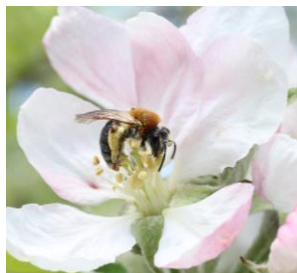
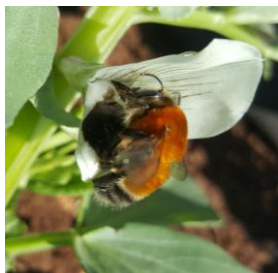


Guide for farmers

Farming with Alternative Pollinators (FAP)



**How to protect pollinators
and benefit more from their services**

Morocco has many effective pollinators enhancing your yields

Come to know them!

White butterfly



Digger bee



Hover fly



Sweat bee



Sand bee



Bumble bee



Digger wasp



Small carpenter bee



Carpenter bee



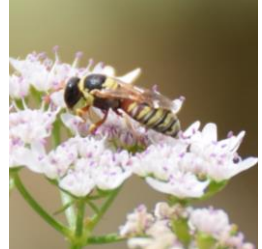
Leaf-cutter bee



Mason bee



Pollen wasp



Banded bee



Long-Horned bee



Carder bee



Orange-tip butterfly



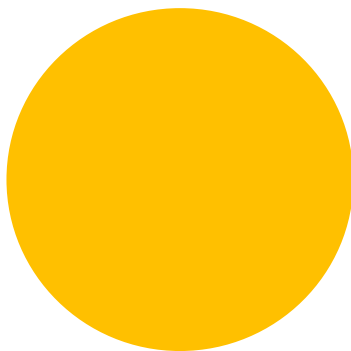
The value of pollinators for crop production is higher than the value of honey

IN JORDAN



x 26

**Value of honey
produced**



Value of pollination

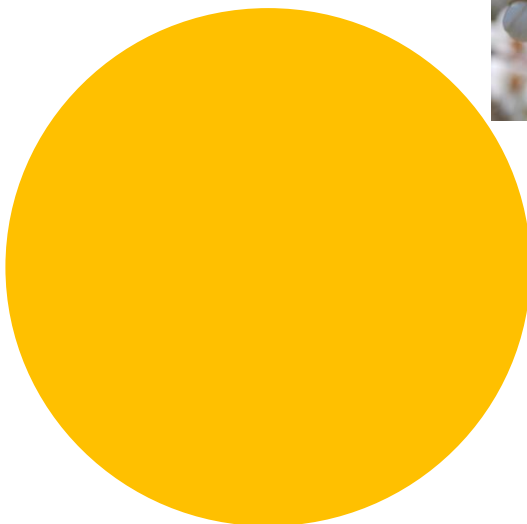


IN AFRICA



x 100

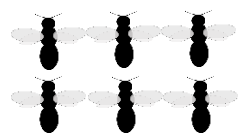
**Value of honey
produced**



Value of pollination



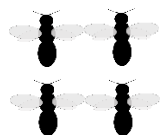
You can lose a high percentage of your yields if you lose pollinators



+90% ↓



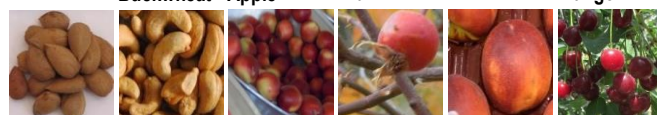
Watermelon Zucchini Kiwi Melon Pumpkin



40-90% ↓



Cucumber Buckwheat Apple Plum Canola Mango



Almond Cashew Nectarine Rosehip Peach Cherries



Avocado Blackberries Coriander Raspberries Apricot Pear

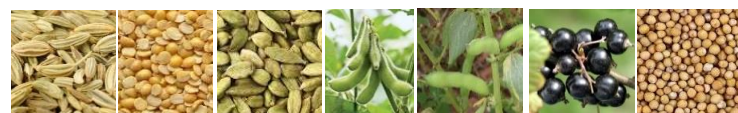
The more bee symbols you see, the higher the share of yields you can lose



