

Effect of Auxin-Synergistic Preparation and Fertilization on Fruit Setting and Fruit Quality of Apple

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SUMMARY

On seven apple cultivars (Gala Must, Gloster, Granny Smith, Idared, Jonagold, Jonathan Csány and Mutsu), the author studied the influence of N-phenyl-phthalamic acid (Nevirol 60 WP) and fertilization on fruit setting and fruit quality.

The research results show that by using Nevirol 60 WP and applying fertilization, we can improve the fruit setting and number of fruit per tree. As a result of this process, the yield amount will increase.

Nevirol 60 WP has a great effect on the improvement of yield amount, especially by good nutrient supply. There is a significant difference between the reactions of different cultivars. The most sensitive to these treatments were the cultivar Gala Must and Granny Smith. Before using Nevirol 60 WP we have to take into consideration that the increased yield needs a higher nutrient supply; otherwise, fruit mass, diameter and fruit height will decrease, and the yield will frittered away. In the study, the most favourable effect of Nevirol 60 WP was detected under additionally fertilized conditions by the author.

Keywords: *N-phenyl-phthalamic acid, Nevirol 60 WP, fertilization, apple, fruit setting, fruit quality*

INTRODUCTION

Ensuring yield-balance – although the applied technologies give a good possibility for this – in large-scale farming is a difficult and complicated task (Nyéki et al., 2002). Pollination of certain horticultural species – because of climatic and genetic influences – is not possible in many cases (Kozma et al., 2003; Nyéki and Soltész, 1996). For sufficient yield amount and required yield quality we have to interfere in pollination. With the help of N-phenyl-phthalamic acid, which is an agent of Nevirol 60 WP, we can achieve this goal (Búza, 1986; Racsó, 2002).

The N-phenyl-phthalamic acid is a regulator that increases the working life of stigma and supports the better pollination, which results in a higher yield (Nyéki, 2002). The acid is not auxin, but it has a synergistic effect with auxin in biological tests (Nyéki, 1980). This has not caused any phytotoxicity or parthenocarpia (Nyéki, 1980). Applying Nevirol 60 WP, the possible unfavourable effects of the objective (agronomics, agrotechnics, species, weather) and subjective conditions of production can be reduced, and yield fluctuation can be levelled, thus, crop safety can be considerably increased. The product, like other regulators and all synthetic pesticides, is not approved in the organic production system (Holb and Heijne, 2001; Holb, 2002b; Holb et al., 2003).

Its application is recommended for the flowering period in greenhouses, and foilhouses, as well as in field (orchard) cultivation for some crops (tomato, paprika, pea, bean, cucumber, grape, apple, sour cherry, lupin, soya) (Eőri, 1984; Teleky, 1985; Teleky and Bésán, 1986; Teleky and Eőri, 1984; Teleky and Horváth, 1986; Teleky and Veress, 1986; Racsó and Lakatos, 2003).

The product may be mixed with insecticides, fungicides and foliar fertilizers, excepting alkaline products. Attention has to be paid to the phytotoxic effect of some scab fungicides in the full bloom period, which should be avoided (Holb, 2002a). The preparation of the spray liquid does not need any special measures, as the preparation contains the necessary constituents to ensure quick and thorough wetting. For applications with ground machine use 400-1000 l/ha, at aerial applications 60-80 l/ha.

It is important to note that while a higher yield is aimed at through better fruit setting, a higher level of basic nutrition should be provided (Szirtes, 1984; Racsó and Lakatos, 2003).

MATERIALS AND METHODS

The research was conducted in the period from 2003-2004, in field experiments involving private growers at Kálmánháza and Nagylapos. The experimental apple plantations and the various characteristics of cultivars are presented in *Table 1*. We have chosen seven apple cultivars for the research. Trees were planted in north-south row direction. In our research, the usual cultivation and integrated plant protection was applied.

For better fruit setting, we applied N-phenyl-phthalamic acid, which is an agent of Nevirol 60 WP in 0.4 kg/ha doses. It was sprayed at full bloom. The conditions of spraying application can be seen in *Table 2*.

