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SOME FACTORS AFFECTING ORANGE FRUIT SPLITTING OF WASHINGTON NAVEL ORANGE UNDER KAFERELSHIKH CONDITIONS.
B- THE EFFECT OF CLIMATIC CONDITIONS AND FRUIT POSITION ON THE TREE CANOPY.

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ABSTRACT

This study was carried out during 2010 and 2011 seasons on 14 years old Washington navel orange trees (*C . sinensis L .*) grown on two citrus rootstocks (Volkamer lemon and Sour orange) and spaced at 5x5 m in private orchard at Kafrelshikh Governorate , to study the effect of the climatic conditions and fruit position on fruit splitting under Kafrelshikh Climatic conditions .

The obtained results showed that, the incidence of splitting starts lightly in September coincidence with maximum air temperature and relative humidity before and after this period followed by gradual increase of fruit maturity. Trees on both Volkamer lemon and Sour orange rootstocks gave a high percentage of splitting, reaching a maximum values in November and December. The highest percentage of fruit splitting was counted in the southern aspect and lower part than in upper part of tree canopy. Trees on Sour orange rootstock in both seasons recorded the highest percentage of splitting compared to those on Volkamer lemon.

INTRODUCTION

Splitting may start as early as in september, with most occurring in late october (Y– Zhengwen *et.al*. 2002). Severity of splitting is variable; some years are worth than others. Splitting orange fruits are usually due to stress on the tree, usually a combination of fluctuation temperatures, humidity and other factors such as the used cultivars on the given rootstock and fruit position on the tree canopy. This study puts light on the influence of air temperatures, relative humidity and fruit position on the tree canopy in relation to fruit splitting of Washington Navel orange at Kafrelsheikh climatic conditions.

MATERIALS AND METHODS

The Present study was carried out at a private orchard at Kafrelshikh governorate during 2010 and 2011 seasons on 14 years old Washington Navel orange trees budded on two citrus rootstocks ie.,Volkamer lemon (*C. volkamariana*) and Sour Orange (*C.aurantium)* . The trees are grown in clay soil and spaced at 5X5 meter in a randomized complete design with three replicates each of three trees. Mechanical and chemical analysis of the experimental soil was done as shown inTable (1).

Table (1): Mechanical and Chemical analysis of experimental field

Mechanical				Chemical			Available %			DTPA extractable ppm				
Sand %	Silt %	Clay %	Structure	pH	EC	O.M	N %	P %	K %	Ca %	Mg %	Na %	Fe Ppm	Zn Ppm
9.65	32.15	58.20	Clay	8.0	3.35	1.90	0.0018	0.0007	0.0237	0.0011	0.0005.	0.0025	20.09	9.97

The experimental trees have been subjected to similar fertilization, irrigation and pest control practices usually done in the same orchard. Air temperature and humidity were recorded according to daily weather observation of Sakha research station. These data are presented in Table (2). In this study, an attempt to divide tree canopy to three parts, upper, medium and lower, then fruit splitting was observed and the percentage of fruit splitting is counted for each part.

Statistical analysis was done as analysis of variance according to the method described by Snedecor and Cochran (1967). The least significant differences (LSD at 5% level). F.Test was used to compare between means

RESULTS AND DISCUSSION

1- Splitting evidence of Washington Navel orange as affected by climatic conditions.

Data in Table (2 and 3) and figs (1 and 2) clear that climatic condition; particularly air temperature and relative humidity are effective in inducing fruit splitting of Washington navel orange variety. It showed that, the incidence of splitting starts slightly in September followed by a gradual increase reaching its maximum values in December, at the same time, relative humidity also gradually increases, reaching a maximum value in December . Also, it was clear that the susceptibility of fruit to splitting increases with advancing fruit maturity. Data in Table (3) showed that , when fruit splitting ranged from (19 to 26 % on sour orange and 16 to 17 % on Volkamer lemon) in september in both seasons respectively, meanwhile air temperature reached a maximum value of about 33.4 and 33.2^{o}C and relative humidity also reached a Maximum Value of about 82.2 and 88 % in both seasons . In November the percentage of splitting also showed higher value and the highest value was recorded in December in both seasons. These results agree with Alfaro Ibenz(1988) who found that fruit splitting in early and late oranges varieties occurred between September and November when air temperatures

