Selected panels of 30 to 40 people are difficult to obtain in most processing plants. It is also difficult to have all these tasters present for three tests in one day when four different samples are to be compared in six possible paired combinations. The data reported in this study were obtained from an unselected group of tasters after approximately establishing a limiting level for the factor to be studied. About 75% of the tasters were able to taste all three sets of samples in one day. Thus, with an unselected panel and slightly different panel groups on three different days, highly significant and reproducible results for both the quality factor and preference ratings have been obtained with this taste panel procedure. Sensitivity and a high degree of reproducibility are desirable in any method to be used for quality control or research where relative ratings between samples are required. The method described in this paper was designed for this purpose and its application for both quality and preference ratings has been demonstrated. Preference ratings from small control panels are not safe guides for consumer acceptance. However, the method described in this paper may be used for an indirect check on consumer preference through comparisons with samples of known consumer acceptance. If the method is unable to detect significant quality differences between samples, it is highly improbable that a consumer group, having none of the advantages of the method, would be able to detect differences on which to base a preference.

REFERENCES


Ornamental Section

PROGRESS IN GLADIOLUS RESEARCH

Robert O. Magie,
Pathologist
and
W. G. Cowperthwaite,
Formerly Assistant Horticulturist Gladiolus Investigations,
Gulf Coast Experiment Station
Bradenton

Florida's gladiolus cut flower industry has grown steadily during the past 25 years in spite of a succession of production and marketing problems, some of which threatened ruin to many growers. The growers, aided by their Association, are solving some of the problems relating to packaging, shipping, and marketing of the flowers. The critical problems of flower production have been studied for the past ten years at the Gulf Coast Experiment Station. Since 1950, the staff has included two men working full time on gladiolus research, one on horticultural problems and one on disease control. Other members of the Station's research staff help with insect control and soil problems.

Research work has been concentrated on disease control primarily because the vascular wilt and corm rot disease caused by Fusarium oxysporum f. gladioli Snyder and Hanson is the most important production problem. The annual crop loss due to this fungus disease is estimated to be over one and one-half million dollars in Florida. The loss of corms has forced several growers out of business.

Although a large share of the research efforts have been directed toward the control of Fusarium disease, other diseases have required considerable attention. Many acres of
flowers were destroyed by the diseases which cause leaf spots and flower rot before the growers obtained the necessary spraying equipment and put it to effective use. Botrytis disease, caused by the fungus, *B. gladiolorum* Timmermans, has been epidemic and very destructive periodically during the past ten years. It is especially damaging in Florida because invisible infections on flower spikes spread through the package, rotting the flowers in transit. In 1947 a new disease, caused by *Curvularia lunata* (Wak.) Boed., was identified in Florida. Although it does not spread in transit, Curvularia disease is fully as important as Botrytis because it is active throughout the year, whereas Botrytis epidemics are generally limited to cool, wet weather. Another leaf spot disease, caused by a *Stemphylium* species, is occasionally epidemic in moderately cool, moist weather.

Some of the less important fungus diseases being studied are a dry neck rot caused by a common *Fusarium* species and a wet neck rot caused by *PelliculariaRolfsii* (Curzi) West, the Southern Blight fungus. These diseases occur only in warm or hot weather whereas *Sclerotinia gladioli* Drayton causes a destructive neck rot only in cold weather.

Another group of diseases under study is caused by viruses, of which five have been identified in corm stocks shipped to Florida. These diseases are carried in the planting stock. Two of these tend to eliminate themselves because affected plants lose the power of producing new corms.

**Present Status of Information on Disease Control**

Only one *Fusarium* species has been found to be responsible for the corm rot and vascular wilt symptoms. The finding of dormant infections in corms and cormlets explains why present control measures fail to prevent severe corm losses. Commercial corm stocks of the important older varieties are generally infested with the fungus so that treating the corms and planting them on new land are inadequate as control measures. Some new varieties have been relatively disease-free when first introduced to the trade. However, a few years later it is impossible to purchase healthy corm stocks of these same varieties.

Several of the many fungicides tested as corn treatments are effective in delaying the rotting and in giving partial control but, to date, no chemical has been found to eliminate dormant infections. Control measures designed to keep corm stocks healthy are relatively useless because of these dormant infections. No adequate stocks of disease-free corms are available to replace the diseased lots and it is doubtful that healthy stocks will be developed in quantity soon enough to help some of the growers being forced out of business by corm rot. Likewise, the development of more resistant varieties will probably not help soon enough.

