Commercial Muskmelon Production In Michigan

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THE MUSKMELON, a warm season crop, requires a relatively long growing season of 70 to 100 days from seed to marketable fruit. As a result, Michigan melons may spend as much as 3-4 weeks of this period in the greenhouse before transplanting to the field.

Michigan ranks 5th in muskmelon acreage in the United States. There were 3,200 acres grown commercially in the state in 1963.

In late summer, Michigan melons compete with melons from California, Colorado, and Texas. Sixty percent of the muskmelons produced in the United States are grown on the irrigated land in arid and semi-arid areas of California and Arizona. About 12 percent of the crop is grown on the irrigated lands in Texas and districts in Colorado and New Mexico.

Michigan's important areas of production are in the southwestern, the southeastern and the Bay City areas. The 1963 average yield for Michigan was 85 cwt. per acre. A "good" yield would be 150 cwt. per acre, but yields double this are obtainable. In 1963 the average price received by the grower was $5.30 per cwt.

All the muskmelons produced in Michigan should be referred to as muskmelons. The term "cantaloupe" strictly applies to the species, *Cucumis melo* var. *cantalupenis*, a warty, scaly melon with a rough surface and a hard rind. The true cantaloupe is not grown commercially in the United States, but is grown in Europe. However, in the U.S.A., melons with netted, green and yellow-green rinds have been improperly referred to as cantaloupes by the consuming public, growers, and the market trade.

The Crenshaw, Casaba and Honey Dew, often called winter melons, belong botanically to *Cucumis melo* var. *inodorus*. They are usually late-maturing and thus not grown extensively in Michigan.

Disease control is the most serious production problem in Michigan. Physiological breakdown of fruits and vines is becoming increasingly serious and demands attention by plant pathologists, horticulturists, extension agents, as well as growers to ascertain the causes. Growers can help by contacting County Extension agent as soon as breakdown is evident. See further comments under "Insects and Disease Control."

Varieties

Growers should select varieties known to be suited to their soil and climate and acceptable to available markets.

Preferred melons are medium-size (four to five inches in diameter) with thick, uniformly deep-orange

flesh, and firm rinds. The following varieties recommended for Michigan, are all resistant but not immune to Fusarium wilt:

Burpee Hybrid **Gold Star Hybrid** **Supermarket Hybrid**	Very uniform, size heavy net, moderate rib, and high quality.
Harper Hybrid	— Medium size, smooth with light netting.
Harvest Queen	— Late, firm, quite susceptible to mosaic.

These varieties have performed well in Michigan. Other acceptable varieties are available but most of these have local adaptation. For descriptions, refer to seed catalogs or write to the Department of Horticulture, Michigan State University.

Site and Soil

Early growth of the muskmelon plant is favored by warm soil, adequate moisture, nutrients, and protection from wind. Muskmelons generally do best on well-drained, sandy or sandy loam soils. Gentle southern or eastern slopes are preferred. Wind protection (see discussion of the use of rye strips) from Michigan's westerly-southwesterly prevailing winds is also desirable. Avoid low areas and others with poor air drainage.

Crop Rotation

To avoid damage from soil-borne diseases plant on land that has not been in muskmelons or cucumbers for at least 3 years. If root knot nematode is prevalent, do not plant cucumbers, tomatoes, and other susceptible crops in a short rotation with muskmelons. Consult the latest edition of Extension Bulletin 312, *Chemical Control of Insects and Diseases on Commercial Vegetables*, for possible use of fumigation to control root knot nematode, weeds, and soil borne diseases.

SOIL MANAGEMENT

Cover Crop: Plowing under a sod or legume is highly recommended. Where this is impractical, use a winter cover crop of rye or rye grass. Plow down about 50 pounds of nitrogen per acre (alone or in mixed fertilizer) with all seed crops or heavy cover crops unless they were recently fertilized with an equivalent amount.

