# Greenhouse Crop Production: Counting the Costs and Making Cents

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## Introduction

How are the cost of production and the profitability of a crop calculated? What are variable and fixed costs? What is a square foot week and why is it important? Regardless of the size of the greenhouse or the size of the desired profit, there is a peace of mind that comes with knowing that the difference between the cost of production and the income generated from sales meets your personal goal. A financial prospectus or estimate of potential income is also important if borrowing money to build a greenhouse or start a business.

Crop production and cultural information is becoming more and more available to those in the business and those wanting to enter the business. A key to staying in business will be learning how to make sure the end of the year bottom line provides the necessary and desired income.

## Types of Costs:

Structure Costs: Property, structure, environmental control, equipment, property taxes, insurance, etc.
Materials Costs: plant material, growing containers (trays, flats, pots), root media, fertilizer, chemicals, labels
Labor Costs: management, growers, workers, clerical, delivery (payroll taxes, insurance, benefits)
Energy or Utilities Costs: Gas, electric, fuel oil, water, etc
Marketing (Packaging and Shipping) Costs: sleeves, pot covers, boxes, trucks, advertising

## Classification of Costs:

*Variable or Direct Costs*: Costs associated with a specific crop and assigned to that crop individually.

*Fixed, Indirect or Overhead Costs*: General production costs that occur regardless of the crops produced in the greenhouse. These are totaled over the entire production season for the entire production area and then divided equally by the total production time and actual growing area. These costs typically are assigned equally to all crops based on the growing time and area. However, they may be assigned by the season at different rates.

Material costs are typically handled as a variable cost.

Labor, energy, packaging and shipping costs can be either a variable or fixed cost.

Structure costs are typically handled as a fixed cost.

## Don't Let Mathematics and Numbers Intimidate You

Getting ready to determine costs of production and profitability of individual crops requires some time and effort put into calculations. Perhaps one of the primary reasons more greenhouse operators do not calculate costs is because many have been intimidated into believing they are not good at math. The phase "I am not good at math" rates right up there with "I have a black thumb" for some of the most useless words ever spoken. Perhaps such people exist, but there are very few of them. All it takes is a positive attitude, a willingness to learn, and a good teacher. While calculating costs and profits can become very detailed and difficult, it does not have to be that way. The necessary calculations can be very simple and easy.

## Step 1. Start with "Action Plans" and a Space Utilization and Planning Schedule

Before the cost estimate is started, a detailed crop schedule or "Action Plan" is developed. The action plan includes what needs to be done, when it needs to be done, and who is going to do it (example on page 3). Start with ordering the plant material and supplies, a list of the schedule and environmental conditions required, and a calculation of either the bench space needed to produce the number of plants needed or the number of plants that can be produced in the given amount of space. For example, if you have 10,000 sq ft of greenhouse and you can cover 90% of the floor area with flats, how many flats can you grow if the flats are 11" x 22"? What if the flats are 10" by 20"? If you are already producing, develop a written summary or outline of what is produced, when it is produced, and develop a one page cultural summary of key information needed by the grower (example page 4). Once schedules are developed for all crops, a greenhouse production area schedule like the one on page 5 can be prepared.

**Calculating the growing time and area required per unit.**

Once an action plan and schedule is available or completed for the crops to be produced, a good next step is to develop information about the total growing space and time required for that crop. Generally, shorter term crops requiring less space are more profitable than longer term crops requiring more space. In order to compare the production costs and profitability of apples verses oranges, or perhaps poinsettias verses petunias, the production time and area in ***square foot weeks (sq ft wks)*** (or square foot days) for a crop must be calculated.

A bedding plant flat measuring 11"x 22" will require 242 square inch or 1.7 square foot.
A square foot is 12" by 12" for a total of 144 sq inches so 242 / 144 = 1.7 sq ft.
With a production time of 5 weeks, the total production area and time is
1.7 sq ft x 5 weeks = 8.5 sq ft wks (square foot weeks).

