PUBLICATIONS
1987

Horticulture Research, 1987 – Overton

Research Center Technical Report 87-1

Texas A&M University Agriculture Research & Extension Center at Overton

Texas Agricultural Experiment Station
Texas Agricultural Extension Service

Overton, Texas

1987

AN OVERVIEW OF NURSERY AND FLORICULTURAL CROP RESEARCH AT OVERTON 1987

Brent Pemberton

East Texas is one of the main centers for rose plant production in the United States (Stump, 1982). Approximately 10.5 and 0.4 million plants were grown during 1986 in Smith and Van Zandt counties, respectively, representing almost 8 million dollars in sales (Anonymous, 1987). Large cooling facilities have been established for plant storage and to facilitate the packaging and final marketing operations. Total ornamental production sales including roses, are estimated at 84 million dollars for the east Texas area. The nursery industry is centered in Smith county. However, 20-30 million dollars of the above figure represents bedding and pot plant production centered in Cherokee county.

A rose research program was initiated at the Agricultural Research and Extension Center at Overton in 1982. Since the establishment of the rose research project, many experiments have been initiated to study problems at various steps during the rose plant production cycle. In addition, research has expanded into other areas of ornamental production, particularly cut flowers and flowering potted plants.

Rose Plant Production Cycle

Removal of all but the apical two or three buds of *Rosa multiflora* 'Brooks 56' rootstock cuttings is the first step in a labor intensive, two-year cycle for rose plant production. The rootstock cuttings are removed from established crop rotations and planted in December. In May, a bud from a desired cultivar is T-bud grafted onto the rootstock stem just below the actively growing shoots. The grafted scion bud is usually inactive until March of the following spring when the rootstock shoots are removed. Active growth of the scion bud commences and continues through the second growing season. The following December, the dormant plants are dug and stored. Approximately 25 manual labor steps are involved before the plants are marketed.

Propagation

Problems with rooting and grafting techniques used for the vegetative propagation phase cause tremendous production losses. Understanding which characteristics of rootstock plants are important for determining subsequent rooting of cuttings is critical to increasing percent stand in the field. A study of the relationship between planting date and carbohydrate and nitrogen content of rootstock cuttings and cutting survival and growth has been initiated in cooperation with Fred Davies (TAES, College Station). Studies completed in Overton and College Station have shown that November 15 to January 1 is the best time period for planting cuttings (Hambrick et al., 1987; Pemberton et al., 1986c). There were no differences in % rooting in the field when comparing cuttings from three cane positions but apical and medial cuttings had a higher % rooting and produced more roots than basal cuttings when rooted in a glasshouse under mist (Hambrick et al., 1987). In addition, starch content was positively correlated and nitrogen content was negatively correlated to % rooting and number of roots on cuttings planted in the field.

Planting of rootstock cuttings is normally accomplished during a time of year that labor is in high demand for other activities such as budwood collection and storage and plant harvest. Storage of prepared cuttings is frequently necessary for the efficient use of available labor. In a recently completed study, hardwood cuttings, 20 cm in length, of Rosa multiflora 'Brooks 56' were taken on 15 December 1985 and 1 and 15 January 1986. On each cutting date, cuttings were stored for 0, 2, or 4 weeks at -1, 4, or 9°C with all but the top 2 buds removed either before or after storage. Cuttings were then planted under field conditions and dug the following May. There was a significant interaction between cutting date and storage time for shoot number, shoot dry weight, root number, root grade, and percent live plants. Cuttings planted after 15 January resulted in plants which were significantly lower in quality than those growing from cuttings planted prior to this date. Percent live plants decreased linearly as storage temperature of cuttings increased (main effect). Root number on plants deteriorated more rapidly with storage time if cuttings were disbudded before storage vs. after storage (storage time x storage condition). Root number also decreased on plants when cuttings were stored at 4° or 9°C vs. -1°C for 4 weeks but not when stored for 2 weeks at any temperature (storage temperature x storage time) (Pemberton et al., 1987c).

