

# **Engineering, Economics Structures and Innovations**

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## Economic Benefits and Value Creation

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**Index Words:** customer benefits, customer value, purchase costs, economic benefits

**Nature of Work:** A comprehensive understanding of customer needs-and-uses situations provides a nursery business with a better opportunity to create customer benefits that add value for customers. However, the overall value derived from customer benefits needs to exceed the costs of acquiring those benefits:

$$\text{Customer Value} = \text{Customer Benefits} - \text{Cost of Purchase.}$$

Creating attractive benefits at a very high cost could result in negative customer value. Thus, a business needs to be sensitive to both the benefits it creates in response to customer needs and the total cost of acquiring those benefits. In the following section, several ways will be examined in which a nursery can create customer benefits and deliver a greater value to target customers.

**Results and Discussion:** To deliver a customer value that creates a superior *economic value* requires that the customer achieve a *net economic gain*. The customer value created must be greater than that of competitors' products/services, and that it is measurable in actual savings (economic value).

There are six primary sources of economic value creation, as outlined in Figure 1. For each of the sources of economic value creation cited, a possible action or example activity that a nursery might pursue is provided.

The price paid for a product or service stands out as the most obvious cost of purchase to most customers. As a result, a nursery with a lower price and the same quality can easily communicate its economic value to target customers. Unfortunately for the nursery, a low price may not equate to profits if the firm's cost exceeds or equals the price, regardless of quality. Because customers may not look beyond a producer's price, other sources of economic value may go unnoticed. However, other sources of value creation can include costs associated with acquisition, usage, maintenance, ownership, and disposal of a product. Discovering these value creation opportunities is marketing's job and one of the key benefits of spending a day in the life of a customer.

Total Cost of Purchase :

<u>Cost of Purchase</u> Price Paid	<u>Nursery Action</u> Provide sensory and emotional experience that surpasses competitors' prices and creates customer value.
Acquisition Costs	Maintain a computerized customer order program, a newsletter, an e-mail address file, a customer data base.
Usage Costs	Reduce cost of inputs for customer (slow release fertilizer, pre-emergence, water holding media, etc.).
Maintenance Costs	Lower cost of plant maintenance by bundling (hanging baskets, plant towers, window boxes, large landscape pots, etc.)
Ownership Costs	Work with customers to create affordable ownership of expensive plants, trees, and/or shrubs.
Disposal Costs	Provide refund to customers for returned gallon and larger containers (applied to next purchase).

**Figure 1.** Economic Benefits and Value Creation

Low price: Quite often, price or terms of payment can destroy customer value. Regardless of benefits and potential economic value, the product may simply be unaffordable, or the price may be too high relative to the benefits provided.

Acquisition costs: Inventory and acquisition costs are a part of the total cost of purchase. Computers in nurseries have streamlined logistic and inventory procedures, creating economic efficiencies and cost savings.

Usage costs: The cost associated with using a product is an obvious area of potential value creation. For nursery plants, usage costs are the costs of getting variety in color, form, texture, height and type. Methods used by nurseries to bundle value include hanging baskets, large landscape pots, window boxes, plant towers, and similar multiple plantings.

Maintenance costs: For many products, the cost of repair and maintenance can be expensive for both customers and businesses. The cost of repair or replacement for products under warranty is generally the responsibility of the business that sold the product. After warranty, repair and normal maintenance are costs to the customer. For perennials and ornamental (environmental) horticulture, nurseries can extend the livability of plants with slow release fertilizer, selection of healthy plants, and use of water holding media or soil amendments.

Ownership costs: Some products are simply more expensive to own than others. Ownership also has the risk of dissatisfaction; thus the need for customer service arises at nurseries: what happens if a customer's plant dies prematurely?

Disposal costs: The way products are disposed of offers another important source of economic value creation. What does a customer do with the gallon plastic/wire-reinforced containers after the plants are planted in the customer's yard or lawn? Offering a refund applied to the purchase price of a customer's next purchase provides a win-win situation for the nursery and customer.

Other value creation techniques, beside *economic benefits*, include (a) *price performance benefits* using the quantitative assessments of relative performance [(product performance ÷ average performance) x 100] and customer value [relative performance — relative price], (b) *perceived benefits*, (c) *emotional benefits*, and (d) *customer trade-offs*.