If you have 10,000 sq ft of greenhouse bench or usable floor space, and you want to keep the greenhouse in operation for 20 weeks, you have a total of 200,000 sq ft weeks of available production area. Keeping the greenhouse full for the 20 weeks would allow production of 200,000 sq ft wks divided by 8.5 sq ft wks per flat which equals 23,529 flats. If there was a week between finishing and replanting so the turnover time was actually 6 weeks instead of 5, the number of flats that could be produced would be (200,000/10.2) or 19,608.

A 6" pot mum grown at 14" x 14" spacing (196 sq in / 144 = 1.36 sq ft)
for 10 weeks will require a **total of 13.6 sq ft wks.**

A 6" pot mum at 7"x 7" spacing (49 sg in /144 = 0.34) for 3 wks, 10"x 10" spacing (100 sq in /144 = 0.70) for 4 weeks, and 14 x 14 spacing (196 in sq / 144 = 1.36 sq ft) for 3 weeks would use a **total of 7.9 sq ft wks.**

Given the same 10,000 sq ft for 50 weeks, the number of pots would change from
(10,000 sq ft x 50 wks) / 13.6 sq ft wks per pot which equals **36,765 pots** to
(10,000 sq ft x 50 wks) / 7.9 sq ft wks per pot which equals **63,291 pots (75% more)**.

Remember, it is recommended to first produce a growing area or space utilization calender so the amount of greenhouse space used can be totaled for the year. Calculating sq ft wks to assign cost is not effective if the cost per sq ft wk is calculated based on the greenhouse being full 52 weeks a year but the greenhouse is not kept full. In a later example, it will be demonstrated that it is important to know how much of the greenhouse area is actually being used to grow crops. The house may be 30' x 100' (3000 sq ft) but the aisle and equipment area may reduce the growing area down to only 65 to 85% of the floor area. (Bench or growing area divided by the total floor area gives the percent space used.) Growing hanging baskets overhead can also be used to increase the efficiency of the growing area.

## Crop Production Action Plan Summary

**TITLE:** Pinched Poinsettia in Six-inch Pot (Michigan)
**PURPOSE:** To Produce 15,000 pots of Freedom poinsettias for shipping week 48-49 (December 1-8).
**PREPARED BY:** Biernbaum and Carlson
**DATE PREPARED:** January 3, 1995

| Step | Cultural Procedure(s) (Action Required) | Person Responsible | Week from Planting | Calendar Week | Date Done |
|---|---|---|---|---|---|
| 1 | order rooted cuttings, pot, media, etc. | Prod.Manager | -32 | 1 | |
| 2 | schedule greenhouse space (12"x12") | Prod.Manager | -32 | 1 | |
| 3 | stage I temperature & light | Grower | -1 | 31 | |
| 4 | fill pots and transplant | Grower | 0 | 32 | |
| 5 | water as needed with 100-200 ppm N | SecGrower | 0-16 | 32-49 | |
| 6 | check pH & EC weekly and graph | GrowAsst | 0-16 | 32-49 | |
| 7 | check yellow sticky cards weekly<br>apply pesticides as needed | GrowAsst<br>SecGrower | 0-16 | 32-49 | |
| 8 | control *Pythium* & *Rhizoctonia*<br>(drenches @ 4, 8, 12 weeks) | SecGrower | 0-16 | 32-49 | |
| 9 | pinch plants to 5-7 nodes | SecGrower | 3 | 35 | |
| 10 | check height weekly and graph | GrowAsst | 3-15 | 35-47 | |
| 11 | Start night break lighting | SecGrow | 4 | 36 | |
| 12 | apply DIF or Cycocel as needed | Grower | 4-14 | 37-47 | |
| 13 | start short days/turn off lights<br>stage II temperature and light | Grower | 8 | 40 | |
| 14 | watch for first color (by Nov 1) | SecGrower | 12 | 44 | |
| 15 | stage III temperature and light<br>bract expansion | Grower | 12 | 44 | |
| 16 | apply Ca sprays to bracts (400 ppm) | SecGrower | 12-15 | 44-47 | |
| 17 | stage IV temperature and light<br>bract color intensity | Grower | 15 | 47 | |
| 18 | lower media nutrient levels | SecGrower | 15 | 47 | |
| 19 | pot covers, sleeves, boxing | Grower | 16-17 | 48-49 | |
| 20 | shipping | Prod.Manager | 16-17 | 48-49 | |
| 21 | | | | | |

