



Summary of N and K Research with Eggplant in Florida¹

George Hochmuth and Kim Cordasco²

Eggplants were grown on 1,800 acres in the 1996-1997 season and produced 1,554,000 (33 lb) bushels valued at \$13,400,000 (Fla. Agri. Stat. Serv., 1998). Most of the eggplants produced in Florida are grown in the southeast Palm Beach County area with the heaviest harvest months in April and May in a harvest season that extends from September through July. Planted acreage fluctuated between 1800 and 2600 acres over the seasons from 1981 to 1996. Crop value per bushel steadily increased through this period from \$5.30 (1981 to 1985) to \$7.44 (1986 to 1990) to \$8.58 (1991 to 1995). In the 1996-1997 season, 33% of the eggplant shipped by truck to cities throughout the U.S. originated in Florida.

The purpose of this publication is to summarize eggplant fertilization research leading to current University of Florida recommendations for eggplant fertilization and to summarize needs for continued research. A 1994 USDA-administered survey of fertilizer use by commercial farms documented an average application of 121-124-120 lb/acre of N, P₂O₅, and K₂O, respectively, in Florida (Fla. Agr. Stat. Serv., 1995). These results indicate that actual N-P-K usage rates, averaged from survey results, are near the current recommendations for eggplant grown in Florida. The current N fertilizer recommendation is

160 lb/acre, with P₂O₅ and K₂O recommendations dictated by the results of Mehlich-1-tested soil concentrations of these nutrients. Recommendations are for 160, 130, 100, or 0 lb/acre P₂O₅ or K₂O based on respective soil-test interpretations of very low, low, medium, and high/very high concentrations of each nutrient.

Data Summary Method

Responses to fertilizer varied depending on season, cultivar, and location in the state. Evaluation of yield data was performed by using relative yield (RY), a calculated percentage chosen as the unit to express eggplant yield responses to fertilization. The highest yield for each fertilizer experiment was assigned a 100% value, and other yields were expressed as a percentage of the highest yield. The actual yield (in 33 lb bushels/acre) was presented for the treatment corresponding to 100% RY. The RYs were plotted against rates of nutrient to determine how eggplant yields responded to fertilizer in Florida. The RY presentation allowed data from a variety of experiments to be included in the graphical summary of yield responses to fertilization. For most studies, RYs of 95 to 100% were not significantly different.

1. This document is HS 751, one of a series of the Horticultural Sciences Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date August 1999. Reviewed May 2003. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu>.

2. George Hochmuth, professor, and Kim Cordasco, technical writer, Horticultural Sciences Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611.

similar to the unmulched plants. Saturation extracted soil NO_3 concentrations on unmulched beds were depleted to half of those from paper- or polyethylene-mulched beds at preharvest sampling in May and June, 1973, and depleted to 20% of the mulched concentrations in May and June, 1974. Soil concentrations of $\text{NH}_4\text{-N}$ from unmulched beds sampled in May and June were depleted to 23% of those from paper- and polyethylene-mulched beds in 1973 and to 3.5% of soil $\text{NH}_4\text{-N}$ concentrations from all mulched beds in 1974.

Poultry manure was compared with a commercial 13-4-13 ($\text{N-P}_2\text{O}_5\text{-K}_2\text{O}$) fertilizer source in the production of eggplant at an experiment in Live Oak, Suwannee Valley Research and Education Center (Hochmuth and Hochmuth, 1996). Lakeland fine sand beds, spaced on 5-foot bed centers received 0, 160, or 200 lb/acre N from the 13-4-13 fertilizer source, or 160, 310, or 470 lb/acre N from poultry manure. Rates of clean-out poultry manure, supplied from sheltered piles, were calculated based on estimated 50% mineralization during the season. Fertilizers were broadcast 4 feet across the bed and tilled in, followed by bed formation, fumigation, and mulching with black polyethylene. 'Classic' eggplants were transplanted, and drip irrigation was applied to maintain soil moisture at -8 to -12 centibars to a 12-inch soil depth.

