Nutrient Level and Seed Number in 'Magness' Pears as Related to Fruitfulness[1]

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The 'Magness' pear, introduced in 1960, is a vigorous tree with high resistance to fire blight *(Erwinia amylovora)*, and has excellent dessert quality. Several 'Magness' plantings have been established in Maryland, but most have been late bearing and have cropped lightly. Bearing problems have also been reported by Janick (2). Caron (1) has reported that honey bee activity is low on 'Magness' trees as compared with other nearby cultivars. Although 'Magness' produces no pollen, it can be effectively cross-pollinated by pollen from a wide range of cultivars (5). In hand-pollination breeding work, van der Zwet, *et al.* (5) have found seed count in 'Magness' to be similar to that in other cultivars. Fruiting was evidently the result of fertilization and not due to parthenocarpic set. However, Scott and Thompson (4) have reported some normal-sized seedless fruits in open-pollinated 'Magness,' indicating that parthenocarpic fruit set can occur.

The objectives of this study were: 1) to evaluate the nutritional status of 'Magness' pear trees from six orchards in Maryland, and 2) to determine seed count in fruit from orchards with different cropping histories. All trees were approximately 12 years old, on seedling roots, in moderate to good vigor, and had received normal pesticide sprays. Two of the blocks had been fertilized and pruned annually; the other four had received little to none of either. Size of the plantings ranged from one row to several acres, and all had adequate provision for cross pollination. Triplicate leaf samples were collected in late July, 1975, and analyzed for 5 major and 5 minor elements. Seed counts were determined at harvest; those which were elongated, but with no embryo development within the seed coat, were considered as being non-viable. The relationship between seed number and fruit size was also evaluated.

Results and Discussion

Cropping in the 'Magness' blocks surveyed in this study has ranged from very light to heavy (Table 1). The Consolidated and Stegmaier orchards are only a few miles apart, yet the former has produced yearly since cropping began at age 7, with production increasing with age; the latter has never had a good crop. The difference in management practices in these two orchards was annual pruning and yearly moderate N applications in Consolidated orchard; whereas, the Stegmaier Orchard has had no N and little pruning. Trees in the Pryor orchard, which have been pruned and fertilized annually with 5-10-10, have been fairly productive, having had very heavy crops in some years. The lighter bearing orchards have had no fertilization and little or no pruning, but tree vigor was very good.

Differences in leaf concentration of the major elements—N, P, K, Ca and Mg—did not appear to account for the differences in cropping among the orchards (Table 1). Consolidated orchard, the highest yielding, was slightly higher in calcium and nitrogen,

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Table 1. Nutritional status by leaf analysis of 'Magness' pears in six Maryland orchards with different cropping histories, July, 1975.

Orchard	Cropping history	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	B (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)	Fe (ppm)
Stegmaier	Light	1.57ab[1]	.13a	1.77c	1.81ab	.29a	35a	100b	37a	6.9bc	105b
Catoctin Mt.	Light	1.70b	.14a	1.53b	1.95b	.34ab	43c	77b	130b	6.8bc	112b
Clopper	Light	1.53a	.16a	1.83d	1.62a	.56d	41bc	237c	102b	7.2c	36a
Tonoloway	Light to Moderate	1.63ab	.12a	1.63bc	1.90ab	.57d	45c	240c	127b	5.1a	32a
Pryor	Moderate to heavy	1.63ab	.15a	1.17a	1.78ab	.37b	40bc	38a	40a	8.3d	54a
Consolidated	Heavy	1.73b	.12a	1.60bc	2.00b	.42c	38ab	239c	54a	6.0ab	52a

[1]Values in columns with the same letter are not significantly different by Duncan's multiple range test, 5% level.

though not significantly different from others with a lower cropping history. Even though this orchard has received moderate N fertilization and annual pruning, it did not appear to be more vigorous than some other orchards which have had no fertilizer. K was lowest in the Pryor orchard, which produced moderate to heavy crops; however, the highest K levels were in the Stegmaier and Clopper orchards where cropping was light. Leaf concentrations of the minor elements—B, Mn, Zn, Cu, and Fe—appear to show no correlation with cropping. The abnormally high concentrations of Mn and Zn in some orchards may have been due to residues from fungicide sprays containing these elements.

No special emphasis has been placed on boron nutrition in the orchards sampled in this study. A study of boron nutrition of 'Magness' at the University Plant Research Farm indicated no relationship of cropping to various applications of boron (3). Boron levels in this study indicated adequate amounts in all orchards.