# "Freedom" Poinsettia Cultural Summary

**Light and Photoperiod**
- Shading may be necessary during propagation and immediately after transplanting to prevent wilting
- Once plants are established, high intensity is beneficial; shading may be needed for temperature control
- Stem elongation is sensitive to light intensity and quality; plant spacing is important to prevent stretch
- Poinsettias are short day plants, with an approximate 12 hour critical photoperiod; Freedom longer?
- Natural initiation occurs in the fall around Sept 15 to 25; to prevent flowering, light starting Sept 5.
- Freedom is an 8 week response group so will flower approximately 8 weeks after start of short days.

**Temperature**
- Day and night temps of 68 to 72 are common at the start of growth
- High night temperatures, >72-75F, will result in "heat delay" or delay in flower initiation
- Leaf unfolding rate is a function of average daily temperature and reaches a maximum around 77F.
- Plant height or stem elongation is a function of the day and night DIF (pos DIF=taller, neg DIF=shorter)
- Largest bracts are formed at temperatures around 68F, and lower temps reduce bract size
- Air temperatures can be lowered to 60 to 65 F to intensify bract color following bract development
- Temperatures below 55 increase the probability of root rot diseases and are to be avoided

**Water and Fertilizer Requirements**
- Poinsettias are tolerant of dry conditions but best growth is obtained with regular watering
- Fertilization requirements for NPK are moderate, not high as often stated in older literature; levels of 150 N - 10 P - 150 K - 100 Ca - 30 Mg - 30 S are desirable for routine applications; root medium EC should be maintained around 0.5 to 0.8 mS for a 1:2 extract or 1.0 to 2.0 for saturated media extract (SME)
- Possible deficiencies include calcium, magnesium, and molybdenum; only routine levels are needed to prevent symptoms, important point is to not let levels get low. Do not provide excess magnesium.
- Root medium pH management is even more important when lower nitrogen levels are used.
- Cultivars susceptible to bract edge burn (BEB) should be sprayed with 400 ppm Ca from CaCl weekly between first color and full color

**Height Control and Growth Regulators**
- Proper pinching (hard pinch or soft pinch with leaf removal) will greatly influence height and quality
- Number of visible leaves on lateral branches at the start of short days should be approximately 6 for Freedom, with 3 leaves unfolded and developed (expanded).
- Using the DIF between day and night temperature should be the first height control option; most beneficial during the rapid elongation phase, not after bract development; use graphical tracking
- Growth regulators, particularly Cycocel as a 750 to 1500 ppm spray or Sumagic as spray or drench can be used to control plant height. Most effective between 10-14 days after pinch and 2 weeks after start of short days. Late applications will reduce bract size, except possibly Sumagic drench.

**Pest and Disease Control Considerations**
- Most common insect pests are white fly, fungus gnats, and thrips
- Poinsettias are sensitive to root rot organisms such pythium and rhizoctonia
- Under high humidity conditions, botrytis and powdery mildew can form on leaves or bracts

Prepared for HRT 322 by John Biernbaum, Michigan State University, 9/98

**Greenhouse Space Utilization Schedule by Calender Week**

**Weeks of the Year**

| House | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 East | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 West | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 East | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 West | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 East | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 West | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 East | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 West | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Crop Codes:

| | Color | Crop |
|---|---|---|
| 1. | Red | Poinsettias |
| 2. | Purple | Easter Lilies |
| 3. | Green | Geraniums |
| 4. | Yellow | Hardy Mums |
| 5. | Orange | Chrysanthemums |
| 6. | Blue | Other |

## Step 2. Calculating Variable or Direct Costs

Variable or Direct Costs are defined as costs associated with a specific crop and assigned to that crop individually. Plant material (seed, cuttings, etc), growing container and root media costs typically account for a large part of the variable costs while fertilizers, water and chemicals are a relatively small part of the cost. Packaging costs vary significantly by crop. Labor and utilities can be considered a fixed cost or they can be handled as a variable cost.