For the nutrition supply of the increased number of fruits, we used artificial fertilizer in two doses. We applied it as a base fertilization in solid and granular formulation in January, then as a head fertilization in liquid foliar formulation in May. *Table 3* demonstrates the conditions of fertilization.

The observation and measurement were carried out on twenty trees per treatment. The total number of trees was 560. Tables contain the average of these data. Trees were assigned at the beginning of research. Each cultivar was represented by four blocks and each block by five trees. Five apple fruits were randomly sampled from each tree for this evaluation, so that the total number was 100 per cultivar.

Table 1

Characteristics of the experimental apple plantations and the chosen cultivars

Place of experiment	Cultivar	Rootstock	Date of plantation (year)	Size of area (ha)	Size of parcel (m ²)	In-row spacing (m)
Kálmánháza	Gala Must	MM106	1998	6.0	700	4 x 1.5
Kálmánháza	Gloster	MM106	1998	1.8	700	4 x 1.5
Kálmánháza	Granny Smith	MM106	1999	0.8	700	3.5 x 1.5
Nagylapos	Idared	M4	1995	4.0	400	3.5 x 2
Kálmánháza	Jonagold	MM106	1998	3.2	700	3.5 x 1.5
Nagylapos	Jonathan Csány	M4	1989	2.5	400	4 x 2
Nagylapos	Mutsu	M4	1995	4.0	400	3.5 x 2

Table 2

The conditions of spaying application of Nevirol 60 WP (in 2003-2004)

Cultivar	Date of treatments (day, month)		Treatments (x times)		Flowering state (%)	
	2003	2004	2003	2004	2003	2004
Gala Must	27 April	1 May	1	1	50	55
Gloster	27 April	29 April and 2 May	1	2	48	35 and 70
Granny Smith	23 and 27 April	2 May	2	1	15 and 60	50
Idared	27 April	26 April	1	1	50	48
Jonagold	28 April	26 April	1	1	50	50
Jonathan Csány	26 April	26 April	1	1	50	50
Mutsu	28 April	30 April	1	1	51	52

Table 3

The conditions of fertilization (in 2003-2004)

Cultivar	Fertilization (kg)			Date of fertilization (day, month)			
				2003		2004	
	N	P ₂ O ₅	K ₂ O	base	head	base	head
Gala Must	80	25	28	22 Jan	14 May	20 Jan	16 May
Gloster	80	25	28	22 Jan	13 May	20 Jan	16 May
Granny Smith	80	25	28	22 Jan	13 May	20 Jan	16 May
Idared	72	25	25	27 Jan	15 May	19 Jan	18 May
Jonagold	80	25	28	22 Jan	13 May	20 Jan	16 May
Jonathan Csány	72	25	25	27 Jan	15 May	19 Jan	18 May
Mutsu	72	25	25	27 Jan	15 May	19 Jan	18 May

In our investigations, we determined the following properties of apple:

- (1) Fruit setting: This means the number of harvested fruit from 100 flowers per tree.
- (2) Number of fruit per tree: This means the number of ripened fruit. The actual value was counted by harvesting.
- (3) Fruit weight: The weight of fruit was estimated in 0.1 grams with the help of digital analitic scales.
- (4) Fruit diameter: This was measured in 0.1 millimeters with slide-gauge.
- (5) Fruit height: This was measured similar to fruit diameter in 0.1 millimeters with slide-gauge.

RESULTS AND DISCUSSION

Results showed that fruit setting of apple cultivars increased in many cases when N-phenyl-phthalamic acid (Nevirol 60 WP) was applied. The increased nutrient supply could enlarge the fruit setting. This increase of fruit setting was detected for cultivars

Gala Must, Gloster, Idared, Jonagold and Jonathan Csány in 2003 (*Figure 1*). In 2004, fruit set of cultivars Gala Must, Idared, Jonathan Csány and Mutsu increased with fertilization (*Figure 2*). However, it is need to mentioned that the increase of fruit setting was not significant in several cases (*Table 4*).

