Testing a Power Duster for Pollination of 'McIntosh' Apples

J.R. Schupp¹ and S.I. Koller²

Highmoor Farm, University of Maine, P.O. Box 179, Monmouth, ME 04259

W.D. Hosmer³

Bates College, Lewiston, ME 04240

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Infestations of parasitic mites, such as *Varroa jacobsoni* (Oudemans) and *Acarapis woodi* (Rennie), threaten honey bee (*Apis mellifera* L.) survival and their effectiveness as pollinators (Calderone and Spivak, 1995; Otis and Scott-Dupree, 1992). Supplemental pollen has been used for increasing pollination of apple by placing pollen into special inserts on beehives. This method still relies on hives with good populations of strong colonies to effect cross pollination. More recently, a mechanical power duster was introduced for blowing pollen directly onto the flowers (Adams, 1994). This study was undertaken to test the efficacy of a power duster for supplemental pollination of 'McIntosh' apple trees, where lack of beehives and nearby pollinizers were thought to limit productivity.

Solid blocks of 'McIntosh' were used in all three studies, except for one replicate in the number of applications study, in which there were two rows of 'McIntosh' with two rows of 'Delicious', a pollinizer that reached anthesis 5 days after 'McIntosh'. To minimize natural pollination, no beehives were placed near these blocks during bloom. All pollen used in these studies was obtained from Firman Pollen, Yakima, Wash. In 1995, the trees were not thinned chemically or by hand, but in 1996 trees were chemically thinned; otherwise standard growing practices were employed. All studies were designed as randomized complete blocks with four replications.

Limb treatments (Expt. 1). To determine the efficacy of the power duster for pollinating, four 'Macspur McIntosh'/M.26 apple trees were randomly selected in 1995, and three individual limbs per tree were selected for study. Limb circumference was measured and the number of flower clusters was counted at pink. The limbs were then covered with a bag made of spun-bonded row cover material. Two of the bags were opened at full bloom; all

flowers were hand pollinated on one limb using 'Delicious' pollen and the bag was resealed. The second limb was then pollinated using 'Delicious' pollen blown from a power duster (Firman Pollen) following the manufacturer's instructions, and the bag was resealed. All bags were removed shortly after petal fall.

All fruit on each limb were counted in July, after final fruit set was complete. Fruit set was calculated as the number of fruit per 100 flower clusters and as the number of fruit per cm² of limb cross-sectional area. The number of fruit per limb was recounted at harvest and a sample of 20 fruits per limb (or all the fruit per limb for limbs with fewer than 20 fruit) was evaluated for fruit mass, fruit diameter, and seed number.

Covering limbs with spun-bonded row cover material at pink effectively eliminated insect pollination. The pollen duster was ineffective in increasing fruit set, fruit size, or seed number on bagged limbs (Table 1). In contrast, hand pollination was highly effective, resulting in increased set and seed number per fruit.

Timing and number of applications (Expt. 2). The effects of timing and number of pollen applications using 'Delicious' pollen applied by the power duster were determined in 1995 on 'Macspur McIntosh'/MM.111 apple trees at 6 × 6-m spacing. The following treatments were applied: 1) nontreated control; 2) a single application at king bloom; 3) two applications at king bloom; 4) a single application at full bloom; 5) two applications at full bloom; and 6) a single application at king bloom followed by another at full bloom.

Fruit set, fruit size, and seed number were evaluated as previously described. In addition, yield was estimated using a 1-to-5 rating scale where 1 = no crop, 3 = a commercially optimum ("full crop"), and 5 = grossly overcropped.

Applying supplemental pollen with a power duster had no effect on fruit set, yield, fruit size, or seed number, regardless of timing or number of applications (data not presented). Average fruit set among all trees in the study was 90 fruits per 100 clusters and final crop rating across all treatments was 2.9—near optimum. All trees in this study were separated from adjacent treated trees by at least one buffer tree; however, all were within the same block and in close proximity to one another. Although no hives were placed in the block and the nearest hives were more than 100 m from the block, there was considerable bee activity; therefore, redistribution of supplemental pollen between treatments by insects could not be ruled out.

Number of applications (Expt. 3). The effects of single applications of 'Rome Beauty' pollen at king bloom plus full bloom were compared with double applications at the same bloom stages and with a nontreated control in 1996. A replicate of each treatment was placed in each of four widely dispersed 'McIntosh' blocks. To minimize the effect of redistribution by pollinating insects, the control tree was separated from the two treated trees by a distance of at least 20 trees and in a different row. Initial fruit set was evaluated 2 weeks after petal fall. Final fruit set, fruit size, seed number, and yield were evaluated as previously described.

Initial fruit set was significantly higher on trees that were pollinated once with the pollen duster compared to the controls and the trees that were pollinated twice (245, 168, and 181 fruit per 100 clusters, respectively). Final fruit set, crop rating, fruit mass, fruit diameter, and seed number were unaffected by treatment (data not presented).

In summary, none of our studies has shown any increase in fruit set, fruit size, seed number, or yield from supplemental pollen applied by a pollen duster. The treatment appears to be an inefficient method of pollinating apple trees.

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¹Associate Professor.

²Scientific Technician.

³Undergraduate Student Intern.

Table 1. Effects of hand or power-duster pollination on bagged limbs of 'Macspur McIntosh' apple trees, 1995 (Expt. 1).

Treatment	Flowers/cm ² limb CSA ^a (no.)	Fruit per 100 clusters	Fruit/cm ² limb CSA (no.)	Fruit per limb (no.)	Fruit diam (cm)	Fruit mass (g)	Seeds per fruit (no.)
Control	11.1	13 b ^b	1.9 b	8 b	3.5	61	1.4 b
Hand pollinated	10.1	134 a	12.4 a	44 a	4.0	81	8.0 a
Power duster	11.5	43 b	4.4 b	18 b	4.6	73	2.4 b

^aCSA = cross-sectional area.

^bMean separation within columns by LSD, *P* < 0.05.