Investigations show that, for the purpose of obtaining adequate control of *Fusarium* in the immediate future, there are three promising leads or lines of approach. Research is now being concentrated along these lines: 1) Chemical treatments to eliminate latent infections, 2) supplying nutrients to plants in such form and in such manner that latent infections tend to remain inactive, and 3) growing corms in soils that tend to eliminate infections.

Two types of chemicals that are new to plant disease control, antibiotics and systemic fungicides, could be the most practical agents in controlling *Fusarium* disease, short of immunity in varieties. There is a possibility that plants are able to absorb into the vascular tissue enough of these chemicals to kill the disease organism without causing serious damage to the plant. Such a chemotherapeutant action is being sought for the purpose of eliminating dormant infections of gladiolus corms.

The Botrytis and Curvularia diseases are generally controlled by spraying the plants with zineb or nabam plus zinc sulfate. These sprays were also effective against *Stemphylium* leaf spot until the appearance of a large lesion strain of the fungus in 1950. Two new fungicides, Manzate and Orthocide 406, were found to be very effective in controlling *Stemphylium* where the new strain is widespread. Plants sprayed with zineb had 12 to 90 times more leaf spots than those sprayed with Orthocide 406 or Manzate.

To control the spread of Botrytis on cut spikes in transit, a post-harvest dip treatment was developed. The spikes are dipped for two to four seconds in a spray mixture made with one of the following fungicides: zineb,
Puratized Agricultural Spray, or Vancide "51", used at recommended spray dilution. In controlling Sclerotinia neck rot, 1500 pounds of calcium cyanamid broadcast on each acre two months before planting reduced the number of infections to one-third in test plots. Gladiolus commonly show severe leaf burn injury from cyanamid unless the full waiting period is allowed and the soil kept moist after application.

Gladiolus plants, corms, and flowers are injured by some of the chemicals used in controlling diseases and insects. Spray programs designed to avoid excessive plant injuries are being tested. Corms are injured by bruising and by improper conditions of storage; resulting in reduction of flower yields. Corm injuries also activate latent infections of Fusarium disease. Severe outbreaks of corm rot have been traced to poor aeration in curing or in storage. It is found that faulty ventilation in cold storage may result in premature root growth, physiological breakdown of corms, and multiple sprouting. Investigations also show the importance of warm curing and the danger of too rapid curing.

**Fertilizing Practices**

The soils used in Florida for the commercial production of gladiolus are generally low in native fertility. Thus, the production of gladiolus in Florida is dependent upon the use of commercial fertilizers, even where a heavy cover crop may have been turned into the soil prior to planting the corms.

In general, a 1-2-2 or 1-3-4 fertilizer ratio, such as 4-8-8 or 3-9-12, is recommended for gladiolus. All applications of the mixed fertilizer should contain minor elements as follows: manganese as MnO, 0.4 to 1.0 percent; iron as FeO₃, 0.25 to 3 percent; copper as CuO, 0.15 to 0.25 percent; and boron as B₂O₃, 0.15 to 0.30 percent. Magnesium should also be included where dolomitic limestone is not used. Zinc is not included where a zinc fungicide is used.

The source of materials used in the mixed fertilizer should be carefully considered. Organic nitrogen sources usually constitute from 25 to 50 percent of the nitrogen, and NO₃-N is preferred to NH₄-N for the greater portion of the inorganic nitrogen. Muriate of potash, as a potash source, should not be used if there is an appreciable quantity of soluble salts in the irrigation water. If the irrigation water does not contain excessive quantities of chlorides, half of the potash can be derived from muriate of potash. Superphosphate is the source of phosphate in most mixed fertilizers.

The total amount of fertilizer applied per acre on flowering stocks is generally from 1500 to 2000 lbs. per acre. If heavy rains occur, additional fertilizer should be used to compensate for the loss by leaching.