**Significance to Industry:** Areas of customer analysis that influence customer benefits include economic benefits, perceived benefits and emotional benefits. Economic benefits are a measurable difference in savings that enables a nursery to create an economic value that is greater than that of competing products/plants/services. Although a lower price is an obvious source of economic value, there are non-price areas from which economic benefit can be created to justify a higher price. Savings derived from lower acquisition, usage, ownership, maintenance, and disposal costs offer ways to lower the total cost of purchase for a target customer. However, not all benefits can be quantified into an economic value expressed in dollar savings.

Customer benefits derived from a plant's appearance or a nursery's exceptional service or reputation are more difficult to put a dollar value on. Likewise, customer perceptions of performance have a strong influence on product preference and purchase behavior. By measuring customer perception of product or service or brand (nursery) benefit

relative to competition, an index of customer value benefits can be derived. The larger the customer value, the greater the potential to attract, satisfy, and retain customers.

Products that serve an underlying psychological need, type of personality, or personal values are creating emotional benefits that add value for the customer. Plants, like people, have personalities, and the closer a marketer positions the plant with respect to the target customer's emotional needs, the greater potential value created.

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## The Status of Computerization for U.S. Landscape Plant Producers

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**Nature of Work:** The U.S. landscape plant industry is increasingly being recognized as one of the fastest growing and healthy sectors in U.S. agriculture (Johnson and Christensen). This fact reflects demand and supply factors. One of the supply factors crucial to the success of a firm is information, both internal and external. The U.S. landscape plant industry also appears to have one of the highest rates of computerization of any agricultural sector (Putler and Zilberman). The purpose here is to examine computerization trends in the U.S. landscape plant industry from 1988 to 1998. This examination will include the different functions, such as accounting, that are being computerized. Furthermore, the relationship between gross sales and computerization are explored.

*Data:* The data used in this study were collected in 1989, 1994 and 1999 from nurseries for the production years of 1988, 1993, and 1998, respectively. A mail survey was conducted in 23 states in February, 1989; in 24 states in February, 1994, and 22 states in February, 1999. The 1988 data included 1337 usable responses while the 1993 data included 1316 usable responses and the 1998 data included 1755 usable responses. The 22 states surveyed in 1999 represented 69% of the 1998 U.S. grower cash receipts. This was lower than the two previous surveys. The 24 states surveyed in 1994 represented 81% of the 1993 U.S. grower cash receipts while the 1989 survey (23 states) represented 79% of the 1988 U.S. grower cash receipts. The primary purpose of the surveys was to examine trade flows and selected marketing practices in the U.S. nursery industry. Information was also requested on computer use and applications. The criteria for selecting the survey samples and descriptive statistics of the samples are presented in Brooker and Turner and Brooker et al.(1995) and Brooker et al.(2000).

**Results and Discussion:** The most striking observation is the dramatic reduction in growth in the computer adoption process (Table 1). It appears that in 1998 about seventy percent of all U.S. nurseries use computers to perform some business function. The functions most computerized are word processing (58%) and accounting (57%). Using computers to manage inventory was cited by 36% of respondents, a 1% increase over the 1993 survey. In 1998, 19% of nurseries had WEB pages, while 5% used CD's in their marketing. The biggest change between 1993 and 1998 as concerns computerization occurred with respect to communication. In 1993, 20% of nurseries used computers to

communicate while in 1998 37% used E-mail and 39% used FAX. This was a 17% and 19% increase, respectively. In general, the computerization rate of change was 5% between 1993 and 1998 for word processing, accounting, and financial investments.

It is hypothesized that computerization is heavily influenced by the size of the nursery. If size is represented by gross sales, then this hypothesis can be examined (Table 2). Only half of the smallest nurseries are computerized. The number rises to 60% for nurseries with gross sales of \$50,000 to \$250,000. It goes to 80% for nurseries with gross sales of \$250,000 to \$1,000,000. Nurseries with gross sales of more than \$1,000,000 had rates of computerization that varied from 93% to 100%. It is interesting that respondents who refused to answer the gross sales question had computerization rates below 50%, which would lead one to believe these non respondents are smaller nurseries.

