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THE EFFECTIVENESS OF THE WESTERN BUMBLEBEE IN POLLINATING HASS AVOCADO TREES

R. McNeil[1] and W. Pidduck[1]

[1]Cal Poly State University. Horticulture and Crop Science Department. San Luis Obispo, CA, USA 93407. E-mail: rmcneil@calpoly.edu

ABSTRACT

There has been recent interest in the use of alternative pollinators for the Hass avocado in California. Eight bumblebee hives were placed in the middle of a .86 hectare (2.125 acres) block of 2-year old Hass avocado trees during bloom in May. Numbers of three types of pollinating insects (bumblebees, honeybees, and syrphid flies) visiting blossoms were surveyed for three weeks. The number of fruit set on each tree was counted in the next winter. Percentages of insect pollinators visiting blossoms were 9.8% for bumblebees, 10.1% for honeybees, and 80.1% for syrphid flies. Fruit numbers per tree were greater in four out of six rows within 16.46 meters (54 feet) of the bumblebee hives than they were for trees in rows further from the hives. This was statistically significant for three of these rows. This study demonstrated that the western bumblebee (*Bombus occidentalis*) will pollinate Hass avocado flowers and thereby increase fruit numbers per tree. A hive spacing of 32.92 meters (108 feet) is recommended for young trees.

INTRODUCTION

The Hass avocado is one of California's most important and economically profitable agricultural commodities. In order for the grower to provide the high quality and quantities of fruit that the consumer demands many necessary steps must be taken. One of these steps is to provide adequate pollination of the avocado flower. In the past this pollination has been achieved by the use of honeybees from hives placed in avocado blocks and also with the help of other natural pollinators. However over the years honeybee populations have declined leaving Hass avocado growers concerned about fruit production in the future. This decline of honeybee populations is partly due to the invasion of two mites, the Varroa mite and the Tracheal mite. Another reason for possible further decline is the invasion of Africanized honeybees in the Southwest and their imminent arrival to the agricultural regions of California. Because of declining numbers of honeybees and the arrival of the Africanized honeybee, it may be necessary to look elsewhere for insect pollinators for the Hass avocado tree. One possibility is the bumblebee.

MATERIALS AND METHODS

This project began in early April. At this time 21 rows of the Hass avocado grove were mapped and the row in which the hives were to be placed was determined. It was decided that the hives were to be placed in row number 7. This row was chosen due to its location in the middle of the longest rows in the grove. Eight bumblebee hives were placed in the center of row 7 on May 5.

For the next three weeks staring on May 7, ten minute visual sweeps and counts were made of three different pollinating agents. The three agents which were reported were honeybees, syrphid flies, and the bumblebee. The sweeps were done five times within the three weeks ending on May 27. Afterwards the numbers of each pollinating agent were tabulated and charted with respect to their share of the total.

During the winter the number of fruit on each tree in the 21 rows was counted. Next the average number of fruit per tree per row was calculated by dividing the row total by the number of trees per row. This made it possible to determine if there was any difference in fruit load as the rows got further away from hive row number 7. The results of the fruit counts were then put in a bar graph form so the differences between rows could be easily distinguished.

RESULTS AND DISCUSSION

Overall percentages of each pollinating agent observed are presented in Figure 1. Although these results seemingly do not favor the bumblebee it is important to understand that research suggests that the bumblebee is a more efficient pollinating agent even in small numbers than honeybees and especially syrphid flies. It is also important to understand that the bumblebee hives only involve about 100 bees, compared to honeybee hives, which normally house up to 50,000 bees.

The results of the fruit count section of this project did seem to favor the bumblebee as a pollinating agent. Four out of six rows, which were within three rows on either side of the hive row 7, contained noticeably more fruit per tree than those rows further away from the hives (Figure 2).

These defining results suggest that the bumblebee had positive effects on pollination of the Hass avocado trees in this grove. Fruit numbers per tree were greater in rows within 16.46 meters (54 feet) of the bumblebee hives than they were for trees in rows further from the hives. This was statistically significant for three out of six rows adjacent to bumblebee hives.

CONCLUSION

Based on the results of this project, bumblebees seem to have provided some of the Hass avocado's pollination agent requirements. Fruit numbers per tree appear to be increased a distance of 16.46 meters (54 feet) on each side north and south of the bumblebee hive row. This would suggest a spacing of 32.92 meters (108 feet) between bumblebee hive locations for the purposes of young Hass avocado tree pollination. Although eight hives were used in this study, more hive density studies are recommended as well as studies in mature avocado orchards. In a time when honeybee numbers are on the decline, the bumblebee could be a viable replacement pollinator for Hass avocado trees.

