Effects of Post-Harvest Sprays of 2,4,5-Trichlorophenoxypropionic Acid on Fruitfulness of 'Magness' Pears[1]

B. L. Rogers and A. H. Thompson[2]

Several small blocks of 'Magness' pears were planted in Maryland orchards shortly after its introduction by the U. S. Department of Agriculture in 1960. One of these blocks began bearing at 7 or 8 years of age, with production increasing each year thereafter, while 4 others of the same age have never produced a full crop, and often little or nothing at all. This cultivar is very resistant to fireblight, *Erwinia amylovora*, and the fruit is of such high quality that roadside marketers cannot supply the demand. Limited production to date has made these plantings unprofitable, yet growers are reluctant to remove them in hope that they eventually will begin regular production. Further plantings would be made if a way could be found to improve fruitfulness of this high quality pear.

Unfruitfulness of the 'Magness' pear in Maryland orchards is not due to a lack of pollinizers. The one orchard which *has* produced is planted with the least proximity to suitable pollinizers, and all blocks are inter-planted by normal standards. Bees do not visit 'Magness' blossoms with the frequency accorded other cultivars (1), possibly because the flowers are very small, non-showy, do not open widely, and produce no pollen. In full bloom, 'Magness' trees are green with new leaves rather than white with blossoms as are other cultivars such as 'Bartlett' and 'Moonglow'.

Girdling by removal of a 5-7 mm strip of bark (7) and scoring (5) have failed to increase fruiting. Boron applied to the soil up to 8.8 kg/ha, boron sprays as Solubor at 120 grams per 100 liters, and several years of early-spring sprays of succinic acid 2,2-dimethyl hydrazide (SADH) failed to increase yield significantly (5).

A nutritional survey of 6 blocks of 'Magness' in Maryland in 1975 showed no correlation between fruiting and the concentration of 5 major and 5 minor elements in leaves (3). The heaviest and most consistently fruiting 'Magness' block received annual pruning in contrast to the little or no pruning in the other orchards. Also, this orchard was fertilized moderately with N annually, and yet leaf analyses indicated no difference in N concentration of leaves between this orchard and all the others.

Fall sprays of 2,4,5-trichlorophenoxypropionic acid (2,4,5-TP) have been reported to increase fruit set on 'Anjou' (2) and 'Bartlett' (4) pears; this report deals with the effect of post-harvest sprays of 2,4,5-TP on cropping of 'Magness' pears.

Mature trees in 2 locations received 2,4,5-TP as post-harvest sprays applied to run-off with hand guns at 35 kg/cm^2. Since fall sprays were used, there was no way to assure that a uniform bloom would occur the following spring among the various treatments; however, an attempt was made to attain uniformity by using only trees with little or no crop prior to the fall spray treatment. Nine single-tree replicates were used in all experiments except one, where 18 were used. Bloom was estimated the spring following treatments as percent of spurs

[1]Scientific Article No. A2432, Contribution No. 5459, Maryland Agricultural Experiment Station, Department of Horticulture.
[2]University of Maryland.

flowering; a measure of cropping was obtained either by crop estimates (scale of 0, none to 10, full) or by harvesting. Fruit set was obtained by counting fruits on 3 limbs (approximately 11 cm circumference) per tree, and expressed as number of fruits per cm of limb circumference. Twenty fruits per tree (10 with 18 replicates) were picked at random for determining diameter and number of developed seeds.

RESULTS

Catoctin Mountain Orchard, Thurmont, Maryland

Planted in 1963, trees in this orchard were vigorous, had received no fertilizer and only moderate pruning, but had never produced a good crop. For cross pollination every sixth tree in each 'Magness' row was a 'Seckel', and each row was adjacent to a row of various cultivars. Sprays of 10- and 20 ppm of 2,4,5-TP with Tween 20 at .025 percent were applied on October 4, 1974. Two successive frosts had just occurred which may have damaged foliage so as to adversely affect translocation from leaves into the tree. A very light fruit set occurred the following spring, and as there was no indication of spray effectiveness, no data were taken.

On September 10, 1975, the same treatments were applied to the *same* trees as in 1974; no adverse weather preceded the sprays and the foliage was in excellent condition. These trees had a heavy bloom in 1976, and the 2,4,5-TP sprays increased fruit set by 2 and 3 times that on unsprayed trees (Table 1). Yield was increased significantly, but fruit diameter was decreased by the 10- and 20 ppm sprays by 0.8 and 1.7 cm, respectively; expressed on a weight basis this represents approximately 31- and 39 percent reduction. Seeds per fruit averaged 1.37 on untreated trees, but 10- and 20 ppm 2,4,5-TP sprays reduced this to .59 and .33 per fruit, respectively. Unsprayed trees had 26 percent seedless fruits; sprayed trees had 2 and 3 times this amount. Return bloom was extremely low, with a somewhat smaller—though not significant—amount on the unsprayed trees. Foliage injury was observed commensurate with concentration used. At 20 ppm, trees looked sparse all season, an appearance caused largely by failure of lateral growth on the shoots produced the previous year. The injury was much less on trees which had received 10 ppm.

