

What's Your Fertilizer Cost?

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How much does it cost to fertilize one plant? One cent? Five cents? Ten cents? The correct answer could be any of these guesses —costs vary widely based on the product used and how it was applied. Granted, as a percentage of total production costs, fertilizers represent a small portion of the input costs per plant. Nevertheless, when margins are low, accounting for every penny makes “cents.” In this article, we'll explore the factors that determine the cost of your fertilizer decisions using some simple (I promise!) calculations from research at Cornell University.

Back to the basics

The cost of your fertility decisions is affected by several factors: product costs, the formulation (percent of nitrogen in the product), the rate at which it's applied (ppm nitrogen), and how much water is used to fertilize your crop. Conventional fertilizers are usually purchased as 25-lb. bags of water-soluble fertilizer. Their formulations typically contain 10% to 25% nitrogen, along with a balance of other macro- and micronutrients. These fertilizers are applied based on the desired concentration of nitrogen in the dilute fertilizer water, noted in parts per million (ppm N).

As you can see from Table 1, the ounces of fertilizer required to make up 100 gal. of water depends on the percentage of nitrogen of the formulation and the desired concentration. If 150 ppm N is the desired concentration, 10.1 ounces of product must be used for a 20% N formulation, whereas twice as much (20.3 ounces) is required when a 10% N formulation is used.

Table 1. Ounces of fertilizer to make 100 gallons of applied fertilizer as a function of % nitrogen in the fertilizer source and the desired concentration (ppm N)

% Nitrogen in Fertilizer	Desired Fertilizer Concentration (ppm Nitrogen)				
	50	100	150	200	250
5%	13.5 oz.	27.0	40.6	54.1	67.6
10%	6.8	13.5	20.3	27.0	33.8
15%	4.5	9.0	13.5	18.0	22.5
20%	3.4	6.8	10.1	13.5	16.9
25%	2.7	5.4	8.1	10.8	13.5

When fertilizer is continually added in the irrigation water (constant liquid feed, CLF), the total volume of water applied is an important factor in fertilizer cost. We know that some crops require more water to grow. Table 2 demonstrates how far a bag of fertilizer will “stretch”—that is how many gallons of water can be made from one 25-lb. bag. For example, let’s say a short crop, like marigolds, takes 1 gal. of water per pot to produce. From Table 2 you can estimate that one bag of 20-10-20 can fertilize 5,904 plants at 100 ppm N. Compare this to a petunia crop that took 2 gal. of water at 200 ppm N—the same bag of fertilizer was enough for 1,476 plants.

Table 2. Gallons of dilute fertilizer water that can be made from a 25# bag of fertilizer as a function of % nitrogen in the fertilizer source and the desired concentration (ppm N).

% Nitrogen in Fertilizer	Desired Fertilizer Concentration (ppm Nitrogen)				
	50	100	150	200	250
5%	2,952 gal	1,476	984	738	590
10%	5,904	2,952	1,968	1,476	1,181
15%	8,856	4,428	2,952	2,214	1,771
20%	11,808	5,904	3,936	2,952	2,362
25%	14,760	7,380	4,920	3,690	2,952

Now let’s put a dollar value to each gallon of dilute fertilizer water applied to the crop. This is calculated as the cost of a bag of fertilizer divided by the number of gallons of water it can make up (Table 3).

Table 3. Cost of one gallon of 100 ppm N dilute fertilizer water (**in cents!**) as a function of % nitrogen and the cost of a bag of fertilizer.

% Nitrogen in Fertilizer	Cost of a 25# bag of fertilizer (\$)				
	\$20	\$25	\$30	\$35	\$40
5%	1.4¢	1.7	2.0	2.4	2.7
10%	0.7	0.8	1.0	1.2	1.4
15%	0.5	0.6	0.7	0.8	0.9
20%	0.3	0.4	0.5	0.6	0.7
25%	0.3	0.3	0.4	0.5	0.5

Calculating costs by crop

Another method to calculate costs is to think about it on a pot-by-pot basis. To use this method you need to record (or estimate) the gallons of water applied per plant and then take into account the cost per gallon of fertilizer that was used. In the example with marigolds and petunias, we assumed a bag of 20-10-20 costs \$30. Remember that the marigolds received 1 gal. of water at 100 ppm N and the petunias 2 gal. of water at 200 ppm N. We can use

Equation 1 and Table 3 to calculate that marigolds cost 5 cents per plant to fertilize (1 gal. of water × 0.5¢ per gal.) and petunias cost 2 cents (2 gal. of water × 1.0¢ per gal.).

Equation 1. Cost of fertilizer per plant = Gallons of dilute fertilizer used × Cost per gallon dilute fertilizer

Comparing conventional versus organic/sustainable fertilizers

Now you know how to calculate input costs for your conventional fertilizer. But how do you do it for a liquid organic product?

When a fertilizer arrives in a liquid form, don't lose sight of how much nitrogen is in it. You can compare liquid versus dry fertilizer costs by comparing the dollars per pound of nitrogen. The weight of liquid fertilizer products varies based on their ingredients (check the label), but the general rule of thumb is 1 gal. weighs 10 lbs. Using Equation 2, a 1-gal. jug contains 0.5 lbs. of N (10 lbs. × 0.05), whereas the 25-lb. bag contains 5 lbs. of N.

