Engineering, Economics Structures and Innovations

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Production Cost Budgets for Selected Varieties of Cut Flowers in Mississippi

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Index Words: cut flower, sunflower, celosia, gypsophila, zinnia, budgets, production costs

Nature of Work: Cut flower production is an industry that is rapidly growing and changing. World cut flower consumption increased from 12.5 billion dollars in 1985 to 31 billion dollars in 1995. Internationally cut flower consumption is concentrated in three regions: Western Europe, North America, and Japan. The highest growth is expected to occur in the U.S. and Japan. In the early 1990s, farmers began to diversify into high-value crops, and they were willing to reduce if not stop producing traditional crops such as wheat, cotton, and oats. Studies conducted in Kansas, Texas, and Oklahoma have determined that half an acre of cut flowers have a potential net income of $10,000 annually (1).

The objective of this study was to develop production budgets for four selected cut flower varieties. The selected flower varieties were Sunflower (*Helianthus annuus*), Celosia (*Celosia argentea*), Gypsophila (*Gypsophila paniculata*), and Zinnia (*Zinnia elegans*). This research is the economic component of an ongoing project to study cut flower production as an alternative enterprise for small acreage farmers in Mississippi.

Results and Discussion: Costs were categorized as variable or fixed. Variable costs are production expenses associated with the materials and chemicals needed to produce a stem of a flower. Variable costs will vary with production. These data were imputed from the results of flower production experiments conducted at the North Mississippi Research and Extension Center. Production methods were patterned after typical small-scale vegetable growers.

Labor required for each production task was recorded as the time it took to complete the task and the number of times a task was repeated during the production period. Labor cost was calculated at $6.44 per hour. This rate included employees' benefits: social security, unemployment insurance, workman's compensation, disability insurance, paid holidays, and sick days. Input costs were based on current prices reported by local and regional input suppliers. The necessity of machinery and equipment was determined by the cultural practices used by researchers at the North Mississippi Research and Extension Center for the four varieties of cut flowers designated in the research project. Machinery and equipment cost was estimated using per-acre performance rates for vegetable equipment as published in the Vegetables 2002 Planning Budgets, Department of Agricultural Economics, Mississippi State University (2).

Fixed and overhead costs for a typical flower grower include depreciation, interest on investment, insurance, taxes, rent, and other items that could not be allocated to a specific crop and therefore were allocated on a cost per acre basis. Investment cost was determined from conversations with researchers, farmers and equipment dealers. Depreciation was estimated using a straight-line method based on purchase price divided by years of useful life of the equipment and machinery used in production. Insurance and taxes were estimated as two percent of the initial cost of investment. The average cost of interest on investment was calculated at six percent of half the initial purchase price of machinery and equipment. Total investment in equipment and refrigeration was estimated to be $53,322, with an estimated annual fixed cost of $8,348.

Flowers were grown on raised beds, 100 feet long by 30 inches wide, using black plastic mulch and drip irrigation similar to current methods used in vegetable production. It was further assumed that for one-acre production only half the land would be in actual flower production, with the other half acre devoted to walking paths and roadways. The beds occupy 21,500ft^2 with two rows of plants per bed. Each bed is 250ft^2, which results in having 86 beds per acre. The spaces between plants in a row were as follows: Zinnias, 12 inches apart; Celosia, 12 inches apart; Sunflower, 9 inches apart; Gypsophila, 24 inches apart. Calculating the length of a bed in inches (1,200") and then dividing by the space between plants and then multiplying by two (number of rows in a bed), yielded the number of plants per bed for each variety. The results were: Zinnias, 200 plants per bed; Celosia, 200 plants per bed; Sunflower, 266 pants per bed; Gypsophila, 100 plants per bed. Multiplying the number of plants on each bed by the number of beds (86) in an acre produced the number of plants used by each variety in an acre. Zinnias, 200 x 86 = 17,200 plants; Celosia, 200 x 86 = 17,200 plants; Sunflower, 266 x 86 = 22,876 plants; Gypsophila, 100 x 86 = 8,600 plants.

Harvest data per unit of production was based on plant trials conducted by researchers at the North Mississippi Research and Extension Center at Verona. Average units per plant were calculated as total production of stems divided by the number of plants in the trial. Average units per plant for Sunflower varieties were one stem per plant. Total production (stems per acre), number of flowers planted (22,876) times the average stems produced per plant (1), was 22,876 stems. Sunflowers were assumed to yield 80% marketable stems or 18,300 stems.

