Tomato Protocol

Information about Plant Treatments

Each regular participant will be responsible for three plants total, one regular plant that will just be exposed to natural pollinators (GREEN STAKE), one plant that excludes pollinators with a net (WHITE STAKES AND NET), and one plant that receives extra pollination with a tuning fork (PINK STAKE). You need to treat all of your plants exactly the same in terms of water, fertilizer, light, etc.

WE ALSO ASK THAT YOU HAND POLLINATE the pink-staked plant with the tuning fork TWICE A WEEK. If you cannot, please let us know and we can ask one of our volunteers to do it for you. It is also CRITICAL to the project that you SUBMIT DATA ON TOMATO NUMBER AND VOLUME AT LEAST ONCE A WEEK after the plants start fruiting, and that you do so for all of your plants each time.

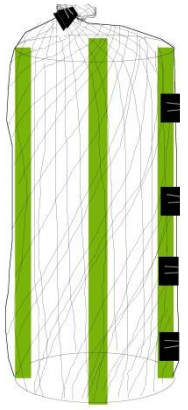
Label Your Plants!

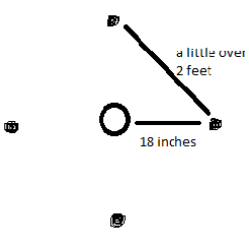
LABEL YOUR PLANTS WITH THE COLORED STAKES PROVIDED. You don't have to actually stake these determinate Gold Nugget tomato plants (though you can if you'd like to), just put the colored stake in the ground right next to the appropriate plant. This will help ensure that your plants receive the correct treatment (bright pink = hand-pollination with tuning fork, white = pollinator exclusion net, lime green = regular). It is also especially important because undergraduate volunteers will be coming to watch bees at the UPP tomato plants in your plot or, if requested, to help perform tuning-fork pollination, twice a week.

Transplanting

Please transplant your tomato plants into your patch within a week of receiving them.

Setting Up the Net Treatment:





The exclusion net treatment will help us understand how much pollinators are contributing to fruit yield by allowing us to see how many/how large the fruits are that are produced by a plant with no pollinators. Comparing the other two treatments with this one will help us figure out how many fruits pollination adds to total yield.

For this treatment, sink the four white the bamboo stakes we provided into a square with each stake about 18 inches from the plant in the center. This will create an approximately 2 foot by 2 foot frame for the exclusion net (the rectangle of bridal veil netting we included with your plants; see diagram to left). The stakes we provide are 48 inches tall, so sink them into the soil 9-12 inches to anchor them well and to make sure the netting will fit over the stakes without space between the net and the ground. Wrap the netting around the stakes, and use 3-4 of the binder clips provided to secure the overlapping ends of the netting to one of the stakes. Leave a couple of inches of netting near the ground at the bottom of the enclosure, then cover this with rocks and/or soil to seal the bottom of the net. Use 1-2 binder clips to secure the top end of the

tube. If you need to access this plant to collect fruit or stake up a branch, you can remove the binder clips near the top of the structure to move down the netting. PLEASE ALWAYS MAKE SURE TO CLOSE THE NET BACK UP AFTER YOU COLLECT FRUIT.

"Buzz-pollinating" with the tuning fork:
The hand-pollination, or "tuning fork", treatment tells us the maximum yield a plant can produce if every one of its flowers is well-pollinated. This allows us to see what proportion of its maximum yield a plant that is able to produce from its encounters with natural pollinators. FOR THIS TREATMENT, YOU WILL USE THE TUNING FORK TO HAND-POLLINATE each of the flowers on your plant TWICE A WEEK OR MORE (if you cannot do this twice a week or more, let us know and we will have our volunteers do it). The tuning fork will be in the UPP bin in the shed at your P-patch. When you are near your plants, hit the tuning fork against the palm of your hand. It will begin to vibrate at the same frequency as a bumblebee's body during buzz pollination. Touch this to the stem of an un-pollinated flower on your plant. This will cause the flower to release its pollen in a small cloud and allow the flower to self-pollinate. Repeat for all flowers on your plant.