Equation 2. Pounds of nitrogen in a fertilizer = Weight of fertilizer (in pounds) × Percent N (20% N = 0.20)

Finally, dividing by cost of the fertilizer by the pounds of N, you can truly compare their product costs in terms of dollars per pound of nitrogen.

Equation 3. Cost per pound nitrogen = Cost of fertilizer (\$ per bag or jug) ÷ Pounds of N in fertilizer

Cornell Trial

We conducted a trial at Cornell to compare performance of six bedding plants in response to different CLF-applied fertilizers. In the trial, we included a conventional 25-lb. bag of 20-10-20 fertilizer, two liquid organic fertilizers (one based on fish emulsion and one based on seed oil extract) and one sustainable fertilizer (containing seed extract plus inorganic additives). We transplanted plugs of impatiens, marigold, pepper, petunia, tomato and torenia into 4-in. pots containing a commercial potting mix. We irrigated by hand daily with water containing 150 ppm N. At the end of five weeks, we examined plant growth (dry weight).

Visually, all plants were commercially acceptable (Figure 1). Plant dry weight varied 10 to 20% for some species in response to fertilizer, but when statistical analysis was applied, none of these differences were significant. These initial results suggest these very different fertilizer products could be used at roughly the same concentration.



Figure 1. Growth of tomatoes in response to fertilizer, photo taken 5 weeks after transplanting.

How did the costs stack up? Fertilizer costs per pound of nitrogen are noted in Table 4. In the trial, an estimated 1.1 gal. was used to water each plant. The resulting cost to fertilize one plant varied from 0.9 to 9.4 cents (Figure 2). It should be noted that our cost estimates take into account the price paid for relatively small quantities of fertilizer (no quantity discount, like you might get). You should conduct your own cost comparison using potential bulk prices you may have available, and crop-specific fertilizer rates and water consumption.

Table 4. Comparison of 4 fertilizers, unit cost and cost per pound nitrogen.

Product	Main Ingredients	Analysis	Cost	Cost (\$ per lb. N)
Conventional Peat-Lite Special®	Inorganic nutrients	20-10-20	\$35 / 25 lb bag	\$7.12
Drammatic® One	Fish hydrolysate + kelp	4-4-0.5	\$114 / 5 gallons	\$68.00
Daniels® Pinnacle	Seed extract	3-1-1	\$51 / 4.7 gallons	\$43.00
Daniels® Professional	Seed extract + Inorganic nutrients	10-4-3	\$34 / 4.7 gallons	\$8.10

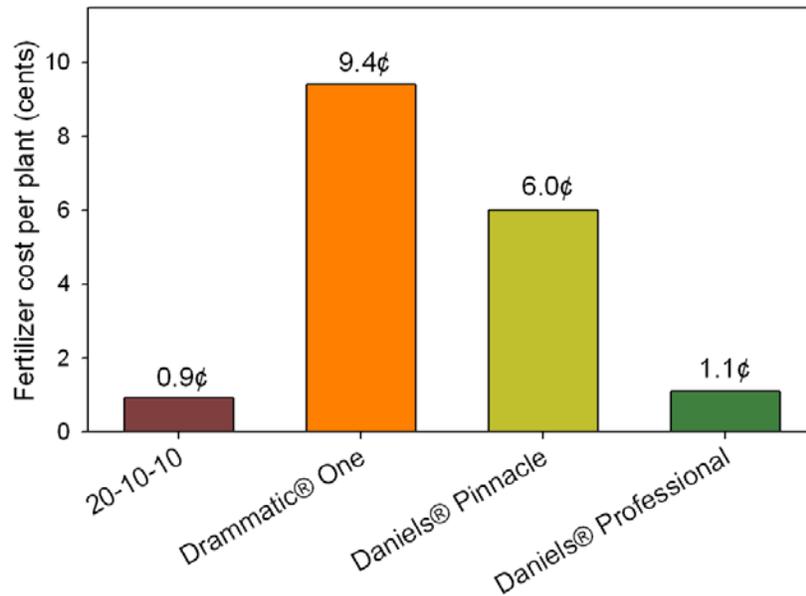


Figure 2. Estimated cost to fertilize each plant in the fertility experiment at Cornell.

While it takes some pencil and calculator time to figure out fertilizer costs, the good news is that knowledge is power! Understanding the factors that affect the cost to fertilize a plant reveals production practices you can follow to save money, by 1) reducing the gallons of water applied to each plant (by irrigating more efficiently or leaching only when indicated by electrical conductivity [EC] monitoring, you'll stretch your bag of fertilizer to cover more plants); 2) move to a product with a higher percentage N (balanced fertilizers with a higher percentage N have been on the market for a couple years now, so conduct your own trials to see if these work with your crops); and 3) reduce your ppm N (conduct trials first if you think you have been over-fertilizing to see how low you can go).

Finally, when considering whether to switch fertilizer products, remember that cost is only one factor. Don't be a "penny wise and a pound foolish" grower—that is, don't cut back on fertilizer rates too much to save a penny when it will reduce the overall marketability of your crop. Also, organic and sustainable fertilization practices may offer a higher value proposition to your consumer. If your clientele will pay competitively for this crop, a switch to an alternative product may be warranted.

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