What Is Research?

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Growers sometimes ask how and why research programs develop as they do. Let's take a look at research with emphasis on floriculture. *Research is investigation or experimentation aimed at the discovery and interpretation of facts.*

There are several levels or categories of research; the terms and interpretation are a matter of personal opinion. 1. *Basic or "pure"*—Presumably this is "high level" research aimed at getting fundamental information about a plant growth process without any particular objective in mind. An example would be the study, isolation and mechanism of action of natural growth regulators in plants without any concern as to whether the information will ever have any practical application. It is difficult to visualize basic research producing information that would not ultimately, have, or lead to, some practical application.

2. *Applied research*—Usually this is research that is conducted with some objective or goal of obtaining information that will have some practical application and value in commercial or non-commercial growing of plants.

Naturally there are various degrees of depth to which applied research can be pursued. For instance, one can simply apply certain treatments to plants and observe what happens. Or one can do a more thorough job and get *fundamental information as to why and how* specific treatments cause specific results.

The latter course is the one that is being pursued to a greater degree in most research organizations. Very fundamental information is being obtained and is enlarging our knowledge of the growth processes of ornamental plants. The interrelationships between various environmental factors such as temperature, daylength, light quantity and quality, atmosphere, moisture and nutrition must be recognized and understood.

Most of the research in the Department of Floriculture and Ornamental Horticulture would probably be classed as Applied Research because we are obtaining fundamental information on which recommendations can be based. Sometimes quite a few years of research are required before recommendations can be made. This leads to greater concentration on fewer projects rather than less fundamental research on many crops.

Let us look at some of the more recent projects.

For many years a snapdragon wilt problem has existed. About seven years ago a team of researchers embarked

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on a study to determine the relationship between possible disease organisms, soil aeration, soil moisture and snapdragon wilt. This led to the research of J. Hanan on snapdragons and the continuation of this research by A. Spomer with chrysanthemums. This research has not only emphasized the need for disease prevention but also has given fundamental information about irrigation practices with various soil depths and various soil mixtures and their effect on soil moisture, soil aeration, and plant growth under various light conditions.

Soil testing has been a standard practice for many years. With the introduction of soil mixes such as peat-lite as well as the need for critical evaluation of the nutrient status of the plant before deficiency or excess occurs, analysis of plant tissue emerged as a possible help in flower and plant production. To interpret the results of the tissue tests, one must first know what part of the plant should be sampled and also know the nutrient content of the leaves when plants are grown at different times of the year with various fertilization programs. Four years of research by J. W. Boodley and P. V. Nelson with concentration on the carnation led to the Carnation Leaf Analysis Service as announced in New York State Flower Growers Bulletin 247 (June 1966). Although this was a practical result of this research, the fundamental information obtained about nutrition of the carnation will aid in solving other carnation nutrition problems. Similar research is in progress with roses and other greenhouse crops.

Daylength and temperature are two environmental factors greatly affecting growth and flowering, and long have been a part of Cornell research program.

Improved greenhouse temperature control, the desire for a higher quality product for consumers, and more rapid growth due to improved nutrient management and disease control have made it necessary and possible for growers to use more precise production control methods. In the last 10 years the emphasis has been on poinsettias, snapdragons, lilies and carnations.

Four years of research on poinsettias by R. W. Langhans and R. Larson produced needed answers which led to recommendations for commercial growers. Along with these answers came fundamental information on the changes in the cells in the stem tip as flower initiation started, the effects of various photoperiods at various temperatures (and vice versa) and light intensity on flower bud initiation. Many varieties were studied because not all varieties have the same reaction.

Research on growth and flowering of Croft and Ace lilies began in earnest in 1959 with the work of D. Smith and R. Langhans, and in the last two years, T. Weiler. Detailed studies showed exactly when the cells changed and the lily flowers were initiated in the stem. Habit of growth, number of leaves, height, abortion of flower buds, and growth rate are affected by combinations of various factors. Added to this is the complication caused by the many factors affecting the bulb in production on the West Coast and in storage and their effect on subsequent growth. Seven years of research have given practical answers for growers but there is much more to be learned on the intricate growth pattern of the various Easter lilies.

