DIPARTIMENTO DI SCIENZE E TECNOLOGIE
AGRO-ALIMENTARI

NATURAL POLLEN REINFORCEMENT TRIAL ON CHERRY AND KIWIFRUIT

This study was carried out during the 2025 growing season, with the aim to evaluate the effect of assisted pollination with an external source of pollen provided by "**COMERCIALIZADORA ZIMEX LIMITADA**", on sweet cherry (Fig. 1) and Actinidia (Fig. 4) commercial orchards.

SWEET CHERRY

Experimental set up

The trial on sweet cherry was set up in an orchard of the cultivar "Kordia" grafted on Gisela 6 located in Bomporto (MO), with major pollination problems. The grower reported of an historical low productivity due to scarce pollination of the cultivar, despite the regular introduction in the orchard of bumblebees during blooming time. The cultivar Kordia is known as an "not-autofertile" cultivar, with major pollination problems if not located close to other varieties blooming simultaneously, as it was the case in the commercial orchard considered.

The orchard, trained at V, was equipped with a white single-raw multifunctional cover (anti-rain and anti-insect) that was left close during pollination.

The orchard was planted in 2021, with a north south orientation. The distance between trees was 1.5 m within rows and 3.5 m in the inter-row with a density of 1905 trees/ha.

In the orchard, two main areas were selected and kept separated by opening one mono-raw net in the middle. At the two extremes of the orchard two treatments were set up on 16 trees each:

1) Control: with trees located as far as possible from beehives enriched with pollen
2) Artificial Pollination: with trees located close to beehives enriched with pollen.

Beehives were introduced half on one side of the orchard half on the opposite side. The hives for each treatment were kept separate, with a distance of 80 m. Artificial pollen sent frozen from the producing company in Chile was distributed regularly at the entrance of the group of beehives which was located closer to the treated trees. The applied pollen corresponds to the Skeena and Rainier varieties. Pollen was distributed early in the morning in correspondence with the Kordia blooming. Full bloom in Kordia occurred on March 31st, while harvest occurred on June 27th. During the full bloom period (April 4th), some precipitation events occurred with a peak of less than 10 mm of May (Fig.2). No frost events were recorded during that period.

Figure 1: Experimental site of cherry in Bomporto

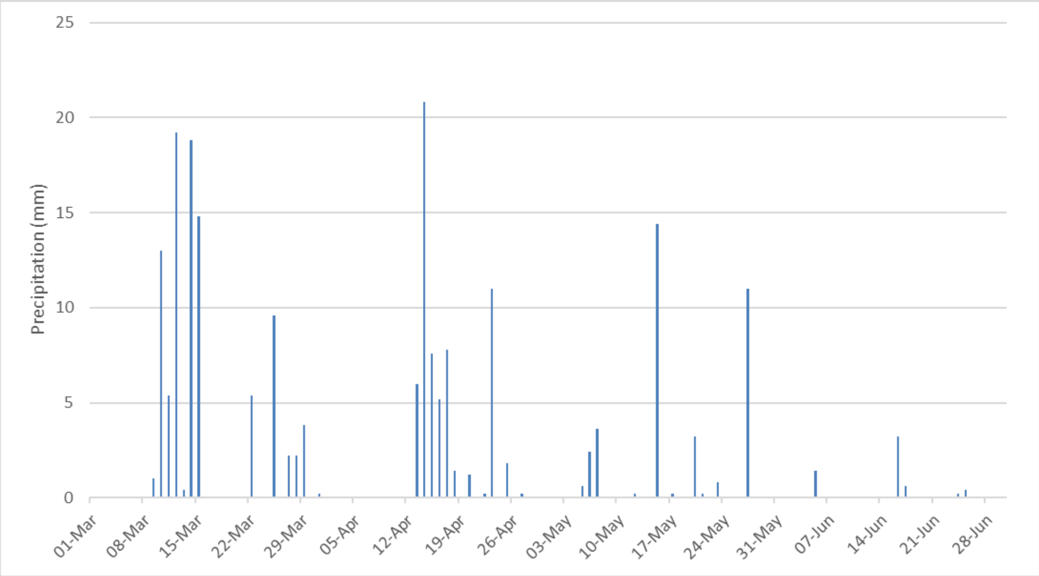

Figure 2: Average daily precipitation trend (mm) in the year 2025 in Bomporto (MO).

