

A Summary of N and K Research with Muskmelon in Florida¹

George Hochmuth and Kim Cordasco²

Muskmelon, also called cantaloupe, and its cultural companions honeydew, casaba, and Persian melons, are minor crops in Florida. Crop losses to diseases and insects have led to a reduction in the large production area that had extended in the early 1900s from the Georgia and Alabama borders south through the Florida counties of Sumter and Marion, to a small insignificant area by 1936 (Whitner et al., 1953). Currently, muskmelons are produced on about 3500 acres in Southwest and North Central Florida (summer) and Southwest and West Central Florida (fall) (Fla. Dept. of Agric. and Consumer Services, 1997; Hochmuth et al., 1991). Peak muskmelon harvests are in May and June, most of which is sold locally at markets and roadside stands or shipped out of the state with loads of watermelon. The introduction of new cultivars with greater disease resistance and longer shelf-life, together with development of new fungicides, have led to increased interest in muskmelon production in the state.

The purpose of this publication is to summarize muskmelon fertilization research leading to current University of Florida recommendations for muskmelon fertilization and to summarize needs for

continued research. Fertilizer use in Florida as published in Agricultural Chemical Usage 1990 Vegetables Summary (USDA, 1991) estimated fertilizer use on melon (muskmelon) and watermelon in Florida at 159-136-209 lb/acre N - P₂O₅ - K₂O. These survey-generated results indicated averaged N-P-K usage rates higher than current recommendations for muskmelon grown in Florida, particularly for potassium (K). The current N fertilizer recommendation is 150 lb/acre with P₂O₅ and K₂O recommendations dictated by the results of soil tests for these nutrients. Recommendations are for 150, 120, 80, or 0 lb/acre P₂O₅ or K₂O based on respective soil test interpretations of very low, low, medium, and high/very high concentrations of these nutrients.

Data Summary Method

Responses to fertilizer can vary depending on season, cultivar, and location in the state. Evaluation of yield data was performed by using a relative yield (RY), a calculated percentage chosen as the unit to express muskmelon yield responses to fertilization. The highest yield for each fertilizer experiment was

-
1. This document is HS-754, 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 April 2000. Reviewed October 2008. Visit the EDIS Web Site at <http://edis.ifas.ufl.edu>.
 2. G.J. Hochmuth, professor, Horticultural Sciences Department, and Center Director, North Florida Research and Education Center, Quincy, and Kim Cordasco, technical writer, Horticultural Sciences Department; Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. U.S. Department of Agriculture, Cooperative Extension Service, University of Florida, IFAS, Florida A. & M. University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Larry Arrington, Dean

assigned a 100% value and other yields were expressed as a percentage of the highest yield. The actual yield in hundred-weight (cwt) units per acre is presented for the treatment corresponding to 100% RY. The RYs were plotted against rates of nutrient to determine how muskmelon 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 from each other.

Fertilizer rates are expressed on a per-acre basis (amount of fertilizer used on a crop growing in an area of 43,560 square feet). Changes in bed spacing often lead to needed changes in fertilizer amounts. For example, to maintain the same amount of fertilizer in the bed for a crop on a 6-foot bed spacing as a crop with 4-foot bed spacing would mean an increase, by a factor of 1.5, in the "per acre" rate of fertilizer for the crop growing in beds spaced 4 feet on center compared to a crop with beds spaced 6 feet on center. The important aspect is to have the same amount of fertilizer per linear bed foot. This linear bed foot system is used by the University of Florida Extension Soil Testing Laboratory to express fertilizer rates. The concept is explained by Hanlon and Hochmuth (1989) and by Hochmuth (1996). Fertilizer rate expressions used in this summary and its figures are those rates presented by the various authors in their research papers. Most authors expressed rates on a per-acre basis, irrespective of variations in bed spacings among reports or experiments. Authors of a few reports chose to use the linear bed foot system to standardize fertilizer rate expressions across experiments and planting patterns. We will attempt to specify planting patterns and fertilizer rates for each experiment as far as we can determine from each report. Current standardized fertilizer recommendations for muskmelon are based on a 5-foot row spacing.

Nitrogen

Mixed Fertilizer Trials

Two mixed fertilizer studies were conducted in early muskmelon fertilization research. Yield results from these studies were presented (Fig. 1) as

responses to changes in nitrogen (N) fertilizer since N is often the most limiting nutrient in sandy soils. Yields, however, were not presented graphically with yields from experiments where the N rate was changed and P and K rates remained constant (Fig. 2).