Seed counts determined in 4 of the orchards averaged from 2 to 2.8 per fruit (Table 2). There was no correlation between average seed number per fruit and crop load. In fact, the highest seed number was in Catoctin Mt. orchard, which had a light crop in 1975, and never has produced a good crop. Number of seeds per fruit was the same in the other 3 orchards, where the crop ranged from light to heavy. A detailed analysis of the 426 fruits these data represent showed that 30% had 3 or more seeds, 59% had 1 or 2 seeds, and 11% were seedless. Scott and Thompson (4) reported 24 and 11% seedless fruit in 1973 and 1974, respectively, in fruits from the University of Maryland Plant Research Farm.

Table 2. Seed number per fruit in 'Magness' pears from 4 Maryland orchards with varying crop loads in 1975.

Orchard	Number of fruits sampled	Average number of seeds/fruit	1975 Crop
Stegmaier	146	2.0	Light
Catoctin Mt.	55	2.8	Light
Tonoloway	175	2.0	Moderate
Consolidated	50	2.1	Heavy

As noted in Table 2, fruits from Consolidated, Stegmaier and Tonoloway orchards had practically the same *average* number of seeds per fruit; however, a breakdown of seed number in relation to fruit size showed that seed number per fruit increased with increasing fruit size in all 3 orchards (Table 3). Fruits from Consolidated orchard, however, had more fruits with a higher seed count (13 pears in 50 averaged 3.7 or more seeds per fruit) and also more fruits with lower seed count (17 pears in 50 averaged 1 or less seed per fruit) than fruit from

the other 2 orchards. This suggests some positive factor affecting fruit set which was not present in the other 2 orchards. The availability of an adequate pollen source did not appear to be a factor, because the 'Magness' trees in Consolidated orchard were in 4 solid rows, flanked on both sides by a single pollinator row; whereas, in the Stegmaier orchard, with a low cropping history, there was more adequate provision for cross-pollination.

Among the smaller-sized fruits, there were very few which showed absolutely no evidence of embryo growth. In fruits which had at least one normal-sized viable seed, most of the non-viable seeds were elongated, sometimes as long as viable seeds, but flat because of a lack of embryo development. These elongated, but non-viable seeds, may have been pollinated without fertilization taking place, and thus may have received a growth stimulus. Shape of the fruits was not affected adversely by low seed number.

The reason for lack of fruitfulness in the 'Magness' pear is not clear. While some significant differences in leaf nutrient concentration were found among the orchards, no definite correlation between nutrition and cropping was evident. Since the 2 highest producing orchards were the only ones which have been fertilized and pruned annually, this suggests that fruit set may have been influenced positively by N fertilization as well as by greater light penetration into the pruned trees. Standard procedure in growing pears in this area has been to avoid fertilization with N, as well as any other practice which would make the trees more susceptible to fire blight. Since 'Magness' has considerable resistance to this disease, more intensive cultural practices may be needed to increase its productivity.

Literature Cited

1. Caron, Dewey M. 1973. Honey bee activity on 'Magness' and pollinizer pear varieties. *Fruit Var. J.* 27:81-83.
2. Janick, Jules. 1972. Observations in 'Magness', 'Moonglow', and "Dawn" pears in Indiana. *Fruit Var. Hort. Dig.* 26:36-37.
3. 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. J.* 30 (3): 74-77.
4. Scott, L. E. and A. H. Thompson. 1975. Observations on "viable" seeds in 'Magness' pear. *Fruit Var. J.* 29 (2):45.
5. van der Zwet, T., H. L. Keil, and W. A. Oitto. 1973. Pollination and fruit set of 'Magness' pear. *Fruit Var. J.* 27:77-80.

Table 3. Number of seeds in 'Magness' pears as related to size of fruit, 1975.

Fruit circumference (cm)	Stegmaier Orchard[1]		Tonoloway Orchard[2]		Consolidated Orchard[3]	
	Number of fruits	Ave. no. seeds per fruit	Number of fruits	Ave. no. seeds per fruit	Number of fruits	Ave. no. seeds per fruit
Sample size	63	—	97	—	50	—
14.1-15.0	0	—	5	0.8	1	0
15.1-16.0	0	—	8	1.0	6	0.3
16.1-17.0	1	0	17	1.5	10	1.0
17.1-18.0	1	1.0	23	1.7	20	2.0
18.1-19.0	4	1.5	17	2.2	10	3.7
19.1-20.0	9	2.0	17	2.5	2	5.0
20.1-21.0	18	2.0	7	2.3	0	—
21.1-22.0	13	2.5	3	2.7	1	5.0
22.1-23.0	13	2.5	0	—	0	—
23.1-24.0	4	2.8	0	—	0	—

[1]Light crop.
[2]Moderate crop.
[3]Heavy crop.