Assessment of the percentage of fruit set

The percentage of fruit set was estimated on 4 branches per trees evenly distributed on the canopy (north/south directions) with a total of 64 branches per treatment evaluated.

The number of flowers per branch was counted right before blooming, while the number of fruits set was evaluated at 87 DAFB on the selected branches. The percentage of fruit set was then calculated using the following equation:

$$\%\, Fruit\ set = \frac{N\ fruits}{N\ flowers}\ x\ 100$$

In the sweet-cherry orchard, the number of flowers (Fig. 3) was counted on April 4th and fruit set was measured both on April 30th and on May 27th 2025, corresponding to ca. 20 and 50 days after full bloom (DAFB). At the same time, the diameter of each of the selected shoots was also measured with a digital calliper.

Figure 3: Examples of data colection phases in Sweet cherry

Assessment of production and fruit quality

On June 26th, 2025, for both treatments, fruit production on each of the selected trees was measured at harvest with a scale, while the equatorial diameter of a total of 100 fruits per selected tree was measured with a digital calliper.

The following parameters were then averaged per treatment while the standard error was calculated:

-Shoot equatorial diameter

-N of flowers per shoot

-n of fruit set per shoot

-% of fruit set

-% of fruit drop

-Production (kg/tree)

-Fruit equatorial diameter

For each parameter, treatments were compared through a student's t-test.

Assessment of the trunk diameter

On November 21st, for both treatments, on each selected tree the trunk transversal diameter was assessed at 50 cm above the grafting point. The diameter was measured using a digital calliper.

Statistical analysis

A t-test in excel was used to compare the mean values of the two treatments for each parameter. For non-parametric data, a Wilcoxon test was performed

Results

The results obtained for each of the parameters listed above are reported in Table 1:

Table 1. Sweet cherry trunk diameter, number of flowers and fruits per shoot, fruit set (%) determined on April 30th, fruit drop (%) determined on May 27th , fruit production per tree and fruit equatorial diameter determined at harvest.

	Trunk equatorial ⌀ (mm)	N Flowers	N Fruits	Fruit set (%)	Fruit drop (%)	Production (kg $tree^{-1}$)	Fruit equatorial ⌀ (mm)
Control	48.27±1.45	33±1	2±0.24	5.22±0.75	0	1.11±0.16	19.35±0.17
Pollinated	46.69±1.29	36±2	3±0.42	7.75±0.85	0	1.52±0.12	20.85±0.12
Statistic	ns	ns	**	*	ns	ns	***

For the Sweet cherry experimental trial, significant differences were observed between the two treatments in several morphological and reproductive parameters (Tab. 1). Although the number of flowers per shoot was slightly higher for the pollen treatment, this difference was not statistically significant. A significant **higher number of fruits set** was observed in the pollinated treatment, reaching 3 fruits per shoot on average, compared with the 2 of the control ($P < 0.01$). However, **the percentage of fruit set was similar between the two treatments,** even though slightly higher in the pollinated treatment, probably due to higher shoot diameter**.** At harvest, the average fruit diameter was significantly higher in the pollinated treatment, reaching 20.85±0.12 mm compared with 19.35±0.17 mm ($P < 0.001$). Lack of differences, both in the percentage of fruit set as well as in fruit production between treatments might be due to a low pollen vitality or to the high capacity of honeybees to fly long distances and visit a high number of flowers. The separate cover open between the two treatments might thus have been ineffective. In any case, the grower confirmed how this season was characterized by a significantly higher percentage of pollination compared to the previous years, which might have been attributed either to a favourable season, to the presence of honeybees instead of bublebees or the application of the external source of pollen.