The first application of fertilizer should be made prior to or at planting time at the rate of 300 to 400 pounds per acre. Subsequent applications of 300 to 400 pounds per acre are made at about two-week intervals following planting. Research showed that frequent and small applications of fertilizer increased quality of spikes as compared to larger applications made only twice during the growing period. It was found that during the period the spike is elongating rapidly, beginning about two weeks prior to flower cutting, the gladiolus utilizes large quantities of potash. To furnish this potash, about 75 pounds of potash as K₂O should be applied on each acre when the spike first shows above the leaves. This supplemental application of potash may not be needed where the ratio of potash to nitrogen in the mixed fertilizer is greater than three to one, as in the 1-3-4 ratio.

The method of application of fertilizer may be as important as the kind and amount of fertilizer used. Common practice has been to bar-off and side-dress in bands. This method of application can damage the root system in two ways; first, by cutting the feeder roots in the bed area; and secondly, by burning the new roots in the area immediately surrounding the fertilizer. To avoid this root injury, the fertilizer should be broadcast on the bed and swept into the soil. The importance of maintaining adequate soil moisture with this method of fertilizing is obvious.

Corms smaller than No. 2 and cormlets benefit from fertilizer rates higher than those suggested for flowering stock. Also, varieties that tend to split excessively benefit from additional fertilizer. Increased corm size from growing stock and cormlets can be expected when as much as 3000 to 3500 pounds of fertilizer per acre is used. Individual applica-
tions should be small and applied frequently during the growing period.

A light application of the mixed fertilizer on flowering-size stock after the spikes have been cut increases the size and weight of the corms produced. This fertilizer application benefits the new corm, and if minor elements are included in the fertilizer, minor element deficiencies in the following year may be minimized.

Three minor-element deficiencies were found to cause severe losses in some Florida plantings. Ruprecht and Whitner studied an iron deficiency in the Sanford area which is corrected by spraying with a ferrous sulfate solution. A copper deficiency which makes the spikes too soft to ship is commonly found in plantings on newly cleared land in the Bradenton area. Severe symptoms develop only in the second year of growing a corm stock in new land. The deficiency is controlled by broadcasting 40 pounds copper sulfate per acre of new land. Further applications should be limited to moderate amounts of copper contained in mixed fertilizers.

Boron deficiency is recognized in most plantings surveyed in the principal, gladiolus-producing areas of the State. Young leaves are stunted, thickened, brittle and cracked. All applications of fertilizer, including an application after flowering, should contain from 0.15 to 0.30 per cent boron as B₂O₅. Where the deficiency shows up on young plants, it is helpful to spray about every two weeks with one pound of borax in 100 gallons of water.

Physiological Disturbances

Heavy losses are experienced on some farms because of a physiological breakdown of florets called “bud rot” and a distortion of petals called “fat bud.” The larger spikes are affected to a greater extent than the small spikes from the same planting and the symptoms are usually limited to the two, three or four buds at the base of the flower head. These troubles lower the flower quality and usually make the spikes unsalable. Bud rot and fat bud occur during warm, wet weather and in plantings where cultural conditions are favorable for vigorous, uninterrupted growth. The most susceptible varieties are Spotlight, Picardy, Valeria and Supreme Beauty.

Experiments have not shown definitely what causes these troubles and how they may be controlled. Observations indicate, however, that several factors are involved, including pH or calcium supply, aeration of soil, and irrigation practices.

Chemical Weed Control

Weed control is a major expense item for the growers. A large number of herbicides have been tested in field plots. Several promising weed killers have been found but further experimentation is necessary before any chemical can be recommended for weed control in gladiolus. The most promising materials to date are Crag Herbicide 1, Chloro IPC, phthalamic acid and MCP.

Research efforts are now being concentrated on the Fusarium disease and on weed control. Other problems being investigated as time permits, or as the opportunity is presented, include 1) nutrition in relation to flower quality and disease control, 2) new materials for controlling insects, 3) physiological disturbances, 4) nematode control, 5) curing and storage practices, 6) cover crops in relation to disease control, 7) virus diseases, 8) spray schedules and new fungicides, 9) breeding for disease resistance, and 10) variety trials.

CHORISIA TREES — HOW MANY KINDS ARE THERE?

Edwin A. Menninger

The Flowering Tree Man
Stuart, Florida

From Florida to Texas to California and elsewhere in warm regions throughout the world is cultivated a Brazilian ornamental flowering tree that blooms usually from October to December. Despite its spectacular beauty it is comparatively rare because it is much too large for most yards, in this country it rarely sets seed, and it does not propagate readily