INFLUENŢA SISTEMULUI DE ÎNTREŢINERE A SOLULUI ŞI A FERTILIZĂRII CU AZOT ASUPRA UNOR COMPONENTE CHIMICE DIN FRUNZELE ŞI FRUCTELE SOIULUI DE PIERSIC SPRINGCREST
THE INFLUENCE OF MANAGEMENT SYSTEM AND NITROGEN FERTILIZATION ON LEAF AND FRUIT CHEMICAL COMPONENTS IN 'SPRINGCREST' PEACH VARIETY

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Abstract

The knowledge of the soil management system (SMS) effect and of the nitrogen doses application on the main chemical components from peach leaves and fruit has an particular importance both for fruit tree nutrition level measurement and fruit quality. During 2002-2006 a study was achieved in order to quantify these effects in Dobrogea - the optimum area for peach culture. Dobrogea is a region characterised as having rich soils with optimum values of chemical elements, but high water deficits. The experiment was carried out in a peach orchard at the Research Station for Fruit Growing Constanta on a calcareous chernozem showing high fertility. The orchard was established in 1991 in a 4m x 2m planting scheme. The peach tree orchard was planted in 1991 with Springcrest cultivar grafted on wild peach rootstock. The following layout was studied according to the subplot method in four replications and five trees were used within a replicate plot: SMS between tree rows (factor A with 2 graduations), SMS on the tree rows (factor B with 2 graduations) and N amount (kg active substance/ha) with 3 graduations. The mowed sod versus the clean cultivation system between the tree rows determined a significant increase in dry matter by 2% and in ash by 16% after four years of study. The values of other studied chemical components of the fruit (sugar content, total acidity, phosphorus, potassium and pH) were not significantly influenced by the SMS between tree rows. The mulch treatment on the tree rows determined a significant increase in leaves nitrogen by 4%, in fruit total acidity by 10%, in phosphorus by 15% and in potassium by 19% versus clean cultivation. Under similar treatment conditions the values of other analyzed chemical components of the fruit were not significant. Versus 60 kg N a.s/ha the fertilization by 90 kg N a.s./ha determined an increase in fruit nitrogen content by 7% and in phosphorus content by 6%, respectively. Also, the fertilization with 30 kg N a.s/ha showed a significant increase in fruit dry matter by 5% and in total nitrogen content by 11.6% versus 90 kg N a.s/ha. The values of other six analyzed chemical fruit components did not indicate significant differences in relation with the applied nitrogen doses.

Cuvinte cheie: sol, management, sistem, fertilizare**,** componente chimice ale fructelor
Keywords: soil management systems, fertilization, leaf nitrogen, chemical components of fruit

1. Introduction

The knowledge of the **soil management system** (SMS) effect and of the nitrogen doses application on the main chemical components from peach leaves and fruit has a particular importance for both fruit tree nutrition level measurement and fruit quality. During 2002-2006, a study was achieved in order to quantify these effects in Dobrogea - the optimum area for peach culture.

2. Material and methods

The experiment was carried out in a peach orchard at the Research Station for Fruit Growing Constanta, on a calcareous chernozem showing high fertility. The orchard was established in 1991, in a 4 m x 2 m planting scheme. The peach tree orchard was planted in 1991 with Springcrest cultivar grafted on wild peach rootstock. The following layout was organized: **Factor A**, SMS between tree rows with the graduations: **a1**= clean cultivation strips (CCS) made by plowings performed in spring and autumn and frequent diskings during the growing season; **a2**= mowed sod strips (MSS), 3 m wide by sowing *Lolium perenne* in spring 2002 and left as mulch in situ.

Factor B, SMS on the tree rows with the graduations: **b1**= CCS made by herbicide application; **b2**= mulch application made by mowed sod.

Factor C, N amount, kg active substance/ha (a.s/ha) with the graduations: **c1**-N_{30}; **c2**-N_{60}; **c3**-$N_{90.}$

A 3- factor experiment of the kind: 2 x 2 x 3 was achieved according to the subplot method in four replications and five trees were used within a replicate plot. The current methods for chemical components analyses were used.

3. Results and discussions

Influence of the SMS and fertilization systems on some chemical components of leaves and fruit in Springcrest peach variety:

MSS between tree rows versus the CCS induced a significantly higher increase in dry matter content by 2% and in ash by 16%. The values of the other chemical components analyzed were not significantly affected by the SMS between the tree rows.

Mulch application on the tree rows induced a significantly higher increase in total fruit acidity by 11%, in phosphorus by 17% and in potassium by 19% versus clean cultivation.

Fertilization by N90 kg a.s/ha determined a significantly higher increase in the leaves nitrogen content by 9% and in fruit phosphorus content by 5% versus N30 kg a.s/ha. In similar conditions, the fertilization with 30 kg N a.s/ha showed a significant increase in fruit dry matter by 5% and in total nitrogen content by 11,6 % versus 90 kg N a.s/ha (table 1).