Nitrogen rates of 210 and 315 lb/acre were cited respectively as the recommended rate and 1.5 times the recommended rate (Circular 225) at the time of a spring 1965 experiment at the North Florida Experiment Station in Quincy (Bryan, 1966). Blended fertilizers were 211-159-251 and 315-289-374 lb/acre N - P₂O₅ -K₂O, but fertilizer sources were not indicated. Fertilizers were applied in bands 8 inches to each side of the bed center before mulching with black, clear, or white/black (smoke) polyethylene. The unmulched, check treatment, received a basic initial fertilization followed by later sidedress fertilizations as recommended in Circular 225. Single-row beds of Ruston fine sand soil (plots 50 x 6 feet) were planted with 'Florida No. 1' cantaloupes. The type of irrigation used in this study was not specified.

The best yield, averaged over mulched and unmulched treatments, occurred with 210 lb/acre N for 85 cwt/acre (100% RY). Yield with 315 lb/acre N was 34 cwt/acre (Bryan, 1966). Yields were evaluated for mulched and unmulched plants this season and in the previous season (1964) where only the recommended N rate was applied to mulched and unmulched beds of 'Florisun' cantaloupes. Mulched cantaloupe plants yielded more than unmulched plants in both spring seasons with 100% RYs with clear polyethylene mulched cantaloupe in 1965 (68 cwt/acre) and with black polyethylene in 1964 (190 cwt/acre). Lower yields occurred with aluminum-painted black polyethylene mulch, 82% RY (1965), and with white/black (smoke) polyethylene mulch, 74% RY (1964). Lower soil temperatures were cited as the yield-reducing factor with these mulches. Relative yields from unmulched plants were 54% and 63% of the high mulched yields in each respective season. Early yield (19 June harvest, 1964) was increased for cantaloupes mulched with black polyethylene, 46 cwt/acre, and clear polyethylene, 43 cwt/acre, compared with unmulched plants, 14 cwt/acre. Cost of the black polyethylene this season (\$100/acre), combined with