reached 19.27°C and coincided with the periods of increased relative humidity in Cuba. Moreover Coit (1915) suggested that the regions which more prone to warm weather are more likely to induce fruit splitting. In the same line Reuther *et al* (1973) found that, Valencia, orange exposed to warmer climate during the rapid growth period, developed thinner rind with higher percentage of fruit splitting compared to those exposed to lower temperatures. As for the effect of relative humidity Rabe *et al* (1989) reported that citrus fruit grown in humid production regions develop thinner rinds than those grown in drier regions and are therefore more likely to split. On the other hand, the results cleared that, the fluctuated climatic condition particularly; air temperature and relative humidity can change the physical and physiological properties of fruit peel and also can modify the water balance of the splitted fruit. These results agree with those of Vercher *et al*., 1994 and Alexander 1983.

Table (2): Air temperature (°C) and relative humidity (%) at Sakha experimental station in 2010 and 2011 years.

Months	Air temperature (°C)			Relative Humidity (%)		
	Max	Min	Mean	Am	Pm	Mean
			2010			
Jan.	21.5	7.8	14.65	83.5	55.5	69.5
Feb.	24.5	9.4	16.95	84.2	55.7	69.95
Mar.	24.3	10.0	17.15	76.3	44.0	60.15
Apr.	28.2	11.0	19.6	96.0	40.7	68.35
May	29.6	14.4	22.0	72.6	39.5	56.05
June	33.5	14.3	23.9	79.2	43.5	61.35
July	32.0	20.0	26.0	82.0	48.2	65.10
Aug.	34.0	21.2	27.6	85.0	50.8	67.90
Seb.	33.4	19.2	26.3	82.2	48.5	65.35
Oct.	30.7	17.0	23.85	72.0	45.0	58.5
Nov.	26.8	11.0	18.9	82.0	54.2	68.10
Dec.	22.0	8.3	15.15	85.0	55.7	70.35
Mean	26.33	13.63		81.67	48.44	
			2011			
June	29.3	5.8	18.55	84.2	54.0	69.1
Feb.	23.4	7.4	15.40	87.0	54.0	70.5
Mar.	21.8	6.7	14.25	76.3	49.5	62.9
Apr.	26.5	10.0	18.25	85.0	47.7	66.35
May	29.0	13.0	21.0	76.7	38.0	57.35
June	31.8	17.2	24.5	82.5	46.5	64.5
July	33.0	19.4	26.2	79.5	49.2	64.35
Aug.	32.5	19.2	25.85	84.0	50.0	67.0
Sep.	33.2	17.7	25.45	88.0	49.6	68.6
Oct	28.0	14.0	21.0	82.0	48.0	65.0
Nov.	24.0	10.5	17.25	86.7	53.0	69.85
Dec.	20.19	6.44	13.32	86.0	61.13	73.57
Mean	27.72	12.28		83.16	50.05	

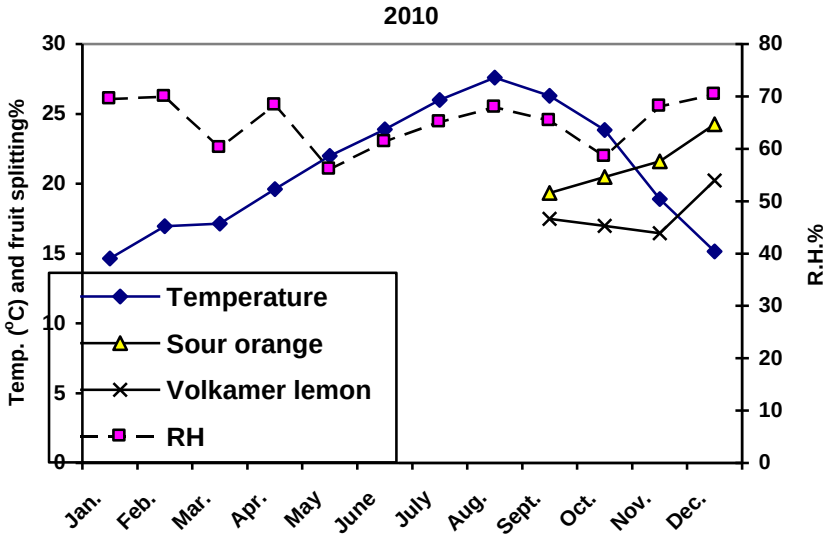

Fig.(1): Fruit splitting of Washington Navel Orange as affected by Air temperature and relative humidity under Kafr elsheikh climatic conditions in (2010) season.