The positive effect of Nevirol 60 WP on fruit setting was considerable for low setting cultivars (such as Granny Smith in 2003), but it resulted in good fruit setting on cultivar Gala Must too. In 2003, the fruit setting was the highest on cultivar Granny Smith (41.9%) and in 2004, on cultivars Jonagold (54.5%) if Nevirol was applied without fertilization. The fertilization slightly increased the effect of Nevirol 60 WP, and it was significant in 2003 for cultivar Granny Smith (55.6%) and in 2004 for cultivar Jonagold (54.5%) (*Table 5*). Nevirol 60 WP had the lowest on cultivar Gloster in both years and the same results were obtained for fertilization too (*Table 5*).

Figure 1: Effect of Nevirol 60 WP and fertilization on fruit setting of apple in 2003

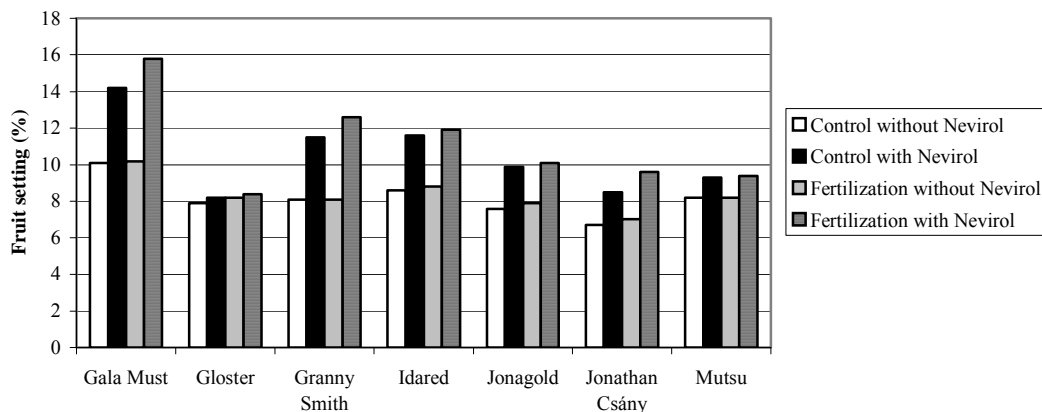


Figure 2: Effect of Nevirol 60 WP and fertilization on fruit setting of apple in 2004

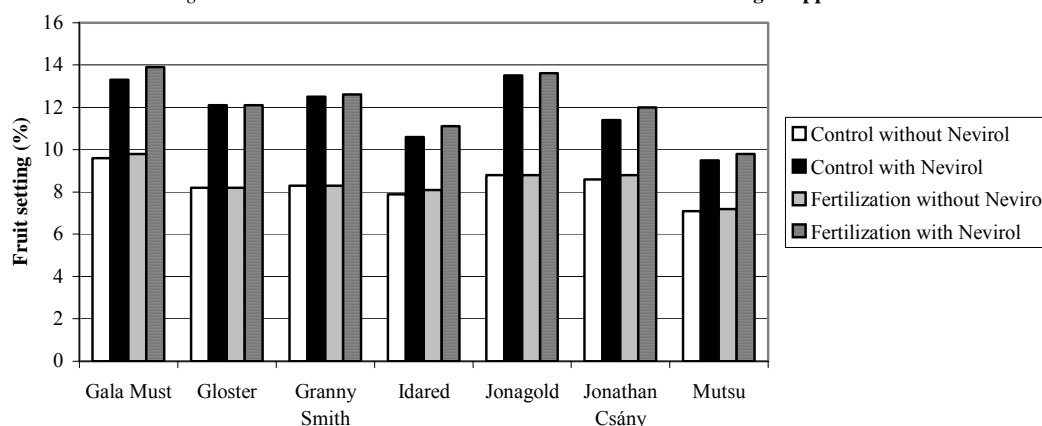


Table 4

Increase of fruit setting (%) by fertilization in 2003-2004

Cultivar	2003		2004	
	without Nevirol	with Nevirol	without Nevirol	with Nevirol
Gala Must	1.0	11.3	2.1	4.5
Gloster	3.8	2.4	0.0	0.0
Granny Smith	0.0	9.6	0.0	0.8
Idared	2.3	2.6	2.5	4.7
Jonagold	3.9	2.0	0.0	0.7
Jonathan Csány	4.5	15.3	0.0	5.3
Mutsu	0.0	1.1	1.4	3.2
Mean	2.21	6.33	0.86	2.74
Std. Deviation	1.91	5.65	1.12	2.20