These data also were used to calculate the labor hours needed to harvest an acre of sunflowers. It has been estimated that a person can harvest twelve stems per minute or 720 stems per hour. Taking this number (720S/H) and dividing the total market stems (18,300) suggests it will take 25 hours of labor to harvest an acre of sunflowers.

Similar procedures were used to calculate the number of marketable stems and harvest labor hours needed for the four varieties. The following list shows stem production and harvest hours needed for the other three varieties of flowers in the study. Gypsophila produced 8,600 plants yielding 120,400 stems per acre. Grading yielded 70 percent or 84,280 marketable stems. Harvest labor per acre of production is 200 hours, averaging seven stems per minute. Celosia produced 17,200 plants yielding 172,000 stems per acre. Grading yielded 60 percent or 103,200 marketable stems. About 215 hours of harvest labor is required for one acre of Celosia, averaging 8 stems per minute. Zinnia produced 17,200 plants yielding 430,000 stems per acre. Grading yielded 60 percent or 258,000 marketable stems. The labor required to harvest one acre of Zinnia is 359 hours, at 12 stems per minute.

Cost estimates for land, management and marketing are not included in this report. Production budgets for the four selected varieties of cut flowers resulted in the following cost per acre: Sunflower - $13,254 per acre or $.73 per stem (Table 1); Gypsophila - $18,734 per acre or $.22 per stem (Table 2); Celosia - $15,181 per acre or $.16 per stem (Table 3); and Zinnia - $14,802 per acre or $.06 per stem (Table 4).

Significance to Industry: Production budgets in this study are estimates and serve as a guide for planning purposes. New producers must develop budgets for their own circumstances since flowers vary tremendously in their types, production method, and markets where they can be sold. Producers must design a unique strategy customized to their abilities and resources.

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Table 1. Total cost of producing one acre of Sunflowers.

Item	Annual Cost/Acre	Cost/. sq. ft.	Cost/Stem
Total Fixed Cost	$8348	$.39	$.46
Total Raw Materials/Inputs	$4242	$.20	$.23
Total Labor Cost	$664	$.03	$.04
Total Cost	**$13,254**	**$.62**	**$.73**

Table 2. Total cost of producing one acre of Gypsophila.

Item	Annual Cost/Acre	Cost/. sq. ft.	Cost/Stem
Total Fixed Cost	$8348	$.39	$.10
Total Raw Materials/Inputs	$8372	$.39	$.10
Total Labor Cost	$2014	$.09	$.02
Total Cost	**$18,734**	**$.87**	**$.22**

Table 3. Total cost of producing one acre of Celosia.

Item	Annual Cost/Acre	Cost/. sq. ft.	Cost/Stem
Total Fixed Cost	$8348	$.39	$.09
Total Raw materials/ Inputs	$4704	$.29	$.05
Total Labor Cost	$2129	$.10	$.02
Total Cost	**$15,181**	**$.78**	**$.16**

Table 4. Total cost of producing one acre of Zinnia.

Item	Annual Cost/Acre	Cost/. sq. ft.	Cost/Stem
Total Fixed Cost	$8348	$.39	$.03
Total Raw Materials/ Inputs	$3846	$.18	$.02
Total Labor Cost	$2608	$.12	$.01
Total Cost	$14,802	$.69	$.06

The Value of All-America Selections Trial and Display Gardens to Land Grant Institutions

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Index words: vegetables, bedding plants, flowers, cultivar evaluation

Nature of Work: The All-America Selections (AAS) program was founded in 1932 by W. Ray Hastings, president of the Southern Seedsmen's Association. The initial proposal was to encourage seed companies to develop trial grounds where new varieties of plants produced from seed could be tested for garden performance, and seed companies were encouraged to submit their promising, unsold varieties to the AAS program for evaluation. Varieties that proved superior across the initial 10 trial sites, as determined by impartial AAS judges, were designated AAS Winners. AAS does not directly market its selections, but does publicize information regarding the AAS winners through various outlets such as gardening magazines, newspapers, garden club networks, and Cooperative Extension publications and activities. The number of trial ground locations has expanded from the initial 10 locations (Table 1), and a large network of AAS Display Gardens are in place to allow the public to view recent AAS winners. From this data it is obvious that AAS has a strong partnership with Land-Grant institutions. At a time when many universities are facing significant budget cuts, it may be worthwhile to reflect on the value of this partnership.