Success of the T-bud grafting operation is critical to producing a saleable rose plant from even the healthiest of rootstock plants. Frequently the shoots gathered the previous autumn to be used for budding in late spring do not survive storage at -1°C (30°F). To study this problem, shoots were cut on various dates during the autumns of 1985 and 1986 from the upper canopy of 'Mr. Lincoln' rose plants which were in the second and final season of production. These shoots were stored at -1°C until inspected for survival the following spring as per the customary practice for budwood storage. In 1985, starch content, as measured by a visual iodine stain test, and % live shoots after storage increased for shoots cut 22 November vs. 16 October indicating a positive relationship for these characters. Percent live increased further concomitant to exposure to freezing temperatures for shoots cut 18 December indicating a role for temperature in survival. On 1 October 1986, shoots were cut which were giving rise to vigorous new growth. These had less starch than shoots cut on the same date showing no such growth indicating the depletion of stored reserves to new growth from the desired shoot. Also, the shoots cut at this date which had no new growth, but had dark thorns, had a higher % live than the same type shoots with green thorns indicating an effect of maturity. By 20 November, all shoot types had been exposed to freezing temperatures and exhibited 100% live. Further experiments will be necessary to separate the effects of new growth, shoot maturity, and environmental factors on the ability of shoots to be stored at -1°C (Pemberton et al., 1987b).

Other experiments are in progress to study the budding technique itself. The optimum time of budding is being considered for several cultivars. Also, different budding covers with or without manual removal are being tested for effects on bud survival.

New grafting techniques are being explored which could give stronger graft unions as well as shortening the production cycle to one year for a field or container produced plant. Cleft grafting of a two-bud scion cutting onto a disbudded rootstock cutting could allow rooting and healing before field or container plant. Currently, this technique is being used for production of a spring finished container crop from propagation in September.

Root-Soil Complex

Little research has been documented concerning soil fertility levels needed to supply plant nutrition requirements of field grown rose plants. East Texas soils are acid (as low as pH 4.5) and present a complex of nutrition related problems for rose producers. These include lime requirements for adjustment of soil pH, as well as the requirement of the plants for nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur. The micronutrients zinc, boron and molybdenum must also be considered. Toxcities of manganese and/or aluminum are potential problems to roses in very acid soils.

A cooperative research project has been in progress with Vince Haby (TAES-Overton) to evaluate the influence of limestone, phosphorus, and potassium on rose rootstock growth and the second year of production. When rootstock cuttings were rooted in the field for 21 weeks, those from stock plants treated with 0 or 1120 kg/ha (0 or 1000 lbs/acre) lime plus 69 or 134 kg/ha (62 or 124 lbs/acre) P produced more roots than cuttings from plants treated similarly with lime but with no P. Cuttings from plants treated with 3360 kg/ha (3000 lbs/acre) lime and 0 or 139 kg/ha (124 lbs/acre) P produced more roots than cuttings from plants treated similarly with lime but with 69 kg/ha (62 lbs/acre) P (lime x P interaction). Cuttings from plants treated with 139 kg/ha (124 lbs/acre) P produced more shoot dry weight than cuttings from plants treated with 0 or 69 kg/ha (62 lbs/acre) P (main effect). Rootstock plants treated with lime and P appeared to produce cuttings with a better propensity for growth than cuttings from untreated plants (Pemberton et al., 1986b).

In a two-year study, hardwood cuttings of Rosa multiflora were field planted in sandy soil low in N, P, and K in December 1982. Calcitic limestone at 0, 1120, or 3360 kg/ha (0, 1000, or 3000 lbs/acre), P_2O_5 at 0, 69, or 139 kg/ha (0, 62, 124 lbs/acre), and K_2O at 0 or 67 kg/ha (0, 60 lbs/acre) were incorporated in factorial combination prior to planting. Plants were budded with 'Mirandy' scions in May 1983, rootstock tops were removed in March 1984, and plants were graded into four grades and harvested in November 1984. Applications of P and K were repeated on half the plots during autumn

1983 and N at 67 kg/ha (60 lbs/acre) was applied to all plots during spring 1984. Percentage yield, % plants in the upper 2 grades (Texas Department of Agriculture grades 1 and 1 1/2), and weight of plants/plot was increased for plants treated with 69 kg P/ha (62 lbs/acre) but not for those treated with 139 kg P/ha (main effect). Percent top grade plants was also increased by treatment with 69 kg P/ha (62 lbs/acre), but only when plants were treated both years and not during the second year only (interaction). Weight of plants per plot was heavier when P and K was applied during both years vs. during the second year only. There was no growth response to lime though beginning pH was 5.5. The field application of 69 kg P/ha increased in rose plant crop cash value by 20% (Pemberton et al., 1986a).

Additional nutrition research is planned to improve identification of specific deficiency symptoms on plants and to further evaluate fertilizer nutrient needs of field grown rose plants in east Texas soils.