The graduations of factors B and C were not significantly affected by the SMS between tree rows regarding the nitrogen content of the leaves and fruit pH. Under similar conditions, for other analyzed chemical components determined by the two studied SMS between tree rows, significant differences at the level of different graduations of factors B and C were noted.

The values of the analyzed chemical components were significantly affected by the applied nitrogen doses at the level of studied factors A and B (table 2).

Influence of the SMS and fertilization systems on correlations between some chemical components of the leaves and fruit for Springcrest peach variety

Some positive correlations were obtained between different values of fruit chemical components for Springcrest variety.

The values of sugar content were significantly correlated with three chemical components and the values of the potassium and total acidity content were correlated with two components. Also, the contents of dry matter, ash, pH, phosphorus were significantly correlated with one chemical component. The lowest numbers of positive correlations were recorded between the values of leaf nitrogen content and leaf chemical components (table 3).

The data presented in table 1 showed that the differences between the two studied SMS between tree rows regarding the values of analyzed chemical components were very low comparative with other studies. Many other researchers (Bould and Jarrett, 1962; Greenham and Priestley, 1980; Johnson and Johnson, 1980; Iancu and Negoita, 1991) found that the values of nitrogen in the fruit trees maintained between the tree rows as mowed sod strips were low in most of the cases versus clean cultivation strips. Also, under the same conditions, many authors noted that the phosphorus and potassium content in fruit increased (Bould and Jarrett, 1962; Perring, 1984; Shribbs and Skroch, 1986; Hogue and Nielsen, 1987; Iancu and Negoită, 1991). The low differences found between the values of the analyzed chemical components in the studied SMS between the tree rows are explained by the high fertility of the soil where the study was carried out and by the weak growing of sod.

Among the two studies with SMS between the tree rows, only the values of dry matter and ash content in fruit were significantly different. The mowed sod versus the clean cultivation system between the tree rows determined a high value of the two mentioned chemical components. That can be explained by the low values of soil moisture and smaller size of the leaves in the mowed sod treatment.

Generally, the researches carried out for many other species in different geographical conditions showed a parallelism between the values of the chemical content components in leaves and fruit (Haynes, 1980), so the processes and the mechanisms that determined the values of chemical components of the leaves are responsible for the chemical values of the fruit, too.

Taking into consideration this opinion, we can appreciate that the highest values of the phosphorus content and potassium content of fruit in the case of the trees mentioned on the tree rows as mulch treatment versus clear cultivation are explained by mulch disintegration and by more favorable conditions for roots at the soil level created by mulching. Also, by using mulching system, better conditions for temperatures and soil moisture occur, for both mulch disintegration and tree roots activity.

The present paper showed that the increasing in potassium content was highest versus phosphorus content in the mulch treatment versus clean cultivation, emphasizing once more that the potassium circulation in soil is faster than phosphorus. The phosphorus is fitted into organic forms that are more stable.

The effect of the three applied nitrogen doses on the analyzed chemical components is the increase in nitrogen content in both leaves and fruit, in relationship with the increasing of nitrogen applied. These results were found before by Gourley and Hopkins, 1971; Hulme, 1956 cited by Letham (1969), Perring (1965, 1980), Johnson and Johnson (1980). The decrease in dry matter content in relationship

with the increasing of applied nitrogen doses is explained through the increase in fruit sizes in the treatments with more nitrogen applied. Also, the decreasing of the pH value is the result of increasing in total acidity in direct relation with the applied nitrogen doses. This result is proven by the significant, negative correlation (r = -0.4*) that was found between the two components.

It is also important to emphasize that the value of the phosphorus content increases similarly with the nitrogen content; however between the two groups there were not recorded significant correlations (table 3). The increasing in the fruit phosphorus content in relation with the nitrogen applied in Springcrest peach variety is not similar with the data found by Wilkinson (1957), cited by Perring (1975). This one showed that the apples in a nitrogen fertilized treatment indicated lower values of nitrogen content than in the unfertilized treatment. The inhibitor effects of nitrogen fertilization on phosphorus content of the fruit were emphasized by Iancu and Negoită (2009) who showed in Golden spur apple variety that the content of phosphorus in an unfertilized treatment was highest, with 10% more than the phosphorus content in the treatments fertilized with different organic and mineral fertilizers.

4. Conclusions

1. The mowed sod system between the tree rows determined a significant increase in dry matter by 2% and in ash by 16% versus the clean cultivation system. The values of other studied leaf chemical components (e.g. nitrogen) and of the fruit components (sugar content, total acidity, phosphorus, potassium and pH) were not significantly influenced by the SMS between tree rows.

2. The mulch treatment on the tree rows determined a significant increase in fruit total acidity by 10%, in phosphorus by 15% and in potassium by 19% versus clean cultivation.

3. Versus 60 kg N a.s/ha, the fertilization with 90 kg N a.s/ha determined an increase in fruit nitrogen content by 7% and in phosphorus content by 6%, respectively. Also, the fertilization with 30 kg N a.s/ha showed a significant increase in fruit dry matter by 5% and in total nitrogen by 11, 6% versus 90 kg N a.s/ha.