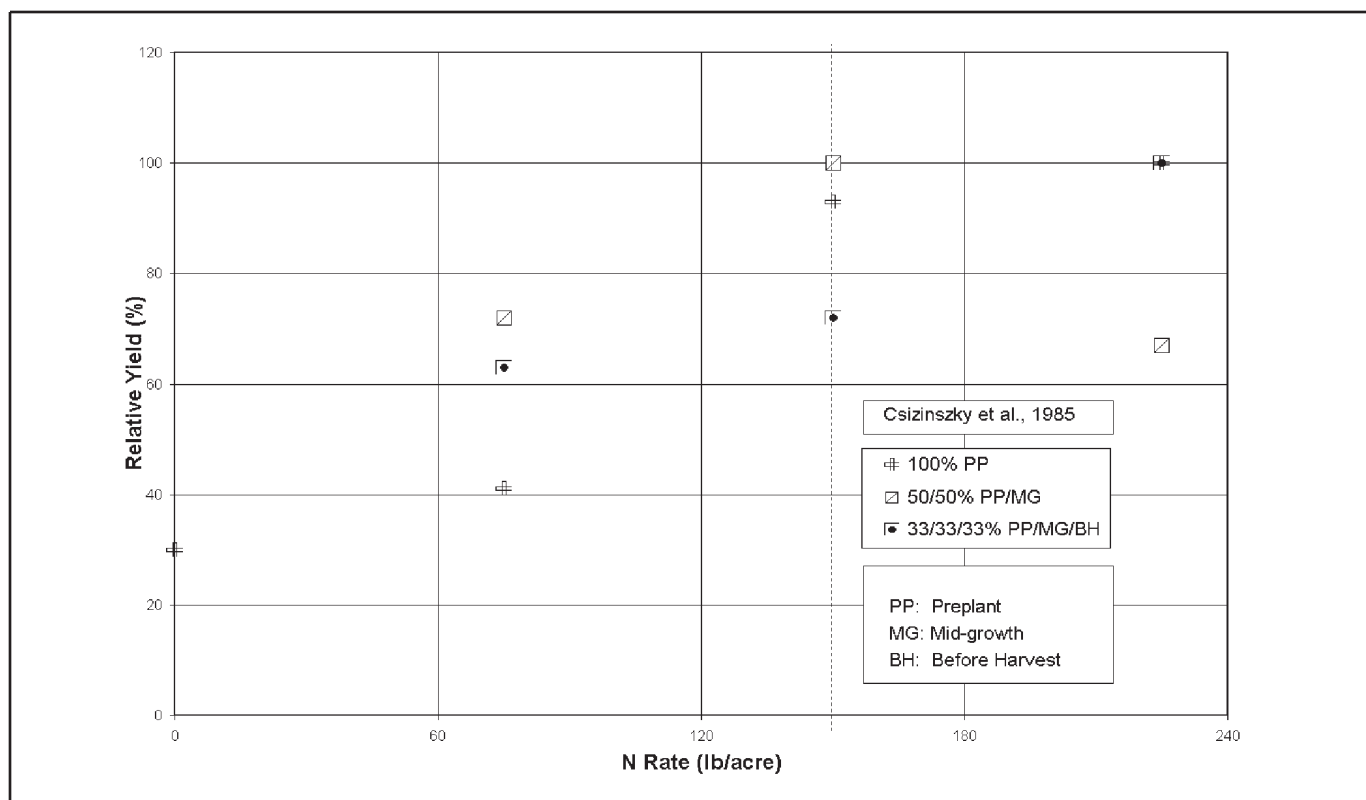


Figure 1. Relative yield of muskmelons for experiments as a function of single or multiple applications of added N (mixed fertilizer).

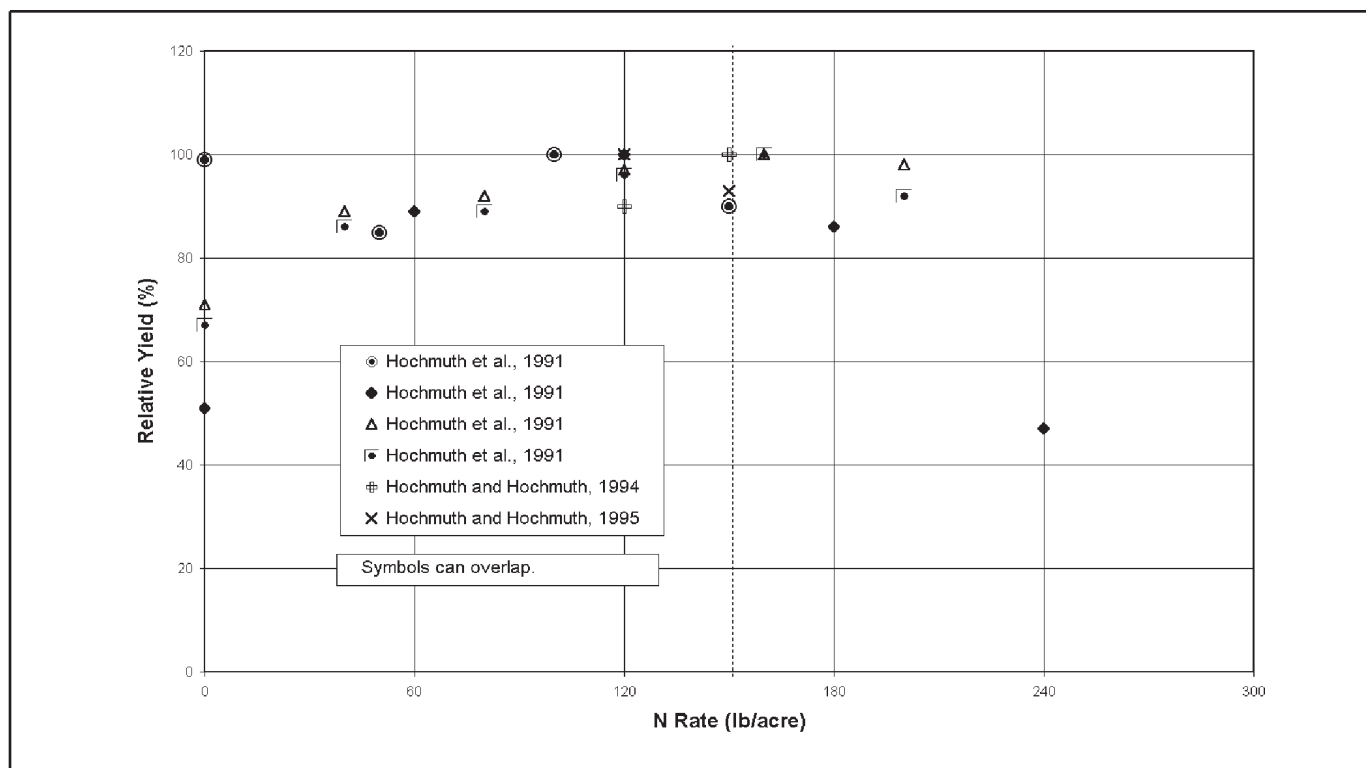


Figure 2. Relative yield of mulched muskmelons for experiments, years, and seasons as a function of added N.

high yield, increased the net return after sale of fruits from plants mulched with this product over those mulched with clear (\$120/acre) or white/black polyethylene (\$200/acre).