Results and Discussion: The University of Kentucky has participated in AAS trials for more than 40 years and currently participates in three areas of the AAS program: Flower Trials, Display Garden, and the newly-established Cool Season Bedding Plant Trials. Both of the trials and the garden are grown at the University of Kentucky Arboretum. The AAS program provides seeds, cultural information, and publicity regarding the location of trial and display gardens, but does not otherwise compensate the participants for their involvement in the program. However, we believe there are several benefits of being involved in the AAS trials and display garden. Local plant evaluations benefit the local industry. While the AAS program seeks to recognize plant varieties that perform well across North America, in some instances, selections may not perform well in a particular environment. For example, the Peter Pan Zinnias series (three AAS winners in the late 1970s and 1980) exhibited poor performance in our trials due to disease pressure under Kentucky growing conditions. Even though the new growth habit exhibited by this series made them desirable, we were able to caution local growers regarding potential disease issues with these plants. However, superior selections can also be brought to the growers' attention. The inclusion in the trials of an outstanding petunia, later named 'Purple Wave' (Winner in 1995), allowed us to promote this exceptional plant to local growers when it was released for sale. Apart from grower interaction, the trials and display garden also provide educational opportunities to the community through the outreach programs of the Kentucky Cooperative Extension Service and the University of Kentucky Arboretum. These plantings also provide plant material for at least three formal courses in the Department of Horticulture. For these reasons, we feel that participating in the AAS trials and Display Garden fits well with the University of Kentucky's Land-Grant mission.

Significance to the Industry: The network of trial grounds and display gardens allow growers to view winners and potential winners (although identified only by anonymous entry numbers) and evaluate their performance under local growing conditions. Our gardens are open to the public year-round, and we participate with local grower organizations to arrange field days and visits to the trial grounds and display garden. At a time when the industry relies heavily on trade-mark recognition, especially of clonally propagated cultivars, the AAS Winner designation is a way to identify superior varieties of seed propagated flowers and vegetables. The network that AAS has established with Cooperative Extension personnel, garden clubs, and garden writers ensures that the AAS Winners are well publicized to the gardening public. To realize the significance to the industry of AAS Winners, one need only name a few: Zinnia 'Profusion Cherry' (1999), 'Profusion Orange' (1999), and 'Profusion White' (2001), all three designated as Gold Medal Winners by AAS; Petunia 'Purple Wave' (1995), 'Lavender Wave' (2002), and 'Blue Wave' (2003); Ornamental Millet 'Purple Majesty' (Gold Medal Winner, 2003); Swiss Chard 'Bright Lights' (1998), and Tomato 'Celebrity' (1984). Some older AAS Winners also continue to be industry standards such as the Snapdragon Rocket series (1960) and Broccoli 'Green Comet' (1969). When given an opportunity to do so, the seed and bedding plant industry should recognize the important contribution the All-America Selections program has made and the role Land-Grant institutions have played in this endeavor.

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Table 1. All-America Selections Trial and Display Gardens and their locations for 2003.

Proving Ground	Locations	States/provinces represented
Flower Trials	32	USA: CA, CO*, FL, GA*, IL*, KY*,ME, MA, MI*, MS*, NE, OK*, OR, PA*,SC, SD*, TN*,TX, WI Canada: AB, BC, ON, PE, QC
Bedding Plant Trials	22	USA: CA, CO, FL, IL*, MA, MI*, NE, NC*, OR, PA*, SC, TN* Canada: BC, ON, PE, QC
Vegetable Trials	21	USA: CA, CO, CT*, GA, IL, ME, MI*, MS*, NY, OK*, OR, PA*, SC Canada: AB, ON, PE, QC
Display Gardens	181	USA: 43 states, Canada: 7 provinces, one location in Japan

*Indicates involvement by a Land Grant Institution.

A New On-line Educational and Research Resource for Crape Myrtles (*Lagerstroemia* spp.)

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Index Words: cultivar database, culture and management, website

Nature of Work: While crape myrtles (*Lagerstroemia* spp.) is native to Southeast Asia (4, 5, 10), it has become a favorite woody ornamental in U.S. gardens and landscapes since the late 1700's (4, 5). A characteristic and prolonged summer flowering with a diversity of flower colors, plant sizes and growth habits, along with its relatively easy propagation and production, led to its wide distribution and use throughout southeastern U.S. gardens by the mid to late 1800's (5). This widespread use has led to the categorization of *Lagerstroemia* as a 'naturalized' U.S. plant (6), a status crowned with its recent designation (in 1997) as the Official Shrub for the State of Texas.