When calculating cost per unit as shown in the following examples, the purchase price of bulk material quantities needs to be divided by the number of units to get the per unit price. This can be done after the crop is finished from receipts or before the crop is grown using prices from catalogs or quotes. It is possible to produce the crop on paper before actually planting to get an idea of costs and how they can be controlled.

If a case of pots is $50 for 500, what is the price per pot? $50 divided by 500 equals equals $0.10 per pot.

If media costs $7.50 per three cubic foot bag, and one cubic foot fills twenty, six inch azalea pots, the media cost per pot is $7.50 divided by 3 cu ft, divided by 20 pots per cu ft which equals $0.125 per pot. Tables of values for containers filled per cubic foot or yard or bag are available from media suppliers or greenhouse operation text books.

**Calculating the cost of fertilizer and chemical applications. (Product costs are examples only and mention of a product does not imply an endorsement or recommendation.)**

If the production cost is being determined from actual receipts after the crop has been grown, the purchase cost of supplies like fertilizer or chemicals can be divided by the number of pots produced to determine the price per pot. For example, if 10 bags of fertilizer at $25 per bag were used to produce 10,000 pots of something, the cost per plant is $200 (10 bags time x $20) divided by 10,000 which equal $0.02.

Cost estimates can also be made even before the crop is grown. Some basic assumptions about the amount of material to be applied will allow an adequate estimate. Following are some examples.

1. Assume a pinched poinsettia in a six inch pot is fertilized at every irrigation with 10 fluid ounces of 150 ppm nitrogen from 20-10-20 water soluble fertilizer ($20/25 lb bag). The crop is grown for 15 weeks (105 days) and fertilized/irrigated every 3 days on average. What is the value of the fertilizer applied per pot?

Suggested steps:

a. How much fertilizer is required per gallon of solution?

$$\frac{(\text{ppm}) \times (\text{stock volume}) \times (\text{stock concentration})}{(\%\ \text{N in fertilizer}) \times (1200)} = \frac{(150) \times (1) \times (1)}{(20) \times (1200)} = 0.00625 \text{ lbs per gallon}$$

b. How many gallons of fertilizer solution are applied to the plant?
105 days divide by 3 days = 35 irrigations x 10 ounce each = 350 ounce divided by 128 ounce/gal = 2.75 gallon

c. How much fertilizer is in that many gallons of fertilizer solution? 0.00625 lbs/gal x 2.75 gallon = 0.017 lb

d. What is the cost of 0.017 lb of fertilizer if 25 lbs cost $20? $20/ 25 lbs = $0.80/lb x 0.017 lb = **$0.0136 (1.4 cent)**

2. A spray of 1500 ppm Cycocel is applied to the poinsettia. Assume one gallon of spray will cover 200 square feet

of bench and there is one plant per square foot. The cost of the Cycocel is $73/quart and the concentration in the bottle is 11.8% AI (1%=10,000 ppm).
a. How much Cycocel per gal? From look up table - 1.6 oz per gallon for 1500 ppm
b. Cost of 1.6 ounce CCC? $73 per qt divide by 16 ounce per qt = $4.56/ounce times 1.63 ounce = $7.44 per gal
c. How much per pot? $7.44 divide by 200 pots = **$0.037 per pot (3.7 cent)**

3. A drench of Subdue and Cleary's fungicides (mixed in the drench tank) is made to control *Pythium* and *Rhizoctonia* root rot fungi. The recommended rate is 0.5 fluid ounce of Subdue per 100 gallon and 8 oz/100 gal for Clearys. Ten fluid ounces of diluted solution are applied per pot. The concentrated Subdue costs $293 per gallon and the Clearys cost $48 per pound. What is the cost per pot to apply both fungicides?
a. How much does 0.5 fl oz of Subdue cost? $293/gal divide by 128 ounce/gal = $2.29/ounce x 0.5 ounce= $1.14
b. How much does 8 oz of Clearys cost? $48/lb divide by 16 oz /lb = $3/ounce x 8 ounce = $24 ($25.14 Total)
c. How many pots can be treated with 100 gallons? (100 gal x 128 ounce/gal) divide by 10 ounce/pot = 1280 pots
d. How much does it cost to treat 1 pot? $ $25.14 divide by 1280 pots **= $0.0196/pot (1.9 cent)**

