

## Effect of Rootstock Type and Scion Cultivar on Citrus Leaf Total Nitrogen

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**Abstract:** In this study was evaluated interaction between rootstock type and scion cultivar on nitrogen concentration of scion leaf in stage of grafted plant production as factorial in completely randomized design in greenhouse with four replications. For this purpose was budded scion of citrus commercial cultivars (Sweet lime, Mexican lime, Kinnow mandarin, Valencia and Washington navel sweet oranges and Orlando tangelo) on Sour orange, Mexican lime, Volkamer lemon and Bakraei rootstocks and after proper growth of grafted plants, was measured total nitrogen concentration in leaf of scion. Results showed that rootstock type had significant influence on total nitrogen concentration in leaf of scion. Highest total N concentration (2.12 dry matter percent) was on Sour orange and lowest (1.77 dry matter percent) on Mexican lime and Volkamer lemon rootstocks. There was significant difference between scions. Arrangement of scions from highest to lowest of total N concentration in leaf was Valencia sweet orange, Sweet lime, Mexican lime, Washington navel sweet orange, Orlando tangelo and Kinnow mandarin. In evaluate of rootstock and scion interaction distinguished rootstock type and scion cultivar have influence on leaf total N concentration.

**Key words:** Citrus • Rootstock • Scion • Total N concentration

### INTRODUCTION

Plant cultivars and species among Citrus have difference in absorption and utility of total nitrogen together and this difference when to become more appear that plant produce from rootstock and scion union. Rootstock type affects over twenty horticultural properties among mineral elements concentration of scion leaf and particular scions received variant amount of nutrients from a special rootstock [1]. Rootstocks directly have influence on ability of grafted plant to absorption of water and nutrients from soil. They also affect growth pattern of grafted plant shoot and in this manner are effective on photosynthesis [2]. Between plant nutrient elements, total nitrogen caused direct role in photosynthesis, carbohydrates and protein synthesis has very importance to plant growth and development control [3]. Sorgona *et al.* [4] reported that between Rough lemon, Sour orange, Sweet orange and Cleopatra mandarin rootstocks, observed highest absorption and utility of total N in Sour orange and lowest in Sweet orange. Thus Sour orange rootstock is suitable for the

soils with low total N level. In the opposite, Toplu *et al.* [5] reported that between Carrizo and Troyer citrange and Sour orange rootstocks, highest total N concentration in scion leaf observed in Carrizo citrange and lowest in Sour orange. Iqbal *et al.* [6] in evaluate the effect of rootstock type on total N concentration of Kinnow mandarin scion leaf found that highest total N concentration in scion leaf was on Citrumelo 4475 and 1452 rootstocks and lowest on Rough lemon and Yuma citrange rootstocks. Satsuma scion on Carrizo citrange rootstock had been more than total N than Sour orange [7]. Total N concentration in Red grapefruit leaf on Alemow rootstock has been in lowest range. Scion on Trifoliate orange rootstock had been less total N than Rough lemon rootstock [8,9]. Total N concentration in scion leaf on Cleopatra mandarin rootstock significantly has been less than other mandarin cultivars rootstock [8]. Scion leaf on Trifoliate orange × Rangpur lime hybrid rootstock had been total N more than Volkamer lemon, Carrizo citrange, Amplicarpa and Alemow rootstocks [10]. Hafez [11] between Sour orange, Brazilian sour orange, Spanish sour orange, Troyer citrange, Rangpur lime and Volkamer lemon rootstocks reported

highest total N concentration in leaf of Sour orange. In report of Abou-Rawash *et al.* [12] between Sour orange, Cleopatra mandarin, Volkamer lemon and Rangpur lime rootstocks, highest leaf total N concentration was in Rangpur lime rootstock. Taylor and Dimsey [13] in evaluate the effect of rootstock and scion on mineral elements concentration of citrus leaf reported that rootstock type attentive to scion cultivar has different effects on mineral elements concentration of scion leaf. Whereas nutrient requirements of scion cultivar specially attentive to rootstock type is different, aim of this investigation has been evaluate the effects of rootstock type and scion cultivar on leaf total N concentration of citrus commercial cultivars in stage of grafted plant production.

