Honeybee adult worker on a flowering onion seed head, or umbel.

ONION VARIETIES, HONEYBEE VISITATIONS, AND SEED YIELD

EFFECT OF AN ISOLATED PLANTING OF ONION VARIETIES ON HONEYBEES AND SEED YIELDS, DAVIS, CALIF., 1972

Onion hybrid varieties	Avg. no. bees/20 heads	Avg. ratio of bees to heads	Yield of seed/head (grams)	Avg. no. viable seeds/100 (soaked)
MS Code 2 (PC712732)	11.8 a	1:1.7	2.27 a	95.7
PP Code 4 (PC712644)	7.1 b	1:2.8	1.10 b	89.5
MS Code 6 (PC712716)	6.1 b	1:3.3	0.99 b	94.2

KNOWLEDGE of insect pollinators and their use on onion seed plants, *Allium cepa* L., is needed in coping with the problems of poor seed set, very low seed yields, increased hybridization, and the increased use of pesticides. Special attention has been focused on the honeybee, *Apis mellifera* L., for pollination because it is the most easily produced and manipulated pollinator.

Field observations

Field observations and counts in northern California indicated that at times it was difficult to get honeybees to accept or forage on the onion seed plants for either pollen or nectar, even when colonies of bees were not moved in until 20–25% of the plants were in bloom. Furthermore, plants adjacent to the beehives yielded significantly more seed than those plants at some distance (ca. 800 ft.) from the hives. Honeybees were observed to leave a field of white onions while in full bloom for carrot and safflower fields coming into bloom. The number of bees in this field was quickly reduced from one bee per five heads to one bee per 100 heads, with the resulting seed set and yield poor.

Caged plants

Observations of caged onion plants at Davis and Dixon indicated that the number of honeybees visiting blooms differed with variety, and that seed set appeared to be greatest in the few varieties having high bee visitation. The current field research attempted to discover a positive difference among onion varieties with respect to their attractiveness and response to honeybees and seed yields. The study also involved isolating hybrid plantings to estimate potential seed productivity and bee relationships.

Seeds of the varieties Red Wetherfield, Yellow Sweet Spanish, Southport White Globe, Australian Brown, and Yellow Globe were planted in April 1970. Bulbs of these varieties were dug on November 2 and 3, and planted by hand on November 18 about one-half mile from a honeybee apiary. Two 20 ft rows were planted per plot on the west side of each bed, and each plot was separated by a buffer row of Yellow Sweet Spanish. Each variety was replicated six times (30 plots) in a randomized block.

Foraging honeybees on the blooming onion heads were counted several times from May 24 through June 14, 1971. Counts were begun when the latest blooming varieties were at least 20% in bloom and were continued until the earliest blooming varieties were nearly finished. Many counts were made from 11 am until noon on separate days during this three-week period by observing the number of bees per 20 blooming heads in each replicate just ahead of the observer walking between both rows of a variety. On June 4, the same type of bee count was made at 9 am, 11 am, 2 pm, and 5 pm of the same day to determine the hour of maximum bee visitation when all heads were nearly at full bloom. The time individual bees remained on a particular bloom also was determined for each variety on as many days as possible. This timing was accomplished in the early afternoon between 1 pm and 2:30 on May 16 and on June 1, 3, 4, and 7.

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Onion seed plants, **Allium cepa** L., exhibited varietal differences regarding honeybee (**Apis mellifera** L.) visitation; incidence of pink root disease, **Pyrenochaeta terrestris** Hansen) Gorenz, Walker, and Larson; numbers of western flower thrips, **Frankliniella occidentalis** (Pergande) present; and seed yields. Results from an isolated onion planting showed that the male sterile, Code 2 hybrid, adjacent to a pollen-parent, was significantly more attractive to honeybees and produced significantly more seed than a second comparable hybrid.

Adult western flower thrips in onion floret of a blooming head.

The number of western flower thrips, *Frankliniella occidentalis* (Pergande), per onion head was determined for all varieties on June 7 by shaking 10 heads per replicate into the hand and counting dislodged thrips. The number of heads lost due to the pink root fungus, *Pyrenochaeta terrestris* (Hansen) Gorenz, Walker, and Larson, was observed on June 24 for all varieties. On July 22, 26 heads per replicate were harvested and dried on paper in the field. The heads were threshed by hand, seed samples were cleaned in a small "Clipper" cleaner, and weighed to determine seed yield. Seeds from each replicate were counted and placed in units of 100, weighed, and the rate of germination determined.

Onion bulbs

In November 1971, onion bulbs of two male-sterile (MS) lines and one pollen-parent (PP) line were planted in 20 ft rows of 4 replications each in an isolated area at Davis. A row of the PP line, Code 4 (PC712644) separated each replicate of MS, Code 2 (PC712732) and MS, Code 6 (PC712716). Honeybees were available from an apiary located one-half mile east of the planting. Bee visitation in 1972 was counted per blooming head in the same manner as in 1971. Heads were harvested in July for determination of seed yield, size, and viability.

Visitations

Red Wetherfield onions attracted the higher average number of honeybees (10.6 bees per 20 heads) and a significantly larger number than all others except Yellow Sweet Spanish (9.2 bees per 20 heads). Southport White Globe also attracted a large number of bees (8.8), and the numbers were not significantly less than for Yellow Sweet Spanish (9.2). Australian Brown attracted fewer bees (7.4) while Yellow Globe attracted the smallest number of bees (6.7).