4. Assume Marathon is applied to poinsettias at the rate of 1.3 grams per six inch pot. The cost of 5 pounds of Marathon is $100. What is the cost per pot for the Marathon?
   a. How many grams/pound? 454 grams per pound
   b. How many grams/5 pounds? 2270
   c. What is the cost per gram? $100 divide by 2270 grams = $0.044 per gram
   d. What is the cost per pot? $0.044 times 1.3 = **$0.057 / pot (5.7 cent)**

**All the variable costs can then be totaled as shown in the example on page 8.**

**Labor Costs**

Labor costs can be assigned as a variable cost if the production time per unit can be determined (ie, filling the pot with media and planting or transplanting, moving the plant, watering, chemical applications, etc) and multiplied by the hourly cost of labor. For example, if it takes 5 workers with a total hourly cost per person of $10 (wages, takes, insurance or benefits), 10 hours to plant 10,000 pots of poinsettias and move them to the greenhouse, the cost would be 5 times $10 times 10 hours which equals $500, divided by 10,000 plants, equals $0.05 per pot.

In a very limited number of large greenhouses, cost of labor is done by computer by using bar codes for each task and each employee. The code for a particular task, for example, pinching poinsettias is scanned with the employees ID card when an employee starts and finishes pinching. The computer can add up all the time spent by all employees pinching poinsettias and assign that cost to that crop. It could also add up planting time, watering time, pest control, etc so the total labor cost in hours can be determined.

**Utility Costs**

Utility costs can also be broken down per month or week and assigned depending on what area the crop occupies and when the crop is in the greenhouse. If utility costs are $20,000 annually and the greenhouse bench or growing space is 10,000 square feet, the costs per square foot is $20,000 divided by 10,000 sq ft which equals $2.00/sg ft. If the greenhouse was full 48 weeks, utility costs per sq ft wk would be $2.00 divided by 48 which equals $0.042 per week. Utility costs are usually available on a monthly basis and cost per sq ft wk can be estimated by month since there is a large difference in heating costs. It has been suggested that one rate might be used for Dec, Jan, Feb, a second rate for Oct, Nov, Mar, a third rate for Sept, Apr, May, and a fourth rate for June, July, August if the greenhouse is in use year round.

**An example energy calculation using sq ft wks is provided on page 9.**

## Step 3: Calculating Fixed or Overhead Costs:

All other costs that cannot be efficiently assigned to a specific crop are added together and assigned to each crop depending on the area used and the length of time in the greenhouse. Based on the opinions expressed by a variety of growers, fixed costs can either be assigned equally across the year or can be allotted more or less to a particular season or production time. Some growers feel that greenhouse space is worth more in the spring than the fall and that a higher percentage of fixed costs can be assigned in the spring than the fall.

The cost of greenhouse construction, equipment purchased and the amount of money borrowed will have the largest impact on the overhead costs. With typical construction costs ranging from $5 to $25 /sq ft, the overhead costs can vary dramatically. If the construction is financed with a high interest rate or a short payback period, the cost can increase even more. Clearly cost planning like this is best done before the greenhouse is built. A construction plan with cost estimated can be used to develop a total construction cost so loan and financing information can then be used to determine monthly overhead costs. Rough Brothers greenhouse construction company has a spreadsheet program available to greenhouse operators to help them determine the costs of new construction and expansion.