ACTINIDIA

Experimental set up

The trial on Actinidia was set up in an orchard of the cultivar "Dori" grafted on Hayward located in Castel Bolognese (Faenza). Kiwifruit is known as a dioic species with high difficulties of pollination due to the consociation of male and female vines.

The orchard, trained at T-trellis, was equipped with a white reflective mulch on the ground and a while anti-hail cover on top (Fig. 4).

The orchard was planted in 2022, with a north south orientation. The distance between trees was 2.5 m within rows and 4.65 m in the inter-row, with a density of 860 trees/ha.

In the orchard, two main rows were selected at a distance of at least 15 m from each other and at least 40 m from male vines. On each raw 10 trees were selected for the treatment set up, while at least 2 trees for each side were kept as non-pollinated borders, to keep the selected trees far from the commercial trees, to ensure that neither the treatment nor the control, can be affected by the natural pollen of the orchard, according to the farmer's protocol for assisted pollination. The applied pollen corresponds to the Matua and Tomuri varieties. During the full bloom period (May 11th), few precipitation events occurred with a peak of less than 5 mm of May (Fig.5). No frost events were recorded during that period.

In kiwifruit only 10 vines were selected for two reasons:

1) Vines were extremely big at least 2 m long along the raw
2) The grower didn't agree to provide more vines for the trial as he was afraid of the production loss.

Two following treatments were then assigned to each raw:

1) Control: with no pollination treatment performed (natural pollination).
2) Artificial Pollination: where pollination was performed with an external source of pollen provided by a modified leaf blower.

Full bloom occurred on May 11^{th,} and artificial pollination was carried out on the 10 "artificial pollination "vines". The pollen was applied mechanically using a modified leaf blower in three repetitions: on April 28th (60% blooming), on May 1st (80% blooming) and on May 2nd (95% blooming).

Figure 4: Experimental site of Kiwifruit in Castelbolognese

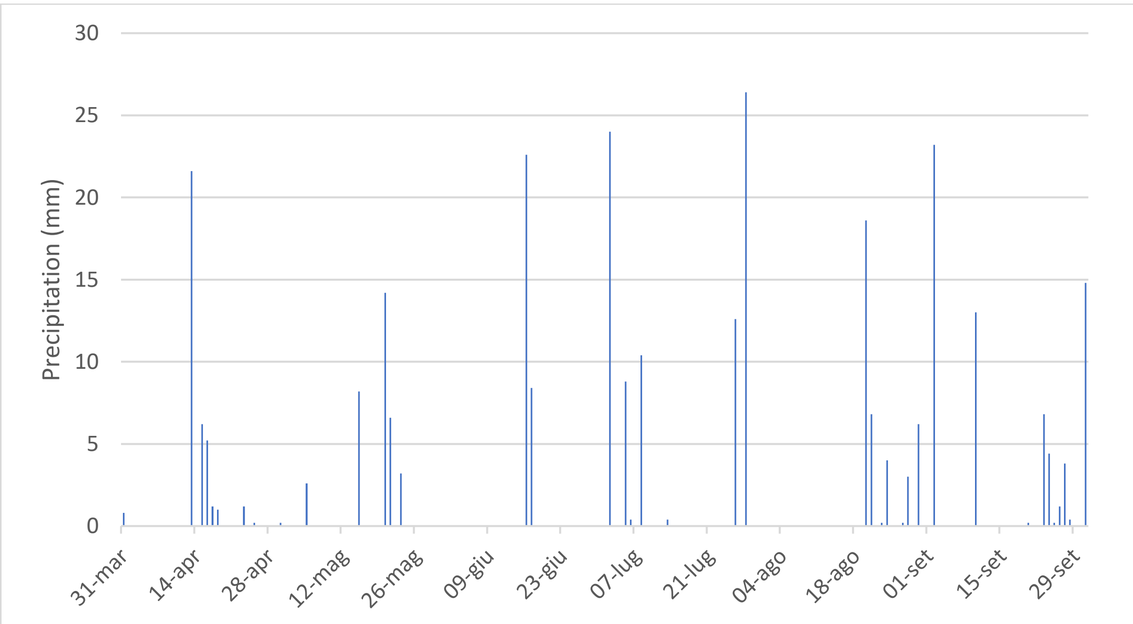

Figure 5: Average daily precipitation trend (mm) in the year 2025 in Castel Bolognese (RA).

