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Correlation studies of leaf nutrient and Physico-chemical properties of physiologically disordered (Wai-Bar) fruits of Nagpur mandarin

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Abstract

Nagpur mandarin (*Citrus reticulata* Blanco) is an important commercial fruit crop. The aim of this study was to find out correlation relationship between leaf nutrient and physico-chemical properties of physiologically disordered fruits of Nagpur mandarin. 25 Nagpur mandarin orchards selected from different location in Vidarbha region i.e., Ruikhed, Jittapur, and Akot from Akola districts, Anjangaon and Partwada from Amravati district during 2018-19. Correlation study revealed that the potassium and zinc is positively correlated with TSS, ascorbic acid and juice content while negatively correlated with rind thickness, pomace content, rag content and acidity of physiologically disordered fruits of Nagpur mandarin.

Keywords: Correlation, Nagpur mandarin, physico-chemical, wai-bar

Introduction

Nagpur mandarin (*Citrus reticulata* Blanco) is an important commercial orange cultivar mainly grown in Vidarbha region of Maharashtra and adjoining states like Madhya Pradesh as well as Rajasthan. In past few years occurrence of fruit oblongation locally called as *way-bar* in Nagpur mandarin fruits has been observed in Amravati district. *Way-bar* meaning a wasteful fruit in Marathi language it is an oblonged fruit disorder. During the fruit developmental stage, the stem attachment of the fruits develops pinkish red tissues on the button albedo partially choking the supply of nutrients and photosynthates to the developing juice vesicles. Such fruits continue to remain stunted in growth assuming oblong shape but persistent, hence this disorder is also locally called as 'cock bund' meaning tap close (Jhade *et al.* 2017). Such physiologically disordered fruits have low TSS:Acidity ratio, Ascorbic acid content and have more acidic fruits than normal fruits of Nagpur mandarin. This physiological disorder is mainly predominant in Morshi, Warud, Achalpur, and Paratwada tehsils of Amravati district. (Anon 2015) ICAR-CCRI, Nagpur has conducted an extensive survey of affected and non-affected orchards. Fruit oblongation was more in Nagpur mandarin on Galgal rootstock as compared to Rangpur and was minimum on Shekwa X Rough lemon. The length breadth ratio of oblongated fruits was higher due to which it showed the abnormal fruit shape as compared to the normal fruits. The reduction of TSS and Vitamin C content and increase in acidity and peel thickness were also recorded in oblongated fruits as compared to the normal fruits in all rootstocks. More importantly, abscisic acid (ABA) level found to be increased (80 $\mu\text{g kg}^{-1}$) in plants with excess soil moisture with higher number of oblongated fruits as compared to normal fruits (15 $\mu\text{g kg}^{-1}$). It indicated that soil moisture was excess during fruit growth and development stages accompanied with higher level of ABA and oblongated fruits in affected orchards. Hence, the first-year preliminary observation indicated that there is a necessity to minimize the excess soil moisture for reduction of ABA concentration in fruits to minimize fruit oblongation during fruit growth stages.

Material and Method

The study was carried out at Department of Horticulture, Dr. PDKV, Akola during 2018-2019. Present study consisted physiologically disordered fruits and leaves of physiologically disordered fruit plant collected randomly from different locations *viz.*, Akola and Amravati. Five Nagpur mandarin fruit orchard were selected from each location and samples were drawn randomly where orchard considered as a replication. Recorded observations were subjected to statistical analysis in two sample t-test *viz.*, rind thickness (mm), pomace content (%), rag

content (%), juice content (%), TSS, ascorbic acid (mg 100 ml⁻¹), acidity (%). Chemical analysis of fruit and nutrient analysis of leaves samples was done at Post harvest Laboratory and Analytical Laboratory respectively, Department of Horticulture, Dr PDKV, Akola.