Soil pH: Muskmelons do not tolerate acid soils. Low soil pH values often result in poor growth, and premature vine breakdown, with cracked stems and a gummy discharge along the cracks. Maintain a soil pH between 6.5 and 7.0.

The amount of lime to be applied to soils with a pH lower than 6.5 can be determined from a soil test through your County Extension agent or fertilizer dealer.

If you use lime, apply a finely ground dolomitic limestone drilled deeply or broadcast and disked after plowing. If more than two tons of limestone are required, one third to one half should be plowed down and the remainder of the lime applied as hydrated lime disked in after plowing. Liming is often neglected even by experienced growers.

Fertilizer grade Epsom salts can be used to supply magnesium where it is deficient in soils containing adequate calcium.

Use of Rye Strips (See Figures 1 and 2)

Newly-transplanted muskmelon plants are very tender and quite susceptible to wind injury. Considerable protection can be provided by fall-planting winter rye in 2-foot strips either between every row as often as practical, or leaving strips when plowing solid stands of rye. These windbreaks are particularly useful in north-south rows. Frost hazard may be increased if the rye strips retard air drainage. Transplant after all danger of frost is over to minimize this hazard. Serious wind injury can occur after removal of the paper, or other type of plant protection, unless windbreaks are utilized. Destroy rye before the vines run if between single rows.

PLANTING

Muskmelons can be grown from transplants or seeded directly in the field. Field seeding can normally be done about one week earlier than transplants can be safely placed in the field and as late as mid-June. Transplants should be placed in the field only after all danger of frost is over.

The fruit of transplants will normally mature earlier than field-seeded muskmelons, but the latter may be maturing fruit in late August and September when little can be harvested from the transplanted crop. Maturity dates of the recommended varieties can be regulated somewhat by the date of planting.

Growing the Transplants

Plant-growing containers are needed to successfully transplant melons on a commercial scale. Use those that best fit into your transplanting operation, provided that plants can be transplanted without disturbing their root system. Remove wood veneer and paper bands when transplanting to the field. Roots should penetrate other containers readily after transplanting.

A wide variety of plant-growing media may be used. The pH of the medium should be between 6.0 and 6.5. To eliminate weed seed and some soil-borne diseases, sterilize the medium in the fall, using steam or methyl-bromide as directed in the Appendix of Extension Bulletin 312.

Fig. 1. — Melon plants on the left had no rye strip for wind protection while plants on the right had an 18-inch strip of rye on both sides of the row. Note the increased vegetative growth where the rye strips were used. The plants are just at the stage where the rye should be cut and removed.

Pack medium firmly into the plant containers. Plant 2 to 4 seeds per container. Covering with ½ inch of clean sand may be preferable to covering with the medium mixture. Germinate seed at a temperature of 75° to 80° F. After plants emerge, thin to two plants per growing container (note discussion below under "Field Spacing"), provide adequate ventilation, and maintain 75° to 85° F. day and 60° to 70° F. night temperatures.

Under above conditions, plants should be ready to transplant to the field in 2 weeks (they should have 2 to 3 true leaves), but at lower temperatures will require 3 or 4 weeks. Plants which are too large at the time of transplanting are easily broken and are severely checked in growth by transplanting. This can result in reduced yields.

Fertilizer Practices

The nutrient requirements of muskmelon vary with soil type and previous fertilizer practices. Have a soil sample tested for acidity (pH), available phosphorus (P) and potassium (K). Apply quantities of phosphate and potash as suggested in Table 1 for 150 cwt. yield of muskmelons on soils previously in rye cover or grass sod.

Fig. 2. — Where rye strips cannot be placed between every row, an alternative is to place them so that 4 to 6 melon rows can be planted between rye strips. Protection can only be expected for a distance of approximately 10 times the height of the rye strip.

Table 1. Pounds of P_2O_5 (phosphate) and K_2O (potash) recommended per acre based on soil test results.