Assessment of the percentage of fruit set

The percentage of fruit set was estimated on 6 to 7 branches per vine evenly distributed on the canopy with a total of 64 branches per treatment evaluated. Each branch was tagged and the number of flowers per branch was counted right before blooming, while the number of fruits set was evaluated at 104 DAFB on the selected branches. The percentage of fruit set was then calculated using the following equation:

$$\%\,Fruit\ set = \frac{N\ fruits}{N\ flowers}\ x\ 100$$

In the kiwifruit orchard, the number of flowers was counted on April 28th while the number of fruit (Fig. 6) was counted on July 10th and August 27th, 2025, corresponding to ca. 60 and 104 days after full bloom (DAFB). At the same time, the diameter of each of the selected shoots was also measured with a digital calliper.

Figure 6: Examples of data colection phases in Actinidia

Assessment of production and fruit quality

On September 29th 2025, for both treatments, fruit production on each of the selected trees was measured at harvest with a scale, while the equatorial diameter of a total of 60 fruits per selected vine was measured with a digital calliper, due to the lack of presence of enough fruit on the vines.

The following parameters were then averaged per treatment while the standard error was calculated:

-Shoot equatorial diameter

-N of flowers per shoot

-n of fruit set per shoot

-% of fruit set

-% of fruit drop

-Production (kg/tree)

-Fruit equatorial diameter

For each parameter, treatments were compared through a student’s t-test.

Assessment of the trunk diameter

On November 21st, for both treatments, on each selected tree the trunk transversal diameter was assessed at 50 cm above the grafting point. The diameter was measured using a digital calliper.

Statistical analysis

A t-test in excel was used to compare the mean values of the two treatments for each parameter. For non-parametric data, a Wilcoxon test was performed

Results

Table 2. *Kiwifruit vines trunk diameter, number of flowers and fruits by shoot, fruit set (%), fruit production per tree and fruit equatorial diameter*.

	Trunk equatorial ⌀ (mm)	N Flowers	N Fruits	Fruit set (%)	Fruit drop (%)	Production (kg tree^{-1})	Fruit equatorial ⌀ (mm)
Control	28.41±0.43	32±2	13±1	43.34±2.48	1±0.06	10.33±1.33	54.63±5.24
Polline	28.24±0.81	31±2	25±2	83.37±2.36	6±0.06	21.53±2.49	54.08±5.20
Statistic	ns	ns	***	***	ns	**	ns

In kiwifruit, no significant differences were observed between treatments in shoot diameter and initial number of flowers (Tab. 2), indicating that the randomization in the choice of the plants was appropriate for the experiment. The pollination treatment significantly increased the number of fruit set, reaching 25±2 fruit per branch compared to 13±1 fruit per branch in the control ($P < 0.001$). Similarly, **the percentage of fruit set was also positively influenced by the pollination treatment**, reaching 83.37±2.36 %, compared with 43.34±2.48 % of the control ($P < 0.001$), while no differences were found on the percentage of fruit drop, which was similar between the two treatments. Fruit production per tree was also significantly higher in the pollination treatment (21.53±2.49 kg tree^{-1}) in comparison to control treatment (10.33±1.33 kg tree^{-1}). No differences were also reported on the trunk diameter measures, which were similar between the pollen treatment and the control (28.24±0.81 and 28.41±0.43). The data indicate a strong influence of pollen application from external sources on the yield, although not affecting the final fruit diameter and shape.

CONCLUSIONS

Results from these trials indicate a positive effect of assisted pollination with an external source of pollen on the % of fruit set and on the quality of Sweet cherry fruit of the cultivar Kordia. Similarly, in kiwifruit, assisted pollination induced an increase in the % of fruit set together with an almost double productivity compared to vines naturally pollinated (controls).

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