**Examples of Fixed (Overhead) Cost Calculations: (These numbers are only examples, actual costs may be different. There are also many other costs that could be added to this list. For this example, utility and labor costs are included as part of the fixed cost.) Actual numbers are usually provided by an accountant's report.**

| **Item** | $ |
|---|---|
| Greenhouse and Property Loan Payment | 41,000 ( $3417/month) |
| Property Taxes | 6,000 |
| Insurance | 2,000 |
| Electricity | 2,500 |
| Natural Gas | 6,000 |
| Truck Rental and Delivery Costs | 5,000 |
| Production and Shipping Labor | 75,000 |
| Administrative and Clerical Labor | 10,000 |
| Office Operating Expenses | 2,500 |
| Total | 150,000 |

**Total costs divided by the number of square feet and the number of weeks gives $/sq ft wk**

$150,000 / (42,000 square feet * 0.90 growing space) / 20 weeks = $ 0.20 / sg ft wk)

Influenced by the number or weeks in production:

$150,000 / (42,000 square feet * 0.90 growing space) / **40 weeks** = $ 0.10 / sg ft wk (37,800 sq ft)

Influenced by the efficiency of the growing area:

$150,000 / (42,000 square feet * **0.70 growing space**) / 40 weeks = $ 0.127 / sg ft wk (29,400 sq ft)

$150,000 / (42,000 square feet * **1.20 growing space**) / 40 weeks = $ 0.075 / sg ft wk (50,400 sq ft)

(> 100% due to hanging baskets)

The fixed cost can range from a few cents per square foot week when the greenhouse is paid for to up to $0.20 or more for a small greenhouse or when an expensive greenhouse is financed. One frequently cited study completed in 1980 at North Carolina State University by Robin Brumfield and others estimated the overhead cost of greenhouses surveyed was $0.208, $0.154, and $0.148 for small, medium and large firms.

**Calculating Total Fixed or Overhead Costs using Square foot weeks (sq ft wks) for a crop:**
A bedding plant flat measuring 11"x 22" will require 242 square inch or 1.7 square foot and if the production time is 5 weeks, the total production area and time is 1.7 sq ft x 5 weeks = 8.5 sq ft wks. If the cost per square foot week is $0.10, the **fixed cost per flat is $0.85.**

A 6" pot mum grown at 14" x 14" spacing (196 sq in / 144 = 1.36 sq ft) for 10 weeks will require 13.6 sq ft wks and would have a **fixed cost per pot of $1.36.** A 6" pot mum grown at 7" x 7", 10" x 10", and 14 x 14 spacing would use a total of 7.9 sq ft wks. The total **fixed cost would be $0.79** at a rate of $0.10 per sq ft wk. This method does not take in to account that there would be a higher labor cost with spacing the plants an additional 2 times.

*Remember: It is recommended to first produce a growing area or space utilization calender so the amount of greenhouse space used can be totaled for the year. Calculating sq ft wks to assign cost is not effective if the cost per sq ft wk is calculated based on the greenhouse being full 52 weeks a year but the greenhouse is not kept full.*

## Step 4. Totaling all costs and determining Profit or Loss per sq ft wk

The final step is to bring all the costs together. One example of how this can be done is on the following page (page 8). All of the costs can be added and compared to the selling price. Adjustments made need to be made based on crop losses and the desired profit margin.

Probably one of the most important calculations is to determine the profit or loss per square foot week of production. If the greenhouse rotation was poinsettias, Easter lilies, geraniums and hardy mums, with a few standard mums every week of the year, one way to compare the relative profitability of the crops is to compare the profit per sq ft wk. While this shows the difference between crops, comparing a fall crop with a spring crop does not take into consideration the market potential for a given season. Using the profit per sq ft wk to compare profitability is even more useful if one makes comparisons between crops produced during the same growing season. One example would be comparing different container sizes of the same crop. Another example would be the relative cost effectiveness of putting more cuttings in a hanging basket and shortening the crop time verses using fewer cuttings and lengthening the crop time. In general, crops that require less space and shorter production times can often generate a higher profit, particularly when fixed costs are high.

