

INFLUENCE OF ORGANO-MINERAL FERTILIZERS ON THE PRODUCTIVITY AND EFFICIENCY OF AN APPLE SCAB RESISTANT VARIETIES ORCHARD

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Abstract

In a young apple orchard planted on the Romanian plain on a brown-reddish soil, organic cultural practices were applied. Apple trees of five scab resistant varieties: Topaz, Rubinola, Gold Rush, Generos and Redix, were planted at 3.5 x 1.0 m and led as vertical axe. A trellis formed with 4.0 m oak wooden poles, 2 wires and bamboo canes was used to lead and to support the trees. The inter row was cultivated with a mixture of perennial grasses and mowed mechanically. Drip irrigation was provided on the row, having a continuous line with auto compensating drippers every 0.5 m. On the row, the soil was maintained clean by hand and mechanical cultivation. For fertilization, organo-mineral products, derived from seaweed have been used. Tecamin Flower was applied before blooming, Tecamin Brix and Tecnokel Amino Ca B was use as foliar fertilizer and Agriful, for soil application. Different parameters as: tree growth, blooming intensity, fruit number, fruit size and productivity per tree have been influenced by the variety and by the applied fertilizers.

Keywords: *Malus x domestica*, organic fertilization, cutting, tree growth.

INTRODUCTION

Apple is the leading species in Romanian fruit growing and in the last 30 years the new orchards were planted mainly with scab resistant varieties. The use of scab and other diseases and pests resistant varieties is a key factor to reduce the chemical pressure on the orchard environment and to develop its sustainability. [3]

Control and monitoring of soil fertility is a set of principles and methods scientifically designed to address soil and plant analyzes, experiments and studies of complex traits evaluation of soil fertility, productivity and soil quality, to determine the measures to increase integrated multiple functions of soils and yields quantitative and qualitative superior crops [2]

The present work was to study the behavior of five apple genotypes in annual vegetativ and flowering shoots, flowering intensity, fruit number, fruit size, productivity and organo-mineral fertilization.

MATERIALS AND METHODS

Orchard characteristics

Within a World Bank- MAKIS project an apple orchard was planted in the spring 2009 at the Bucuresti Faculty of Horticulture on the Romanian plain, on a brown-reddish soil.

Three scab resistant varieties: Topaz, Rubinola and Gold Rush, grafted on M9 rootstock were planted at 3.5 x 1.0 m (2857 trees/ha) and then lead as a vertical axe. A trellis formed with 4.0 m oak wooden poles, 2 wires and bamboo canes was used to lead and to support the trees.

The inter row was cultivated with a mixture of perennial grasses and mowed mechanically. On the row, the soil was maintained clean, both by hand and mechanical cultivation.

Drip irrigation was provided on the row, having a continuous dripping line with auto compensating drippers (2 l/hour) every 0.5 m.

Fertilization

Fertilization was done with 4 products, 3 of them are foliar , respectively Tecamin Flower, Tecamin Brix, Tecnokel Amino CaB and Agriful for soil application. The fertilization was done in early spring with Techamin Flower, is a seaweed extract 4%, 3% L-amino

acids, 3% nitrogen (N), 10% phosphorus (P₂O₅) 1% boron (B), 0,5% molybdenum (Mo) with the implementation stage of floral button intended for stimulate flowering and fruit set. When trees have reached the stage of development of fruit was used for 3 months repeated fertilization of 15 to 15 days which a bio-stimulator Tecamin Brix for fruit development, improve fruit color and sugar content, fruit size, increases with the content 18% K₂O, 0.2% B, 10% seaweed extract and Tecnokel Amino CaB which is a additionalt fertilization programs designed to increase fruit firmness and postharvest quality, increase resistance to cracking and control of physiological disorders associated, with a concentration of 10% CaO, 0.2 B, 6% L-amino acids. Agriful is a natural fertilizer effect which stimulates the development of root system quickly, latching enhances fruit on the tree, etc., with a concentration of 4.5% N, 1.0% P₂O₅, 1.0 % K₂O, pH4,7. Dose applied was 0.6 ml / tree (17.4 l / ha) for application to soil and 0.3 ml / tree (9.52 l / ha) in the foliar. Were used four fertilization variants marked with V1- Control, V2- Tecamin Brix and Tecnokel CaB (foliar fertilization), V3- foliar fertilization + soil fertilization with Tecamin Brix, Tecnokel CaB and Agriful and V4-Agriful(soil fertilization).