Reuse of polyethylene mulched beds for a second season muskmelon crop was the subject of an experiment in Bradenton Gulf Coast Research and Education Center (GCREC), spring 1984 (Csizinszky et al., 1985). The subsurface-irrigated, EauGallie fine sand beds were planted the previous fall with tomato. Single-row beds were spaced on 4.5-foot centers in groups of beds separated by irrigation/drainage ditches. Fertilizer calculations and yields were based 7500 linear bed feet of crop per acre. Fertilizer treatments were a zero fertilizer check and multiples of one, two, and three times a base fertilization rate of 75 - 30 - 75 lb/acre N - P₂O₅ - K₂O from a liquid 6 - 1.1 - 5 N-P-K analysis. Fertilizer was applied 100% preplant, 50:50 preplant and mid-growth, or 33% each at preplant, at mid-growth, and at fruit set. All fertilizer applications were made using an liquid fertilizer injection wheel.

Fertilizer rate and number of applications interacted in their effects on total marketable yield (significant at 1% probability) (Csizinszky et al., 1985). Yield responses for each fertilizer rate applied on a single, double, or triple application schedule were plotted in Fig. 1. Yield was optimized with 150 lb/acre N applied in two equal applications (599 cwt/7500 linear bed feet/acre). Two equal fertilizer applications, averaged over all application rates, likewise increased individual fruit weight to 3.22 lb/fruit at the third week compared to 2.5 and 3.1 lb/fruit with a single preplant fertilization or three equal fertilizer applications, respectively. Yields were low and fruit considered unmarketable due to low soluble solids content from plants grown on the unfertilized check plots. Fruits from all fertilized plants resulted in marketable quality fruit. Use of the fertilizer injection wheel facilitated split fertilizer applications on mulched beds and provided sufficient fertilizer for muskmelon yields above estimated state yields of 80 cwt/7500 linear bed feet/acre.

Results of work on the economics of muskmelon production conducted at Live Oak in spring, 1987 (Meline and Hochmuth, 1988) showed that enhanced

early yields and resulting higher pre-season prices provided cost justification for polyethylene-mulch and transplant-established muskmelons. Cost comparisons were made for direct-seeded or transplanted muskmelon grown with or without polyethylene mulch. Net return was greatest with the mulch/transplant cultural method (\$403/acre), followed by mulch/direct-seed (\$62/acre), no mulch/transplant (\$51), and no mulch/direct-seed (\$3/acre).

Nitrogen

Polyethylene-mulch and raised beds have become standard cultural practices for muskmelon production in the state (Hochmuth et al., 1991). The N rate recommendation for muskmelon grown on irrigated, mineral soils (subsurface and overhead-irrigation) was 120 lb/acre N (Montelaro, 1978) and remained unchanged in 1989 for mulched or unmulched muskmelon (Kidder et al., 1989). In experiments with mixed fertilizer, muskmelon yield was optimized with 150 lb/acre N applied equally at preplant and mid-growth (Csizinszky et al., 1985). Additional experimentation with muskmelon fertilization was conducted in Gainesville (1986) with overhead irrigation, in Osteen (1986) with subsurface irrigation, and in Live Oak (1988 and 1989) with drip irrigation to further document muskmelon N requirements on sandy Florida soils (Hochmuth et al., 1991).

Mulched beds in Gainesville experiments (overhead irrigation) were fertilized with 0, 50, 100, or 150 lb/acre N (NH₄NO₃) and 120 lb/acre K₂O, broadcast and incorporated before application of black polyethylene mulch (Hochmuth et al., 1991). Unmulched beds received the same N rates applied in three equal applications; at bedding, at the 5-leaf stage, and at initiation of vining. Muskmelons were direct-seeded. Nitrogen and mulch interacted in their effects on total season yield. Mulched plants produced nearly twice the yield of unmulched plants and ten times the early fruit yield with no increased yield of mulched plants due to increased N. A high soil organic matter content, 2.3%, may have decreased the response to added N for 99% RY (301 cwt/acre) with zero lb/acre N. Yields from unmulched plants responded quadratically to increased N fertilizer

leveling off above 50 lb/acre N (184 cwt/acre, 100% RY). Yields from the mulched plants only were presented with results from other mulched experiments in Fig. 2.