10-40% ↓



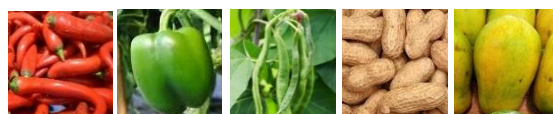
Okra Eggplant Fig Strawberry Pomegranate Red currant Sunflower



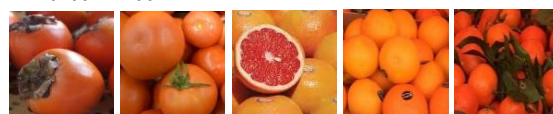
Fennel seed Pigeon pea Cardamom Soybean Faba bean Black currant Mustard



0-10% ↓



Chili pepper Pepper String beans Peanut Papaya



Persimmon Tomato Pamplemous Orange Mandarin

No pollinators needed



Barley Wheat Maize Millet Chickpea Potato Banana Olive

(modified from Klein et al. 2006)

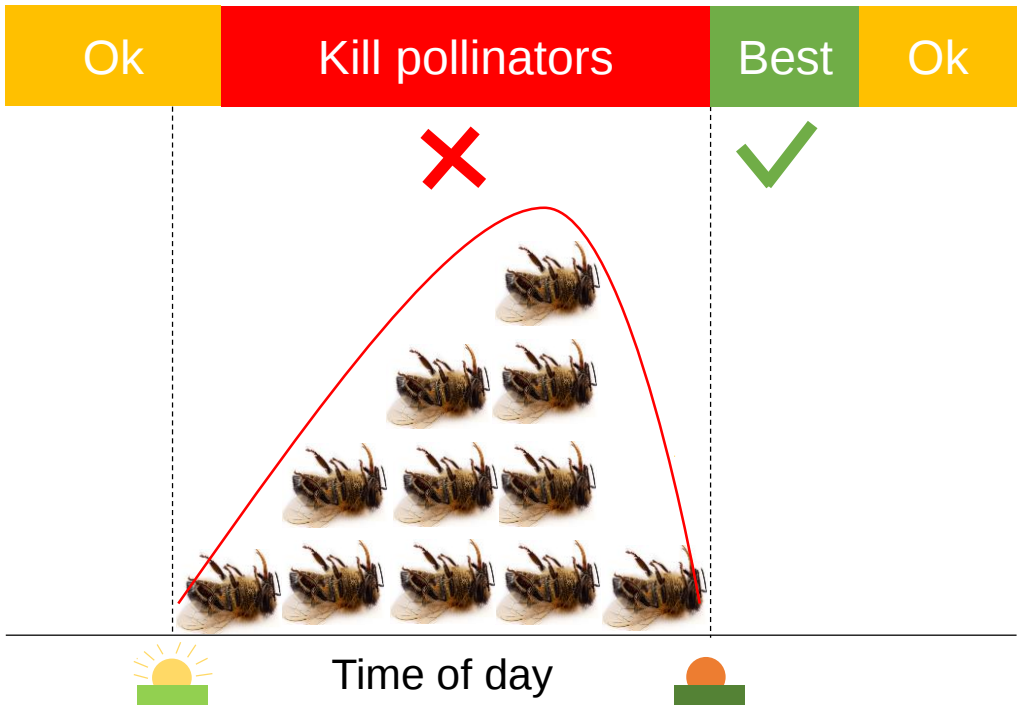
Don't kill your pollinators!

Reduce pesticides use

1. Spray when pollinators are not flying

- *If possible*: before/after flowering period
- *Otherwise*: after sunset (dusk to dawn)

Best time to spray pesticides



Don't kill your pollinators!

Reduce pesticide use

2. Remove weeds before spraying, it reduces your costs!

- Mow before applying pesticides

Best practice



Bad practice



Don't kill your pollinators!

Reduce pesticide use

3. Reduce spray drift

- Spray on target only



- Use larger droplet sizes



- Avoid spraying under high wind speeds

Don't kill your pollinators!

