

## Use of maleic hydrazide (MH) to induce branches in maiden fruit trees

L. S. JANKIEWICZ, J. KOZYRA

Research Institute of Pomology, Skierniewice, Poland

(Received: July 5, 1972)

### Abstract

MH as a single spray in concentrations 700 - 1500 mg/l was used in July to induce premature offshoots in nursery trees. The trees of pear, plum and of 3 apple cultivars showed little or no response to MH treatment. Due to this treatment, however, the trees of 7 other apple cultivars formed 3 - 5 branches longer than 20 cm, possessing large crotch angles. The growth of the main axis was only temporarily inhibited by the MH treatment.

### INTRODUCTION

Maiden apple, pear and plum trees usually produce few branches in the lower part of their axis. Such branches are useless for tree head formation. Methods of breaking the apical dominance in maiden fruit trees in order to induce branching higher on their axis have been investigated by several authors (Jankiewicz and Kemula 1962; Preston 1967, 1968). One of such methods is spraying the trees with MH (Jankiewicz 1960; Marcelle 1966). The purpose of this work was to try MH treatment on the trees of several apple cultivars and on plum and pear trees.

### MATERIAL AND METHODS

The apple trees were sprayed with MH on July 7 - 12 when they were 70 - 85 cm high or on July 20 - 21 when they had attained 85 - 115 cm. The weather during spraying was sunny and wet. Pear trees and plum trees were sprayed on July 6 during cloudy and very wet weather. Only the apical part of the trees was sprayed including 5 - 6 fully developed leaves. MH in diethanolamine was applied in concentrations 700 - 1500. The surfactant Pagin was also used to facilitate

absorption. The leaves were sprayed abundantly using 5-8 ml of the solution per tree. Two types of control trees were used: intact sprayed only with the surfactant, and decapitated not sprayed.

The measurements of the length of the branches and of crotch angle width were taken during the autumn. Crotch angles were measured as the angle between the main axis and the tangent to the branch 1 cm from its point of attachment.

The experiments were set up in 5 randomized blocks. Three equally treated trees comprised a plot. The results were worked out statistically using the method of analysis of variance.

## RESULTS

The apple trees treated with the higher concentrations of MH showed irregular chlorosis and deformations of the leaves which were the youngest during the treatment. Also the leaves and the internodes which had not attained their final size at the time of treatment were afterwards smaller than those in control trees.

Table 1  
The number of lateral branches longer than 20 cm growing on the trunk higher than 45 cm above the soil surface

The name of the variety	Control untreated	Control decapitated	MH 1200 ppm	MH 1400* ppm
Wealthy	0.0	—	0.0	0.0
Close	0.0	—	0.0	0.0
Antonovka	0.0	0.8	0.0	0.0
Bancroft	4.5	5.7	4.3	4.9
Boiken	0.6	3.4	1.2	3.7
McIntosh	0.2	3.3	3.1	3.1
Oberländer				
Himbeerapfel	1.2	4.5	4.5	4.9
Yellow				
Transparent	0.0	4.4	3.1	4.1
Piękna z Rept	0.06	3.1	0.1	4.1
Starking	0.06	1.9	1.6	3.8

\* Piękna z Rept and Starking 1500 ppm.

The trees of seven apple cultivars (Tab. 1) showed a marked influence of MH on branch formation. In most cases the concentrations of 1400-1500 mg/l induced more offshoots per tree than 1200 mg/l. Concentrations lower than these were only slightly effective or not effective. With 1400 or 1500 mg/l of MH, 3-5 branches longer than 20 cm were formed per tree. Besides that, several branches shorter than 20 cm were formed,

which in some cases may also help to from the tree head. The decapitated control trees produced a similar number of laterals per tree but of these the 1-2 uppermost and most vigorous ones formed narrow crotches (Tab. 2). Such laterals cannot be used as scaffold branches. Only Bancroft trees produced so many vigorous laterals after decapitation that the trees could easily be trained by Černík's (1956) method, i.e. by pinching the 1-2 uppermost narrow-crotched laterals.

Table 2

The crotch angles (in degrees) of three consecutive uppermost branches (1, 2, 3)

The name of the variety	Control decapitated			MH 1200 ppm			MH 1400* ppm		
	1	2	3	1	2	3	1	2	3
Bancroft	25.6	47.9	68.3	55.8	53.3	66.2	56.2	57.2	64.3
Boiken	20.3	45.0	59.5	65.6	66.4	66.4	54.1	48.6	52.0
McIntosh	14.4	30.5	47.8	46.7	45.7	52.1	42.9	41.9	46.1
Oberländer									
Himbeerapfel	20.7	40.1	57.9	50.8	48.5	54.7	47.2	47.8	49.2
Yellow									
Transparent	13.2	33.4	55.1	48.5	44.7	41.0	47.9	43.6	51.4
Piękna z Rept	25.6	50.0	67.2	—	—	—	60.7	62.6	60.1
Starking	24.9	51.7	61.3	62.9	60.4	63.8	47.4	46.6	47.7

\* Piękna z Rept and Starking 1500 ppm.