**Significance to Industry:** Nurseries in the United States are complex business enterprises with vast amounts of data and information to manage. The latest available data indicates that about 70% of U.S. nurseries are computerized in some way. As expected, smaller nurseries are less likely to be computerized and larger nurseries are almost certain to be computerized. It appears that the computerization of the communication function has grown the most during the last five years, with 37% of all nurseries utilizing E-mail in 1998. About 20% of the nurseries had WEB pages in 1998.

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**Table 1. Computerization in The U.S. Nursery Industry, 1988-1998.**

	1988 (N=1337)	1993 (n=1316)	Change	1998 (n=1755)	Change
Computer	586 (44%)	851 (65%)	21%	1220 (70%)	5%
Word Processing	395 (29%)	700 (53%)	34%	1017 (58%)	5%
Accounting	497 (36%)	688 (52%)	16%	1000 (57%)	5%
Inventory	340 (25%)	473 (35%)	10%	632 (36%)	1%
Marketing	171 (13%)	310 (23%)	10%		
WEB Page				338 (19%)	?
CD				97 (5%)	?
Communication		265 (20%)	?		
E-Mail				661 (37%)	?
FAX				687 (39%)	?
Financial Investment		208 (15%)	?	360 (20%)	5%
Production Scheduling		211 (16%)	?	255 (14%)	-2%
Plant Locator		147 (11%)	?		
Design		62 (5%)	?	127 (7%)	2%
Greenhouse Production Controls				141 (8%)	?

**Table 2. Computerization and Gross Sales in The U.S. Nursery Industry, 1998.**

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Gross Sales Categories	Number of firms	Percent Computerized
Less than \$50,000	401	50.37
\$50,000 - \$99,999	168	60.71
\$100,000 - \$249,999	229	60.70
\$250,000 - \$499,999	221	80.09
\$500,000 - \$999,999	203	81.28
\$1,000,000 - \$1,999,999	167	94.61
\$2,000,000 - \$2,999,999	65	98.46
\$3,000,000 - \$3,999,999	41	95.12
\$4,000,000 - \$4,999,999	29	96.55
\$5,000,000 - \$9,999,999	48	100
\$10,000,000 or above	32	93.75
No Response	140	47.86
Total	1744	69.90

## Innovative Use Of *Echinacea purpurea* as an Anti-Cancer Source

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**Index words:** *Echinacea purpurea*, mitotic index, anti-cancer

**Nature of Work:** *Echinacea purpurea* (purple coneflower) is a highly valued perennial due to its ornamental attributes and medicinal value as an herb. As an herb, purple coneflower has been used as a remedy for more ailments than any other plant (Anonymous. 1997a). All parts of this plant have been used for medicinal purposes such as the treatment of snakebites, common colds, toothaches, sores, wounds, and herpes. Currently, research is examining its potential to treat cancer, arthritis, AIDS, and chronic fatigue syndrome due to its immune-boosting properties. In West Germany, more than two hundred pharmaceutical preparations, including extracts, salves, and tinctures, are made from purple coneflower (Anon. 1996). These compounds appear to increase the efficiency of the immune system in mammals (Anonymous. 1997a; Melchart et al., 1998, See et al., 1997). Although several studies are currently investigating the possible health benefits that purple coneflower may offer the immune system, other medical or health benefits may exist. The natural compounds (secondary compounds) synthesized by purple coneflower include terpenenes, lactones, polyacetylenes, alkaloids, and flavonoids. Many of these compounds have anti-bacterial, anti-fungal and anti-cancer activities. Historically, higher plants have served as a valuable source of agrochemicals and more recently proved to provide economical value (cash flow) to growers. Investigation of many plants for their synthesis of economically important agrochemicals is incomplete or uninitiated (McChesney, 1992).