Early yields with 160 lb/acre N were highest from plants fertilized with the commercial fertilizer, resulting in 517 bushels/acre compared to 311 bushels/acre with poultry manure. An increased early yield of U.S.-No.-1-grade fruit from commercially fertilized plants created the yield difference. Failure of the manure-fertilized plants to produce optimum early yields was attributed to delayed mineralization compared to the readily available commercial fertilizer. Poultry manure (310 lb/acre) at twice the N rate of the commercial fertilizer (160 lb/acre) resulted in similar total marketable yields, 1215 and 1274 bushels/acre, respectively. Yields were not different with either N source at rates above 160 lb/acre N. Optimum yields occurred with 200 lb/acre commercial-fertilizer N (1400 bushels/acre) and with 470 lb/acre of poultry-manure N (1370 bushels/acre). Researchers suggested that poultry manures, used in combination with commercial fertilizer, may provide

the most efficient usage of poultry manure in the area of Suwannee, Madison, and Hamilton counties where a large poultry industry exists.

Nitrogen

Spring experiments in 1963 and 1965 were conducted in Dover on Scranton fine sand soils (Sutton and Albregts, 1970). Nitrogen rates were increased from 0 to 200 lb/acre in increments of 50 lb/acre in 1963 and from 0 to 268 lb/acre in increments of 67 lb/acre in 1964. Five rates of each phosphorus (P) and potassium (K) were applied factorially from a zero check treatment each season to highest P rates of 230 lb/acre P_2O_5 (1963) and 280 lb/acre P_2O_5 (1965) and highest K rates of 145 lb/acre K_2O (1963) and 275 lb/acre (1965). Fertilizer sources NH_4NO_3 , superphosphate, and KCl were band applied in three equal applications in 1963 and in two equal applications in 1965. Unmulched beds were spaced 4 feet on center each season, established with 'Florida Market' transplants, and overhead irrigated as needed.

Interaction effects among treatments were not significant in either experimental season. Yields responded quadratically to increased N in 1963, leveling off above 100 lb/acre N (621 bushels/acre, 99% RY, bushel weight not specified). Yield results in 1965 were linear, with yield increases through 268 lb/acre N (753 bushels/acre, 100% RY), a slight yield increase from 99% RY with 200 lb/acre N. Researchers cited an additional N treatment, not included in the analysis, of 335-344-344 lb/acre ($\text{N-P}_2\text{O}_5\text{-K}_2\text{O}$) where yield was reduced to 90% of the highest yield with 268 lb/acre N. Two or three equal applications of a total 270 lb/acre N were favored for eggplant production on fine sand soils used in these experiments. Eggplants treated with the lower N rates developed an "off color" in 1963, likely due to sun damage from fewer shading leaves with these low N rates, and in 1965, bacterial wilt occurred in plants where no N or K were applied.

Experiments conducted near Live Oak in the spring seasons of 1988 to 1990 were designed to determine N requirements for mulched eggplant (Hochmuth et al., 1991a). Klej (Lakeland) fine sand soils had an organic-matter content of 1.4% and N was applied each spring at rates of 0, 60, 120, 180,

240, and 300 lb/acre. Uniform seasonal rates of P_2O_5 and K_2O were 0 and 50 lb/acre (1988), 50 and 120 lb/acre (1989), and 0 and 100 lb/acre (1990), respectively. Nutrients were from NH_4NO_3 , triple superphosphate, and $K_2Mg(SO_4)_2$. All fertilizer materials were broadcast in the beds, tilled, mulched with black polyethylene, and planted with 'Classic' eggplant transplants each spring. Beds were spaced 5 feet apart with plants grown in a single row 18 inches apart; plants were untied in 1988 and 1989 and staked and tied in 1990. Soil moisture was monitored by tensiometer and maintained at -10 centibars, using drip irrigation.