Phosphorus soil test (lbs./A)	Pounds P_2O_5 per acre recommended*		Potassium soil test (lbs./A)	Pounds K_2O per acre recommended*	
	Sandy soil	Loam soil		Sandy soil	Loam soil
10	110	140	25	150	100
25	95	120	50	130	85
40	80	100	100	110	70
55	65	80	150	90	55
70			200		
or more	50	60	or more	70	40

* Multiply pounds P_2O_5 by 0.44 to obtain pounds P and multiply K_2O by 0.83 to obtain pounds K.

Apply 40 to 50 pounds of nitrogen (N) per acre with the prosphorus and potassium recommended in Table 1. If the field is heavily manured, reduce the amount of nitrogen and potassium applied in the fertilizer (1 ton of manure is roughly equivalent to 12 pounds of N and 9 pounds of K_2O).

For efficient use of your fertilizer and to reduce the possibility of fertilizer injury to transplants, broadcast and work one-half the recommended fertilizer in prior to planting. Then, at planting time, place the balance 2 inches to the side and at the depth of the root system.

Sidedress: Apply 30 to 40 pounds of nitrogen per acre 10 to 15 inches to the side of the plants during cultivation before plants begin to vine. This is to assure a continual supply of nitrogen through the growing season. In rainy seasons or where irrigation is excessive, leaching may necessitate a top dressing of nitrogen especially if low rates were used in prior applications and soils are very sandy.

Field Spacing

Spacing between rows should be about 6 feet with variations depending on cultivation equipment, use of plastic, and rye windbreak strips. Results of research indicate that increasing the number of plants in the row results in a decrease in early yield but an increase in total yield. This decrease in early yield can be mainly attributed to reduction in fruit size. A spacing between plants (or hills) in the row of 2 to 4 feet is suggested, using closer spacing for wider rows. If seeding directly in the field, plant three to four seeds per foot and thin to the above spacing.

Plant Protectors

Plant protectors (hotcaps, "hotents," etc.) may be used on either field-seeded or transplanted crops, provided there is adequate ventilation. Use any of the available protectors, but be sure to provide ventilation on sunny days when temperatures rise above 80 to 85° F. Plant protectors permit 10 days to two weeks earlier planting and should result in about a week earlier maturity. Their main benefits are (1) protection of young plants from cold winds and (2) increase in the soil temperature under the tent.

Plastic Mulch

Polyethylene (clear or black) film increases early muskmelon yields primarily by increasing the crown set of muskmelons. Beneficial effects of polyethylene can be expected almost every year, with perhaps the greatest response in years when June is cool and low in rainfall.

Soil temperature records and crop yields show that clear plastic film increases soil temperatures and early yield more than does black polyethylene. Soil temperature under black polyethylene is usually only 3 to 5° F. higher than bare soil. However, this slight difference may significantly increase plant growth. The main advantages of using black plastic are: conservation of moisture, freedom from weeds, eliminating the need for cultivation and possible root injury, and improved surface soil structure.

Weeds continue to grow under clear polyethylene. Therefore, the soil under the clear plastic must be fumigated to destroy weed seeds. Fumigation may be done the previous fall, or as the plastic is laid 2 to 4 weeks before transplanting, depending on fumigant, rate of application, and soil temperatures.

How to Apply

Lay polyethylene that is three to four feet wide and 1.5 mils (1½ thousandths of an inch) thick. Use a tractor-mounted applicator. Set plants through the film, using a post hole digger or similar tool to make the holes. There are machines that will lay plastic and transplant plants in growing containers in one operation.

Weed Control

Good cultural practices are essential for weed control in muskmelons. Avoid fields that are known to contain many weed seeds.

On unmulched fields, spray NPA (Alanap-3) herbicide at 4 pounds actual per acre immediately after planting, and irrigate after application. Under favorable conditions, this herbicide will control annual weeds, but many growers experience variable results.

