سكرى ونامية فى مزرعة رملية تحت نظام الرى بالتنقيط بمنطقة وادى النطرون – محافظة البحيرة – مصر خلال موسمين تجريبيين متتاليين أعوام 2019–2020،2020–2021. وتم دراسة التأثيرات النوعية والتفاعلية للتظليل بالسيران ، وخف النورات الزهرية. هذا وقد صممت التجربة بنظام القطاعات التامة العشوائية وكررت كل معاملة ثلاثة مرات ومثلت كل مكررة بشجرتين.

وقد إستهدفت هذه التجربة دراسة إمكانية إنتاج محصول إضافى (ثانوى) لأشجار المانجو ناعومى من خلال بعض الوسائل الآمنة تحديداً معاملات بستانية كخف النورات الزهرية وتظليل الأشجار بشباك السيران عديم اللون الشفاف نوعاً ما. حيث أختبر مستويان من الخف (إزالة 25 % ، 50 % من عدد النورات بالشجرة) إضافة الى عدم الخف كمقارنة فى تباديل مع التظليل وعدم التظليل. وعليه أختبرت ستة معاملات للتراكيب بين (ثلاثة معاملات خف النورات لاشجار ناعومى تم تظليلها واخرى غير مظلله). وقد تم تقييم تاثير المعاملات من خلال دراسة بعض قياسات الإنتاجية وبعض خصائص الثمار سواء الطبيعية أوالكيميائية. وعن اهم النتائج المتحصل عليها خلال موسمى الدراسة يمكن ان نوجزها فى ان عدم الخف وتظليل الاشجار هما الاكثر تفوقا فى انتاج اعلى القيم لقياسات المحصول الاول (عدد الثمار– وزنها/ شجرة) ، والعكس كان صحيحا بالنسبة للاشجار التى عوملت بخف 50 % من نوراتها سواء ظللت الاشجار ام لم تظلل. أما بالنسبة للمحصول الاضافي فإن الإتجاه كان مضاداً تماماً لما ذكر مع المحصول الأول. وبالنسبة لصفات الجودة فقد لوحظ ان ثمار المحصول الاول للاشجار المظللة والتى تم خف نوراتها بمعدل 50% كان متوسط وزنها ونسبة اللب بها هى الاعلى خلال موسمى الدراسة. أما ثمار المحصول الاضافى فأظهرت العكس تماما لما ذكر مع ثمار المحصول الاول. وبالنسبة لصفات الجودة الكيماوية فقد لوحظ ان ثمار المحصول الأول للأشجار المظللة خاصة تلك التى خفت نوراتها بمعدل 50% كانت هى الأغنى (الأعلى) فى محتوى عصيرها من نسبة المواد الصلبة الذائبة الكلية ونسبتها إلى الحموضة الكلية والسكريات الكلية وفيتامين ج ، والعكس تماما لثمار تلك الاشجار التى لم تظلل ولم تخف نوراتها. أما بالنسبة لثمار المحصول الثانوى فإن الإتجاه كان معاكساً تماماً لما سبق ذكره مع ثمار المحصول الأول.