The importance of soil microorganisms to rose plant growth has been recently demonstrated by Don Paterson (TAES, Overton). Stunting of rootstock plants resulted from fumigation treatments. Ruth Taber (TAES, College Station) has confirmed the presence and absence of mycorrhizal fungi in the nonfumigated and fumigated plots, respectively (Paterson et al., 1983; Paterson et al., 1983b; Paterson et al., 1984). In addition, when Rosa multiflora 'Brooks 56' cuttings were grown in a 0.01 normal nutrient solution and inoculated with vesicular arbuscular mycorrhizae (VAM) from live rose roots, the VAM caused a significant increase in both fresh and dry weight of R. multiflora shoots. Infection from at least two genera of mycorrhizal fungi was observed (Taber et al., 1983; Paterson et al., 1986). Future studies are planned to look at growth of R. multiflora in fumigated soil with or without VAM inoculation while fertilized with various levels of phosphorus. This information will be important to interpretation of future studies of fertilization and pest control practices and development of industry recommendations.

Nematodes continue to constitute a major problem for rose producers (Forse et al., 1984). An infested plot has been established at the Overton Center for a cooperative project with James Starr (TAES, College Station) and George Philley (TAEX, Overton) to determine control measures for this group of pests which can render an entire crop unsaleable. Earlier, a fumigation study was completed, in cooperation with principal investigator Don Paterson, which emphasized effects of methyl bromide, a possible nematode control agent, on rose plant production. As stated above, plants in the fumigated plots were stunted during the first year of growth, but differences were not as apparent after two years. Herbicide treatment improved plant growth in non-fumigated plots (Paterson et al., 1984). Currently, fumigation of a nematode infested field using methyl bromide or 1, 3 dichloropropene with or without subsequent nematicide treatments is being studied for control effectiveness. In addition, susceptibility of Rosa multiflora to different species of root-knot nematode is being examined. R. multiflora 'Brooks 56' has been found to be susceptible to Meloidogyne hapla (northern root-knot) and resistant to Meloidogyne incognita (southern root-knot) so that species determination in field samples could be important in determining control measures (unpublished data). Future studies will emphasize the screening of various selections of R. multiflora for resistance to these soil born pests.

Branching

Basal branching is a critical factor in rose bush production, as the final grade of a plant and thus the dollar value is largely based upon this character. Pruning practices are suspected to have an influence on cane production and will be studied. Timing of pruning treatments will likely be critical. In addition, growth regulator applications will be studied to determine if increased basal branching can be induced.

Cultural Practices

Currently, most rose crops are not irrigated in east Texas. Though the area receives an average of 100 to 110 cm (40-44 inches) of rainfall each year, very little occurs in July, August, or September. Overhead irrigation during the summer at a 60% pan evaporation replacement rate has not been succesful for increasing yield (unpublished data). Currently, drip irrigation is being used during the second year of production to determine if rates up to 120% pan evaporation replacement can increase yield.

Row spacing for field production has been changing from the traditional 132 cm (52 inches) to 112 cm (44 inches) with the increasing use of two row tractor equipment. In a recent study, no difference in yield was found between using 132 or 102 cm (52 or 40 inches) between row spacings. However, as within row spacing increased from 7.5 cm (3 inches) to 22.5 cm (9 inches), % of harvested plants of the top two grades (Texas Department of Agriculture grades 1 and 1 1/2) increased from 59 to 79% (Pemberton and Roberson, 1987). However, these systems will have to be considered in light of production cost figures and optimization of fertilization and irrigation regimens.

Weed control is critical for successful rose bush production in east Texas. Herbicide use is rapidly though not completely replacing the hoe for keeping rose fields free of weed competition which can dramatically lower plant grade and crop value. Paterson et al., (1980) have found that oryzalin (Surflan), napropamide (Devrinol), and simazine (Princep) plus Surflan would control a broad spectrum of grass and broadleaf weed species. However, Surflan, at 4.5 kg active ingredient (ai)/hectare (4 lbs ai/acre), can cause leaf chlorosis on rootstock plants and plants in their second year of production. Recently, a mixture of metolachlor (Dual) and Princep, applied to budded rootstock plants at 3.4 kg ai/ha (3 lbs ai/acre) and 0.9 kg ai/ha (0.8 lbs ai/acre), respectively, was found to control several weed species including <u>Diodia teres</u> (poorjoe) during the first year of plant production (Pemberton et al., 1984). Oxyfluorfen (Goal) controlled the same weed species at 4.5 kg ai/ha (4 lbs ai/acre), but the liquid formulation used burned and defoliated the rootstock plants. Plants were then treated with the same treatments the following spring. When these plants were harvested, Goal was found to decrease plant grade dramatically. However, Dual plus Princep applied twice during the two-year production cycle using 3.4 kg ai/ha (3 lbs ai/acre) plus 0.9 kg ai/ha (0.8 lbs ai/acre), respectively, did not reduce plant grade when compared to controls (unpublished data). Further testing of herbicides for use in rose plant production is warranted as many new chemicals and formulations are being introducted which could allow more efficient weed control while minimizing the amount of chemical used and the need for extensive hand labor. Currently, several herbicides are being tested for effects on winter weed growth as well as rooting and growth of rootstock cuttings during the first spring of production.