An acetone extraction of secondary compounds from the dried roots of purple coneflower was performed. The supernatant containing the extract was separated after twenty minutes of centrifugation at 15x g. This crude extract was applied to cancer cells to determine its anti-cancer activity. The breast cancer cell line (BT549) was obtained from the American Type Tissue Culture Collection and was grown at 98.6°F (37°C) and 5% CO<sub>2</sub>. The experiment was initiated by placing 100,000 cancer cells in six well plates and exposing them to purple coneflower extracts. The growth rate was determined by counting the total number of cells after two and four days of exposure. The control group received

100 micro-liters ( $\mu\text{l}$ ) of physiological saline while the experimental groups were exposed to either 100  $\mu\text{l}$  of acetone or 100  $\mu\text{l}$  of acetone plus extract. The mitotic index was determined by counting 1,000 nuclei from each treatment (control, acetone and extract). The differences were determined using ANOVA and Fishers t-test.

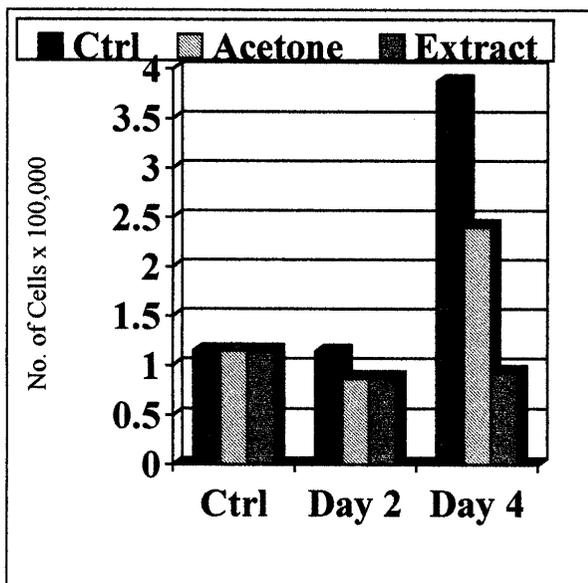
**Results and Discussion:** The growth rates of cells in the control and acetone groups were significantly higher than cells exposed to the extract. Extract from purple coneflower inhibited growth of cancer cell line BT549 (Figure 1). After two and four days of exposure to the extract, there was a 25% and 74% reduction in growth rate respectively. Acetone alone affected the growth of cells. The control group grew better than the acetone and the extract treatments. The mitotic index of cells exposed to the extract was zero (Figure 2). The effect of the acetone on the mitotic index was not significantly different from the control.

**Significance to Industry:** An unidentified compound in the crude extract of purple coneflower inhibits the growth of the cancer cell line BT549. These results also suggest that the crude extracts may have antagonistic effects on bacterial and fungal cells. The economic importance of this plant appears to be broader than previously anticipated. Increased utilization of this plant for medicinal purposes will increase the demand for purple coneflower and could potentially serve as an alternative cash crop for the nursery industry.

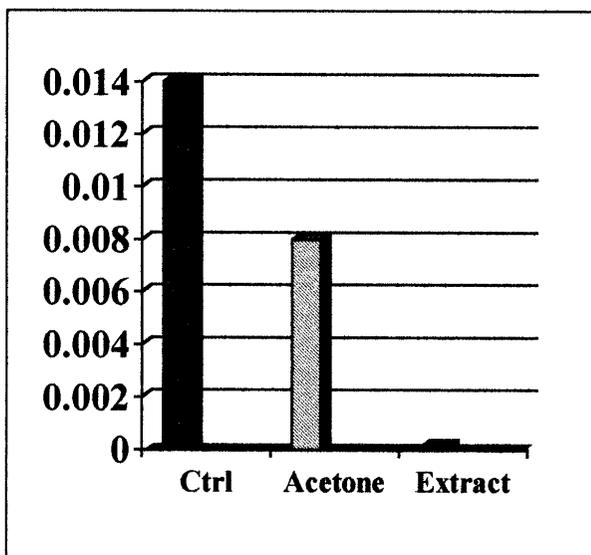
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**Figure 1. Growth Rate of Cells After Exposure to 100 micro-liters of Physiological Saline (control), Acetone and Acetone Plus *Echinacea purpurea* Extract.**



**Figure 2. Mitotic Index of Cells After Exposure to 100 Micro-liters of Physiological Saline (control), Acetone and Acetone Plus *Echinacea purpurea* Extract.**



## One Strategy for Industry Investments In a State's Nursery/Landscape Research

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**Index Words:** fundraising, research, funding, endowments

**Nature of Work:** With decreases in state and federal funds to support agricultural research and extension programs through our land grant universities, industry support of these programs becomes paramount. It is simply not possible to have the type of programs necessary to fulfill our mission without private funding. The multi-disciplinary nursery/landscape research and extension at the University of Kentucky is characterized by faculty with the expertise and commitment to make a real difference. They, like many of their colleagues in the U.S., are being inefficiently used at times due to the lack of technical support and operating funds. Industry leaders are recognizing that investments in these programs allow more effective resource utilization. It is like buying gasoline for a piece of equipment. The return on investment to make the equipment operational, or more efficient, is significant.