Determinations and Measurements

Early in spring were determined annual vegetative and flower shoots (cm / tree), flowering intensity (no / tree), number of fruit-related (no / tree), fruit number after manual thinning and physiological fall) (no / tree), fruit set (%) and productivity (kg /tree, t/ha).

Soil characteristics: pH (potentiometric method), soluble salt content (%), N index (I_N%), P_{AL} ppm and K_{AL} ppm –Riehm Domindo Egnor method.

The dry matter content of leaves was determined by measurements of samples after storage at 65°C for 48 hours causing the N content (%) by the Kjeldahl method, P content (%) by colorimetric method and content of K (%) photometrica method.

RESULTS AND DISCUSSION

Trees growth

Annual average vegetative growth was achieved at the largest variety Topaz (4998.0 cm/tree) followed by Goldrush with 4619.9 cm/tree. The lowest value recorded in Generos with 631.0 cm/tree (Table 1). The greatest total length of flowering shoots was found in Goldrush with 9752.0 cm/tree followed by Topaz (7693.5 cm/tree) (Table 2).

Table 1. The annual growth of the vegetative shoots (cm/tree)

Variety	Vegetative shoots (cm/tree)			
	Spurs	Long shoots	Total	Sprouts
Generos	305.5	325.5	631.0	468.0
Goldrush	632.4	3987.5	4619.9	1574.0
Redix	361.0	2452.0	2813.0	910.5
Rubinola	523.5	3798.5	4322.0	1164.0
Topaz	493.0	4505.0	4998.0	3205.0

Table 2. The annual growth of the flowering shoots (cm/tree)

Variety	Flower shoots (cm/tree)			Total length (cm/tree)
	Flowering rods	Off shoots	Total	
Generos	3314.5	2400.5	6183.5	6814.5
Goldrush	3214.5	6537.5	9752.0	14371.9
Redix	5628.0	1420.0	7048	9861.0
Rubinola	2942.0	1908.5	6014.5	10336.5
Topaz	6023.0	1670.5	7693.5	12691.5

Flowering, fruit set, yield and productivity.

The highest numbers of flowers per tree in The was produced by Goldrush (125.5), meanwhile Rubinola produced only 25.5 flowers/tree. From the point of view of binding the fruits, Goldrush remains on the first place 97.5 (no/tree) followed by topaz with 57.5 (no/tree).(Fig.1)



Photo 1. Topaz flower

The fruit sizes varied from 173.3 g at Goldrush to 232.0 g at Topaz. Goldrush produced also the highest number of fruits per tree (70) and highest fruit yield (34.65 t/ha) followed by Topaz with 27.14 t/ha (Table 3).



Photo 2. Goldrush apple

Table 3. The final fruit number, fruit size and productivity (fruits/tree)

Variety	Final fruit (no/tree)	Fruit size g	Yield	
			kg/tree	t/ha
Generos	15.0	174.5	7.77	22.19
Goldrush	70.0	173.3	12.13	34.65
Redix	44.0	171.5	7.84	21.55
Rubinola	14.0	181.5	2.54	7.25
Topaz	41.0	232.0	9.5	27.14