Reduce tillage

1. Practice shallow tillage (< 10 cm)

In Morocco, 70% of the wild bees nest in the ground

Sand bees



Sweat bees

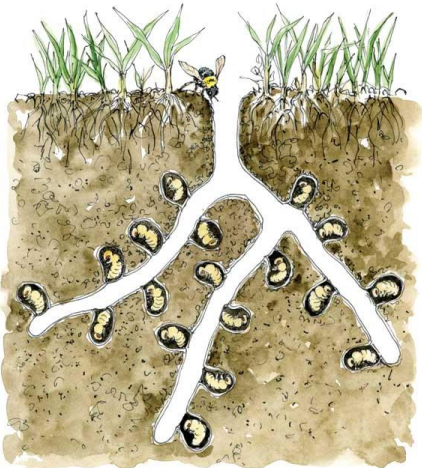


Illustration Elayne Sears



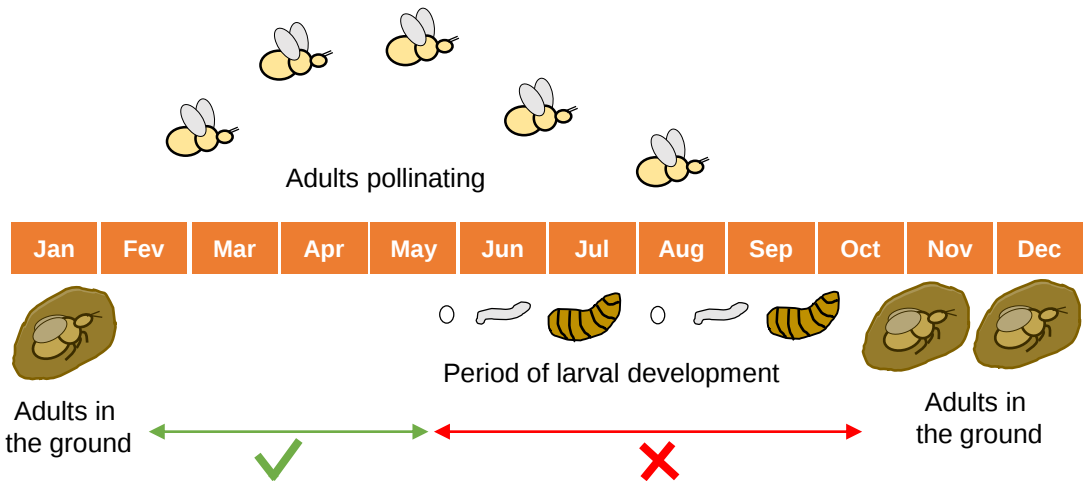
Illustration Art Cushman

Shallow tillage (< 10 cm) will reduce the risk of killing all bee larvae

Don't kill your pollinators!

Reduce tillage

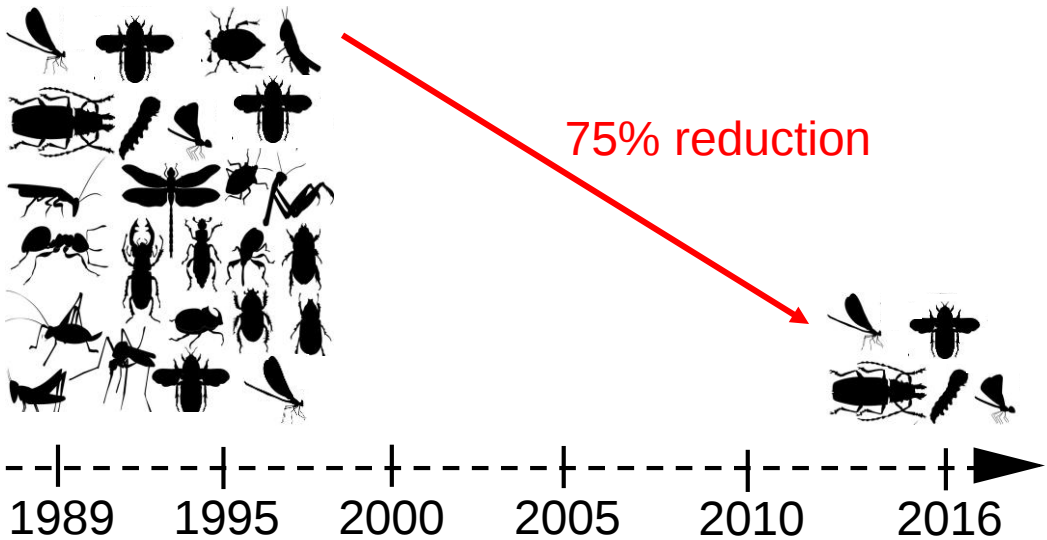
2. Reduce tillage frequency



Tillage recommendation:

- Winter or early spring, when females are building nests and can still change nest location
- If possible, **avoid tilling in the summer and early fall** when the new generation is developing
- **If possible**, keep some areas unploughed

Let us avoid such decline of insect diversity and quantity



Loss in Germany within 27 years

Pollinator decline accelerates rapidly

This is our solution: Support pollinators in your fields and get much higher yields in return!

Farming with Alternative Pollinators (FAP) FAP-eggplant field (Kenitra)



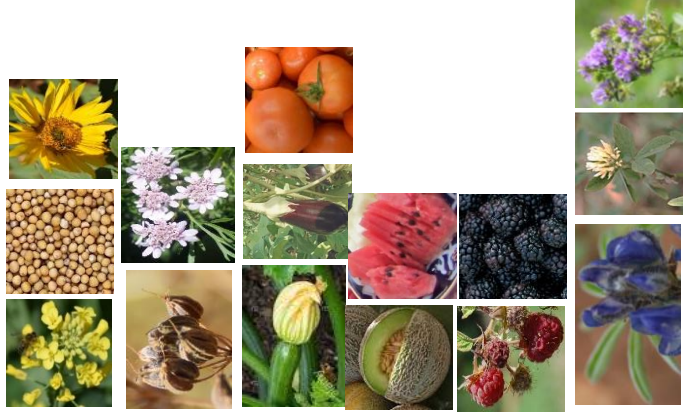
Which plants can you plant to support pollinators?

The habitat enhancement plants

Diversify the type of plants, with flowers of different types and colors, to attract a higher diversity of pollinators.

Some pollinator-attracting marketable plants

- **Oil seeds** : canola, mustard, sunflower
- **Spices** : anise, coriander, basil
- **Vegetables** : zucchini, eggplant, tomato
- **Fruits** : melon, watermelon
- **Berries** : raspberry, blackberry
- **Forage plants** : lupinus, clover, sainfoin



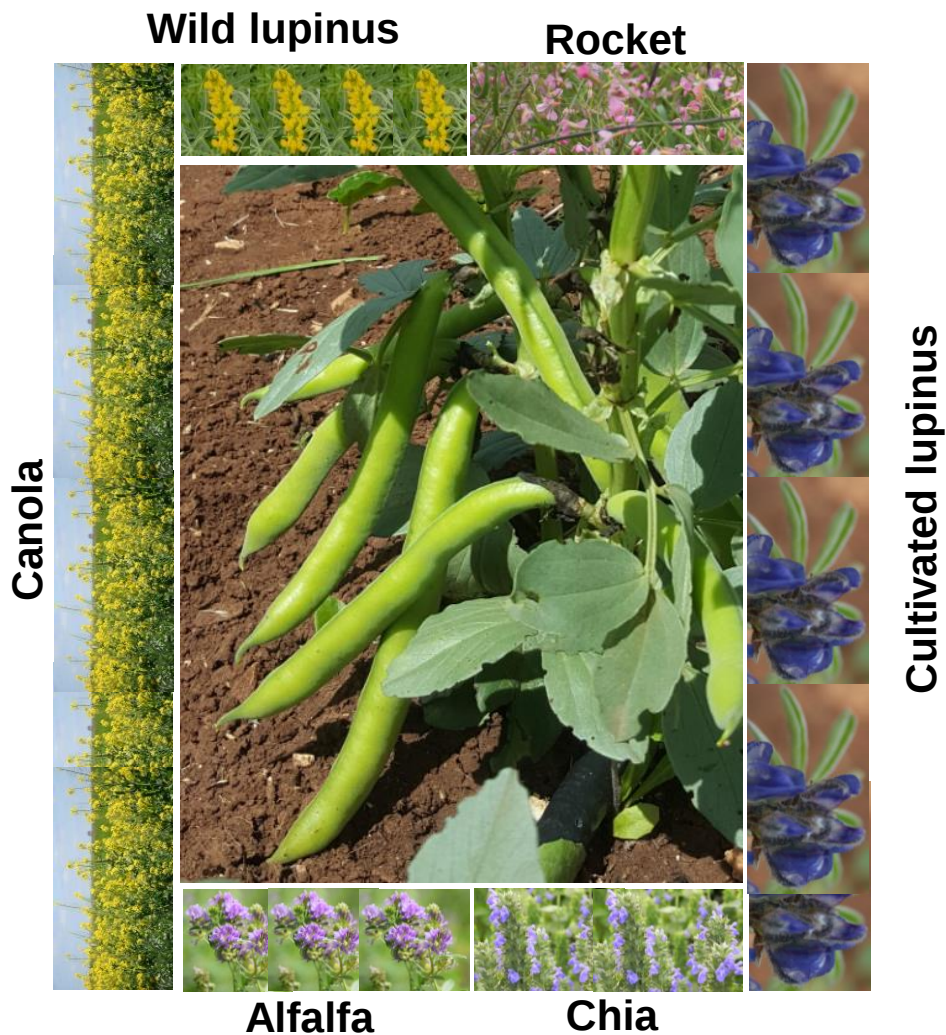
Very important: Nesting and water support