| Crop | Total Weeks | Total sq ft weeks | Cost to Produce | Selling Price | Profit or Loss | Prof/loss /sq ft wk | Gross Income | Net Prof/loss |
|---|---|---|---|---|---|---|---|---|
| Pointsettia | 15 | 12.75 | $4.74 | $3.95 | -$0.79 | -$0.062 | $51,192 | -$10,238 |
| Easter Lily | 15 | 7.5 | $3.95 | $4.10 | +$0.15 | +$0.02 | $106,272 | +3,888 |
| Geranium | 5 | 0.55 | $0.50 | $0.65 | +$0.15 | +0.27 | $ 75,816 | +19,829 |
| Hardy Mum | 10 | 8.5 | $2.50 | $2.50 | 0 | 0 | $32,400 | 0 |
| Pot Mum | 12 | 10.26 | $4.54 | $4.25 | -$0.29 | -$0.028 | $42,432 | -$2,895 |
| Totals | | | | | | | $308,112 | +10,583 |

Notice that both poinsettias and lilies took about 15 weeks to produce. The lilies were grown at much smaller spacing (7x8 compared to 12x12), which reduced the fixed costs per unit and help make the crop profitable. Another possible example is that both lilies and geraniums had a per unit profit of $0.15. However, since geraniums require much less space and time, the profit per sq ft wk is over 10 times as much for geraniums. Together with the fact that there was a lot more geraniums produced, this makes geraniums the most profitable crop. Other relevant points include the importance of paying fixed costs with the crops showing losses, so the losses are small.

## Crop Summary: Poinsettia

**Variable Cost per Unit:**

| Item | Description | Purchase Cost ($) | $ per unit |
|---|---|---|---|
| 1. Plant Material | rooted poinsettia cutting | $50/100 | 0.50 |
| 2. Growing Container | 6" azalea pot | $50/500 case | 0.10 |
| 3. Root Medium | bulk peat-lite media (16 pots/cuft) | $7.50/ 3 cuft bag | 0.125 |
| 4. Fertilizer | 20-10-20, 150 ppm CLF (15 wk/3 days)x 10 oz = 2.75 gallons) | $20/25 lbs | 0.014 |
| 5. Chemicals | Cycocel @ 1500 ppm | $73/qt | 0.037 |
| 6. Pesticides | Marathon (1.3 gram/pot)<br>Fungicide (3 drenches) | $100/5lbs | 0.057<br>0.06 |
| 7. Labor | (Calculated as fixed cost) | | |
| 8. Packaging/shipping | pot cover, sleeve, care tag, box | ??? | 0.35 |
| Total | | | 1.25 |

**Square foot weeks of Production Area and Fuel Costs per Unit:**

| Week(s) (Stage) A | Temp (D/N) B | Spacing (in x in) C | $ft^2$ (C/144) D | Total Weeks E | $ft^2$ wks (D x E) F | Fuel Cost $/ft^2$ wk G | Fuel $/pot (F x G) |
|---|---|---|---|---|---|---|---|
| 0-5 (I) | 70 | 12 x 12 | 1 | 5 | 5 | 0.04 | 0.20 |
| 6-10 (II) | 65 | 12 x 12 | 1 | 5 | 5 | 0.05 | 0.25 |
| 11-15(III) | 60 | 12 x 12 | 1 | 5 | 5 | 0.05 | 0.25 |
| Totals | | | | 15 | 15 | | 0.70 |

**Fixed Costs per Unit:**

Cost per $ft^2$ week: $ 0,10 Crop time in $ft^2$ week: 15 Fixed Cost per Unit: $1.50

(Total of column F from previous table) (Cost x sq ft wk)

**Summary of Costs:**

Variable Cost Per Pot: (*1) $ 1.25 (36 %)

Fuel Costs Per Pot: (*2) $ 0.70 (20 %)

Fixed Costs Per Pot: (*3) $ 1.50 (44 %)

Total Costs Per Pot: $ 3.45 (100%)

**Profit Loss Statement:**

Selling Price Per Pot: $ 4.00

Total Cost Per Pot: $ 3.45

Profit/Loss Per Pot: $ 0.55

**Profit/Loss Per $ft^2$ wk: $ 0.037** *******

**Accounting for Product not sold:**

Not all of the crop will be sold and this needs to be accounted for when estimating true or actual costs of production. Crop losses can range from 2 to 3 % up to 10% depending on the crop and the market standards. If income is based on selling 1000 plants at $5.00 but only 950 plants sell and 50 are discarded, the difference in income is $5000 verses $4750 or $250. To get $5000 from 950 plants the price would have to be $5.26. The $0.26 difference can be important to the bottom line, and the number of plants sold in a competitive market.