Timing

Honeybees remained significantly longer per umbel on both Red Wetherfield and Australian Brown (132 and 143 seconds, respectively), which indicated that the nectar present was more likeable or of larger volume. Only the nectar gathering bees were timed, but the exact reasons for the greater acceptability of the nectar were not determined.

The time of day influenced the number of visiting honeybees. Numbers were lowest at 9:45 am and varied from a high visitation ratio per head of 1:3 for Red Wetherfield to a lower 1:6 for Yellow Sweet Spanish. The numbers of bees increased significantly by 11 am for all varieties, once again by 2 pm, and began decreasing by 5 pm.

Seed yields

Yellow Sweet Spanish gave the highest seed yield (3.99 gm average yield per head), but it was not significantly higher than that obtained from Red Wetherfield (3.42 gm), and Australian Brown (3.72 gm). Southport White Globe yielded less seed (3.26 gm), and Yellow Globe yielded significantly less than all of the other varieties (2.44 gm). The low yield of Yellow Globe appears to correlate with bee visitation, which was at its lowest

ratio (1:3) for this variety. There does not appear to be any correlation between yield of seed and length of time that a bee stayed per bloom, since Yellow Sweet Spanish was highest in yield but lowest in bee visitation time. Yet, Australian Brown gave a high seed yield despite a low bee visitation per head, which may have been due to the long length of time that bees remained on the heads. Red Wetherfield also resulted in a high seed yield, but had both high numbers of visiting bees and a high time per visitation.

Thrips, pink root

Thrips populations were never very high and did not appear to influence yields, but were significantly lower in numbers on Red Wetherfield (25.2 average number of thrips per head) and Yellow Sweet Spanish (28.5). Pink root was of extremely low incidence in Yellow Sweet Spanish (5.3 average number of heads lost per replicate because of pink root), but was not significantly lower than for Australian Brown (14.5 heads lost). All other varieties had high plant mortality and head losses due to pink root disease, but only sound heads were considered for all bee counts and yield data. Australian Brown had the smallest seed, while all the other varieties were larger seeded and equal.

Viability tests conducted on dry, unsoaked seed were low, and indicated that Yellow Sweet Spanish had the least viable seed (49 viable seeds per 100). Seed yield for the latter variety may have been of somewhat less significance compared with the others, if only the good viable seed had been weighed, after being soaked in water to eliminate the poor light seed.

Isolated hybrids

The 1972 data (see table) show a positive correlation between onion seed hybrid varieties, honeybee visitation, and seed set. The MS Code 2 (PC 712732) onion strain had a significantly higher number (11.8 average number of bees per 20 heads) and ratio of honeybees per head during bloom (1:1.7), plus a significant increase in seed yield (2.27 gm per head) over that obtained from the other strains (1.10 gm for PP Code 4 and .99 gm for MS Code 6). The results showed that the onion hybrid having the greatest atractiveness to honeybees produced the highest seed yield, when a PP was present. There was an inherent difference between hybrid varieties with respect to attractiveness to honeybees. This research also indicated that new hybrids could be tested for yield potential and attractiveness to honeybees in isolated onion plantings interplanted with a pollen parent.

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NAA SPROUT INHIBITION

shown in olives, pomegranates, prunes, plums, and walnuts

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Application of an ethyl ester formulation of NAA to tree sprouts and suckers at rates of .5% to 1% solution resulted in growth suppression on olives, pomegranates, prunes, plums and walnuts.

SEVERAL FRUIT CROPS grown in California's San Joaquin and Sacramento Valleys have annual problems of profuse sprout and sucker growth from the trunk, crown, and roots close to the tree base. These sprouts become very competitive and eventually disrupt growth and tree shape. Sprouts interfere with cultural and harvest operations and thus reduce yields and fruit quality.

To prevent these problems fruit growers currently remove sprouts either by hand rubbing or pruning at least once each year. The operation is difficult and expensive. In addition, pruning near or below the soil surface provides entrance sites for disease infections. Crown gall (a bacterial disease) of plum and peach can often be traced to sprout removal operations.

Rootstock sprouting is also a problem in nursery operations. Again, removal of unwanted, competitive growth is expensive and time consuming, and a faster, simpler and less costly method is desired.

Recent investigations and reports have shown two formulations of naphthalene acetic acid, or NAA (ethyl ester 72-A112 and sodium salt 72-A96), are effective in suppressing sprouts when applied as sprays to the trunk and crown area. In 1973, Tulare County and U.C. Davis tests were conducted to evaluate NAA on olive, pomegranate, plum and prune (Marianna 2624 rootstock) in orchard situations and black walnut (*Juglans hindsii*) rootstock in the nursery. The two formulations were compared as a spray treatment at 50 gals per acre and as a hand "paint-on" application, with 50% latex paint added to the solution. Sprout length at application time varied with the crop.

At Davis, applications were made to root sprouts cut back to two inches. In one Tulare County plum test, sprouts were cut back to the tree base or ground level before treatment. Sprouts were not cut in the other Tulare County tests, and sprout lengths at treatment were: olives, 1–18 inches; pomegranates, 3–9 inches; plums, 3–12 inches; and walnuts, 1 inch