



USING NATUPOL BUMBLEBEES FOR EFFECTIVE POLLINATION

If your hive(s) were shipped by UPS, the nectar tank in the hive unit(s) must be uncapped. Please refer to the “Attention” sticker located on the cardboard lid for instructions. Please contact Koppert (1-800-928-8827) or your local distributor if there are any questions.

*The bees in your order are a native species, *Bombus impatiens*. The colony includes the worker bees that pollinate your crop, a laying queen, and developing brood that will add new workers during the life of the colony.*

A) Receiving and unpacking your NATUPOL hive.

Open the shipping container carefully to avoid disturbing the hive. Keep the hive temperature between 60°F and 80°F until you are ready to place it in the greenhouse. On the end of the box you will find a number indicating the week the bees were shipped. For Class A hives, a second number indicates the week you should remove the hive from the greenhouse.

You may inspect the hive by opening the cardboard top of the NATUPOL box. View the bees through the plastic top of the hive. You will see bees walking on the cotton insulation that covers the brood. DO NOT disturb the bees by tapping on the box. If you have any questions about what you see, please call your distributor.

Now, read Section B before placing the hive and opening the flight doors.

B) Placing the hive in your crop.

Place the hive on a stand or bench between the plants at the beginning of an aisle.

Keep the hive on a stable, horizontal surface. Don't place it on vibrating or swinging poles.

Keep the hive away from bright sunlight, especially when greenhouse temperature is above 85 °F. In warm conditions, provide shade on all sides.

Don't put the hive in front of fans or close to a vent intake.

Avoid locations where people gather. Both bees and people are more comfortable if the hive entrance is away from people!

Use the open position to begin pollination. Use the bee-home position when you need to collect the bees into the hive in order to protect the bees from pesticides, or to prevent them from foraging when grow lights are used at night (see Section C). *If you have closed the exit door, remember to open it again. Forgetting this can cause death of the colony!*

Opening and closing flight door:

- The foraging of the bees can be controlled by adjustment of the flight door. The flight door is a plastic plate, located on the right hand side of the box. There are three:
- Open position: Grasp the plate and pull gently upwards until the lower double flight holes are open. This position allows bees to come and go so they can fly in your crop.
- Bee-home position: Move the plate up or down so that only the single, top flight hole is open. All bees will be in the hive 1-2 hours after setting the bee-home position.
- Closed position: Push the plate all the way down to close the hive completely.

When you receive the colony the open position entrance/exit hole will be covered with fiber tape. Please leave the tape in position. The fiber tape is in place to allow the bees an hour or two to calm down after the shipping process. After you have placed the hive, simply open it as described above and walk away. The bees will chew their way through the fiber tape in 1 to 2 hours. If after 2 hours the bees have not chewed through the fiber tape, you may remove it.

C) How greenhouse conditions can affect your bumblebees.

Fans can kill many bees. Use a minimum of 1/4" mesh screen to protect bees.

CO₂ Lines. Don't place hives too close to CO₂ lines. High concentrations of CO₂ will make the bees much less active, resulting in lower pollination levels.

Materials.

Some types of plastic affect the light quality, interfering with the bee's flight and reducing pollination performance.

Grow lights: Bumblebees *can* be used in combination with grow lights. However, in the absence of natural daylight, the lights can distract the bees from their normal flight behavior. If you use grow lights, observe the following points:

- Always shut off the lights at least one hour before sunset. The bees will return to their hive in a natural way at the end of the day.
 - Keep lights at least 2 feet above the crop.
- If lights are used during the night, be sure to set the flight door to the bee-home position one hour before sunset, and reopen the hive in the morning after sunrise.

Ants are attracted by the high sugar content of the Bee-happy. Protect the hive from ants by:

- Applying a band of glue or heavy grease around the hive support
- Removing other routes by which ants can reach the hive, such as leaves that touch the hive.
- Placing the hive support(s) in a container of water, to create a barrier that ants cannot cross.

D) What to do when you have to spray chemicals

Many chemical treatments can kill bees. If you are unsure about the toxicity of a pesticide, please contact your distributor, who can provide a "Koppert Side Effect List." In most cases, this list will help you to determine the appropriate action. Options include:

Collect the bees into the hive, and keep the door closed until it is safe for the bees to forage. Confine the bees by closing the entrance after the bees return at sunset, or by setting the door to the "bee-home" position 2 hours before closing the entrance.

Remove the hive from the greenhouse. Collect the bees, close the door, and remove the hive for as long as necessary (though no more than 3 days). Store the hive on a stable, vibration-free surface at moderate temperature (65-70 °F). Before removing the hive, note its original location so that it can be returned to the same place, and in the same orientation.

Find an alternative chemical treatment. Some persistent pesticides are simply incompatible with bumblebees. Biological pest control is compatible with bumblebees.

Please contact your distributor if you are interested in investigating pest management techniques including parasites, predators, insecticidal soaps and microbial pesticides.

E) Managing pollination (comments specific to tomato production)

The pollination percentage is a measure of how many flowers have been visited, indicating the potential fruit set. Checking pollination levels will give you good insight into the bee's performance and indicate when to order a new hive.

How do the bumblebees pollinate?

Bumblebees visit flowers as they begin to produce pollen and nectar, which they use as food for developing brood. In collecting pollen from a flower, bumblebees show a behavior that makes them especially effective: they clamp their jaws around the anther cone, and rapidly shake it. This “buzz” pollination causes the pollen to fall onto the stigma and also on the bumble bee. After just a few hours in the greenhouse, you can usually see some dark pollination marks left by the bee’s jaws.

