Response of 'Santa Maria' Pear Budlings Grown on Two Rootstocks to Soil Application of FeEDDHA

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ABSTRACT

Young 'Santa Maria' pear (*Pyrus communis* L.) plants grown on quince (*Cydonia oblonga Mill*) and *Pyrus betulaefolia Bunge*, rootstocks, were soil treated with five different rates of iron chelate, FeEDDHA (0, 5, 10, 15 and 20 grams/plant), to correct for a possible lime-induced iron chlorosis. The FeEDDHA treatments checked iron chlorosis within 2–3 weeks of application and stimulated trunk and vegetative growth. Plants grown on *betulaefolia* rootstocks were more vigorous, and suffered less chlorosis than those grown on quince. Untreated plants suffered severe leaf burning, especially on quince rootstock.

INTRODUCTION

Pear trees grown in the Westcoast region of Libya, show, in many areas, symptoms of iron deficiency. This is commonly associated with the calcareous upper subsoil. Pear trees are very sensitive to iron deficiency, and are more subjected to iron chlorosis than other deciduous fruit trees, especially when it is lime-induced (3,5).

Pear leaf chlorosis symptoms have been noted and described (1,12), and pear leaf analysis was studied by many investigators (2,11,13). The study of the relative concentrations of nutrients in pear leaves under calcareous conditions, showed that K concentration was increased and Ca decreased, as a result of chlorisis (2,7).

Pear cultivars vary in their responses to metal chelates. The kind of rootstock, soil and climatic factors may also further alter cultivar responses (1,12,13). Thus the use of resistant rootstocks may not solve the problem of lime-induced iron chlorosis. Soil application of FeEDDHA has been the most effective mean of controlling Fe chlorosis (6,8,9).

Some greenhouse experiments (6,8,9,10) have shown that the overuse of FeEDDHA for correcting Fe chlorosis may induce Mn deficiency in many peach and apple culti-

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vars. This experiment was conducted to study the effect of soil applications of five rates of FeEDDHA on Fe, K, Ca contents of leaves, trunk diameter, and plant growth of 'Santa Maria' pear budlings grown on two rootstocks.

MATERIALS AND METHODS

One year-old pear plants budded on two different rootstocks, *Cydonia oblonga*, and *Pyrus betulaefolia*, were grown in two blocks in the nursery on calcareous (10–12% $CaCO_3$) sandly loam soil having a pH of 7.9, and very low organic matter content (0.12%).

There was no apparent graft incompatibility in any scion/stock combination. Prior to the appearance of leaf chlorosis, the budlings were uniform and healthy. Each block consisted of eleven rows (six plants each). Every other row received one of the five FeEDDHA soil applications, with a guard row separating every two treatments. Treatments were applied to the soil surface at rates of 0,5,10,15, and 20 grams/plant, of iron-chelate (Sequestrene 138 Fe). At the time of application, each row of treatments received 15 grams of Mn-chelate (Sequestrene Na_2Mn), and 500 grams of $N:P_2O_5:K_2O$ fertilizer 12:24:12, and all plants were irrigated: Treatments were applied on April 23, 1975. On August 8, 1975, 25–30 leaves from the middle portion of shoots were randomly collected from each of five plants for leaf determination of Fe, K, and Ca. Leaves were dried at 65°C for 48 hours, ground, and analyzed according to Chapman and Pratt (4). Iron was determined by the O-phenanthroline method; Ca, and K were determined by the flame photometric method. The following growing season (1976), only the NPK fertilizer was added to plants, and near the end of the season plant height and trunk diameter (15 cm above the ground) were measured. All data were statistically analyzed.

RESULTS AND DISCUSSION

Soil application of FeEDDHA to chlorotic young pear plants, significantly removed lime-induced iron chlorosis within 2–3 weeks. In the first growing season, the iron content of leaf increased with FeEDDHA. Potassium and calcium contents of leaves were not affected by FeEDDHA (Table 1). Trunk diameter and plant height significantly increased with FeEDDHA over the check. There were no significant differences between FeEDDHA rates in respect to controlling iron chlorosis or stimulating trunk and vegetative growth. Differences between various rates of FeEDDHA, however, were apparent on the next growing season. All treated plants budded on quince showed some symptoms of iron chlorosis, while untreated plants were completely chlorotic; and suffered severe leaf burning, and some leaf drop (Fig. 1). Treated plants budded on *betulaefolia* did not show any symptoms of iron chlorosis, except for plants receiving low level of FeEDDHA (5 grams/plants). The untreated plants, though chlorotic, were less affected than those budded on quince, and the burning was noted on the shoot tips only (Fig. 1). The two different rootstocks demonstrated some variation in their iron content of leaves (Table 1). Plants budded on *betulaefolia* contained significantly greater amounts of iron than those on quince. Perhaps, this explains why pear plants on *betulaefolia* rootstock suffered less chlorosis on the next growing season than those on quince, pear plants on *betulaefolia*, attained more vegetative growth, as measured by plant height, but no significant differences were obtained as to trunk diameter, or K and Ca contents of leaves (Table 2).

Fig. 1. 'Santa Maria' pear plants on quince rootstock, one season after treatment with FeEDDHA(A_1 = Treated, A_2 = Untreated).

