

GROWERTALKS

Features

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Making Greenhouse Math Easy

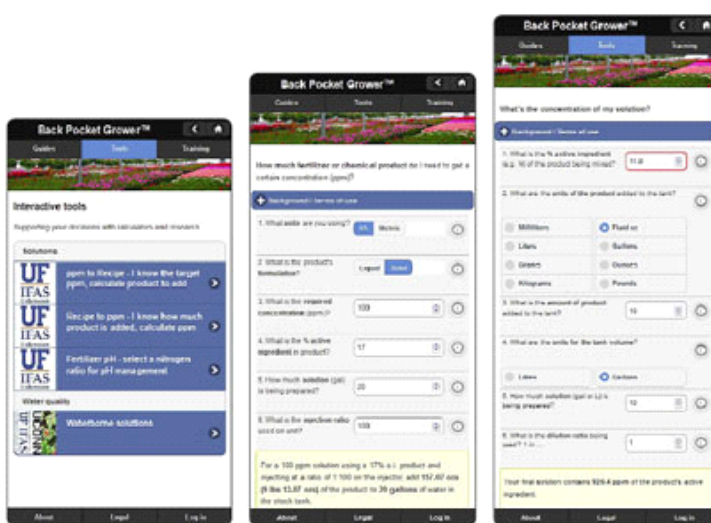
Paul Fisher and Bruce MacKay



We've all done it some time: You come into the greenhouse in the morning and see a previously healthy crop browning out from phytotoxicity from a chemical application (Figure 1). Stress levels in both your crops and you are at an all-time high.

Most of us didn't get into horticulture because we loved math, but you can't avoid dilution calculations in crop management. In Back Pocket Grower (backpocketgrower.com), we have two calculators to provide confidence with pesticide and fertilizer dilutions and avoid mistakes.

Back Pocket Grower is a website that's optimized for mobile devices, such as your smartphone or tablet, for use out in the greenhouse, but can also be accessed on a desktop computer. As with all of our tools in Back Pocket Grower, these are funded by our industry partners in the Floriculture Research Alliance (floriculturealliance.org). Our ppm calculators are general tools that you can apply to any chemicals including fertilizer, pesticide or PGRs. In this article, we'll run through the two tools and how to use them.



left: The "Tools" screen in Back Pocket Grower.

center: The "ppm to recipe: I know the target ppm, calculate product to add" tool in Back Pocket Grower.

right: The "Recipe to ppm: I know how much product is added, calculate ppm" tool in Back Pocket Grower.

Go to backpocketgrower.com on your browser and click on the "Tools" button. You'll see a list of calculator apps (Figure 2). (This list will grow

during our *GrowerTalks* series as we publish new tools. For example, last month we introduced the

“Waterborne Solutions” tool for finding out about research on the doses of different sanitizing agents, such as chlorine or copper, found to control pathogens in irrigation water. Earlier, we described the “Fertilizer pH” tool, which helps you select a fertilizer that will balance the pH of the growing media over time.)

Parts per million, or ppm, is a common unit of concentration. For agrichemical solutions, ppm of active ingredient is the same as milligrams per liter ($1 \text{ ppm} = 1 \text{ mg/L} = 1 \text{ mg.L-1}$). You might be more familiar with percentages (one percent = one per one hundred = $1\% = 1/100$), which we typically use for high concentrations (for example, an undiluted fertilizer or pesticide). In contrast, ppm is useful for much smaller concentrations ($1 \text{ ppm} = 1/1,000,000$). One percent is the same as 10,000 ppm. In other words, a 1% undiluted chemical would have to be diluted at 1:10,000 to give a 1 ppm final dilution.

By now your mind may already be drifting away, so let’s turn to the tools that calculate dilutions for you.

Tool 1—“ppm to recipe: I know the target ppm, calculate product to add”

Click on this option in the list of tools in Back Pocket Grower. Note that there’s a “background” section that includes a video on how to use the tool. Run through the video the first time you use the tool.

A recent “Culture Notes” article in *GrowerTalks*, as an example, recommended applying 100 ppm of 17-5-17 to begonias. With fertilizers, unless another nutrient is specified, the active ingredient usually referred to is nitrogen (N). In 17-5-17, the first number 17 refers to the percent of nitrogen by weight. So let’s take a case where we prepare a fertilizer stock solution in a 20-gal. tank that will pass through a 1:100 injector to deliver 100 ppm N.

Here’s the information used in the ppm tool (Figure 3):

- The units you’ll use (U.S. for gallons, pounds, ounces or Metric for liters, grams and kilograms)
- Whether the original chemical is in a liquid or solid form
- The target ppm in the final diluted solution—based on the pesticide or fertilizer label
- The percent active ingredient of the undiluted chemical, which should be available on the pesticide label, technical description or Material Safety Data Sheet (MSDS)
- The volume of the tank
- The dilution rate if passing a concentrated stock through a dilutor (otherwise, set to 1)

As shown in Figure 3, 9 lb. and 13 oz. of 17-5-17 is required in the 20-gal. stock tank to produce a 100 ppm solution out the injector.

Tool 2—“Recipe to ppm: I know how much product is added, calculate ppm”

Often, growers inherit recipes for chemical calculations from past staff or are given mixing recommendations such as 4 oz. in 100 gal. or 1:1,000. It’s helpful to know what ppm concentration that recipe will end up with so you can compare your recipe with pesticide label rates, or perhaps an article or recommendation from a consultant. It can also help when comparing the cost of two products with the same active ingredient.

Let's take the example of applying 10 oz. of chlormequat chloride (11.8% active ingredient) plant growth regulator in a 10-gal. spray tank. Figure 4 shows that this recipe will result in a 920.4 ppm solution.

For effective crop management, safety to your workers and managing costs, it's critical that dilutions are correctly calculated. Always follow agrichemical and fertilizer label instructions that apply to your location, crop and growing conditions. Run through the short training videos in the "background" section for the ppm tools in Back Pocket Grower. We hope you find these tools helpful! **GT**

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