Data collection- Fruit Number and Size

You will need to enter and submit this information online, but we will have print-outs of the data sheet available on our website, www.urbanpollinationproject.org, and in the UPP bin in your P-Patch shed so you can easily record the data while you are at your plot. **Make sure to note which plant treatment your data is for (pink/tuning fork, green/regular, white/netted) and that you transfer your data from the printed sheet to our online form when you have access to a computer.**

When you harvest fruit (once a week or more):
Record the date. Pick the ripe fruit that is on the plant. ***Count and record the number of fruits***. Also assess the size of the group of fruits by either measuring volume. IT IS CRITICAL THAT YOU DO THIS SEPARATELY FOR EACH PLANT, and that you collect data on ALL your plants each time you collect data. DO NOT MIX THE TOMATOES FROM YOUR PLANTS TOGETHER BEFORE MEASURING.

To measure volume, use the graduated cylinder provided in the bin we've placed in your P-Patch shed (this bin also has the tuning fork in it). Put between 250 and 500 mL of water in the cylinder; write down the exact volume of the water you've put in the cylinder (in milliliters). After noting which plant you are measuring from, add as many tomatoes from the harvest of a single plant that you can fit *with all of the tomatoes still completely underwater*. Write down the volume of the tomatoes + water in the graduated cylinder. Empty the water and count the number of tomatoes whose volume you measured; write this number down. Repeat this for all of your plants. WE WILL HAVE A VIDEO OF THIS IN THE "INSTRUCTIONAL VIDEOS" TAB ON OUR WEBSITE, www.urbanpollinationproject.org.

Stuff where it is okay to do your own way! (A suggested protocol for growing tomatoes):

If you would like to grow them another way, feel free! ***But, PLEASE TREAT ALL YOUR TOMATO PLANTS FOR THIS PROJECT THE SAME WAY*** *(time of transplant, any covering, light conditions, fertilizer application, watering schedule, etc.), so that there is no difference between your two plants with respect to these variables. This will allow us to accurately assess the effect of pollinators alone on the fruit yield of the plants. Please still collect data using the methods we described.*

Transplanting

Within a week of receiving your tomato plants:

Find an area of your patch that is in full sun to plant your tomatoes. Blend the quarter cup of complete fertilizer into the soil around the plant. Dig three holes 36 inches from one another and 18 inches from the sides of your plots that are about as deep as the root ball plus a couple extra inches. Please plant your tomatoes these holes. Put the root ball, as well as much of the bottom part of the stem, in the hole and cover them with dirt. The bottom part of the stem that you bury will sprout new roots! When replacing the dirt in the holes, keep a slight depression in the soil around the base of the plants, as this will facilitate watering. Prune off any leaves or branches that are touching the ground to prevent disease.

After planting, sink the colored stakes to mark each treatment, as well as setting up your exclusion net.

Watering

Throughout the season:

Tomatoes require lots of water. Each day check the soil for moisture. If you see the top of the soil is dry, water at the base of the plants until soil is saturated, but not so much that large puddles form. Try not to get water on the leaves. Keeping water off of leaves and not overwatering prevents fungal disease.

Pruning

Throughout the season:

To prevent disease, prune off or stake up any branches of the plant that touch the ground.

Prune off suckers (smaller branches that start growing from the junction of the stem and main branch), because these draw energy away from the main branch and decrease fruit yield.

Pest Management

- Make sure not to smoke right before handling your tomato plants. Cigarettes can contain tobacco mosaic virus, a pathogen of tobacco plants that can also infect tomatoes.
- Pick any tomato hornworm (or other caterpillars you see) off of your plants each day you visit.
- Tomatoes in this region are prone to blossom-end rot, which is often caused by calcium deficiency. If you see black spots developing at the blossom-end of your fruit, it may be helpful to treat your soil with lime. If the disease becomes severe, treating with calcium nitrate may be helpful. Fungicides and insecticides are not helpful against this disease since it is due to a mineral deficiency in the plant.
- If your tomato plants start showing any signs of other disease in one branch, prune off that branch and note it in your data entries. If they start to show signs of severe disease throughout the whole plant, please note this in your data entries.