**Profit Margins**

Two Different methods, margin of selling price and mark-up of cost. For example, a margin of 25% is equal to a mark-up of 33.3%. (ie, multiply cost by 1.333 for 25% margin) From the example on the previous page the profit margin would be $10,583 divided by $308,112 or (0.034) 3.4%. (Assumption was all costs were met first, including salaries.)

| Margin % of Selling Price | Mark-up % of cost |
|---|---|
| 5% | 5.3% |
| 10% | 11.1% |
| 15% | 17.7% |
| 20% | 25.0% |
| 25% | 33.3% |
| 30% | 42.9% |
| 35% | 53.8% |

**Range of Gross Income Values** (How much income is possible from a greenhouse?)

*Gross income*: total number of plants sold times selling price

*Net income*: profit per plant (selling price minus cost of production) times the number of pots sold.

Low end for part year bedding plant production, high end for year round potted plant production.

Value per square foot: Ranges from $4 to $16
Value per acre: Ranges from $175,000 to $700,000

The example provided on the previous page was for a 22, 800 sq ft greenhouse so the value per square foot was $308,112 divided by 22,800 sg ft which equals $13.51 per sq ft. Multiplying by 43,560 sq ft per acre gives a value of $588,656 per acre. The values are on the high end but are intended to represent a pot plant production greenhouse maintained full most of the time.

## Summary

This is a quick review of basic cost accounting methods. While more detailed records will allow more accuracy and confidence in the results, in many cases an estimate of profitability will help provide the necessary financial protection and confidence to help improve the quality of life.

**References:**

Production Costs chapters in the *Tips on Growing Series* (Poinsettias, Easter lilies, Chrysanthemums, Hanging Baskets, Bedding Plants) that provide some of the best information.
Chapter 18, Business Management, in Greenhouse Operation and Management by Paul Nelson.
Cost of production chapter in Bedding Plants IV, from Ball Publishing.

# Example Crop Cost Calculations Template

**Crop:**_____ **Cultivar:**_____

## Variable Costs per Unit:

| Item | Description | Purchase Cost ($) | $ per unit |
|---|---|---|---|
| 1. Plant Material | | | |
| 2. Growing Container | | | |
| 3. Root Medium | | | |
| 4. Fertilizer | | | |
| 5. Chemicals | | | |
| 6. Pesticides | | | |
| 7. | | | |
| 8. Packaging/shipping | | | |
| Total | | | *1 |

## Square Foot Weeks and Possible Fuel Costs per Unit:

| Week(s) (Stage) A | Temp (D/N) B | Spacing (in x in) C | $ft^2$ (C/144) D | Total Weeks E | $ft^2$ wks (D x E) F | Fuel Cost $/ft^2$ wk G | Fuel $/pot (FxG) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Totals | | | | | | | *2 |

## Fixed Costs:

Cost per $ft^2$ week: $_____ Area per unit in $ft^2$ week:_____ Fixed Cost per Unit: $_____

(Total of column F from previous table) (Cost x sq ft wk)

## Summary of Costs:

Variable Cost Per Pot: (*1) $_____ (____ %)

Fuel Costs Per Pot: (*2) $_____ (____ %)

Fixed Costs Per Pot: (*3) $_____ (____ %)

Total Costs Per Pot: $_____ (100%)

## Profit Loss Statement:

Selling Price Per Pot: $_____

Total Cost Per Pot: $_____

Profit/Loss Per Pot: $_____

Profit/Loss Per $ft^2$ wk: $_____