Because of the success in increasing fruit set with fall sprays in 1975, another experiment was set up in the fall of 1976 on trees *not* used previously. Trees were used with a crop rating of 0 to 3 (on a scale of 0 to 10) in anticipation of a good bloom in 1977. Since 20 ppm had caused some reduction in vegetative growth and substantial loss in fruit size the previous year, 5-, 10-, and 15 ppm of 2,4,5-TP were used. Sprays were applied, without a wetting agent, on September 1, when foliage was in excellent condition. Even though these trees cropped at 30 percent or less of a full crop, the amount of bloom in 1977 was extremely low (Table 2). Evidence of abnormal flower development and abortion was found in all 'Magness' blocks in the state, possibly due to the severe winter. This could account for the disappointing amount of bloom in this block compared to that which was expected. Yields were low, with no significant difference caused by spray treatments. Fruit size was reduced and the number of seedless fruit was increased, both to a significant degree at concentrations over 5 ppm. Data were based on 10 fruits per tree, 180 per treatment.

Plant Research Farm, College Park, Maryland

Planted in 1962, these 'Magness' trees were large, had received a

Table 1. The effect of post-harvest (1975) sprays of 2,4,5-TP on fruiting characteristics of 'Magness' pears the following year. Catoctin Mountain Orchard.

Spray conc.	Fruit set	Yield[1]	Fruit diameter at harvest	No. seeds per fruit	Seedless fruit	Return bloom 1977
(ppm)	(No./cm limb circ.)		(cm)		(%)	(%)
0	1.55a[2]	2.7a	6.4a	1.37a	26a	1.8a
10	2.64b	5.3b	5.6b	.59b	61b	1.1a
20	4.17c	6.3b	4.7c	.33b	76c	1.0a

[1]Rated on basis of 0, none to 10, full crop.
[2]Mean separation within columns by Duncan's multiple range test, 5% level.

Table 2. The effect of post-harvest (1976) sprays of 2,4,5-TP on fruiting characteristics of 'Magness' pears the following year. Catoctin Mountain Orchard.

Spray conc.	Bloom[1] 1977	Yield[2]	Fruit diameter at harvest	No. seeds per fruit	Seedless fruit
(ppm)	(%)		(cm)		(%)
0	3.6a[3]	2.5a	5.7a	2.8a	5a
5	5.4a	3.2a	5.5a	2.4a	13a
10	5.8a	2.6a	5.3b	1.8a	27b
15	6.2a	2.9a	5.1c	1.5a	39b

[1]Rated as percent of spurs blossoming.
[2]Rated on basis of 0, none to 10, full crop.
[3]Mean separation within columns by Duncan's multiple range test, 5% level.

Table 3. The effect of post-harvest (1976) sprays of 2,4,5-TP on fruiting characteristics of 'Magness' pears the following year. Plant Research Farm.

Spray conc.	Bloom[1] 1977	Yield	Fruit diameter at harvest	No. seeds per fruit	Seedless fruit
	(%)	(kg/tree)	(cm)		(%)
0	30a[2]	35.8a	6.0a	1.8a	38a
10	55a	45.8a	5.8ab	1.4a	50a
15	37a	34.0a	5.7bc	1.1a	58a
20	46a	39.0a	5.4c	1.0a	64a

[1]Rated as percent of spurs blossoming.
[2]Mean separation within columns by Duncan's multiple range test, 5% level.

moderate amount of pruning, but no N fertilizer. This block had been used earlier in experiments involving SADH, as well as soil and spray applications of boron (2). Pollinators were 'Moonglow', 'Seckel', and 'Stewart Bartlett' at a ratio of 1 pollinator to 3 'Magness'. Sprays were applied on August 6, 1976, a year with no crop. A highly variable but moderate bloom occurred in 1977 (Table 3). Despite the failure of spray treatments to influence the very light yield of less than 50 kg per tree, fruit size was

significantly reduced by the 15 and 20 ppm concentrations. Influence of treatments on number of seeds and the percent of seedless fruits was not significant. The small crop may have been affected by frost following blossoming, yet adjacent apples at the same elevation produced a large crop.

DISCUSSION

It appears that flower bud initiation in the 'Magness' pear is a companion problem to that of fruit set. In the orchards involved in this work, the trees have not blossomed heavily as normally expected following a year with little or no crop. A specific example of this is found in the data recorded at Catoctin Mountain Orchard (Table 1) in which unsprayed trees yielded a very modest crop in 1976, yet had a very light bloom in 1977.

In these experiments, response to fall sprays of 2,4,5-TP on 'Magness' trees has been varied. Increased fruit set and cropping, the real objectives of this investigation, occurred in only one year. Yet smaller sized fruit and a greater percentage of seedless fruits has been a consistent response in all years. Therefore, presumably the chemical is being absorbed and translocated provided foliage is not advanced toward senescence as was the case in 1974. A wide variation in the occurrence of seedless fruit was found on unsprayed trees in this study, ranging from 5- to 38 percent. Fruit size reduction on sprayed trees apparently was caused by lower seed numbers rather than by a direct effect of the 2,4,5-TP, since this occurred when yield was not increased (Tables 2 and 3); if yield were increased, then a reduction in fruit size would be expected, even if seed numbers were *not* reduced. 'Magness' fruits have been reported to have rather low seed counts, and that this cultivar sets some fruit parthenocarpically (3, 6). Data from 2 years in one orchard indicated that fruit size was unrelated to seed number (6); however, another report from 3 orchards in 1 year indicated that larger fruits had a higher seed count than smaller ones (3). We have seen little or no evidence that fruit shape is influenced by 2,4,5-TP sprays regardless of seed count. Parthenocarpic fruits, then, would not be objectionable in this cultivar if fruit set could be increased without decreasing fruit size. The most serious objection to 2,4,5-TP would appear to be the reduction in fruit size.