Table 5

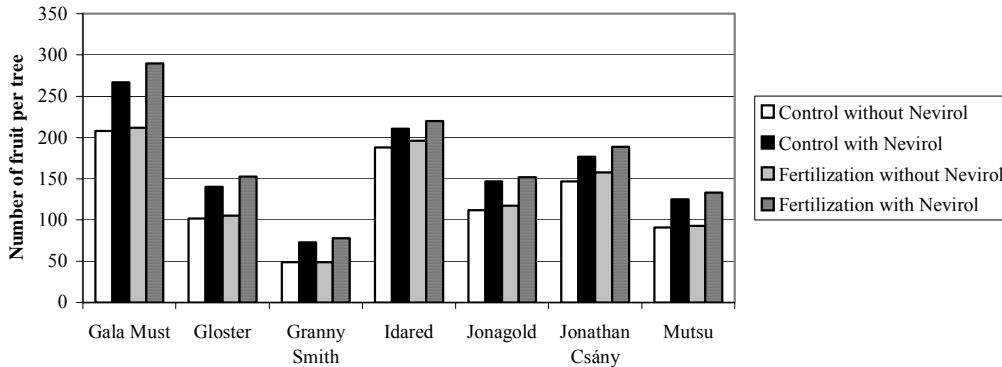
The measure of increase of fruit setting (%) by Nevirol 60 WP (in 2003-2004)

Cultivar	2003		2004	
	control	fertilized	control	fertilized
Gala Must	40.6	54.9	38.5	41.8
Gloster	3.8	2.4	47.6	47.6
Granny Smith	41.9	55.6	50.6	50.0
Idared	34.9	35.2	34.2	37.0
Jonagold	30.3	27.8	53.4	54.5
Jonathan Csány	26.9	37.1	32.6	36.4
Mutsu	13.4	14.6	33.8	36.1
Mean	27.40	32.51	41.53	43.34
Std. Deviation	14.16	19.63	8.78	7.42

The increase of fruit setting increased the number of fruit per tree too. Mean fruit number of tree in 2003 and 2004 can be seen in *Figure 3*. The greatest

numbers of fruit were in cultivar Gala Must and it was decreased in the order of cultivars Idared and Jonathan Csány.

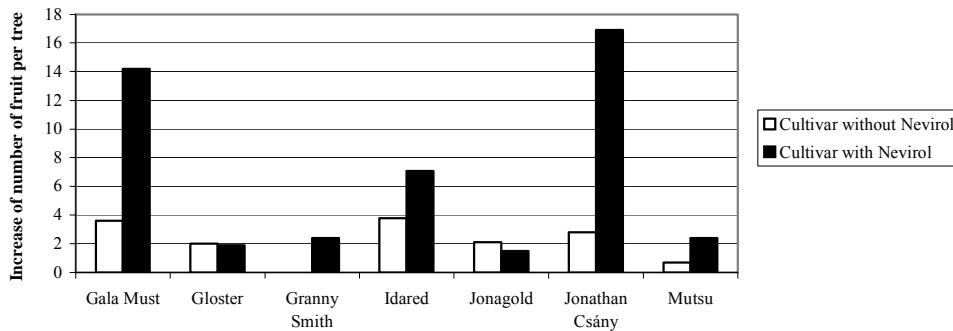
Figure 3: Effect of Nevirol 60 WP and fertilization on number of fruit per tree (average of 2003-2004)



The fertilization increased the fruit numbers per tree, however it was low. The positive effect of fertilization resulted from the lower flower abortion which is can be explained by the increased nutrient content of flowers by the fertilization. The effect of fertilization was the highest on cultivar Jonathan

Csány (16.9 fruits per tree), Gala Must (14.2 fruits per tree) and Idared (7.1 fruits per tree). The low values of fruit number for other cultivars showed that that the number of fruit per tree could be increased by not only with fertilization (*Figure 4*).