Subsurface irrigation, in the 1986 Osteen experiment, was established with a perched water table maintained at 20 inches below the bed surface (Hochmuth et al., 1991). Muskmelons were transplanted into beds mulched with black polyethylene and fertilized with 0, 60, 120, 180, or 240 lb/acre NH_4NO_3 - N and 150 lb/acre each of P_2O_5 and K_2O . Fertilizers, N and K, were applied in bands to each side of the row and in grooves on the bed surface. Phosphorus was broadcast in the bed and incorporated. Yields responded quadratically to increased N with a peak response at 120 lb/acre N (211 cwt/acre, 100% RY). Yields were reduced with 240 lb/acre N to 47% RY. Leaf tissue N concentrations of 4.8%, from most-recently-matured leaves taken at first fruit, were associated with high yield.

Drip irrigation was applied to maintain soil moisture at -10 centibars, as measured by tensiometer to a 12-inch depth, in Live Oak experiments in 1988 and 1989 (Hochmuth et al., 1991). Muskmelons were transplanted into Klej (Lakeland) fine-sand soil beds fertilized with 0, 40, 80, 120, 160, or 200 lb/acre NH_4NO_3 - N. Fertilizers, including 50 lb/acre P_2O_5 and 150 lb/acre K_2O , were incorporated in the bed area and beds were mulched with black polyethylene. Total marketable yield (1988) increased linearly with added N, although model fit was poor and there was negligible increase in yield above 120 lb/acre N (221 cwt/acre, 97% RY). Yields of cull fruit, No. 1 large, and No. 2 medium-sized fruit also increased linearly in response to N. Total, marketable grade fruit yield, in the 1989 experiment season increased quadratically with 96% RY with 120 lb/acre N and 100% RY (359 cwt/acre) with 160 lb/acre N. Using the quadratic equation, maximum yield was calculated to occur with 143 lb/acre N (352 cwt/acre), $r^2 = 0.54$. Leaf-tissue N concentrations of 4.0% at early fruit set were associated with high yields with N rates of 120 and 160 lb/acre N.

Experimentation with controlled-release (CR) fertilizer on drip-irrigated beds was conducted at the

Suwannee Valley AREC at Live Oak in the spring of 1993 (Hochmuth and Hochmuth, 1994). Lakeland fine sand soils were fertilized with a factorial set of CR - K treatments and two N-rate treatments. Nitrogen treatments were 120 lb/acre soluble - N (NH_4NO_3 and KNO_3) or 150 lb/acre applied as soluble - N or as 50/50 CR (urea and KNO_3) and soluble - N. Treatments to evaluate yield response to N also included 100 lb/acre K_2O . Nitrogen and K fertilizers were broadcast in a 36-inch wide swath and incorporated preplant. No phosphorus (P) was applied since soils tested high for P. Beds were prepared on standard 5-foot centers, drip irrigated to maintain soil moisture at -8 to -12 centibars as measured by tensiometer (8-inch soil depth), and mulched with black polyethylene. 'Hymark' muskmelons were direct-seeded through the mulch. Yields were not affected by N rate or N source, averaging 338 cwt/acre with 150 lb/acre of soluble or blended soluble and CR - N (100% RY) and 90% RY with 120 lb/acre soluble - N fertilizer.

Experimentation with CR - N and K fertilizers continued at Live Oak Suwannee Valley Research and Education Center (SVREC) in the spring of 1994 (Hochmuth and Hochmuth, 1995). Fertilizer treatments were formulated and applied on Lakeland fine sand soils as in the previous 1993 experiment. Beds were prepared as before on 5-foot centers with drip irrigation applied to maintain soil moisture at -8 to -12 centibars. In 1994, Hymark muskmelon transplants were used instead of direct-seeding. Total marketable yields again were similar with fertilization at 120 or 150 lb/acre N. Yields were 219 cwt/acre with 120 lb/acre N (100% RY) and averaged 204 cwt/acre with 150 lb/acre N (from soluble or blended soluble and CR - N sources). Leaf-tissue N concentrations also were not different with increased N averaging 5.8% at first flower and 3.0% one week before first harvest.