The UK Nursery/Landscape Fund was initiated in 1993 to provide an avenue for companies and individuals to support UK's research and educational activities to benefit the industry. An industry Advisory Committee was appointed to help develop and support the fund-raising efforts and to advise the UK Horticulture Department Chair on priorities for fund utilization. Many industry personnel recognized that a dependable, consistent supply of support funds would allow faculty to increase research and educational programs addressing industry needs.

In order to maximize immediate impact on the research and extension program for the industry, the Advisory Committee made the decision to delay establishment of an endowment and utilize the initial funds in the year they were provided. All contributors are recognized by listing in an annual research report and in a handsome plaque that is updated annually and displayed at the Kentucky Landscape Industry Trade Show and in the UK Agricultural Center North Building. Giving levels are designated as Fellows (\$10,000 over 10 years), Associates ( $\geq$ \$500 annual contribution), 100 Club ( $\geq$ \$100 annual contribution), and Donors ( $<$ \$100 annual contribution). Fifteen individuals/companies committed to contribute at least \$10,000 each over a ten-year period. Those contributing at this level are Nursery/Landscape Fund/Endowment Fellows and can designate an individual or couple as University of Kentucky Fellows and members of the Scovell Society in the College of Agriculture.

It was the goal of the initial Advisory Committee to develop the annual giving to a level that could endow a fund from which the interest could be

used to support this program. This year that goal became a reality through the encouragement of a state match, dollar-for-dollar, of private contributions to create research endowments at UK. The Research Challenge Trust Fund was created by the Kentucky General Assembly at the recommendation of Governor Patton to assist UK in reaching the goal of becoming a top 20 public research institution by 2020. Donors took advantage of this opportunity and all state funds available to UK for matching in 1999 were committed quickly. The state budget passed in the 2000 General Assembly has provided additional matching funds for this purpose.

**Results and Discussion:** Since its establishment, the UK Nursery/Landscape Fund has provided an average of \$13,000 annually to support this program. These funds were primarily from contributions by individuals and companies. The Kentucky Nursery and Landscape Association, in cooperation with the Kentucky Arborists Association and the Kentuckianna Greenhouse Association, have generated support through an annual auction of booths and special items (Coach Rick Pitino - autographed basketball, Coach Hal Mummmie - autographed football, art, golf outings, etc.) at the Kentucky Nursery and Landscape Conference and Trade Show in Lexington in January. The majority of these funds have been utilized for student labor and specialized materials and equipment. These investments have allowed us to initiate new research and to collect more in-depth data from existing plots.

In 1999, a family of endowments was established to support nursery/landscape research at the University of Kentucky. Three named endowments and a general endowment, that will total more than \$250,000 within three years, have been established to support nursery and landscape research through the Department of Horticulture. The general Nursery/Landscape Research Endowment was established by 8 individuals and 6 companies and will total \$64,000 by 2001. Funds can be added to this endowment at any time and can gain a dollar-for-dollar match with state funds this year.

Named endowments were established in 1999 by a minimum \$25,000 commitment over three years. The named endowments include: **the James and Cora Sanders Nursery/Landscape Research Endowment**, provided by the Sanders Family and friends, the **Don Corum and National Nursery Products Endowment**, funded by Bob Corum, and the **Ammon Nursery/Landscape Research Endowment**, established by Richard and Greg Ammon.

The opportunity to gain a dollar-for-dollar match of industry investments in endowments to support research at UK definitely boosted fund-raising efforts. A renewed campaign is underway to inform the industry of this renewed opportunity in 2000, and hopefully, the family of endowments will continue to grow.