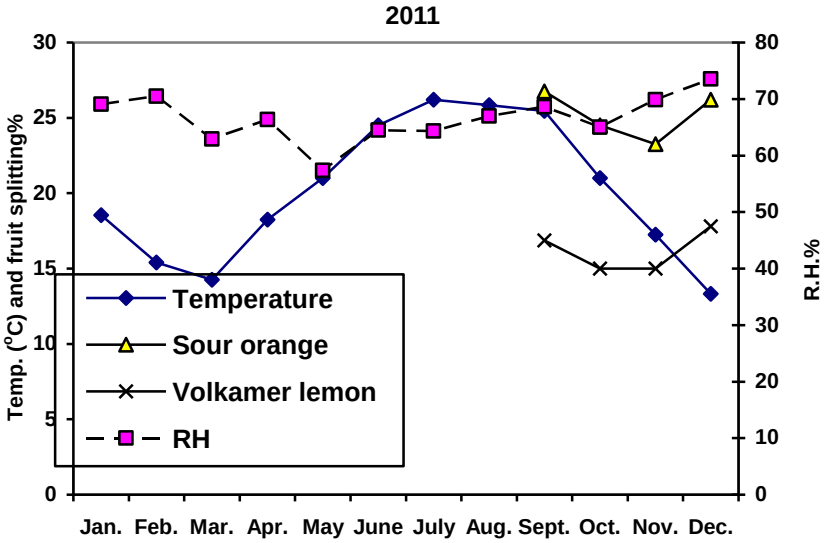

Fig.(2): Fruit splitting of Washington Navel Orange as affected by Air temperature and relative humidity under Kafr elsheikh climatic conditions in (2011)Season.

Data in Table (3) showed a clear influence of the used different rootstocks on fruit splitting. In this Respect, it was clear that Volkamer lemon rootstock recorded less percentage of fruit splitting when compared with Sour orange rootstock with significant differences between them in both seasons. This influence can be attributed to the vigorous effect of Volkamer lemon rootstock. This rootstock produced fruit with larger size and also thicker peel when compared to those on Sour orange rootstock. These results agree with those of Chen and Zhang (1995) they found that rootstock was shown to have an important effect on the percentage of cracking which reached 70.6% with Poncirus trifoliata rootstock , contrary to Yucheng (*Citrus aurantium*) rootstock who recorded only 5.5% of cracked fruit on it.

Table (3): Beginning of Splitting of Washington Navel orange on two different root stocks under climatic conditions of Kaferelsheik in 2010 and 2011 seasons.

Rootstocks	% Fruit splitting 2010			
Time	Sep	Oct	Nov	Dec
		2010		
Sour Orange	19.34	20.47	21.60	24.25
Volkamer lemon	17.48	16.00	16.45	20.23
F-test	*	*	*	*
		2011		
Sour Orange	26.76	24.5	23.25	26.20
Volkamer lemon	16.68	15.0	15.00	17.80
F- test	*	*	*	*

*** = significant**

2- Splitting as affected by fruit position on the tree :

Data in Table (4) show that the southern side of the tree have fruits with higher percentage of splitting than on the other sides of the tree canopy in both rootstocks in the two seasons. These results agree with those of Garcia –Louis et al., (1994and 2001). Most likely, fruit position on the tree is behind the effect of air temperature and relative humidity around the fruit at different parts of the tree canopy as shown in tables (2,4 and figs 1,2).