## MATERIALS AND METHODS

In order to evaluate the influence of rootstock type and scion cultivar on leaf total N concentration in grafted plants of citrus cultivars, an experiment was performed in greenhouse (Average temperature 25-45°C, 65-85% relative humidity and without artificial light) as factorial in completely randomized design. For this purpose, were cultured annual seedlings of four citrus rootstocks consist Sour orange, Mexican lime, Bakraei and Volkamer lemon in 5 liters pots containing regional dominant soil (Calcareous soil, pH=8.5 and silt texture) with 4 replications. Necessary cares were done until grafting stage. Five months after transfer, rootstocks were budded by Sweet lime, Mexican lime, Kinnow mandarin, Orlando tangelo, Washington navel and Valencia sweet oranges scion by T-budding method. Twenty days after budding, plastic band opened around of graft place. After growth of scion, rootstocks cut from 5 cm above graft place. During study period did not use fertilizer except 50 g animal manure for each pot. After 6 months shoots cut from graft place and put in oven with 75 °C for 48 hours and then was powdered [14]. Total nitrogen measured by 0.3 g plant powder by using of Microkjeldahl set [15]. Obtained data analyzed by MSTAT-C software and means compared by Duncan's multiple range test.

## RESULTS AND DISCUSSION

Analysis of variance results showed significant difference in 1% level between rootstocks, scions and them interaction (Table 1). Rootstock type had influence on total N concentration in scion leaf. In this relation Sour orange rootstock significantly had highest level.

Table 1: Analysis of variance of total nitrogen concentration in scion leaf

S.V	d.f	S.S	M.S	F.S	C.V
Rootstock	3	2.049	0.682	451**	12.08 %
Scion	5	17.281	2.456	2282**	
Rootstock × Scion	15	4.680	0.212	206**	
Error	72	0.109	0.001514	-	
Total	95	24.119	-	-	

\*\* Significant in 1% level

Table 2: Effect of rootstock and scion interaction on total N concentration

Scion	Rootstock			
	Sour orange	Bakraei	Mexican lime	Volkamer lemon
Sweet lime	2.33 <sup>e</sup>	2.27 <sup>f</sup>	2.17 <sup>g</sup>	2.03 <sup>h</sup>
Mexican lime	3.03 <sup>a</sup>	1.76 <sup>i</sup>	1.74 <sup>i</sup>	1.53 <sup>k</sup>
Kinnow mandarin	1.61 <sup>j</sup>	1.26 <sup>m</sup>	1.16 <sup>n</sup>	1.38 <sup>l</sup>
Orlando tangelo	1.61 <sup>j</sup>	1.26 <sup>m</sup>	1.34 <sup>l</sup>	1.38 <sup>l</sup>
Washington navel	1.64 <sup>j</sup>	1.76 <sup>i</sup>	1.75 <sup>i</sup>	1.74 <sup>i</sup>
Valencia	2.47 <sup>d</sup>	2.65 <sup>b</sup>	2.44 <sup>d</sup>	2.55 <sup>c</sup>

Means with same letter have not significant difference in 1% level of DMRT.

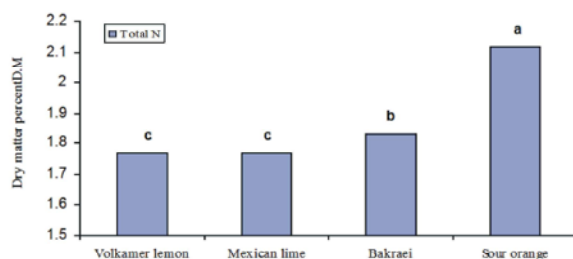


Fig. 1: Mean comparison of the effect of rootstock type on total N concentration Means with same letter in each column have not significant difference in 1% level of DMRT