## Survey of Technical Information Requirements for Hispanic Nursery Employees

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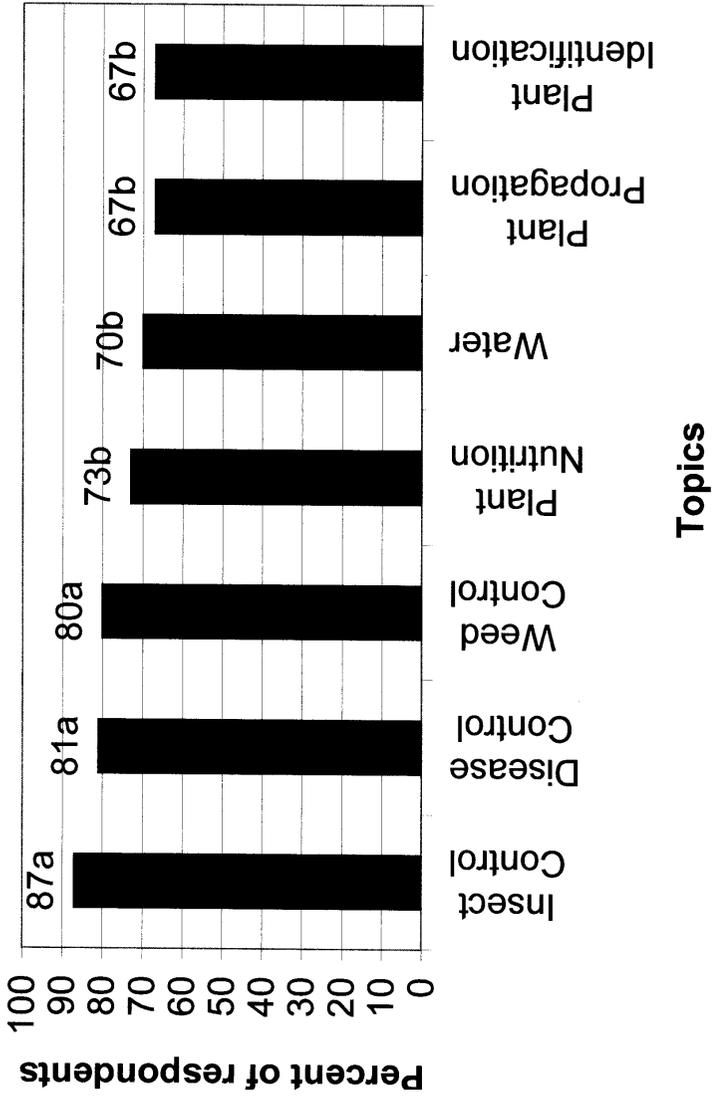
**Index Words:** Nursery Employees, Labor

**Nature of Work:** In May 1999, an Oregon State University (OSU) Promise Grant was obtained to hire a Bilingual /Bicultural Intern for the summer. In June 1999, an OSU Extension Innovation Grant was obtained to produce a Spanish Nursery Newsletter. Survey information was collected via three formats. Forty surveys were conducted during on-farm visits, in small group settings, with the OSU Promise Intern. Eighty-six survey responses were collected at the Spanish sessions of the Ornamentals Northwest Seminars and FarWest Trade Show, August 1999 and 32 survey responses were received from the Spanish newsletter questionnaires. In total 340 surveys were distributed and 158 individuals responded. The target audience for the surveys was the crew leader or foreperson level of staff at various sizes of nurseries. The same multiple-choice and fill-in-the-blank questions were asked in all three formats.

**Results and Discussion:** Several issues are involved in securing a stable nursery and landscape industry work force today. Four issues are legalization, availability, retention and reduction via mechanization. Several approaches can be taken to produce stabilization. Our approach has been to "help the existing work force work smarter." Approximately 90-95% of the Oregon green industry workforce is composed of Hispanic employees. Many of these Hispanic employees understand little English. Spanish is their primary language. Currently, most of the technical information available to the green industry is in English. There is *little* information available to Hispanic employees regarding potential pest threats, industry events and trends, educational opportunities, cultural practices and plant nutrition. By determining the technical information requirements of the Hispanic Oregon nursery employees and beginning to provide current technical information in Spanish we hope to increase nursery production efficiency and increase worker job satisfaction. We targeted crew leader, foreman level employees or section supervisors (ex. propagation area supervisor). The nursery production manager supervises these positions. The production manager is predominantly an English speaking or bilingual individual. On average, survey respondents had 10 years of experience. Fifty-five percent of the Hispanic