Result and Discussion

Correlation is useful to find out the degree of relationship between the fruits of physico-chemical properties and leaf nutrient i.e. potassium and zinc. It was found that most of the physical characteristics of physiologically disordered fruits were dependent on leaf nutrient. The results at different location are as follows.

i. Ruikhed

The correlation coefficient of physico-chemical properties and leaf nutrient of physiologically disordered fruit plant samples collected at Ruikhed are presented in (Table 1) it was found that the total potassium content in leaves negatively correlated with the L:B ratio (r= -0.83), diameter of central core (r= -0.87), rind thickness (r= -0.83), rag content (r= -0.66), pomace content (r= -0.58), acidity (r= -0.66) while it is positively correlated with juice content (r= 0.84), TSS (r= 0.75) and ascorbic acid (r= 0.83). Zinc content in leaves is negatively correlated with the L:B ratio (r= -0.91), diameter of central core (r= -0.87), rind thickness (r= -0.92), rag content (r= -0.73), pomace content (r= -0.66), acidity (r= -0.77) while it is positively correlated with juice content (r= 0.90), TSS (r= 0.89) and ascorbic acid (r= 0.90) of physiologically disordered Nagpur mandarin fruits.

ii. Anjangaon

Perusal of data presented in (Table 2) revealed that the total potassium content in leaves negatively correlated with the L:B ratio (r=-0.78), diameter of central core (r= -0.70), rind thickness (r= -0.70), rag content (r= -0.67), pomace content

(r= -0.29), acidity (r= -0.65) while it is positively correlated with juice content (r= 0.80), TSS (r= 0.75) and ascorbic acid (r= 0.79). Zinc is negatively correlated with the L:B ratio (r= -0.88), diameter of central core (r= -0.82), rind thickness (r= -0.70), rag content (r= -0.59), pomace content (r= -0.15), acidity (r= -0.78) and positively correlated with juice content (r=0.88), TSS (r= 0.85) and ascorbic acid (r= 0.89).

iii. Paratwada

Perusal of data presented in Table 3 revealed that the total potassium content in leaves negatively correlated with the L:B ratio (r= -0.52), diameter of central core (r= 0.48), rind thickness (r= -0.51), rag content (r= -0.43), pomace content (r= -0.23), acidity (r= -0.29) and positively correlated with juice content (r= 0.49), TSS (r= 0.53) and ascorbic acid (r= 0.51). Zinc content in leaves is negatively correlated with the L:B ratio (r= -0.92), diameter of central core (r= -0.48), rind thickness (r= -0.91), rag content (r= -0.83), pomace content (r= -0.61), acidity (r=-0.75) while it is positively correlated with juice content (r= 0.90), TSS (r= 0.87) and ascorbic acid (r= 0.94).

iv. Akot

Perusal of data presented in Table 37 revealed that the total potassium content in leaves negatively correlated with the L:B ratio (r= -0.84), diameter of central core (r= -0.81), rind thickness (r= -0.83), rag content (r= -0.67), pomace content (r= -0.24), acidity (r= -0.71) while it is positively correlated with juice content (r= 0.77), TSS (r=0.82) and ascorbic acid (r=0.84). Zinc content in leaves is negatively correlated with the L:B ratio (r= -0.88), diameter of central core (r= -0.85), rind thickness (r= -0.89), rag content (r= -0.71), pomace content (r= -0.43), acidity (r= -0.74) and positively correlated with juice content (r=0.83), TSS (r= 0.83) and ascorbic acid (r= 0.89).

Table 1: Correlation of potassium and zinc in leaves with various fruit parameters of physiologically disordered Nagpur mandarin fruit from Ruikhed.

	L:B ratio	Core diameter	Rind thickness	Rag content	Pomace content	Juice content	TSS	Acidity	Ascorbic acid	Plant potassium	Plant zinc
L:B ratio	1.00										
Core diameter	0.94	1.00									
Rind thickness	0.98	0.94	1.00								
Rag content	0.84	0.73	0.84	1.00							
Pomace content	0.72	0.63	0.72	0.65	1.00						
Juice content	-0.98	-0.94	-0.97	-0.81	-0.64	1.00					
TSS	-0.92	-0.87	-0.93	-0.80	-0.61	0.92	1.00				
Acidity	0.76	0.71	0.76	0.59	0.53	-0.76	-0.70	1.00			
Ascorbic acid	-0.99	-0.93	-0.98	-0.86	-0.77	0.97	0.93	-0.77	1.00		
Plant potassium	-0.83	-0.87	-0.83	-0.66	-0.58	0.84	0.75	-0.66	0.83	1.00	
Plant zinc	-0.91	-0.87	-0.92	-0.73	-0.66	0.90	0.89	-0.77	0.91	0.76	1.00

Table 2: Correlation of potassium and zinc in leaves with various fruit parameters of physiologically disordered Nagpur mandarin fruit from Anjangaon.