Summary Nitrogen

Early experiments with mixed fertilizers resulted in optimum muskmelon yield responses with 150 lb/acre N applied half preplant and half at mid-growth. Mid-growth fertilizer applications were applied through polyethylene mulch using a liquid-fertilizer injection wheel. Individual fruit

weight was increased by two fertilizer applications as opposed to one or three fertilizer applications. Yields from muskmelon mulched in clear or black polyethylene in the spring resulted in yields nearly twice those of unmulched melon. Early muskmelon harvest was three times greater with mulched than with unmulched muskmelon, offsetting the higher cost of this production method.

Studies designed to isolate yield responses to N were generally conducted with mulched muskmelon. Muskmelon yields were either optimized with 120 lb/acre N, leveled off above 120 lb/acre N, or did not respond to N rates between 120 and 150 lb/acre. A quadratic yield response to N rates occurred in one experiment resulting in a calculated (quadratic equation) optimum yield with 143 lb/acre (352 cwt/acre). Nitrogen fertilization to 240 lb/acre resulted in a severe yield reduction to 47% RY from an optimum yield with 120 lb/acre N in one experiment. Yield responses with mulched muskmelon experiments were presented in Fig. 2 where the dashed line indicates the current 150 lb/acre N recommendation. The N rate recommendation was increased to 150 lb/acre from 120 lb/acre in 1995 (Hochmuth and Hanlon, 1995). Muskmelon yields did not differ where N was derived from soluble or soluble plus CR - N sources.

Potassium

Soil Testing

Knowledge of soil nutrient levels, particularly P and K, before planting is the starting point to muskmelon 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 for degree of support of current 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 (Hochmuth et al., 1995). 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 review.

Potassium

Two studies were conducted on potassium (K) fertilization of muskmelon, both at Live Oak (SVAREC) on Lakeland fine sand beds spaced on 5-foot bed centers (fertilizer rates calculated on 5-foot centers) (Hochmuth and Hochmuth, 1994; 1995). Factorial fertilizer treatments in each experiment were grouped by percent CR - K present in their formulation, 0, 25%, or 50%, with K rates of 0, 50, 100, or 150 lb/acre K_2O . Due to an interaction between K rate and percent CR - K in the spring 1993, yield responses to K rate were presented graphically by percent CR - K (Fig. 3). A zero K check treatment was also included. Percent K and K rate did not interact in the spring 1994 experiment season. Soluble (KNO_3) and CR - K fertilizer sources (polymer-coated KNO_3) were the same each year. Soluble and CR - N sources (NH_4NO_3 and polymer-coated urea) were applied at 150 lb/acre N each season with all fertilizers broadcast in a 36-inch swath (1993) and 30-inch swath (1994), tilled, pressed into beds, and covered with black polyethylene mulch. 'Hymark' muskmelon were direct-seeded through the mulch in 1993 and transplanted in 1994. Drip irrigation was applied both seasons to maintain soil moisture between -8 and -12 centibars.

Soil K concentrations (M-1) tested low (35 ppm) in spring 1993 and 130 lb/acre K_2O was recommended (Kidder et al., 1989). Yields did not differ with 50 lb/acre K_2O formulated with no CR - K, 25%, or 50% CR - K. With 100 lb/acre K_2O , however, yields increased from 280 cwt/acre (no CR - K) to the highest overall yield of 409 cwt/acre (25% CR - K). A similarly high yield (377 cwt/acre) required 150 lb/acre K_2O when no CR - K was included in the K fertilizer. Researchers cited improved K efficiency with the 25% CR - K treatment or reduced soluble salt injury potential with CR - K. Yields with the 150 lb/acre K_2O rate were also best with 25% CR - K (403 cwt/acre). Linear