In 1988, early yield increased linearly from 22 to 72 bushels/acre with added N fertilizer from 0 to 300 lb/acre N, respectively, while early yields in 1989 and 1990 were not affected by N. Total marketable yields were lower in 1988 than yields in 1989 and 1990 but exceeded the north Florida average yield that year (670 bushels/acre) (Anon., 1990) and the state average yield in 1989 and 1990 (815 and 806 bushels/acre, respectively) (Fla. Dept. of Agric. and Consumer Ser., 1997). Total marketable yields increased quadratically and were significant at 5% probability with N fertilization in all experimental seasons. Yields leveled off above 60 lb/acre N in 1988 (680 bushels/acre, 92% RY) and above 120 lb/acre N in 1989 (1253 bushels/acre, 80% RY) and 1990 (974 bushels/acre, 100% RY). Medium fruits made up 28% to 37% of the total fruit yield, and large fruits made up 9% to 31% of total fruit yield during these experimental seasons. Based on a regression analysis of RYs for each season, total marketable yields leveled off after 112 lb/acre N during these seasons of four to five harvests over a period of about 6 weeks. A supplemental N application of 30 lb/acre N was recommended for extended harvest seasons (Shuler and Hochmuth, 1990). Leaf-tissue N concentrations increased quadratically (1% probability) with increased N. Critical leaf N concentrations of between 4.0% and 5.0% at early flowering were tied to optimum N rates, with leaf N concentrations of less than 4% at harvest associated with poor yields.

Nitrogen and potassium (K) rates below the standard grower rates of these nutrients were evaluated in a Palm Beach County fall/winter

1992-1993 experiment (Shuler and Hochmuth, 1993). Beds were on 5-foot centers, and plants were spaced 23 inches apart in the row. Starter fertilizer, 40-180-40 lb/acre N- P_2O_5 - K_2O , was broadcast on Myakka fine sand followed by bed preparation, fumigation, and mulching with silver-coated black polyethylene on September 15. Nitrogen to 160, 240, or 244 (grower rate) lb/acre was applied by pulling back the mulch and laying two bands 20 inches apart. On refastened mulch, 'Classic' eggplants were transplanted, later staked, tied four times, and harvested ten times over a 14-week period from 8 December through 16 March. Nitrogen and K_2O rates were increased to 280, 360, and 364 (grower rate) lb/acre by four 30 lb/acre liquid fertilizer injections applied with a liquid injection wheel. Subsurface irrigation was used. Addition of the injected fertilizer increased all of the N rates above the 160 lb/acre maximum recommendation for eggplant but did not increase yields or average fruit weight. Yield with 280 lb/acre N (1478 bushels/acre, 100% RY), was similar to the yield with 360 lb/acre N, 96% RY. Yield with the grower fertilization program was 1361 bushels/acre.

Summary Nitrogen

Eggplant yields responded to mixed-fertilizer N rates as high as 400 lb/acre (Fig. 1), but yields generally maximized near 120 lb/acre N in most experiments (Fig. 2). The dashed line in both figures indicated the current fertilizer N recommendation of 160 lb/acre (Hochmuth and Hanlon, 1995). Nitrogen rates to 310 lb/acre, supplied from poultry manure, were required for optimum yield with this N source, while yield in another mixed-fertilizer experiment was reduced by 10% with 335 lb/acre N. The mineralization rate of poultry manure appeared to be inadequate for use as the sole N source for eggplant, resulting in lower early yield and requiring two times the N for yields similar to those with commercially fertilized plants. Used in combination with commercial fertilizer, poultry manure may yet be a potential N source for eggplant production. Off-color eggplant fruits with light lengthwise streaks resulted from plants treated with 50 to 100 lb/acre N, likely due to reduced leaf area and sun damage from insufficient leaf cover. Early yield was doubled with mulched compared to unmulched eggplant in one

season. Soil beneath black paper or polyethylene mulch and occasionally strip mulch had from 2 to 6 times more soil $\text{NO}_3\text{-N}$ and from 3 to 40 times more $\text{NH}_4\text{-N}$ at harvest sampling than soils from unmulched plants.

Potassium

Soil Testing

Knowledge of soil nutrient levels, particularly P and K, before planting is the starting point to predicting eggplant response to varying rates of applied nutrient. Mehlich-1 (M-1) soil extractant is used on mineral soils to determine preplant soil nutrient concentrations and provide information to review research results for degree of support of existing fertilization recommendations established by M-1.