The 'Magness' pear was introduced by the USDA as a blight resistant cultivar. In 15 years in Maryland orchards, this attribute has been clearly evident with only a trace of fireblight being noted even when severe infections prevailed in adjacent apple blocks. Yet the prevailing fear of applying N to susceptible cultivars has influenced most growers to omit N on 'Magness' as well. All trees in the state have grown well without N, but it may be significant that the most productive block has been modestly pruned and fertilized annually (3).

The 'Magness' pear is unique in having both superb eating quality and fireblight resistance. It cropped satisfactorily prior to its introduction, both at the U.S.D.A. Station and in the University of Maryland orchards where scions were grafted to bearing 'Orient' and 'Old Home' trees. Yet, after introduction, most have cropped poorly. It seems unlikely that this cultivar is not bearing due to juvenility, since the plantings in Maryland are now about 15 years old. Thus, no one can be encouraged to plant 'Magness' unless a means can be found to increase its bearing potential. Possible approaches to this problem might include growth regulators, limb spreading and training techniques, N manipulation, and perhaps dwarfing quince rootstocks.

Literature Cited

1. Caron, D. M. 1973. Honey bee activity on 'Magness' and pollenizer pear varieties. *Fruit Var. Jour.* 27(4):81-83.
2. Degman, E. S. and L. P. Batjer 1955. Delayed effects of 2,4,5-trichlorophenoxypropionic acid sprays on Anjou pears. *Proc. Amer. Soc. Hort. Sci.* 66:84-86.
3. Funt, R. C. and B. L. Rogers. 1977. Nutrient level and seed number in 'Magness' pears as related to fruitfulness. *Fruit Var. Jour.* 31(1):4-6.
4. Griggs, W. H. and B. T. Iwakiri. 1961. Effects of gibberellin and 2,4,5-trichlorophenoxypropionic acid sprays on Bartlett pear trees. *Proc. Amer. Soc. Hort. Sci.* 77:73-89.
5. Rogers, B. L., A. H. Thompson, L. E. Scott, and G. J. Stadelbacher. 1976. Effects of boron and succinic acid 2,2-dimethyl hydrazide (SADH) on fruitfulness and storage behavior of 'Magness' pears. *Fruit Var. Jour.* 30(3):74-77.
6. Scott, L. E. and A. H. Thompson. 1975. Observations on "viable" seeds in 'Magness' pear. *Fruit Var. Jour.* 29(2):45.
7. van der Zwet, T., H. L. Keil, and W. A. Oitto. 1973. Pollination and fruit set of 'Magness' pear. *Fruit Var. Jour.* 27(4): 77-80.

Red Raspberry Cultivars for the Pacific Northwest

HUGH A. DAUBENY[1]

The Pacific Northwest is considered to be one of the major red raspberry (*Rubus idaeus* L.) production regions in the world at the present time. Undoubtedly it is the most efficient region for production with the highest yields per unit area being recorded there (7). For almost 30 years, Willamette, which was released from the Oregon State University–United States Department of Agriculture program in 1943 (1), has been the most widely grown cultivar throughout the region. One of the main reasons for Willamette's longevity has been its freedom from virus diseases. Particularly important in this regard has been its escape from raspberry mosaic virus (RMV) which can be a limiting factor in red raspberry production (5). The cultivar is susceptible to *Amphorophora agathonica* Hottes, the aphid vector of the virus, but does not become infected. It appears to have innate resistance the basis of which is not understood at the present time (6). Another reason for the longevity of the cultivar has been the suitability of its fruit for the processing market which has been the main outlet for fruit produced in the region.

During the period from 1967 to 1977, three new cultivars were released by two of the red raspberry breeding programs in the Pacific Northwest. Meeker came from the Washington State program and Haida and Matsqui from the British Columbia program (1, 2). At the present time Meeker is being planted extensively in Washington and Oregon. In comparison to Willamette, the fruit shakes off the plants more readily and it is thus better adapted to mechanical harvesting. In addition the fruit is firmer and shows more rot resistance. These characteristics also make it better adapted to the fresh market. Haida is being planted in British Columbia mostly for local fresh market sales because of its particularly bright red fruit colour. Matsqui was released because it was better adapted to mechanical harvesting than Willamette. Plant stands and subsequently yields of this cultivar have been extremely variable. Preliminary evidence suggests that this is due to susceptibility

[1]Agriculture Canada, Research Station, 6660 N.W. Marine Drive, Vancouver, B.C. V6T 1X2.