	L:B ratio	Core diameter	Rind thickness	Rag content	Pomace content	Juice content	TSS	Acidity	Ascorbic acid	Plant potassium	Plant zinc
L:B ratio	1.00										
Core diameter	0.88	1.00									
Rind thickness	0.82	0.90	1.00								
Rag content	0.79	0.67	0.73	1.00							
Pomace content	0.20	0.36	0.41	0.22	1.00						
Juice content	-0.98	-0.89	-0.84	-0.77	-0.17	1.00					
TSS	-0.89	-0.81	-0.75	-0.61	-0.05	0.91	1.00				

Acidity	0.80	0.74	0.72	0.59	0.21	-0.79	-0.77	1.00			
Ascorbic acid	-0.98	-0.92	-0.85	-0.75	-0.25	0.99	0.90	-0.80	1.00		
Plant potassium	-0.78	-0.70	-0.70	-0.67	-0.29	0.80	0.75	-0.65	0.79	1.00	
Plant zinc	-0.88	-0.82	-0.70	-0.59	-0.15	0.88	0.85	-0.78	0.89	0.75	1.00

Table 3: Correlation of potassium and zinc in leaves with various fruit parameters of physiologically disordered Nagpur mandarin fruit from Paratwada

	L:B ratio	Core diameter	Rind thickness	Rag content	Pomace content	Juice content	TSS	Acidity	Ascorbic acid	Plant potassium	Plant zinc
L:B ratio	1.00										
Core diameter	0.96	1.00									
Rind thickness	0.98	0.96	1.00								
Rag content	0.85	0.86	0.85	1.00							
Pomace content	0.71	0.74	0.74	0.60	1.00						
Juice content	-0.94	-0.92	-0.96	-0.81	-0.67	1.00					
TSS	-0.93	-0.87	-0.94	-0.80	-0.62	0.93	1.00				
Acidity	0.81	0.83	0.83	0.70	0.65	-0.80	-0.68	1.00			
Ascorbic acid	-0.99	-0.97	-0.99	-0.86	-0.73	0.97	0.93	-0.84	1.00		
Plant potassium	-0.52	-0.48	-0.51	-0.43	-0.23	0.49	0.53	-0.29	0.51	1.00	
Plant zinc	-0.92	-0.93	-0.91	-0.83	-0.61	0.90	0.87	-0.75	0.94	0.45	1.00

Table 4: Correlation of potassium and zinc in leaves with various fruit parameters of physiologically disordered Nagpur mandarin fruit from Akot.

	L:B ratio	Core diameter	Rind thickness	Rag content	Pomace content	Juice content	TSS	Acidity	Ascorbic acid	Plant potassium	Plant zinc
L:B ratio	1.00										
Core diameter	0.96	1.00									
Rind thickness	0.98	0.96	1.00								
Rag content	0.75	0.75	0.74	1.00							
Pomace content	0.41	0.27	0.44	0.16	1.00						
Juice content	-0.94	-0.91	-0.96	-0.63	-0.43	1.00					
TSS	-0.96	-0.91	-0.97	-0.67	-0.49	0.94	1.00				
Acidity	0.82	0.80	0.82	0.60	0.31	-0.80	-0.77	1.00			
Ascorbic acid	-0.99	-0.97	-0.99	-0.74	-0.41	0.96	0.96	-0.82	1.00		
Plant potassium	-0.84	-0.81	-0.83	-0.67	-0.24	0.77	0.82	-0.71	0.84	1.00	
Plant zinc	-0.88	-0.85	-0.89	-0.71	-0.43	0.83	0.83	-0.74	0.89	0.77	1.00

Conclusion

The study concluded that there was a strong positive and negative association between different important physico-chemical characters and leaf nutrient of Nagpur mandarin fruits.

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