Mehlich-1 extractant indices (expressed as ppm soil-extracted nutrient) are classified as very low, low, medium, high, and very high, and a crop-specific fertilizer recommendation is made from that classification. The M-1 solution became the accepted extractant standard in 1979 at the University of Florida. Prior to M-1, ammonium acetate and water extractants were used. Indices recorded from these methods cannot be directly equated with M-1 indices or fertilizer recommendation rates. Water-management practices, fertilizer sources, and application methods will also be summarized in this report.

Potassium

Factorial applications of five rates each of N, P, and K were banded in three equal applications in spring 1963 and in two equal applications in the spring of 1965 (Sutton and Albrechts, 1970). Potassium from KCl was applied at rates of 0, 50, 100, 150, or 200 lb/acre K_2O in 1963 and at rates of 0, 70, 140, 210, or 280 lb/acre K_2O in 1965. Experiments were conducted near Dover on Scranton fine sand beds spaced 4 feet apart and set in a single plant row with 18 inches (1963) or 24 inches (1965) between 'Florida Market' eggplants. Beds received overhead irrigation (mulch use was not specified). Nutrient effects did not interact significantly for yield responses in either experimental season. Total

marketable yields increased quadratically in 1963, leveling off above 100 lb/acre K_2O (625 bushels/acre, 100% RY, bushel weight was not specified). In 1965, marketable yields increased linearly in response to increased K to 280 lb/acre K_2O (878 bushels/acre, 100% RY). Based on nutrient deficiency symptoms and low yields with zero lb/acre K_2O , soils in both seasons were interpreted as having low residual soil K concentrations.

Experiments conducted near Live Oak at the Suwannee Valley Research and Education Center in the spring and fall of 1991 had low M-1 soil K concentrations, 21 ppm in spring and 31 ppm in fall (Hochmuth et al., 1992; Hochmuth et al., 1993). The K recommendation in 1989 was for 130 lb/acre K_2O (Kidder et al., 1989). Potassium treatments from $\text{K}_2\text{Mg}(\text{SO}_4)_2$ in the spring and from KCl in the fall were applied at 0, 50, 100, 150, 200, or 250 lb/acre K_2O each season, and $\text{NH}_4\text{NO}_3\text{-N}$ was applied uniformly at 120 lb/acre. Fertilizers, including 50 lb/acre P_2O_5 , were mixed, broadcast 36 inches across the bed area, and tilled. Klej (Lakeland) fine sand beds, mulched with black polyethylene in the spring and white-on-black polyethylene in the fall, were planted with 'Classic' eggplants in single rows spaced 5 feet on center. Drip irrigation was applied to maintain soil moisture between -8 and -12 centibars to an 8-inch depth.

In the spring, early marketable yield increased linearly with 0 to 250 lb/acre K_2O from 242 to 364 bushels/acre, respectively. Soil K concentrations were lower this season than in the fall where K fertilization had no effect on early yields. In both seasons, total marketable yields responded quadratically to increased K fertilizer, consisting of quadratic increases in yields of USDA-No.-1-grade fruits. Total marketable yield leveled off after 100 lb/acre K_2O in both seasons (93 and 87% RYs, respectively) with 100% RYs with at lb/acre K_2O (1500 and 1630 bushels/acre, respectively). An average of calculated high-yield K rates from the linear-plateau and quadratic equations resulted in K recommendations of 125 lb/acre K_2O (spring) and 100 lb/acre K_2O (fall). Spring-season leaf-tissue K concentrations ($\geq 3.5\%$) were sufficient with 100 lb/acre K_2O at early fruit set, but a leaf-tissue K concentration of 3.0% appeared adequate at harvest

(Hochmuth et al., 1991b). Fall-season leaf-tissue K concentrations were 3.5% with 100 lb/acre K_2O at all sampling periods but the final harvest. With 100 lb/acre K_2O , petiole-sap K concentrations were sufficient, 3500 ppm in spring and 3800 ppm in the fall, but were less than sufficient in both seasons with K rates below 100 lb/acre. A high correlation between petiole-sap K concentration and leaf-tissue K concentration led researchers to recommend the petiole-sap test for K as a quick and reliable in-the-field method of assessing plant K nutrition.