We have launched the development and release of an educational *Lagerstroemia* website (http://dallas.tamu.edu/woody/cmyrtle/index.html) which covers information on its taxonomy, botany, culture and management, along with research updates, bibliographical information and links to other educational websites with related information. A major feature of this website is a searchable database containing information and pictures on most of the commercially available ornamental cultivars of *Lagerstroemia* available in the U.S. and abroad. Next we highlight some of information and resources contained in this website.

Results and Discussion: (Summary of information and resources in the crape myrtle website.) *Lagerstroemia* is one of the approximately 31 genera composing the *Lythraceae* family (Order: *Myrtales*). Carl Linnaeus used the name *Lagerstroemia* in 1759 after his friend Magnus von Lagerstroem (1, 5, 6). Since Lagerstroem brought the plant from India, Linnaeus named it *L. indica*, when in fact the plant, being native to south and western China should have been called *L. sinensis* (or *L. chinensis*). A review of botanical and taxonomic databases points to at least 80 species. Here in the U.S. we know mostly those species of ornamental interest, namely *L. indica* and *L. fauriei* (Japanese crape myrtle). There are several other species, however, that have important commercial uses (other than as ornamentals) in other parts of the world. For instance, timber or wood from *L. speciosa* L. and *L. piriformis* Kohene, with qualities and characteristics similar to teak, is highly prized in the world market, bringing premium prices (5, 6). *L. speciosa* (L.) Pers. has been used in Southeast Asia for centuries as a medicinal plant, particularly in the treatment of diabetes. The large leaves of this plant are dried, ground and made into a tea (banaba) that has recently been confirmed to have chemical properties and effects similar to those of insulin (8).

Since its introduction to the western world in the late 1700's, *L. indica* was the primary species that provided the bulk of the ornamental cultivars and selections used throughout the world. It was not until the mid-1900's that discerning and deliberate breeding programs surfaced, primarily in the U.S. and France (5, 6, 10). Plant breeders began seeking to expand the range of plant sizes and growth habits with desirable flower colors, and eventually to develop varieties less susceptible to powdery mildew and improved cold tolerance. The pioneering interspecific hybridization (between *L. indica* and *L. fauriei*) that D. Egolf began at the US national Arboretum primarily has produced over 20 superior cultivars with powdery mildew resistance, out-standing exfoliating bark characteristics and improved cold tolerance (reliable down to USDA Zone 7a-b; 5 to 0 ºF).

There are more than 200 registered ornamental *Lagerstroemia* cultivars, and about one half of them are currently available in the horticultural trade. As mentioned above, our website (http://dallas.tamu.edu/woody/cmyrtle/index.html) features a searchable database containing information and pictures on most of these cultivars. The modern *Lagerstroemia* cultivars offer a diversity of plant sizes (30 cm (12 in) miniatures to +10 m (+33 ft) trees), growth habits (i.e. vase, globose, upright, weeping, spreading), flower colors (including bi-colored or picotée petals), length of flowering period (from 60 to 120 days) bark characteristics and foliage fall color to name a few. This diversity is the basis for its versatility and types of landscape uses, including potted and bedding plants, hanging baskets, mass plantings, hedges, street and specimen trees. Table 1 highlights some of this diversity by showing characteristics of some representative (and ornamental) *Lagerstroemia* cultivars.