You can make bee hotels (1), clear patches of bare ground around the field, keep dead wood around your farm. Add water points (2) when needed.



Get higher faba bean yields by protecting pollinators in mountainous regions!

FAP planting instructions



Main crop = 75% zone

Faba bean

Marketable habitat enhancement plants = 25% zone

Canola, Wild and cultivated Lupinus, Chia, Alfalfa, Zucchini, Rocket

Increase your income through FAP

ex: Faba bean (field size : 0.03 ha)

+ 75% on average (2017)



FAP

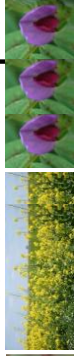


Without FAP

Main pollinators of faba bean

FAP field sketch

Canola Grass pea



Clover



Vetch



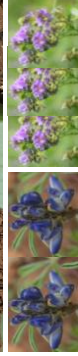
Sunflower



Zucchini



Cult. lupinus Alfalfa



Main pollinators

Digger bee



Mason bee



Bumble bee



Long-horned bee



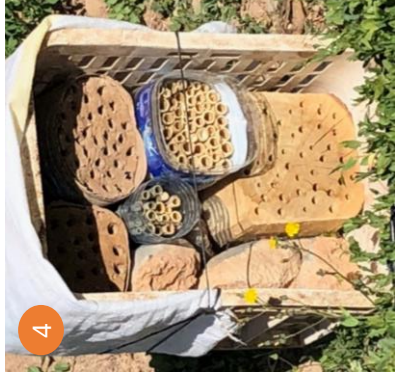
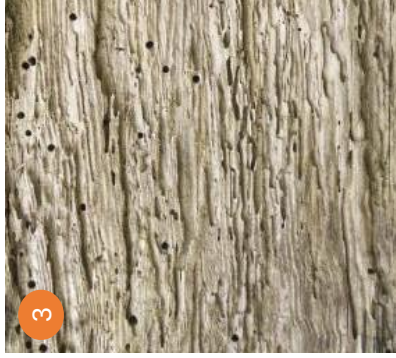
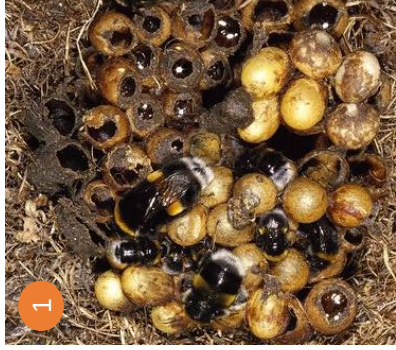
How to support these bees concerning nesting?

Bumble bees are much bigger than honeybees. They have often black, yellow and white bands. They are effective for eggplant, tomato, pepper, blueberry, faba bean, zucchini, sunflower and fruit trees. They live in colonies (1), the queen builds her nest inside abandoned holes of mice. Leaving these nesting areas intact will help support bumble bees.

Digger bees are usually smaller than honeybees. They are attracted by faba bean, aromatic plants and also tomato, pepper and eggplant. They are solitary and nest in the ground, often they dig horizontally into slopes (2). Leaving these nesting areas intact will help support digger bees.