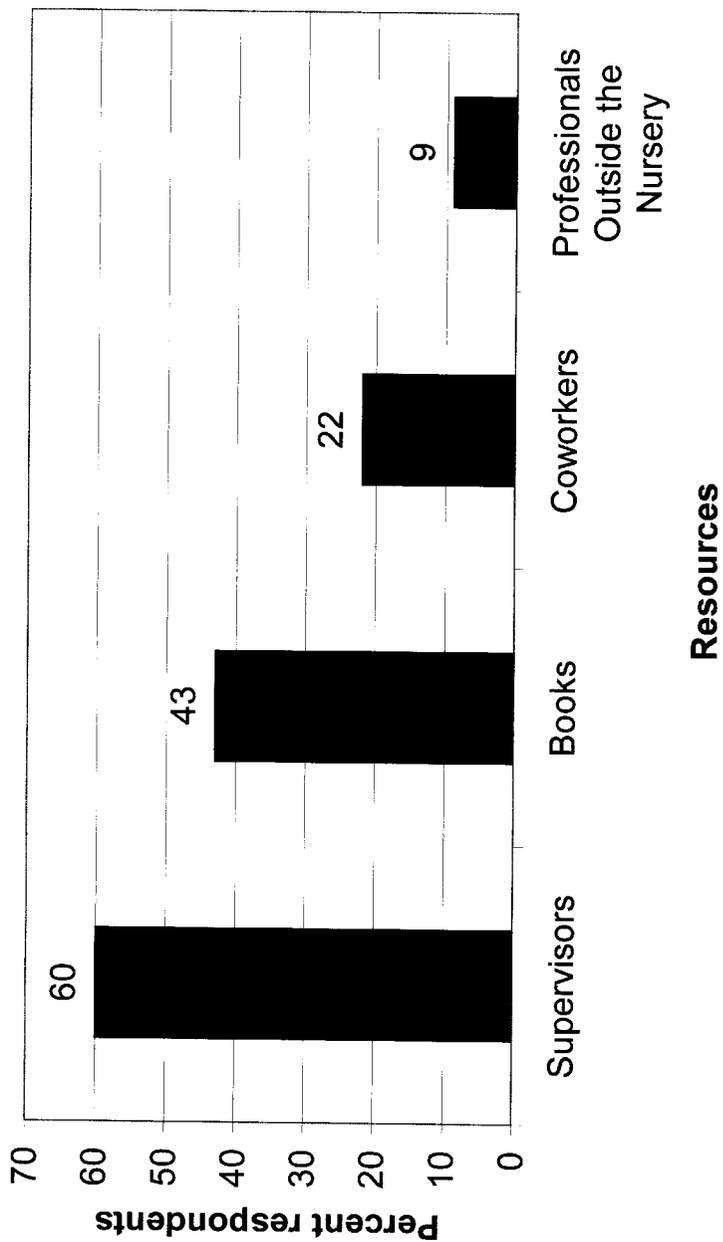
workers who attended the ONW Spanish sessions in 1999 had attended the seminars two to three times before. Eighty-seven percent replied that insect control information was their leading technical information interest, 81% disease and 80% weeds (Figure 1). Other interests were nutrition at 73%, water management at 70% and propagation and plant identification at 67% (Figure 1). In similar English audience surveys, weed control rates much lower and plant identification is not a priority topic. Most of the Hispanic workers surveyed indicated 60% of their information comes from their bilingual supervisors (Figure 2). The other two educational resources currently available to these workers, in order of importance, were books and Hispanic coworkers with more experience (Figure 2). Hispanic employees are involved in almost every aspect of nursery production (Figure 3); however, Hispanic workers almost exclusively perform pest management and several propagation activities. Ninety-one percent of the newsletter questionnaire respondents indicated all the information presented was of value to them and 97% wanted to continue to receive future newsletter issues. This finding was consistent with responses from nursery visits where respondents indicated their delight to be receiving technical information in Spanish. The Hispanic workers also indicated that they wanted to see more educational programs provided in Spanish. A recent survey of English speaking Oregon nursery employees found 77% attended more than three educational events per year.