Most *Lagerstroemia* propagate fairly easy by seeds or vegetatively and grow well in most soils, tolerating a relatively wide range of physical and chemical characteristics (1, 4, 5). A main requirement is full sun, as insufficient light exposure and temperatures below 20oC (68oF) impair or limit flowering (11). Landscape plants require irrigation for a period following transplant, but once established they can thrive with minimum irrigation, and are known to tolerate moderate drought conditions. Although high and frequent fertilizer applications are often employed during nursery production (2) landscape established *Lagerstroemia* plants adjust their growth and nutrient status to the existing soil fertility conditions (3). Minimal fertilization of landscape *Lagerstroemia* is recommended (1, 5, 6), and in particular the avoidance of excessive nitrogen levels, as these could delay flowering and cause undesirable nutrient imbalances (2, 3). Although there are a small number reasons to prune *Lagerstroemia*, including the removal of suckers, dead, rubbing and broken branches, the wide range of plant sizes and growth habits available in today's cultivar palette should minimize or practically eliminate pruning requirements. Removal of old flower and fruit structures and light pruning that accentuates the natural character of the individual cultivar are about the only horticulturally-sound recommendations, both contrary to the widely practiced and severe cutback or "stump-cutting" pruning (1). Modern *Lagerstroemia* cultivars are fairly pest and disease tolerant. Powdery mildew (*Erysiphe lagerstroemiae* West) is the most common disease affecting *L. indica* cultivars, but modern interspecific hybrids containing *L. fauriei* germplasm are resistant (7). Insect problems are mostly limited to the aphid *Tinocallis kahawaluokalani* (9), which causes distortions in tender leaf tissues and lays copious honeydew excretions on leaves. This honeydew serves as substrate for sooty mold fungi, which could significantly reduce photosynthesis by blocking sunlight. Large plants and those with *L. fauriei* germplasm appear to be more susceptible to aphid attacks (9). Other reported minor pests are Japanese beetles (*Popilla japonica*) and flea beetles (*Altica* species), which in recent years have been reported as a major nuisance in nurseries in Georgia and Texas. We have recently found that *L. indica* cultivars are highly susceptible to attack and damage by the flea beetles, but most interspecific hybrids containing *L. fauriei* germplasm are resistant to the insect (Cabrera, Reinert and McKenney, In preparation).

Significance to the Industry: We believe that the educational website highlighted here will be of significant interest and utility to nursery growers, landscapers, homeowners, and horticulture students and educators. Our intention is to provide up-to-date research based information, new developments, references and links to everything related to the biology, culture and management of this versatile woody ornamental plant: the crape myrtle (*Lagerstroemia* spp.).

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Table 1. Characteristics of selected ornamental Lagerstroemia cultivars.

Cultivar Name	Mature Size (m)	Growth Habit	Flower Color	Exfoliating Bark	Cold[y] Hardiness	Disease[z] Resistance	Origin or Breeder
L. indica							
'Sacramento'	0.4 - 0.6	Miniature weeping	Pink red	---	Moderate	Poor	D. Chopin (Louisiana)
'Victor'	0.9 - 1.5	Upright dwarf	Dark red	---	Very	Good	University of Arkansas
'Velma's RD'	1.5 - 3	Compact, upright	Purple	Average	Very	Good	Kansas State University
'Prairie Lace'	1.5 - 3	Compact, upright	Pink & white	Average	Very	Fair	Oklahoma State Univ.
'Catawba'	3 - 6	Dense, globose	Purple	Average	Good	Good	U.S. Nat. Arboretum
'Wm. Toovey'	3 - 6	Vase	Pink	Average	Good	Good	Howell Nurs. (Tennessee)
Dynamite™	6 - 10	Upright	Cherry red	Average	Very	Good	C. Whitcomb (Oklahoma)
'Byers W. White'	6 - 10	Upright vase	White	Average	Very	Good	M. Byers (Alabama)
Yang Tse™	6 - 10	Upright, vigorous	Crimson red	---	Good	---	A. Desmartis (France)
L. fauriei							
'Townhouse'	4.5 - 6	Upright, spreading	White	Outstanding	Very	High	Raulston Arboretum, NC
'Kiowa'	6 - 9	Arching	White	Outstanding	Very	High	U.S. Nat. Arboretum
'Fantasy'	9 - 15	Upright, arching	White	Outstanding	Very	High	Raulston Arboretum, NC
L. indica* X *L. fauriei							
'Pocomoke'	0.4 - 0.5	Compact miniature	Dark pink	---	Good	High	U.S. Nat. Arboretum
'Acoma'	1.5 - 3	Spreading dwarf	White	Good	Very	High	U.S. Nat. Arboretum
'Tonto'	1.5 - 3	Compact globose	Red	Good	Very	High	U.S. Nat. Arboretum
'Apalachee'	3 - 6	Upright vase	Lavender	Outstanding	Very	High	U.S. Nat. Arboretum
'Tuskegee'	3 - 6	Broad spreading	Dark pink	Great	Very	High	U.S. Nat. Arboretum
'Natchez'	6 - 10	Broad, tall	White	Outstanding	Very	High	U.S. Nat. Arboretum
'Basham's P.Pk'	6 - 15	Broad, tall	Light lavender	Good	Moderate	Good	L. Lowery (Texas)

[y]Above-ground survival and performance in USDA Zone 7a.

[z]Powdery mildew resistance