Researchers in a Palm Beach County fall/winter 1992-1993 experiment sought to evaluate eggplant yield responses to 40, 100, 200, and 300 lb/acre K_2O (calculated for beds spaced on 5-foot centers) and to the grower application of 376 lb/acre K_2O (Shuler and Hochmuth, 1993). Based on low (M-1) soil-test K concentrations, 32 ppm (130 lb/acre) K_2O were recommended (Kidder et al., 1989). Potassium was broadcast on the Myakka fine sand with the starter fertilizer, 40-180-40 lb/acre N- P_2O_5 - K_2O , followed by bed preparation, fumigation, and mulching with silver-coated black polyethylene on September 15. The mulch was pulled aside ten days later and fertilizer treatments at the specified rate were applied in two bands 20 inches apart. The mulch was refastened, and 'Classic' eggplants were transplanted, later staked, tied four times, and harvested ten times. In addition to the preplant and band-applied KNO_3 -K fertilizer, 120 lb/acre K_2O were applied in four 30 lb/acre K_2O liquid fertilizer injections using an injection wheel. Irrigation was by subsurface.

Application of the liquid fertilizer combined with the dry band-applied fertilizer increased K treatment rates to 160, 220, 320, and 420 lb/acre K_2O (500 lb/acre K_2O grower treatment). Marketable yields did not respond to K, with 100% RY (1544 bushes/acre) with 160 lb/acre K_2O and 90% RY with 420 lb/acre K_2O . Marketable yield with the grower K treatment of 500 lb/acre K_2O was 1361 bushes/acre. Early or total yields of large, medium, or small fruit were not affected by increased K, nor was average fruit weight (1.09 lb/fruit) affected by K fertilization. Residual soil K concentrations (M-1) sampled through the fertilizer band increased linearly (1% probability) from 15 to 89 ppm with dry K treatments of 40 to 300 lb/acre K_2O (160 lb/acre N) and

increased to 400 ppm with the grower dry fertilizer application of 336 lb/acre K_2O (244 lb/acre N).

Two K rates, 100 and 150 lb/acre K_2O , and a zero K treatment were evaluated in a spring 1993 experiment on M-1 low K (31 ppm) Lakeland fine sand soils at the Suwannee Valley Research and Education Center near Live Oak (Hochmuth and Hochmuth, 1994). A percent, 0, 25, or 50%, of each K rate was supplied from controlled-release (CR) K (KNO_3) with the balance of the fertilizer from soluble KNO_3 . Likewise, 150 lb/acre N were applied as 50% CR-urea and 50% NH_4NO_3 . No phosphorus was applied due to high soil-test P concentrations. Broadcast fertilizers were tilled into beds which were formed on 5-foot centers (fertilizer rates were calculated on a standard 6-foot bed spacing), fumigated, and mulched with black polyethylene. 'Classic' eggplants were planted in a single row with 18 inches between plants, and drip irrigation was applied to maintain soil moisture between -8 to -12 centibars as measured by tensiometer.

Marketable yields were similar with 100 (958 bushes/acre, 100% RY) or 150 lb/acre K_2O (96% RY). Nearly 50% of the yields from K-fertilized plants were No. 1 large eggplants. These large eggplants increased the crop value, compared to 72% RY from plants that received no K. The proportion of CR-K fertilizer interacted with K rate for effects on the early and total yields of No. 1 large fruit. Yields of these fruit increased when 150 lb/acre K_2O contained 25% or 50% CR-K, and with 100 lb/acre K_2O a yield increase occurred with 50% CR-K. Authors concluded that soil soluble salt concentrations were likely reduced where the fertilizer contained CR-K. Fertilizer leaching due to heavy rainfall was not a factor in the response to CR-K this dry season. Average fruit weight did not differ with K treatment. Potassium-deficiency symptoms and deficient leaf-tissue K concentrations (4.4% and 2.5% when plants were 12 inches tall and at mature fruit stages, respectively) occurred in plants that received no K fertilizer. Adequate (> 5% and > 3.5% at the same respective plant stages) leaf-tissue K concentrations and optimum yield with 100 lb/acre K_2O led researchers to conclude that 100 lb/acre K_2O was sufficient on these low K soils.