Fig. 2. 'Santa Maria' pear plants on *Betulaefolia* rootstock, one season after treatment with FeEDDHA (B_1 = Treated, B_2 = Untreated).

Table 1 Effect of FeEDDHA treatments on the leaf content of Fe, K, and Ca; and on the trunk diameter and plant height of young 'Santa Maria' pear budlings.

FeEDDHA/ plant (grams)	Means[a]				
	Fe(ppm)	% K	% Ca	Trunk diameter (cm)	Plant height (cm)
0	124.38 a	0.88 a	1.57 a	2.32 a	143.75 a
5	130.75 a	0.59 a	1.58 a	2.83 ab	182.75 b
10	146.00 ab	0.66 a	1.68 a	2.94 b	188.38 b
15	155.13 ab	0.62 a	1.70 a	3.21 b	199.50 b
20	170.50 b	0.69 a	1.71 a	3.41 b	203.38 b

[a]Means in a column, followed by the same letter, are not significantly different at P = 0.01 according to Duncan's Multiple Range Test.

Table 2 Effects of two different rootstocks on the leaf content of Fe, K, and Ca; and on the trunk diameter and plant height of young 'Santa Maria' per budlings.

Rootstock	Means[a]				
	Fe (ppm)	% K	% Ca	Trunk diameter (cm)	Plant height (cm)
Cydonia oblonga	128.45 a	0.65 a	1.66 a	2.88 a	155.85 a
Pyrus betulae folia	162.25 b	0.73 a	1.65 a	3.00 a	211.25 b

[a]Means in a column, followed by the same letter, are not significantly different at P = 0.01 according to Duncan's Multiple Range Test.

LITERATURE CITED

1. Bakr Ahmed, M. and M. Tewfik. 1959. The development of chlorosis on young LeConte pear trees as related to rootstock. Indian J. Hort. 16:5–13.
2. Bennett, J. P. 1945. Iron in leaves. Soil Sci. 60:91–105.
3. Boynton, D. 1954. Pear nutrition, pp. 642–665. In N. F. Childers (ed.) Mineral Nutrition of Fruit Crops. Horticultural Publications, Rutgers. The State Univ., New Brunswick, New Jersey.
4. Chapman, H. D. and P. F. Pratt. 1961. Methods of analysis for soils, plants, and waters. Univ. of Calf. Division of Agriculutural Sciences.
5. Harley, C. P. and R. C. Lindner. 1945. Observed responses of apple and pear trees to some irrigation waters of north central Washington. Proc. Amer. Soc. Hort. Sci. 46:35–44.
6. Kochan, W. J. 1962. Iron chelate control of chlorosis in peach trees. Idaho Agr. Exp. Sta. 384.
7. Lindner, R. C., and C. P. Harley. 1944. Nutrient interrelations in lime-induced chlorosis. Plant Physiol. 19:420–439.
8. Rogers, E. 1972. Iron-Manganese relation of 'Starking Delicious apples in Western Colorado. J. Amer. Soc. Hort. Sci. 97(6): 726–728.
9. ——— 1975. Mineral content and iron chlorosis of 'Redhaven' peach trees as affected by iron source and rate. Hort. Sci. 10(5):519–521.
10. ———. 1975. An attempt to overcome iron-induced manganese deficiency in 'July El-berta' peach trees with manganese chelate. J. Amer. Soc. Hort, Sci. 100(5):531–535.
11. Thorne, D. W. and A. Wallace. 1944. Some factors affecting chlorosis on high-lime soils. I-Ferrous and ferric iron. Soil Sci., 57:299–312.
12. Wallace, T. 1951. The Diagnosis of Mineral Deficiencies in plants by visual symptom (A Colour Atlas and Guide). 3rd ed. H. M. Stationary Office, London.
13. Westwood, M. N. and P. B. Lombard. 1966. Mineral uptake as related to rootstocks in pear. Proc. 17th Int. Hort. Congr. Md., 1966. 1, Abstr. 596.

تأثير التسميد بالحديد المخلوب FeEDDHA على شتلات كمثرى (صنف سانتا ماريا) نامية على أصلين مختلفين

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مستخلص

استعمل لهذا البحث شتلات كمثرى صنف سانتا ماريا نامية على أصلين مختلفين أحدهما السفرجل والآخر كمثرى صنف بيتيليفوليا ٠

تم تسميد الشتلات بالحديد المخلوب عن طريق التربة بخمسة معدلات مختلفة وهى صفر ، ٥ ، ١٠ ، ١٥ و ٢٠ جم لكل شتلة وذلك لعلاج اصفرار الاوراق الذى يحتمل أن يكون ناتجا عن نقص الحديد فى التربة ٠

لوحظ أن الشتلات المعاملة بالحديد المخلوب قد زال عنها الاصفرار بعد اسبوعين الى ثلاثة أسابيع من تاريخ التسميد ، علاوة على ازدياد نمو الجذع والمجموع الخضرى ٠

وقد لوحظ أيضا أن الشتلات المعاملة والنامية على أصل بيتيليفوليا كانت أكثر قوة وأقل اصفرارا من الشتلات النامية على أصل سفرجل ، أما الشتلات التى لم تعامل فقد احترقت أوراقها بشدة وخاصة النامى منها على أصل سفرجل ٠