Muskmelons have an extensive root system, but many of the roots are concentrated in the upper 4 to 6 inches of the soil, particularly under plastic, where the soil oxygen concentration is relatively high. The root system may grow as much as 3 feet away from the row. Cultivation should be shallow and should cease when the vines become 1½ to 2 feet long. Some hand-hoeing may be necessary after the plants start to vine. Eliminating weeds when they are small is best. Pulling large weeds within the row is sure to damage the muskmelon roots.

Pollination

Male flowers usually appear first on muskmelon plants. These flowers do not produce fruit. A small

percentage of the later flowers are female, and bees must transfer pollen from the male flowers to the pistils of the female flowers for normal development of the fruit. There should be one or more swarms of bees within ¼ mile of the field. It takes about one hive of bees to adequately pollinate 3 acres of muskmelons, provided there is little competition from crops preferred by bees. Otherwise, more bees may be needed, but generally best results are obtained by moving new bees from a distant location into the melon fields after melon blossoms appear.

Irrigation

Since muskmelons are normally planted on sandy, well-drained soils, they usually respond markedly well to irrigation. During June and July, 1½ inches of water is required weekly on light soils. Irrigate early in the morning to bring the total application up to this amount. Adequate soil moisture makes for more efficient utilization of fertilizer.

Additional irrigation should be provided if the rye strip begins to compete with the muskmelons for moisture. When the fruits begin to ripen, irrigate to prevent wilting. Extreme fluctuations in soil moisture can cause fruit splitting, and excessive moisture during ripening frequently reduces the sugar content of the fruit.

Insect and Disease Control

Because of the frequent changes in permissable uses of pesticides, no insecticide or fungicide is recommended in this bulletin. Consult the latest edition of M.S.U. Extension Bulletin 312 for materials and rates to control insects and diseases. Following is brief discussion of the more common insects and diseases to watch for.

The striped and spotted cucumber beetles spread bacterial wilt. These beetles frequently attack the plants as soon as they are transplanted or may feed on the roots of field-seeded melons even before they emerge and kill the plants. The bacteria are carried over winter by these beetles. Infected plants generally wilt suddenly while still green. A sticky discharge may often be found in the stems and petioles. Because these beetles frequently harbor and over-winter in weedy hedges and headlands, these areas should be cleaned up at frequent intervals.

The melon aphid is a small louselike insect that feeds on the underside of leaves. Its presence often is indicated by a slight curling or cupping of the leaves. These aphids spread the virus of cucumber mosiac from plant to plant. Cucumber mosiac is becoming more serious. Use resistant varieties where available. Cucumber mosiac is easily identified by the crumpled, dwarfed, and generally mottled terminal leaves, but often older plants collapse and die from mosaic when symptoms are faint or on terminals of shoots only. Heavy infestation of very young plants dwarfs them permanently.

Powdery mildew disease can be very destructive to muskmelons. The first symptom is small, white patches on the underside of the older leaves and on shaded parts of the stem near the soil. Spots soon appear on both surfaces of the leaves and enlarge until the older leaves and stems are covered with the white, powdery growth of the fungus. Chemical control is possible but difficult. Powdery mildew-resistant lines adaptable to Michigan will soon be available. Avoid growing transplants in contaminated greenhouses.

Anthracnose is a common harmful leaf spot disease of muskmelons. It also infects the fruit. The first symptoms of this fungus disease appear on the leaves as small, yellowish, water-soaked spots, irregular in shape, which often occur along the veins of the leaf. The spots enlarge to form reddish-brown dead patches ¼ to ⅜ inch wide. Long, dark, sunken spots appear in the stems and petioles; they girdle the petioles and young runners. Infected fruit has dark, sharply sunken, circular spots about ½ to ¾ inch in diameter. In warm, moist weather the centers of the spots have pinkish masses of spores.

Alternaria is a fungus disease with leaf symptoms that are often confused with anthracnose. The first symptoms of alternaria usually appear in mid-season on the older leaves. At first, the affected leaves show very small, round, water-soaked spots. These spots enlarge rapidly until their diameters range from ⅛ to ½ inch and may show concentric ring markings. The spots gradually turn brown and often several spots merge, forming a dead area of considerable size. Overripe fruit of severely diseased vines sometimes has a few small, sunken spots.