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Figure 1

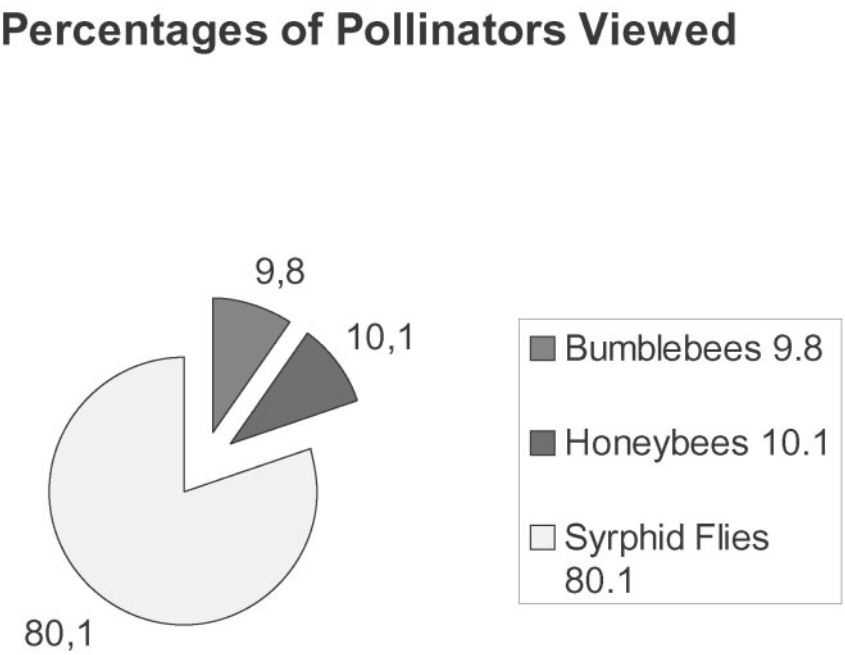
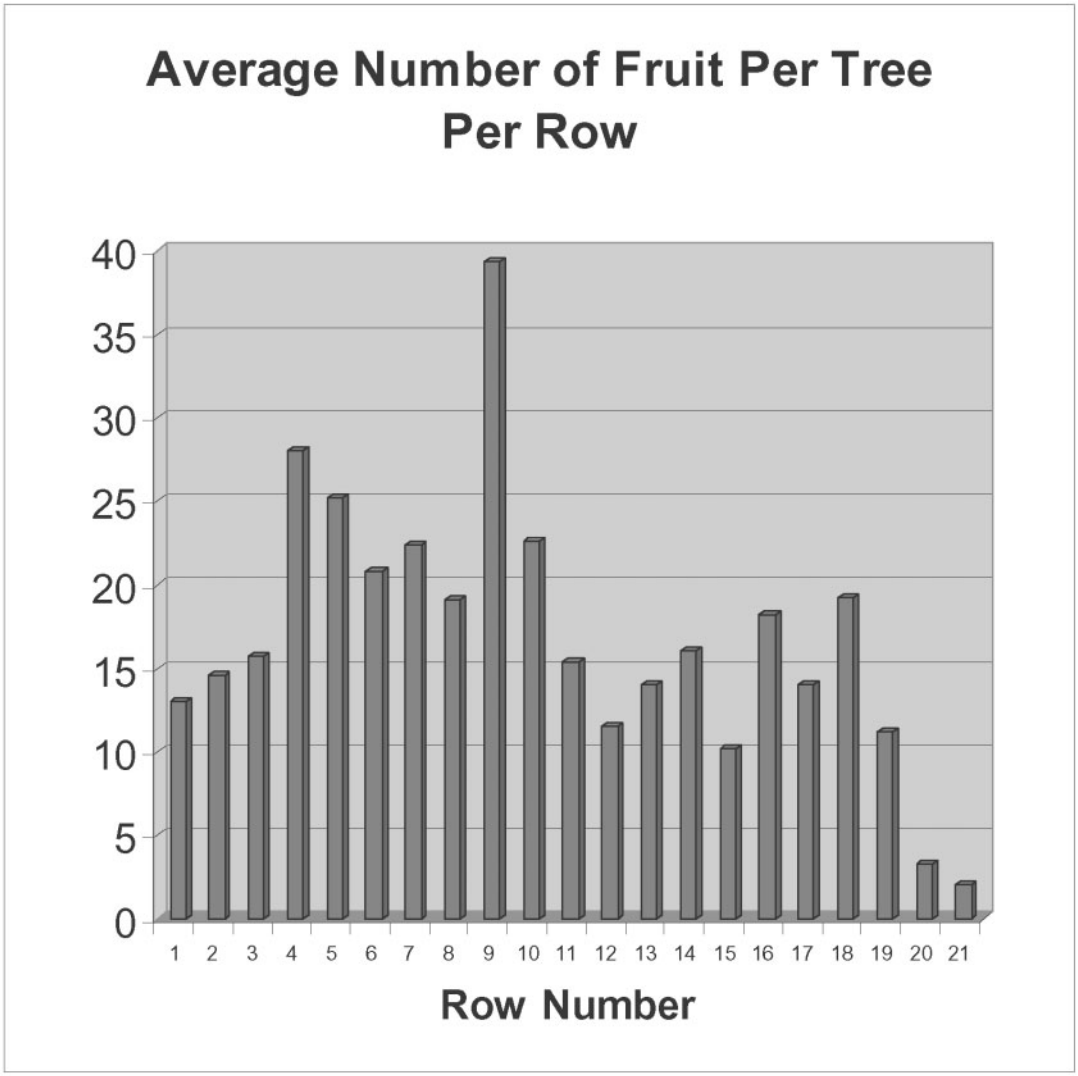


Figure 2



Row 7 = hive row; bumblebee hives in middle of row

Row 4,5, and 9 = rows with significantly higher fruit numbers per tree than the average per tree for the block