Experimentation with CR-K fertilizer continued at the Suwannee Valley Research and Education Center near Live Oak in the spring of 1994 (Hochmuth and Hochmuth, 1995). Most of experimental conditions were the same as in the previous season, including the Lakeland fine sand soils with M-1 low (28 ppm) K concentrations. Exceptions were an increased N rate, 175 lb/acre this season, and five harvests this season compared to four in the previous season. Nitrogen fertilizer was derived equally from CR-urea and NH_4NO_3 , with fertilizer rates calculated on standardized 6-foot bed centers (beds were spaced 5 feet apart). Marketable yields were increased from 76% RY with zero K to 100% RY (1475 bushels/acre) with 100 lb/acre K_2O . Potassium fertilization did not affect total marketable yields (96% RY with 150 lb/acre K_2O), early marketable yields (227 bushels/acre), or average fruit size (1.13 lb/fruit). Unlike the previous season, the proportion of CR-K fertilizer had no effect on total season U.S. No. 1 fruits or on total marketable yield. Leaf-tissue K concentrations were deficient with the zero K treatment and were unaffected by either K rate of 100 or 150 lb/acre or proportion of CR-K. Adequate leaf-tissue K concentrations, between 3.5% and 5.0% at early fruit set, occurred with both K fertilization rates. Researchers concluded that the 130 lb/acre K_2O recommendation for low K soils would be sufficient.

Summary Potassium

Relative yield responses from K fertilization experiments are presented in Fig. 3, where the dashed line indicates the current maximum recommended K rate of 160 lb/acre K_2O for soils with very low soil K concentrations. Seven experiments were conducted with K fertilization of eggplant largely on drip irrigated and mulched beds with low M-1 soil K concentrations. Total marketable yields optimized at or near the recommended 130 lb/acre K_2O in all experiments where M-1 soil testing was performed. Yields responded linearly through 280 lb/acre K_2O (KCl) in a single overhead-irrigated experiment where mulch use was not specified and soil K concentrations were not evaluated. In other experiments, yields did not respond to K rates above 100 or above 160 lb/acre K_2O , the minimum tested K rate, nor were fruit quality factors, size, or average

fruit weight affected by increased K through 420 lb/acre K_2O . Potassium applied above plant needs, to 300 lb/acre, remained in the fertilizer band after harvest as 89 ppm M-1 extracted K (increased from an initial 32 ppm M-1 soil K concentration). Experimentation with CR-K sources resulted in increased yield of U.S. No. 1 fruit when 25% to 50% CR-K were applied with 150 lb/acre K_2O or 50% CR-K with 100 lb/acre K_2O in a single experiment season. Researchers cited reduced soluble salt concentrations and potentially higher yields of No. 1 fruit with the CR-K source, though total marketable yields were similar with both CR or soluble K sources in two experiment seasons. A positive correlation between petiole-sap K concentrations and leaf-tissue K concentrations qualified the petiole-sap test as a reliable tool for nutrient testing with eggplant. Additional research is needed in southeast Florida, where eggplants are chiefly grown, to supplement the research results from north and west Florida.

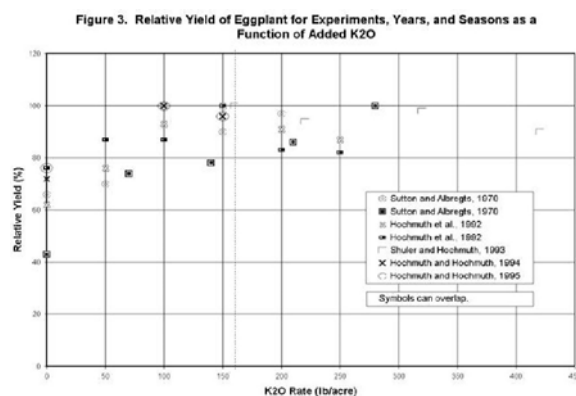


Fig. 3.