Fusarium wilt of muskmelon has been serious in Michigan. This soil-borne fungus enters the plant through the roots. On very young plants grown in badly infested soil, it may cause root rot or wilting of the seedling with little external evidence of stem injury. On older plants, the first symptom is a wilting of one or more runners. The leaves of wilting shoots turn brown; brown, dead streaks commonly develop on the stems near the ground line. These streaks may extend some distance, and in moist weather they often have salmon-pink masses of fungus spores along the streaks of the stem.

Slightly sunken, sometimes cracked lesions, which are corky in cross section, occur in rinds and cause very rapid fruit decay in transit. This is Fusarium fruit rot.

The fungi causing Fusarium wilt and fruit rot can live for a long time in the soil. Do not grow muskmelons on soil known to be heavily infested. Avoid carrying fungus-infested soil to clean fields on cultivators or other farm equipment.

Successful muskmelon culture in Michigan requires the use of pesticides to control some of these diseases. U. S. Department of Agriculture, Agricultural Handbook No. 216 gives good descriptions and illustrations of many of the insects and diseases of muskmelons.* For chemicals to control these insects and diseases, consult the most recent edition of M.S.U. Extension Bulletin 312.

Harvesting and Marketing

Vine-free paths should be maintained to facilitate harvesting and avoid injury to the plants. This is done by training the vines in on the row during the last few weeks before harvest. Handle the vines only as much as necessary, however, and avoid tight bunching or rowing of vines.

Most Michigan muskmelons are of the "free slip" type. When the melon is ready to harvest, a circular crack develops where the fruit is attached to the stem. Muskmelons that require some transport and shelf life should be harvested at less than ¼ "slip" (the crack at the stem attachment has developed less than ¼ the way around the stem). These melons should release from the stem with some difficulty. If they are to be marketed immediately, as in many roadside markets, they should be harvested at ¼ to ¾ "slip." These suggestions may need to be modified slightly depending on the variety and season.

Harvest in the early morning while the melons are still cool. If picked during the heat of the day, they will be warmer and will soften more rapidly during marketing.

In order to insure shelf life and to compete with California-grown melons, rapid handling and early refrigeration are necessary. Place the fruit carefully in field baskets or crates not more than two layers deep. Size and grade them according to requirements of local markets or shippers.

Only uniformly shaped, firm, evenly netted fruits, free of blemishes or splitting, can be classed as No. 1 melons. Fruit not having these characteristics should be kept off the market.

A variety of containers for shipping muskmelon fruit are used. The best containers have sturdy exteriors allowing stacking for transport, provide for ventilation, and are equipped with partitions that prevent fruit contact. Several new corrigated fiberboard containers have proven very satisfactory.

Michigan's muskmelons of superior exterior and interior quality will find a place on distant markets if grading, packaging and handling are improved.

Costs and Returns

The following are given solely as guidelines. Individual per acre grower costs and returns will differ considerably.

(Costs and Return Table)

	Expected Costs		Your Actual Cost	
Growing:				
Land (rental value)	$ 31		____	
Lime	2		____	
Fertilizer	30		____	
Cover crop	6		____	
Plants	50		____	
Polyethylene	50		____	
Spray & dust material	20		____	
Custom spraying	20		____	
Irrigation	50		____	
Tractor	8		____	
Other equipment	9		____	
Labor	50		____	
All other	10		____	
Total growing		$ 336	____	____
Harvesting:				
Labor (harvesting grading & packing)	125		____	
Tractor	7		____	
Other equipment	5		____	
Packages	250		____	
Marketing	25		____	
All other	6		____	
Total harvesting		418	____	____
Total cost per acre		$ 754		____
Returns: Melons (based on 200 cwt./acre @ $5.50/cwt.)		1,060		____
Gain per acre		$ 306		____

* *It can be obtained for 25 cents by writing to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.*

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