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Table 1 **- Influence of the SMS and nitrogen fertilization systems on some chemical components of the leaves and fruit in SPRINGCREST peach variety (the average values of the studied factors graduations)**

No.	Chemical component	a_1	a_2	5% LSD	b_1	b_2	5% LSD	c_1	c_2	c_3	5% LSD
1	Nitrogen-leaf (%)	2.54	2.56	N.S	2.55	2.66	N.S	2.51	2.56	2.74	0.094
2.	Dry matter (%)	10.57	10.80	0.221	10.79	10.57	N.S	10.84	10.88	10.33	0.50
3.	Ash (%)	0.396	0.460	0.02	0.42	0.43	N.S	0.42	0.42	0.44	N.S
4.	pH	3.98	4.05	N.S	4.00	4.03	N.S	4.04	3.95	4.05	0.08
5.	Total acidity (mg/100 g fruit)	0.613	0.602	N.S	0.58	0.64	0.04	0.602	0.618	0.602	N.S
6.	Total sugar (%)	7.04	6.82	N.S	7.04	6.82	N.S	7.32	6.91	6.56	0.51
7.	Phosphorus (mg/100 g fruit)	28.4	28.8	N.S	26.6	30.6	2.69	27.9	28.4	29.5	1.78
8.	Potassium (mg/100 g fruit)	177	187	N.S	166	197	0.69	180	180	185	N.S
9.	Total nitrogen (mg/100 g fruit)	2.52	2.21	N.S	2.44	2.30	N.S	2.37	2.46	2.27	0.18

5% LSD = least significant difference for the probability of 95%

Table 2 - **Influence of the SMS and nitrogen fertilization systems on some chemical components of the leaves and fruit for SPRINGCREST peach variety (the interaction of studied factors A/B/C)**

Chemical component	Interaction of experimental factors A/B/C							5% LSD		
		b_1			b_2					
		c_1	c_2	c_3	c_1	c_2	c_3	1	2	3
Dry matter %	a_1	9.22	9.96	11.09	11.11	10.04	11.21	1.01	1.12	0.89
	a_2	12.85	11.33	10.32	10.17	11.40	8 .71			
Ash %	a_1	0.39	0.45	0.35	0.41	0.34	0.44	0.062	0.070	0.058
	a_2	0.40	0.40	0.55	0.49	0.50	0.42			
pH	a_1	4.00	3.86	4.09	4.03	4.01	3.91	0.016	0.018	N.S
	a_2	4.07	3.90	4.11	4.08	4.05	4.11			
Total acidity (mg/100 g fruit)	a_1	0.53	0.62	0.53	0.65	0.66	0.69	0.065	0.083	0.071
	a_2	0.63	0.62	0.53	0.60	0.57	0.66			
Total sugar (%)	a_1	6.75	6.83	6.46	7.72	6.69	7.81	1.01	1.11	1.66
	a_2	7.96	7.81	6.46	6.88	6.30	5.53			
Phosphorus (mg/100 g fruit)	a_1	26.1	24.1	32.0	29.3	26.9	32.0	3.56	4.75	4.15
	a_2	26.3	27.7	23.4	30.0	34.9	30.6			
Potassium (mg/100 g fruit)	a_1	149	168	178	186	166	214	31.2	33.4	28.6
	a_2	180	184	138	205	202	211			
Total nitrogen (mg/100 g fruit)	a_1	2.94	2.31	2.55	2.41	2.52	241	0.35	0.45	0.49
	a_2	2.10	2.62	2.10	2.03	2.38	2.03			
Nitrogen (leaf)%	a_1	2.42	2.36	2.62	2.48	2.60	2.83	0.19	0.24	NS
	a_2	2.49	2.58	2.82	2.66	2.68	2.81			

5%LSD = 1 ab constant, c differs; 2= ac constant, b differs; 3= bc constant, a differs

Table 3 **- Influence of the SMS and fertilization systems on correlations between some chemical components of the leaves and fruit for SPRINGCREST peach variety**

No.	Chemical component	Dry matter	Ash	pH	Total acidity	Total sugar	Phosphorus	Potassium	Nitrogen
1.	Nitrogen (leaf)%	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
2.	Dry matter %	-	N.S	N.S	N.S	0.65***	N.S	N.S	N.S
3.	Ash %	-	-	N.S	N.S	N.S	N.S	N.S	-0.429**
4.	pH	-	-	-	- 0.4*	- 0.505**	N.S	N.S	N.S
5.	Total acidity (mg/100 g fruit)	-	-	-	-	0.429**	N.S	0.419**	N.S
6.	Total sugar (%)	-	-	-	-	-	N.S	N.S	N.S
7.	Phosphorus (mg/100 g fruit)	-	-	-	-	-	-	0.729***	N.S
8.	Potassium (mg/100 g fruit)	-	-	-	-	-	-	-	N.S