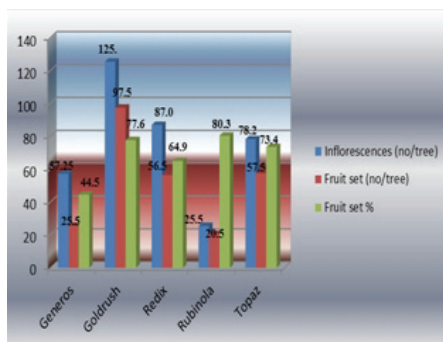


Fig. 1. The flowering, fruit set and final fruit

Effect of organo-mineral fertilizers on soil characteristics

Of the four variants studied can be seen as the best result in the content of soluble salts to obtain the V3 with a higher percentage of 0.041% soluble salts from the control sample (V1 whit 0,034%) and the highest I_N of 2.4% from the rest variants. I_N is synthetic indicator which is highlighted possible plant soil to provide nitrogen according to soil humus content and the degree of saturation of the soil base.

Insurance status of the soil with phosphorus and potassium mobile forms of the four variants V4 showed the highest value of 76.6 ppm P and 266.2 ppm K followed V3 with 76.4ppm P and 263.4 ppm K (Table 4.) Averaged and reported P_{AL} and K_{AL} scale interpretation for intensive orchards are: ≤ 36.0 ppm P_{AL} (very poor insurance) ≥ 144.0 ppm P_{AL} (very good insurance) and 132.0 ppm $\leq K_{AL}$ (poor insurance) $K_{AL} \geq 400.0$ ppm (very good insurance)

Table 4. The chemical characteristics of soil

Variant	pH in H ₂ O	Total soluble salts %	I_N %	P ppm	K ppm
V ₁ Control	6.0	0.034	2.2	73.0	256.7
V ₂ Techamin Brix, Tecnokel CaB	6.0	0.039	2.25	74.2	258.5
V ₃ Techamin Brix, Tecnokel CaB + Agriful	6.5	0.041	2.4	76.4	263.4
V ₄ Agriful	6.5	0.040	2.35	76.6	266.2

Effect of organo-mineral fertilizers on NPK content in leaves and shoots

During the fertilization and nutrition tree vegetation can be controlled analytically by foliar diagnosis and the results are reported in normal nutrient content in dry matter. Average N content is 2.2 to 2.5%, P 0.18 to 0.20% and K 1.3 to 1.6%. [1].

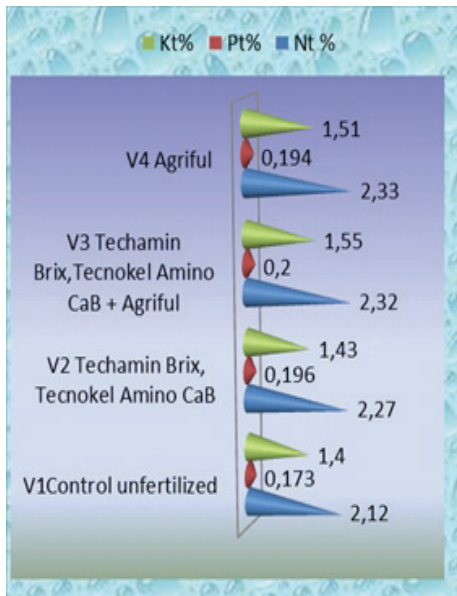


Fig. 2. Dinamic of apple leaves content in total NPK (%)

After studies effectuate can see that the V3 have the largest amount of NPK, respectively 2.33% N, 0.2% P, 1.55% K followed by V4 with 2.33% N, 0.194% P, 1.51% K (Fig. 2).

CONCLUSIONS

Following the study, we can deduce that variety ability to form vegetative and flowering shoots in a balanced number and the capacity to keep the fruits on the tree after the natural thinning, leads to high productivity (Goldrush and Topaz).

Fertilization in a plantation is necessary and mandatory for the increasing amount of our fruit branches, inflorescence, number of fruit-related and high production.

After this study we have seen the beneficial effects of organo-mineral fertilizers on plant and soil.

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