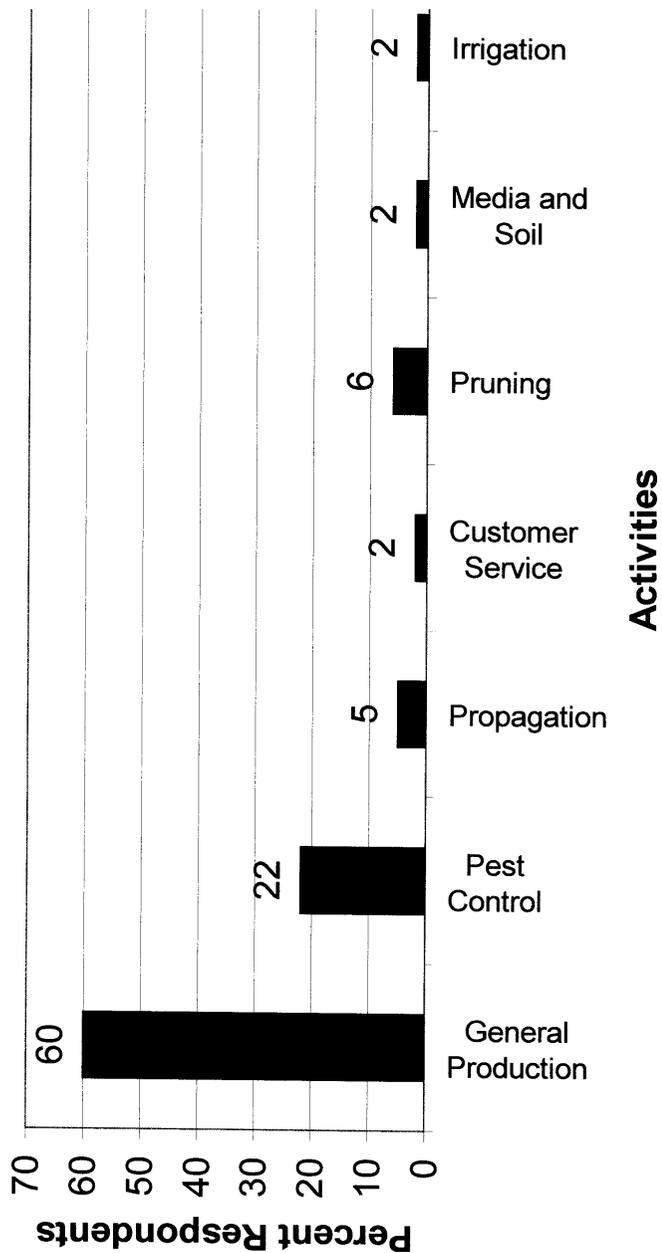
**Significance to Industry:** Hispanic crew leaders frequently have 20-25 years of experience. Often they have worked all these years at the same nursery and on average respondents had 10 years of experience. In future surveys, we would like to reach other levels of staff. The audience we reached were only those Hispanic employees the nursery owners felt "merited" the exposure to the seminars, newsletters or on-farm visits. We believe that by reaching this supervisor level, however, that we will have a trickle down effect. Ninety-one percent of all survey respondents found all the information presented of value and 97% wanted to continue to receive similar materials. This finding was consistent with what we found in our on-farm surveys where respondents indicated their delight to be receiving any technical information in Spanish. There is a tremendous absence and demand for technical information to this audience. The purpose of this project was to determine the experience level, attitude, technical information interests, work activities and current technical information resources available to Hispanic nursery workers in Oregon. The information that was gathered in this project will be used to establish a baseline for future surveys to determine if the educational materials being provided by Oregon State University are increasing worker job satisfaction and effectiveness.



**Fig. 1.** The seven most important technical topics of interest to Hispanic nursery employees in Oregon.

**Fig. 2. Technical resources currently available to Hispanic Oregon nursery employees.**





**Fig. 3. Work activities of Hispanic employees in Oregon.**