Long-horned bees are usually smaller than honeybees. In particular males are easy to recognize as they have long antennae. They have the same flower and nesting preferences as digger bees.

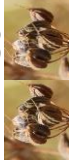
Mason bees are often smaller than honeybees. Many are black, metallic green or blue. They are attracted by aromatic plants, fruit trees, berries, faba bean or clover. They are solitary. They look for narrow cavities in dead trees. Keeping old wood (3). Making bee hotels (4) out of bamboo canes and wood logs will help support mason bees.



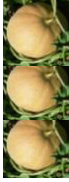
Main pollinators of eggplant

FAP field sketch

Anise



Melon



Coriander



Sunflower



Zucchini Green pepper



Main pollinators

Carpenter bee



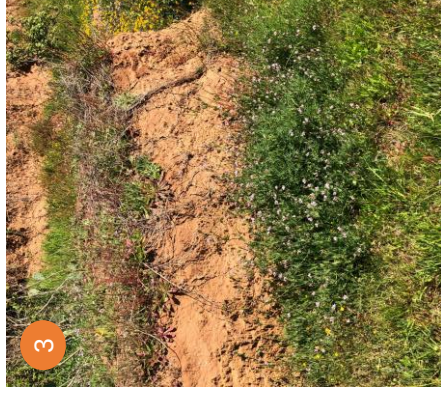
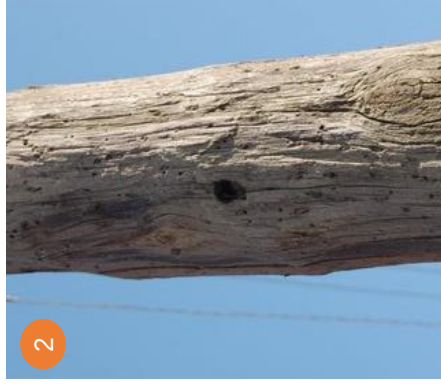
Banded bee



How to support these bees for nesting?

Carpenter bees are much bigger than honeybees and either black or yellow. They are attracted by faba bean, tomato, eggplant and sunflower. They are solitary, the female chew large holes in old wood for their nests (1,2). Keeping old wood in your farm will help attract and support them.

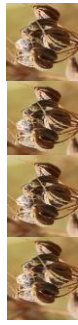
Banded bees are usually smaller than honeybees. They fly very fast and have a black abdomen with clear white stripes. They are attracted by plants with narrow tube flowers like faba bean, sunflower, many aromatic plants (basil, mint, rosemary, sage, oregano, thyme) but also tomato, pepper and eggplant. They are solitary and nest in the ground, often on vertical slopes (3,4). Leaving these nesting areas intact will help support them.



Main pollinators of zucchini

FAP field sketch

Coriander



Anise



Eggplant



Tomato



Sunflower

Main pollinators

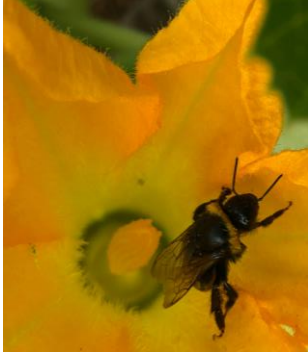
Mining bee



Sweat bee



Bumble bee



Carpenter bee



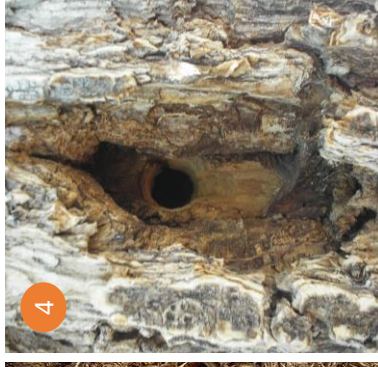
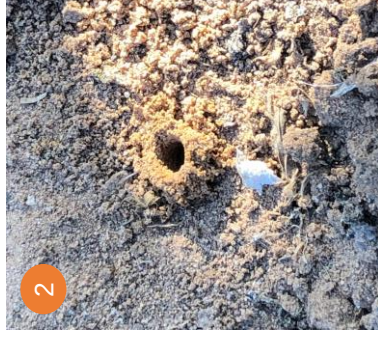
How to support these bees concerning nesting?