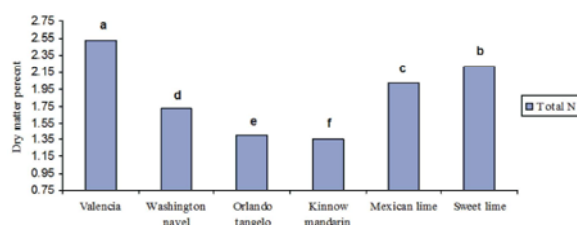


Fig. 2: Mean comparison of the effect of scion cultivar on total N concentration Means with same letter in each column have not significant difference in 1% level of DMRT

There was not significant difference between Mexican lime and Volkamer lemon. Bakraei significantly had between Sour orange with Mexican lime and Volkamer lemon (Fig. 1). On basis of Fig. 1 highest total N amount (2.12 dry matter percent) was in scion leaf on Sour orange rootstock and lowest (1.38 dry matter percent) on scion leaf on Mexican lime and Volkamer lemon rootstocks.

There was significant difference in 1% level of Duncan's Multiple Range test between all scions in viewpoint of total N concentration (Fig. 2). Total N amount in scions leaf was variable from 1.35 to 2.53 dry matter percent. Highest total N concentration (2.53 dry matter percent) was in leaf of Valencia sweet orange and lowest (1.35 dry matter percent) in leaf of Kinnow mandarin. Arrangement of scions from highest to lowest of total N concentration in leaf was Valencia sweet orange, Sweet lime, Mexican lime, Washington navel sweet orange, Orlando tangelo and Kinnow mandarin (Fig. 2).

There was significant interaction between rootstock type and scion cultivar in viewpoint of total N concentration (Table 2). Leaf of Mexican lime on Sour orange rootstock had highest total N concentration (3.03 dry matter percent) whereas total N concentration in leaf of this cultivar on Volkamer lemon (1.53 dry matter percent) significantly was in very lower level. Lowest total N concentration (1.16 dry matter percent) observed in Kinnow mandarin leaf on Mexican lime rootstock. Total N concentration in leaf of Washington navel sweet orange on Bakraei, Mexican lime and Volkamer lemon rootstocks approximately was equal but on Sour orange rootstock significantly was in lower level. Total N concentration in leaf of Sweet lime and Kinnow mandarin on all rootstocks had significant difference in 1% level of Duncan's test whereas in leaf of Washington navel sweet orange on all rootstocks except Sour orange had not significant difference (Table 2).

Comparison the obtained amounts with optimum amounts of total N in citrus leaf (2.5-2.8 dry matter percent) showed that total N concentration in leaf of Valencia sweet orange on all rootstocks except Mexican lime was in optimum range [16] and between rootstocks, only Sour orange was able absorption optimum range of total N concentration in three scions of Sweet lime, Mexican lime and Valencia orange. After Valencia sweet orange, there was Sweet lime that total N concentration in its leaf on all rootstocks was a few less than optimum range. Thus can be said between rootstocks, Sour orange could be operate better than other rootstocks in used soil in this study. These results are according to findings of Sorgona *et al.* [4] and Hafez [11] in relation to Sour orange but have not accord to results of Toplu *et al.* [5] and Abou-Rawash *et al.* [12]. This non-conformity probably is due to difference between experimental conditions. Iqbal *et al.* [6] reported that in similar soil conditions, some citrus rootstocks absorb more nitrogen from soil and transfer to shoots, which reason of this subject can be due to rootstocks genetics. This subject also can be

encouraging our findings. Evaluate of rootstock and scion interaction showed that rootstock type and scion cultivar affect total N concentration in citrus leaf that in report of Taylor and Dimsey [13] also has been emphasized. It is mentionable that irregular utility of nitrogen in addition to economical cases can be lead to contamination of underground waters and environment. Generally, in relation to obtained results can be said that under condition of this experiment in stage of grafted plant production of Sweet lime, Mexican lime, Valencia and Washington navel sweet orange, Kinnow mandarin and Orlando tangelo cultivars on Sour orange, Volkamer lemon, Mexican lime and Bakraei rootstocks should utilize nitrogen fertilizers in attentive to rootstock type and scion cultivar and Sour orange rootstock and Valencia sweet orange and Sweet lime scions have higher efficiency.

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