Also, data in table (5) clear that, fruit position on tree canopy is important factor. The highest percentage of fruit splitting was recorded in the lower part of the tree at (1m height), medium part of the tree at (2m height), and upper part of tree canopy at (3m height), respectively in both seasons. As for the influence of rootstock, it was clear that Volkamer lemon rootstock recorded least value of fruit splitting in the low part when compared with Sour orange rootstock and the differences were significant between them (table 5). In this connection, lower parts of the tree canopy exhibited significant increase in splitting more than higher parts .These results agree with those reported by Chikazumi (1989) and Augasti *et al* 2002, they reported that fruit position on tree canopy is effective in inducing fruit splitting and greeter splitting was observed in the interior than in exterior part of the tree canopy. The obtained results pay attention of the importance of tree pruning to open windows in interior and lower parts of the tree canopy. It could be concluded that pruning in winter service is not only important for improving fruit quality but also to minimize fruit splitting.

Table (4)- Effect of fruit position and distribution on % fruit splitting of Washington Navel Orange grown under Kaferelsheikh climatic Conditions in 2010 and 2011 seasons.

Rootstocks	% fruit splitting 2010				
Fruit position	East	West	South	North	Average
Sour Orange	4.04	7.20	9.69	4.01	6.02
Volkamer lemon	3.19	5.30	9.43	3.29	5.31
F- test	*	*	*	*	NS
		2011			
Sour Orange	4.83	6.87	16.13	3.09	7.73
Volkamer lemon	4.61	3.93	14.75	4.11	6.85
F- test	*	*	*	*	*

*** = significant NS = No significant**

Table (5) - % fruit splitting at different position of Washington Navel orange grown on two rootstocks under KafrElsheikh climatic conditions in 2010 and 2011 seasons.

Rootstocks	Fruit Splitting % at different heights of tree canopy(m)) 2010		
Tree high	Lower part(1m)	Medium part (2 m)	Higher part(3m)
Sour Orange	12.65	7.10	5.94
Volkamer lemon	11.91	5.60	2.98
F- test	*	*	*
	2011		
Sour Orange	16,43	8.523	6.035
Volkamer lemon	13.07	6.213	5.015
F- test	*	*	*

***= Significant**

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بعض العوامل المؤثره على تشقق ثمار البرتقال ابوسره صنف واشنطن تحت ظروف كفر الشيخ
ب - تاثير الظروف الجويه و موقع الثمارعلى محيط الشجره

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قسم الموالح - محطة بحوث البساتين بسخا – كفر الشيخ – مصر

اجرى هذا البحث خلال موسمى ٢٠١٠ - ٢٠١١ على اشجار البرتقال ابوسره صنف واشنطن عمرها ١٤ عاما مطعومه على اصلى ليمون الفولكاماريانا و النارنج و ناميه فى مزرعه خاصه بمحافظه كفر الشيخ وذلك لدراسه تاثير كل من الظروف المناخيه السائده وموقع الثمار على الكانوبى على التشقق فى ثمار البرتقال ابوسره .

وقد اظهرت النتائج مايلى :

١ - يبدأ التشقق فى سبتمبر و اكتوبر تزامنا مع ارتفاع درجه الحراره و الرطوبه و يزداد تدريجيا مع نضج الثمره فى نوفمبر و ديسمبر حيث اعطت اعلى نسبه تشقق على كلا الأصلين.

٢ - اوضحت النتائج ان اعلى نسبه تشقق كانت فى الجهه الجنوبيه من الشجره عن الجهات الاخرى كما اظهرت النتائج ان نسبه التشقق فى الجزء السفلى من الشجره خاصه فى المتر الاول من الكانوبى كانت اعلى منها فى الجزء العلوى من الشجره و ذلك فى كلالاصلين .

٣- اظهرت النتائج ان التشقق فى ثمار البرتقال ابو سره يزداد بزياده المحصول على الشجره وبصفه واضحه على اصل الفولكاماريانا

٤ - يتضح من االنتائج المتحصل عليها ان مكان الثمره على الشجره من المحتمل ان يكون وراء اختلاف درجه الحراره حول اثمارعلى الشجره وهذا يؤكد أهميه التقليم لتحسين الاضاءة فى الداخل و ألأجزاء المنخفضه من الشجره و كذلك تقليل نسبه التشقق فى الثمار.