The trees treated with MH possessed branches which in most cases were attached at sufficiently wide angles, although at the concentration of 1200 mg/l the angles were wider than at 1400 or 1500 mg/l. Thus with increasing inhibition of the growth of the main axis the tendency to produce narrow crotches rises. This tendency was especially distinct in weaker trees. The growth of the main axis was only temporarily inhibited by MH treatment and a leader 25-35 cm long grew out above the zone where offshoots were formed.

On the subsequent spring the frost injury and growth of decapitated and MH-treated trees of the two cultivars Piękna z Rept and Starking were observed. They belong to the group of cultivars with medium frost resistance. There were found only occasional frost injuries of the ends of the branches similar in both decapitated and MH-treated plants. The growth of all investigated trees was similar.

Three other apple cultivars Wealthy, Antonovka and Close (Tab. 1) showed marked symptoms of MH treatment on their leaves but formed no branches, even at the highest concentration of MH. In the trees of cv. Close MH treatment seemed to increase the growth of branches which were already present lower on the axis at the time of treatment.

The later application of MH on July 20-21 in another nurseries in

the northern part of Poland on trees of McIntosh, Spartan, Wellspur, Red Boskoop and Yellow Transparent budded on M IX induced only short shoots in the treated zone. Decapitation was also little effective at that time.

The pear trees cv. Colorée de Juillet and Clapp's Favourite and the plum trees cv. Wangenheim's Frühzwetsche and Reine Claude d'Oullins, treated with the same concentrations of MH as apple trees, did not ramify. The pear trees showed very weak symptoms of MH treatment on their leaves. This may be related to the fact that a pear shoot does not form a large group of young leaves on its top (as an apple shoot does), which could retain the solution. Pear leaves are also smoother and more waxy than apple trees, which makes absorption of the spray solution difficult. In contrast to this a plum shoot ends with a very large and dense group of partially unfolded leaves which present a considerable absorbing surface for the spraying solution. So it is not surprising that the symptoms of MH action were very marked on plum trees and that higher MH concentrations often killed the apices. Nevertheless, the production of laterals was not observed in plum trees after MH treatment. This may be connected with the early dormancy of plum axillary buds or with a direct inhibitory influence of MH on axillary buds in this species.

The results presented on apple trees corroborate those of Jankiewicz (1960) and Marcelle (1966). It is probable that the method of inducing premature offshoots on apple trees with MH may find practical application in the nurseries after further refinement. It would be advisable however, to perform the treatment as early as possible and never later than on July 12. The very weak response of apple trees to treatment on July 20 - 21 may be connected with progressing dormancy of buds (Champagnat, 1965). Also, when the trees are treated too late the newly formed shoot does not have enough time to attain sufficient length. The effect of MH on apical dominance may be tentatively explained as due to a temporarily lowering of the production of gibberellins and auxins in the shoot apex and young leaves. As the apex resumes its growth, the newly formed laterals come under the influence of the renewed production of auxins and gibberellins, which leads to the formation of large crotches (Jankiewicz 1956).

This work was partly supported by the U.S. Department of Agriculture, Agricultural Research Service, Grants No. FG-Po-111 and 265.

#### REFERENCES

- Cernik V., 1956, Sb. Čs Akad. Zeměd. Věd. Rostl. Vyr. 29: 452 - 481.  
Champagnat P., 1965, Encyclopedia of Plant Physiology Vol. 15/1, pp. 1165 - 1172, Springer Verlag, Berlin.

- Jankiewicz L. S., 1956, Bull. Acad. Polon. Sci. Cl. II. 4: 173-178.  
Jankiewicz L. S., 1960, Bull. Acad. Polon. Sci. Cl. V, 8: 515-517.  
Jankiewicz L. S. and Kemula F., 1962, Prace Inst. Sad. 6: 19-26, 27-38.  
Marcelle R., 1966, Hort. Res. 6: 100-112.  
Preston A. P., 1967, Rep. E. Malling Res. Stat. for 1966, 211.  
Preston A. P., 1968, J. Hort. Sci. 43: 351-357.

Zastosowanie hydrazidu kwasu maleinowego (MH) dla wywołania rozgałęziania się drzewek owocowych w pierwszym roku ich wzrostu

#### Streszczenie

Górną część siewek opryskiwano jednorazowo MH w stężeniach 700-1500 mg/l. Doświadczenie przeprowadzono 6-12 lipca w szkółce, gdy okulanty osiągnęły 70-85 cm wysokości. Drzewka grusz, śliw i trzech odmian jabłoni: Wealthy, Antonówka i Close nie rozgałęziały się pod wpływem MH, natomiast drzewka siedmiu innych odmian jabłoni wytworzyły pod jego wpływem 3-5 gałązek o długości powyżej 20 cm. Gałązki te miały duże kąty rozwidlenia.

Wzrost osi głównej był tylko przez pewien czas zahamowany i ponad koronką gałęzi wytworzył się przewodnik o długości 25-35 cm. Drzewka kontrolne dekapitowane miały przeważnie tyle rozgałęzień co traktowane MH, ale kąty rozwidlenia gałązek drzewek kontrolnych dekapitowanych były zbyt ostre. Drzewka kontrolne nie ogłowione rozgałęziały się tylko sporadycznie. Opryskiwanie MH w dniach 20-21 lipca było już nieskuteczne.