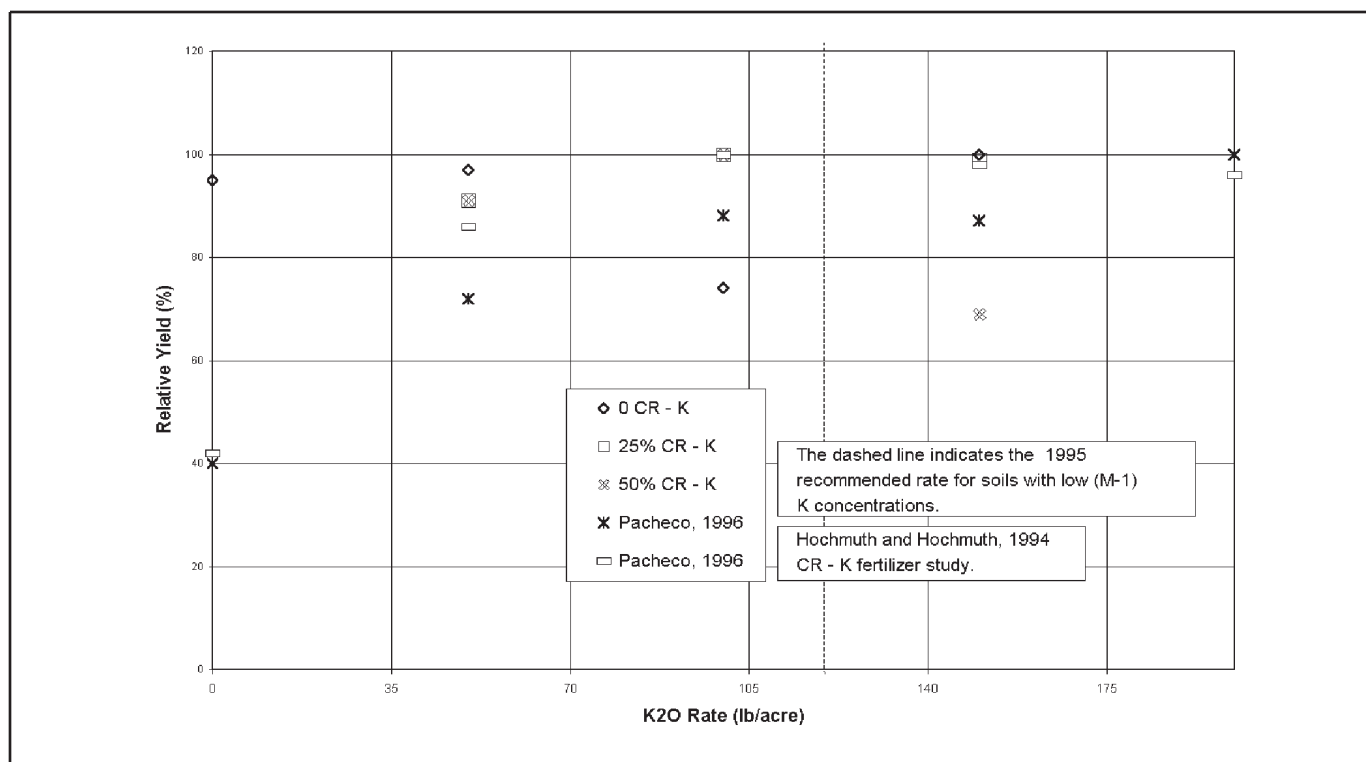


Figure 3. Relative yield of mulched melons for experiments as a function of added K₂O (0 to 50% controlled-release K)

increases in leaf-tissue K concentrations resulted from added K fertilizer at both sample dates with K concentrations below the sufficiency range at the 18-inch runner stage with all K treatments and within the sufficiency range (except with 50 lb/acre K₂O) at the full-size fruit stage. The proportion of CR - K in the K fertilizer had no effect on leaf K concentrations.

Low M-1 soil test K concentrations (28 ppm) also resulted in the second season, spring 1994, and 130 lb/acre K₂O was again recommended. The proportion of CR - K did not, however, interact with K rates this season. Muskmelon yields responded linearly (5% probability) to K fertilizer rates, presented as main effects over all CR - K percentages, with highest 100% RY with 150 lb/acre K₂O (222 cwt/acre). The main effects of CR - K treatments, averaged over all K rates, also were described by a linear function (5% probability). Muskmelon treated with 25% to 50% CR - K responded with 100% and 95% RY, respectively, compared to 69% RY where no CR - K was included in the fertilizer treatment.

Two cultivars of muskmelon were used in spring and fall experiments evaluating crop response to K on soils testing very low in K (Pacheco, 1996). The spring experiment was on a sandy soil testing 14 ppm

M-1 K (very low) and the fall experiment was conducted on a sandy soil testing 17 (VL) in K. Melons were planted on beds spaced on 5-foot centers and were drip irrigated. In the spring, there was a quadratic response to K with total marketable yield leveling off after 90 lb/acre K₂O (linear-plateau model). The quadratic model predicted a maximum yield with 170 lb/acre K₂O. In the fall, yield was maximized with 60 lb/acre K₂O (linear-plateau) and the quadratic maximum K rate was 145 lb K₂O/acre.