Disease control is necessary for economic rose production. Spray trials for powdery mildew and blackspot have been initiated with George Philley (TAEX, Overton). No improvement over current practices has been found. However, a new effort is being directed, in cooperation with Creighton Miller (TAES, College Station), to study disease resistance to blackspot in roses. Understanding more about the physiology of this disease and how some rose species resist its attack will lead to the development and utilization of new breeding lines. From these, the production of desirable cultivars which would perform well in a landscape without the excessive use of chemicals could be eventually realized.

Virus diseases have been on the increase in rose plant production in this country. To determine the extent of the problem in Texas, plants are being grown from indexed virus free budwood and rootstock. Stunted growth and weak graft unions susceptible to wind damage are suspected symptoms of virus infected plants which may not have any visible symptoms.

Forty-three cultivars of roses, some of which have been in cultivation for 400 years and are not common in modern trade, have been planted to aid in the study of desirable traits such as disease and pest resistance and ease of rooting. An emphasis is being placed on collecting rootstock species particularly selections of Rosa multiflora. Cultivars will be continually added, observed, and tested for commercial and scientific value.

Post Harvest Practices

Currently, processors dip the canes of packaged plants in hot wax to prevent cane dessication during the marketing period. Waxing is undesirable to the consumer and has caused more rapid sprouting when compared to nonwaxed canes in a preliminary study (unpublished data, H. B. Pemberton). The use of anti-transpirant or fruit wax dips has been explored in an effort to replace this practice. However, the use of alternate cane dips does not appear promising. Future experiments will include the use of plastic bags to enclose the canes or whole plant for maintaining viability and quality during marketing.

In addition to work with standard rose plants, work on shipment of miniature roses grown as a flowering potted crop has begun in cooperation with John Kelly (Clemson University) studying the effects of high temperatures during dark storage on leaf abscission. This work will determine the feasibility of long distance shipping of miniature roses in bud and bloom for mass marketing. Currently, this practice is risky due to deterioration of the plants during the shipping period. Studies are in progress to screen several commercial cultivars for sensitivity to adverse shipping conditions.

Floricultural Crops

The primary emphasis of this project has been and still is field production of rose plants. However, expansion into the area of other nursery and floricultural crops has begun. In the area of cut flowers, *Narcissus* bulbs grown at three planting densities produced as many as 230,000 flowering stems/acre (Pemberton et al., 1987a). Plantings are also being established to determine the cut flower production feasibility of *Liatris* grown in the field and long-stem roses grown under different greenhouse covers and in the field.

Herbaceous perennials are enjoying a resurgence in popularity for garden use, but production information in Texas is lacking. In cooperation with Jayne Zajicek (TAES, College Station), plug-grown plants of two species are being grown in one gallon containers in full sun or under 30% saran for varying lengths of time up to 15 months. After the growing periods end in spring, summer, or autumn, plants are being planted in the field to study ease of establishment and water use patterns under different irrigation regimens. This information should prove useful to consumers and producers alike so that these plants can be marketed and placed in the landscape at the optimum time for this part of Texas.

Eustoma and *Aeschynanthus* are new flowering potted crops being tested in cooperation with Mark Roh of the USDA Florist and Nursery Crops Laboratory at Beltsville, MD. These crops are being tested at several locations in the U.S. as potential introductions for use as 4" flowering potted crops. *Eustoma* is a native of Texas which has undergone extensive hybridization in Japan and now the U.S. for use as a cut flower and a pot plant.

The use of growth regulators is often critical to optimum production of flowering potted plants. To understand more about the underlying physiology of plant responses to these chemicals, Terri Woods Starman used Helianthus (sunflower) to study the effects of anymidol, a growth retardant, on the morphology, anatomy, and leaf chlorophyll content of dwarf and standard cultivars. Besides controlling height, ancymidol was found to increase leaf thickness due to more extensive development of the palisade layer. Chlorophyll content also increased independent of anatomical effects. Gibberellic acid reversed the effects of ancymidol (Starman, 1986). This information will prove valuable as we try to improve the timing and efficacy of growth regulator applications in all phases of horticulture.

LITERATURE CITED

Anonymous. 1987. Agricultural Income 1986. Texas Power and Light. Dallas, Texas.

Forse, L. B., J. L. Starr, H. B. Pemberton, and D. R. Paterson. 1984. Losses due to nematodes and crown gall in the East Texas rose bush industry. TX Ag. Expt. Stat. Prog. Rept. PR-4255.