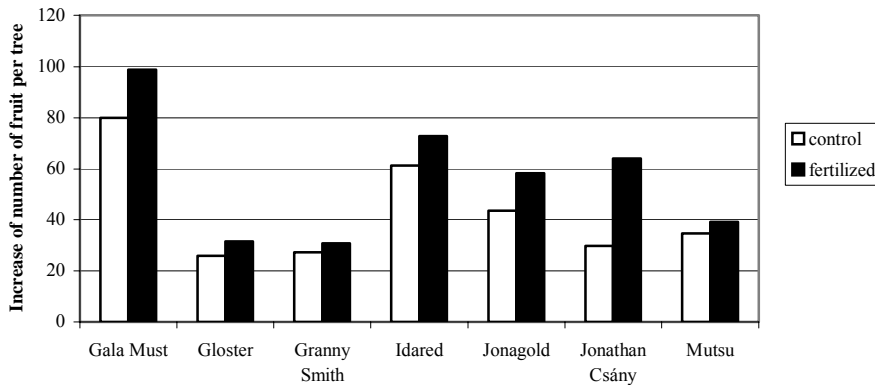
Figure 4: Effect of fertilization on the numbers of fruit per tree (means of 2003 and 2004)



Nevirol 60 WP increased the number of fruit per tree as it was seen for fruit set. The order – without fertilization – was as follows: Gala Must, Idared, Jonagold, Mutsu, Jonathan Csány, Granny Smith and Gloster. The fertilization changed the order as

follows: Gala Must, Idared, Jonathan Csány, Jonagold, Mutsu, Granny Smith and Gloster. Higher values of fruit number was observed when fertilization was applied because the fruit abortion was also decreased (*Figure 5*).

Figure 5: Effect of Nevirol 60 WP on the fruit number per tree



Quality parameters determined by fertilization and fruit number per tree as it can be seen in *Table 6*. For example, when Nevirol 60 WP was applied without fertilization the fruit number per tree increased considerably however, it caused a considerable frittering away.

Increase of fruit weight was considerable on all cultivars when fertilization was applied without

Nevirol (*Table 6*). However, fruit weight decreased when Nevirol 60 WP was applied without fertilization. The reason for this is that fruit set was high and fruit received not enough nutrition for growing up.

Similar tendency was found for the diameter and the height of fruit, but differences among cultivars were little (*Table 6*).

Table 6

Effect of Nevirol 60 WP and fertilization on quality parameters of fruit

Cultivar	Control		Fertilization	
	without Nevirol	with Nevirol	without Nevirol	with Nevirol
Fruit weight (g)				
Gala Must	151.8	120.4	160.2	152.4
Gloster	169.2	146.8	194.3	170.2
Granny Smith	146.7	131.5	159.8	147.8
Idared	154.6	144.2	176.9	153.9
Jonagold	199.3	175.4	220.4	197.5
Jonathan Csány	137.8	114.8	149.8	132.8
Mutsu	146.1	126.5	166.8	145.2
Fruit diameter (mm)				
Gala Must	70.1	63.9	73.1	70.2
Gloster	72.2	69.1	75.4	72.6
Granny Smith	67.5	64.8	70.0	67.9
Idared	71.8	69.5	74.2	71.8
Jonagold	76.5	73.0	80.9	75.2
Jonathan Csány	69.3	62.8	72.1	66.7
Mutsu	70.9	65.5	74.4	69.6
Fruit height (mm)				
Gala Must	61.7	57.6	62.9	61.9
Gloster	68.2	66.1	70.1	68.2
Granny Smith	65.1	62.3	67.2	65.2
Idared	64.2	62.0	65.4	65.8
Jonagold	66.8	65.6	69.0	68.7
Jonathan Csány	58.9	54.9	60.4	57.0
Mutsu	60.4	57.1	62.5	60.3

CONCLUSION

Results show that Nevirol 60 WP and fertilization could increase fruit setting and the fruit number per tree, which resulted in a yield increase too.

Nevirol 60 WP had a great effect on crop yield, especially when Nevirol 60 WP was applied with

fertilizer. Both treatments (Nevirol 60 WP and fertilization) showed significant differences among cultivars. Before using Nevirol 60 WP we have to take into consideration that the increased yield needs higher nutrient supply, otherwise fruit mass, diameter and fruit height will decrease, and the yield will frittered away.

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