Overall Summary

Research with N and K adequately documents current N and K recommendations in most studies. Most eggplants are produced in Palm Beach County and studies with N and K are incomplete for rates of N less than the rate currently recommended. More research is needed for drip-irrigated eggplant to determine optimum fertigation schedules. No research has been conducted to relate fertilizer and irrigation management practices to nutrient leaching. No studies on phosphorus fertilization of eggplant have been reported.

Literature Cited

- Albregts, E. E., and C. M. Howard. 1975. Influence of mulch type and fertilizer rates on eggplant response. *Soil Crop Sci. Soc. Fla. Proc.* 34:61-62.
- Anon. 1990. Florida Agricultural Statistics, Vegetable Summary 1988-1989. Fla. Agric. Stat. Serv., Orlando, FL 32803.
- Florida Agr. Statistics Serv. 1995. Vegetable Chemical Use. 8 pp. Fla. Agric. Stat. Serv., Orlando, FL.
- Florida Dept. of Agriculture and Consumer Services. 1998. Florida Agricultural Statistics­­Vegetable Summary 1996-1997. 70 pp. Fla. Agric. Stat. Serv., Orlando, FL.
- Hanlon, E., and G. Hochmuth. 1989. Calculating fertilizer rates for vegetable crops grown in raised-bed cultural systems in Florida. Fla. Coop. Ext. Serv. Spec. Series SS-SOS-901.
- Hochmuth, G., and E. Hanlon. 1995. IFAS standardized fertilization recommendations for vegetable crops. Fla. Coop. Ext. Serv. Circ. 1152.
- Hochmuth, G. 1996. Vegetable fertilization. pp. 3-17. IN: G. Hochmuth and D. Maynard (eds.). Vegetable production guide for Florida. Fla. Coop. Ext. Serv. Circ. SP 170.
- Hochmuth, R. C., and G. J. Hochmuth. 1996. Comparison of different commercial fertilizer and poultry-manure rates in the production of eggplant. Fla. Agr. Expt. Sta. Research Report, Suwannee Valley REC 96-15.
- Hochmuth, G., B. Hochmuth, E. Hanlon, and M. Donley. 1991a. Nitrogen requirements of mulched eggplant in northern Florida. Fla. Agr. Expt. Sta. Research Report, Suwannee Valley REC 91-14.
- Hochmuth, G., D. Maynard, C. Vavrina, and E. Hanlon. 1991b. Plant-tissue analysis and interpretation for vegetable crops in Florida. Fla. Coop. Ext. Serv. Spec. Ser. SS-VEC-42.
- Hochmuth, G. J., B. C. Hochmuth, E. A. Hanlon, and M. E. Donley. 1992. Effect of potassium on yield and leaf-N and K concentrations of eggplant. Fla. Agr. Expt. Sta. Research Report, Suwannee Valley REC 92-2.
- Hochmuth, G. J., R. C. Hochmuth, M. E. Donley, and E. A. Hanlon. 1993. Eggplant yield in response to potassium fertilization on sandy soil. *HortScience.* 28(10):1002-1005.
- Hochmuth, G., and B. Hochmuth. 1994. Response of eggplant to controlled-release potassium fertilization. Fla. Agr. Expt. Sta. Research Report, Suwannee Valley REC 94-02.
- Kidder, G., E. A. Hanlon, and G. J. Hochmuth. 1989. IFAS standardized fertilization recommendations for vegetable crops. Fla. Coop. Ext. Serv. Spec. Ser. SS-SOS-907.
- Shuler, K. D., and G. J. Hochmuth. 1990. Fertilization guide for vegetables grown in full-bed mulch culture. Fla. Coop. Ext. Serv. Circ. 854.
- Shuler, K. D., and G. J. Hochmuth. 1993. Eggplant yield response to reduced rates of nitrogen and potassium fertilizer, Thomas Produce, Delray Beach, fall-winter, 1992-93. Fla. Agr. Expt. Sta. Research, Palm Beach County Ext. Report 1993-5.
- Sutton, P., and E. E. Albregts. 1970. Response of eggplant to nitrogen, phosphorus, and potassium fertilization. *Soil Crop Sci. Soc. Florida Proc.* 30:1-5.