How to check the pollination percentage

Check the pollination percentage twice a week. You will need approximately 10 minutes to check a 4,000 M² (43,000 ft.².) greenhouse. Walk through your aisles and randomly pick 30 to 50 flowers that have closed within the previous day. These flowers will be easy to pick because they will be loose at the base of the flower. Collect the flowers from throughout the greenhouse (each aisle, high and low, center and edges). On a tray or table, open each flower and look at the yellow cone. Visited flowers will have dark bruises (pollination marks) on the anther cone. The marks always occur in pairs, made by the two jaws of the bee.

Note: When there are many flowers of good quality available the marks may be faint. This is because the bees can achieve good pollination without having to “buzz” so vigorously.

<p>Determine the pollination percentage as in the example at right:</p> <p>For crops that flower over a long period of time, you’ll want to track the pollination percentage on a regular schedule, such as in the example at right.</p>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td>Marked flowers:</td> <td style="text-align: right;">42</td> </tr> <tr> <td>Unmarked flowers:</td> <td style="text-align: right;">+ <u>8</u></td> </tr> <tr> <td>Total:</td> <td style="text-align: right;">50</td> </tr> </table> <p>Pollination Percentage: $42/50 \times 100 = 84\%$</p> <table style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 30%;"></th> <th colspan="3" style="text-align: center; border-bottom: 1px solid black;">Compartment Number</th> </tr> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Date</th> <th style="text-align: center; border-bottom: 1px solid black;">1</th> <th style="text-align: center; border-bottom: 1px solid black;">2</th> <th style="text-align: center; border-bottom: 1px solid black;">3</th> </tr> </thead> <tbody> <tr> <td>Nov. 1</td> <td style="text-align: center;">84</td> <td style="text-align: center;">95</td> <td style="text-align: center;">89</td> </tr> <tr> <td>Nov. 4</td> <td style="text-align: center;">90</td> <td style="text-align: center;">99</td> <td style="text-align: center;">91</td> </tr> <tr> <td>Nov. 8</td> <td style="text-align: center;">97</td> <td style="text-align: center;">98</td> <td style="text-align: center;">92</td> </tr> <tr> <td>Nov. 11</td> <td style="text-align: center;">95</td> <td style="text-align: center;">100</td> <td style="text-align: center;">96</td> </tr> <tr> <td>Nov. 15</td> <td style="text-align: center;">93</td> <td style="text-align: center;">93</td> <td style="text-align: center;">91</td> </tr> <tr> <td>Nov. 18</td> <td style="text-align: center;">90</td> <td style="text-align: center;">91</td> <td style="text-align: center;">88</td> </tr> </tbody> </table>	Marked flowers:	42	Unmarked flowers:	+ <u>8</u>	Total:	50		Compartment Number			Date	1	2	3	Nov. 1	84	95	89	Nov. 4	90	99	91	Nov. 8	97	98	92	Nov. 11	95	100	96	Nov. 15	93	93	91	Nov. 18	90	91	88
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Troubleshooting: how to handle low pollination percentages:

Normally your pollination percentage should be between 80 and 100%. If pollination falls below 80% (or a higher percentage for cluster tomatoes) you should start to hand pollinate while you determine what’s causing the problem.

Possible causes of low pollination rates include:
 Failure to protect the hive from toxic chemicals that kill bees (see Section D).

Extreme high temperatures (above 85°F) can reduce foraging (the bees will be busy ventilating the hive to cool the brood). Correct by providing shade at the hive location.

Extreme high temperatures may also reduce pollen quality, causing the bees to forage for more productive flowers outside the greenhouse.

Extreme low temperatures (below 60 °F) will also reduce foraging, as bees will remain inside the hive to keep the brood comb warm.

Too many flowers. A period of bright weather following a long dark period will produce a surge in flowering. The bees will usually catch up within a couple of days.

An expired hive. Check the entry week on the front of the hive. A Class "A" hive may last 8 to 12 weeks depending on season, pollen quality, temperature, etc. We recommend leaving an "A" hive in your greenhouse for 16 weeks. Class "B" hives last 6 to 10 weeks.

If you cannot find the cause of the pollination problem please contact your distributor.

F) Pollinating two small greenhouse compartments with one hive

If you have two small greenhouses, up to 500 M² (5,000 ft²), you can provide pollination with a single shared colony and a hotel hive. A hotel hive is a nest box without bees but completely equipped with a Bee-happy bag and insulation material.

Before introducing bees to your greenhouse, set up a stand in each compartment. Then place the hive with bees in the first compartment and your hotel hive (without bees) in the second compartment. After two (summer) or three (winter) days, close your active hive after sunset and exchange it with the hotel hive. The Hotel hive will collect the remaining bees in the first compartment, and for the next two days functions as a temporary home for stray bees. Exchange the hives in the same manner every two (or three) days.

Note:

The hotel hive should be ordered as an extra (there is an additional charge).

G) Caring for bee stings.

Bumblebees don't have an aggressive manner. They generally sting only when agitated or frightened. Nevertheless stings may occur when the nest box is accidentally disturbed, or when a bee is trapped in clothing.

Stings are less likely if you avoid exposing bees to:

Strong smells, such as alcohol, perfume, scented soap, deodorant, and chemicals.

Rapid movements. Bees are much less sensitive to slow, deliberate motion.

Obstructions to their flight path. Don't stand too long in front of the hive. The bees will become disoriented and fly around or even against you.

If someone is stung, make sure that he or she does not have an allergic reaction. If that happens (in rare cases), call immediately for medical assistance.