Summary Potassium

Muskmelon yields responded below the recommended K rate in a spring 1993 experiment and above the recommended rate in a spring 1994 experiment. In both seasons, increased fertilizer efficiency resulted when fertilizer contained 25% to 50% of a CR - K source. Optimum yield the first season occurred with 100 lb/acre K₂O compared to 150 lb/acre when the fertilizer contained no CR - K. Potassium rate recommendations were decreased at the time of this publication to 120 lb/acre K₂O for soils with low K concentrations (Hochmuth and Hanlon, 1995). Research in Gainesville with two muskmelon cultivars documented a requirement for more K (170 lb/acre K₂O) in spring than fall (145

lb/acre K_2O). Additional experiments with K fertilization of muskmelon are needed for all key production areas, the Southwest, North Central, and West Central areas of the state in addition to research utilizing current production practices, drip irrigation, mulch, CR - K fertilizer, and fertigation to assess muskmelon response and adjust recommendations as needed.

Overall Summary

High yields for Florida-grown muskmelon have ranged from 200 to 600 cwt/acre in research with N and K fertilization since 1965. Significant yield increases resulted with the use of polyethylene mulch (clear or black in the spring) to ten times those of unmulched muskmelon. Results summarized in Fig. 2 show that muskmelon yield was maximized in most studies with 150 lb/acre N. Muskmelon grown as a second crop on previously mulched beds proved a viable production alternative facilitated by use of a fertilizer injection wheel. Split fertilizer application, once at preplant and again at mid-growth, significantly increased yields with this cultural method. No research has been conducted with fertigated muskmelon, though muskmelon are generally grown on raised, mulched beds. Experimentation with CR fertilizers resulted in no yield effect with CR - N sources, but had significant yield effects when applied as 25% to 50% of the K fertilizer source (polymer-coated KNO_3). Nearly 80% of the research presented in this summary was conducted in North Florida and additional research is needed in key production areas in Southwest and West Central Florida for a comprehensive study of Florida muskmelon fertilization.

Literature Cited

Bryan, H. H. 1966. Effect of plastic mulch on the yield of several vegetable crops in North Florida. Proc. Fla. State Hort. Soc. 79:139-146.

Csizinszky, A. A., D. N. Maynard, G. J. Hochmuth, P. R. Gilreath, and R. L. Mitchell. 1985. Liquid fertilization of squash and muskmelon grown as a second crop following tomatoes. Proc. Fla. State Hort. Soc. 98:287-291.

Florida Dept. Agric. Consumer Serv. 1997. Florida Agric. Statistics - Vegetable Summary 1995-1996. 72 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. J. 1988. Muskmelon production guide for Florida. Fla. Coop. Ext. Serv. Circ. 122C.

Hochmuth, G. J., and E. A. Hanlon. 1995. IFAS Standardized fertilization recommendations for vegetable crops. Fla. Coop. Ext. Serv. Circ. 1152.

Hochmuth, G. J., and B. Hochmuth. 1994. Response of muskmelon to controlled release potassium fertilization. Fla. Agr. Expt. Sta. Research Report, Suwannee Valley AREC 94-03.

Hochmuth, G. and B. Hochmuth. 1995. Effects of K rate and proportion of K supplied from controlled-release K on muskmelon. Fla. Agr. Expt. Sta. Research Report, Suwannee Valley AREC 95-07.

Hochmuth, G. J., E. Hanlon, and R. Hochmuth. 1991. Nitrogen crop nutrient requirements for muskmelons grown in various polyethylene mulch systems. Fla. Agr. Expt. Sta. Research Report, Suwannee Valley AREC 91-5.

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.

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.

Meline, C. D., and G. J. Hochmuth. 1988. Economics of watermelon and muskmelon planting systems in North Florida. Proc. Fla. State Hort. Soc. 101:404-407.

Montelaro, J. 1978. Commercial Vegetable Fertilization Guide. Fla. Coop. Ext. Serv. Circ. 225-B.

Pacheco, Alvaro O. 1996. Muskmelon (*cucumis melo*, L.) cvs. Galia and Mission fruit yield, leaf tissue, and sap concentrations, and fruit quality responses to potassium fertilization. MS thesis, University of Florida, 140 pp.

United States Dept. of Agric. 1991. Agricultural chemical usage 1990 Vegetable Summary. Nat 1 Agric. Stat. Serv. Econ. Research Serv. Wash., D.C.

Whitner Jr., B. F., D. G. A. Kelbert, J. Montelaro, G. Swank, Jr., and J. W. Wilson. 1953. Cantaloupes in Florida. *Proc. Fla. State Hort. Soc.* 66:100-103.