Hambrick, C. E., III, F. T. Davies, Jr., and H. B. Pemberton. 1987. Carbohydrate/nitrogen levels and seasonal rooting of *Rosa multiflora* 'Brooks 56' hardwood cuttings. Submitted to the J. Amer. Soc. Hort. Sci.

Paterson, D. R., R. M. Menges, D. R. Earhart, and M. C. Fuqua. 1980. Herbicide research with East Texas roses, 1977-1979. Texas A&M Ag. Exp. Station PR-3752.

Paterson, D. R., R. A. Taber, D. R. Earhart, and H. B. Pemberton. 1983a. Influence of methyl bromide soil fumigation on VA mycorrhizal infection of *Rosa multiflora* understock. HortScience 18:173 (Abstr.).

Paterson, D. R., R. A. Taber, D. R. Earhart, H. B. Pemberton, G. A. Rowland, and W. E. Roberson. 1983b. Influence of methyl bromide soil fumigation on VA mycorrhizal infection and growth of *Rosa multiflora* understock. HortScience 18:607 (Abstr.).

Paterson, D. R., R. A. Taber, D. R. Earhart, H. B. Pemberton, G. A. Rowland, and W. E. Roberson. 1983c. Mycorrhizae beneficial soil fungi. TX Ag. Expt. Stat. Tech. Rept. 83-3:54-66.

Paterson, D. R., Ruth A. Taber, D. R. Earhart, H. B. Pemberton, G. A. Rowland, and W. E. Roberson. 1984. Influence of soil fumigation, herbicide, variety, and fertilizer on grade of *Rosa multiflora*/Mirandy and *R. multiflora*/Tiffany cultivar combination. HortScience 19:521 (Abstr.).

Paterson, D. R., R. A. Taber, H. B. Pemberton, and D. R. Earhart. 1986. Interaction between an indigenous endomycorrhizal fungus and mineral nutrition of *Rosa multiflora* understock. HortScience 21:312-313.

Pemberton, H. B. and W. R. Roberson. 1987. The effects of between and within row spacing on final plant grade of field produced rose plants. TX Ag. Expt. Stat. Tech. Rept. (1987 Field Day)

Pemberton, H. B., R. M. Menges, and W. E. Roberson. 1985. New chemicals for weed control in field production of rose plants during the first season of growth. TX Ag. Expt. Stat. Tech. Rept. 85-1:63-67.

Pemberton, H. B., V. A. Haby, J. V. Davis, and W. R. Roberson. 1986a. Response of field grown rose plants to lime, P, and K fertilization. HortScience 21:934 (Abstr.).

Pemberton, H. B., V. A. Haby, W. E. Roberson, and J. V. Davis. 1986b. Increases in root and shoot growth of Rosa multiflora cuttings taken from stock plants fertilized with lime and P. Acta Horticulturae 189:123-126.

Pemberton, H. B., W. E. Roberson, F. T. Davies, Jr., and M. L. Struthers. 1986c. Optimum planting dates for Rosa multiflora Thunb. hardwood cuttings used for field production of rose plants. HortScience 21:818 (Abstr.).

Pemberton, H. B., M. L. Struthers, and W. R. Roberson. 1987a. Flower yield from field grown Narcissus bulbs at three planting densities. TX Ag. Expt. Stat. Tech. Rept. (1987 Field Day)

Pemberton, H. B., W. R. Roberson, and W. L. Struthers. 1987b. Observations concerning the capacity of Rosa cv. Mr. Lincoln shoots in different physiological states to be stored at -1°C. TX Ag. Expt. Stat. Tech. Rept. (1987 Field Day)

Pemberton, H. B., W. E. Roberson, M. L. Struthers, and C. J. Bull. 1987c. Requirements for successful pre-plant storage of Rosa multiflora 'Brooks 56' hardwood cuttings. TX Ag. Expt. Stat. Tech. Rept. (1987 Field Day)

Starman, T. Woods. 1986. Effects of the growth retardant ancymidol on sunflower morphology, pigments, and leaf anatomy. Ph.D. Thesis. TX A&M University, College Station, TX, U.S.A.

Stump, D. S. 1982. Research Summary - The census of horticultural specialities. Hort. Research Institute, Washington, D.C.

Taber, R. A., D. R. Paterson, H. B. Pemberton, D. R. Earhart, G. A. Rowland, and W. E. Roberson. 1983. Influence of indigenous rose root mycorrhizal and nutrient solution concentration on growth of Rosa multiflora understock. HortScience 18:571 (Abstr.).