Some types of research have been called *"bread and butter" research* by some commercial growers. This is because they can quickly see results which they can apply to their business. For instance, some of the chemical weed control studies and the tulip precooling investigations of A. Bing have given results easy for the grower to see and use in his business. The peat-lite mixes and nutrition of bedding plants as studied by J. W. Boodley and R. Sheldrake gave results readily visible to and applicable by growers. But this research also has taken several years and will continue as certain other details of information are desired and needed.

Sometimes we speak of *"demonstration research."* By this, I mean, demonstration of a new procedure or technique along with the obtaining of new information at the same time. Usually this is a practice which a grower can use in his own establishment very quickly if he wishes. Consider, for example, the starting of chrysanthemums in peat pots and setting them on soil in benches where they rooted through, resulting in a saving of labor and improved scheduling. The work on detergents in water and their effect on plant growth gave an answer to a problem. Similarly tests on the effects of paradichlorobenzene and napthalene on rooting and growth of tulips are examples of this kind of research to help answer a problem.

A balanced program of various types of research is essential to get the needed answers for problems and to also get detailed fundamental information about ornamental crops. The new greenhouses and bioclimatic chambers should aid the more fundamental research.

Many research projects benefit the floriculture industry in another way. Graduate students become better trained as they conduct research and thus become valuable assets to the industry as they later enter the educational or commercial fields.

How do research projects get started?

In a variety of ways. Some research is started as the result of definite needs of the industry as expressed by industry members or industry committees, sales representatives, by county cooperative extension agents, extension specialists, and college extension faculty. Often the information needed to solve a problem or to answer a question is available from previous research here or at other experiment stations. If not, research may be needed to get the answer.

For instance, the snapdragon wilt trouble in various parts of the state, led to soil moisture—aeration studies along with the disease aspect. Lack of suitable soil in some areas and the need for standardized materials led to peat-lite research. Proper timing of poinsettias and lilies for specific holidays led to the temperature-photoperiod research.

Sometimes the research need is determined by a previous project. The studies of heat treatment and cold storage of lily bulbs became essential when it was found that

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the previous history of bulbs had an important effect on the forcing treatments.

Sometimes a specific research project comes about as a result of an industry development in another part of the country, as well as previous research. For instance, the temperature-photoperiod research with carnations combined with single crop culture and daylength control of stock plants led one to believe that a very competitive high quality carnation can be produced on the East Coast. Research is needed to determine whether this can be done economically.

Sometimes the research project is based on work done at another location. The more promising treatments will be repeated to determine whether the recommended treatments are satisfactory for New York State conditions.

Other factors affect selection of a research project. Usually, but not necessarily, the present or potential value of a particular crop is considered. For instance, it is doubtful that we would invest in a research project on Strelitzia since this is not an important crop in New York State nor does it appear to have economic potential for New York.

Selection of research projects is also governed by physical, monetary, and staff resources. For instance, air pollution is important but would require a great expansion in special greenhouse and laboratory facilities and special technical and professional staff. If other universities are conducting such research, it does not seem reasonable to make an expensive duplication of effort and expenditure. Sometimes duplication of research at other institutions has some value but excessive duplication is not desirable if for no other reason that research is very costly.

The interest and ability of the professional staff also have a bearing. In the Department of Floriculture and Ornamental Horticulture at Cornell, research workers dealing with commercial floriculture crops have particular interests in the plant physiology aspect of crop production, especially daylength temperature, modified atmosphere, moisture and nutrition. On the other hand, the postharvest physiology of cut flowers and the best methods for maintaining the high quality for the retailer and consumer are important. Since an additional staff member with this particular specialty can not be added, a project is being initiated with the appointment of a special graduate student and additional laboratory technician assistance along with the cooperation of staff members in other fields such as biochemistry.

It can be expected that the research in floriculture will be geared to producing fundamental information that will not only add to our knowledge of plant growth but will also give information leading to specific recommendations to growers. Rather than a superficial effort trying to cover a diverse group of crops and problems, there will continue to be a more detailed and concentrated effort on a lesser number of crops and projects, with subsequent effort to get this information into the growers' hands through a broad extension educational program.