Mining bees are smaller than honeybees. They are attracted by plants with open flowers like, canola, fruit trees. They are solitary and nest in the ground (1). Clearing patches or bare ground and reducing tillage will support mining bees.

Sweat bees are often much smaller than honeybees. They are attracted by sunflower and fruit trees. Sweat bees are mostly solitary and nest in the ground. You can notice the little mound of excavated soil left at the nest entrance (2). Clearing patches or bare ground and reducing tillage will support sweet bees.

Bumble bees are much bigger than honeybees. They are hairy bees with often black, yellow and white bands. They are attracted by eggplant, tomato, pepper, faba bean, zucchini, sunflower and fruit trees. They live in colonies (3) in the ground. Leaving these nesting areas intact will help support bumble bees.

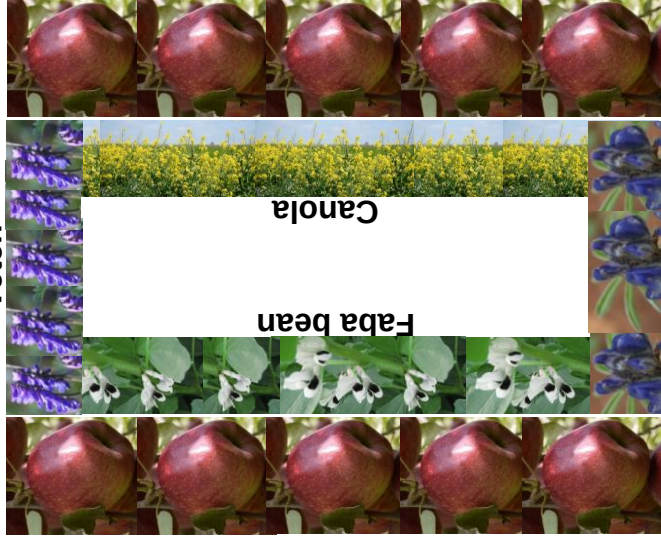
Carpenter bees are much bigger than honeybees and either black or yellow. They are attracted by faba bean, tomato, eggplant and sunflower. They are solitary, the female chew large holes in old wood for their nests (4). Keeping old wood in your farm will help attract and support carpenter bees.



Main pollinators of apple

FAP field sketch

Vetch



Cultivated Lupinus

Main pollinators

Mining bee



Hover fly



Mason bee



Bumble bee



Photo by: Dora Stoney

How to support these wild pollinators for nesting?

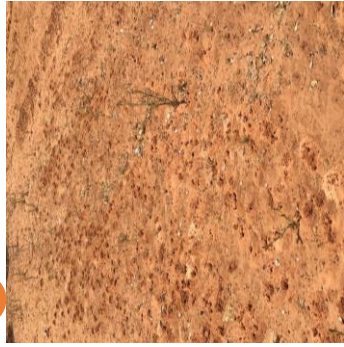
Mining bees are smaller or have the size of honeybees. They are attracted by canola and fruit trees. They are solitary and nest in the ground (1). Clearing patches of bare ground and reducing tillage will support mining bees.

Hover flies often look like bees. They are attracted by fruit trees, canola and strawberry. Some hover flies eat aphids as larvae, so they are beneficial also for pest control. Many species breed in stagnant little water puddles with organic rotting matter inside. Using a container with water and grass clippings (2) will encourage hover flies breeding in your field.

Mason bees are often smaller than honeybees. They are attracted by aromatic plants, fruit trees, berries, faba bean and clover. They are solitary. They look for narrow cavities in dead trees. Keeping old wood or making bee hotels (3) out of bamboo canes or wood logs with drilled holes will help support mason bees.

Bumble bees are much bigger than honeybees. They are hairy bees with often black, yellow and white bands. They are attracted by eggplant, tomato, blueberry, faba bean, zucchini, sunflower and fruit trees. They live in colonies (4), tin the ground. Leaving these nesting areas intact will help support bumble bees.

1



2



3



4



Farming with Alternative Pollinators (FAP)



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