Field Production of Baby Carrots

Production of baby carrots differs considerably from full sized carrots. The roots are smaller and must be planted more densely to achieve satisfactory yields. Quality of the roots is important as they are packaged, processed, sold and prepared in the home as a small complete carrot. All roots in a serving must be of uniform shape, size and color, not showing any green, and most important, must look like a complete carrot. Some requirements call for a miniature carrot with even more stringent size limits.

Equipment for growing carrots can be classed in two categories: row production and bed production. Equipment for row production is based on one of two machines: the TAWCO radish combine or the FMC red beet and carrot combine.

Row Production

1. Seed bed preparation. The same seed bed preparation as would normally be required for radishes and/or carrots is required. The same criteria for soil choice must be followed.
2. Seeding. Seed must be planted in rows to suit the harvester, usually 9 in. apart for the Tawco and 14 inches apart for the FMC. The Tawco can handle a row up to 2 inches wide, the FMC can handle a row somewhat wider. A Planet Jr. seeder is the most popular type used, either fitted with a wide scatter shoe or the three channel wide row shoe.
3. Seed Rates. Information is given elsewhere on the program.
4. Weed Control. The same weed control methods used for ordinary carrots are used for baby carrots. Be sure that wheel tracks are left for passage of tractor and sprayer.

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5. Harvest

A. TAWCO Radish Combine

The Tawco Radish Combine is marginal in strength for handling baby carrots. It does not handle the amount of foliage well and is not equipped with a digging blade. A flail type forage harvester works well to remove part of the carrot tops, as the foliage can be blown clear of the rows being harvested. A rotary mower is suitable as well. Leave 3 to 4 inches of top for harvesting. In most soils, the carrots must be undercut with a tractor mounted blade to loosen the carrots.

Most TAWCO combines are three-row models and six rows can be planted between the tractor wheelings. No modification is required on the combine, as elevators are sized to convey all marketable carrots. The topping mechanism is capable of handling baby carrots, but lifting belts can give problems, especially where there is wood in organic soils.

There are several other makes of radish combines available, but most use a different type of topper. Only the TAWCO has the roller bar type topper.

B. FMC Red Beet and Carrot Combine

The FMC combine must be equipped with elevators with smaller openings than supplied by the manufacturer. This may be done by welding rods between the chain rods on the standard chains, or the elevator chains may be replaced with a finer pitch chain. No other modifications are required.

Bed Production

1. Seed bed preparation. Bed type planting methods require a flat even seed bed for topping and harvesting. A bed former was used in 1976 to achieve a suitable seed bed, but the raised bed proved to be vulnerable to wind and water erosion. In lieu of this, a leveling board passed over the rows ahead of planting is suggested.

2. Seeding. Seeding may be done with any seeder on which the openers can be placed reasonably close together. A special seeder for close rows, as developed for this project, will be available commercially.

   An indentation drum seeder was tried during the 1976 season to increase density in beds. The seeder was capable of placing seed in rows 1½ inches apart. The seeder is still under development and cannot be recommended at this time.

   Tests were made with Brillion and Viking grass seeders. Ideal growing conditions at the time of tests helped to produce an acceptable seed bed. Sufficient testing has not been done to know performance in adverse conditions. The seed dispensing boxes on both seeders were unacceptable for across the width seed uniformity and were difficult to adjust. Planet Jr. seed boxes could be mounted to improve performance.

3. Seed Rates. Information is given elsewhere on the program.

4. Weed Control. Same as for other carrots.

5. Topping. Tops are ideally removed prior to harvest when using a bed-type harvester. Several machines can be used.

   A. Defoliator. For fresh market carrots a defoliator which does not cut the carrots must be used. The machine used in tests was a Martin from France which has two contra-rotating beater shafts made up of flexible rubber paddles about 2 inches wide and extending from an axle about 8 inches.

   B. Crowner. For processing carrots it is desireable to remove the tops and green crowns. A two rotor crowner was built in 1976 by E.R.S. and performed satisfactorily in mineral soils but not organic soils. The crowner is being modified to three rotors, and manufacturing arrangements will be made.

C. Flail Mower. A flail type grass mower was tried for decrowning and worked well except for depth control. The mower has a heavy gearbox on one side causing the mower to cut deeper on one side and damage carrots. A rotary mower was also tried and showed sufficient success that if a grower has one, it could be adapted.

With all top removers, it is absolutely essential that the carrots be grown on a flat even surface to have control of topping or crowning depth.

6. Harvesting. A S.A.M. bed harvester imported from Holland was used in 1975 and 1976 tests. The machine is somewhat like a potato harvester in that it has a digging share and an elevating chain to lift the carrots. A separating bed made up of star-shaped rubber wheels separates soil from carrots and will remove large pieces of soil sticking to the carrots. A vibrating screen at the end of the rubber-finger bed removes more soil and provides a sorting table for hand removal of rocks and weed clods.

Several modifications were made to the machine, and are described elsewhere.

Other makes of bed harvesters are available and may be suitable. No tests have been done in North America. Information on manufacturers and distributers are given in Appendix 1.

Harvest performance with the S.A.M. harvester ranged from a situation of insufficient soil elimination in 1975 tests to one of carrot loss in 1976. In 1975, an elevator belt made up of rubber covered rods was used which had a limited amount of soil elimination capacity. The result was soil carried right through to the collection box. In 1976 the belt was modified by welding a second bar between the existing rods of the original equipment chain. This provided double the soil elimination capacity of the chain used in 1975. In 1976 tests the problem became one of carrot

loss, up to 20%, on the rubber finger bed. These losses could be reduced substantially by matching forward speed to the harvester speed to keep the machine loaded, but could only be done when operated by a tractor with a variable speed transmission. Thus, a tractor with hydrostatic drive provides a definite advantage. Digging depth had to be maintained accurately to reduce the amount of soil handled. It is suggested that future harvesters be equipped with depth wheels.

Bed type harvester provide the most advantage in obtaining optimum yields. Research by others indicate that yield of baby carrots can reach 25 tons per acre when grown in beds, but field tests in 1976 in Ontario and Quebec fell short of that figure by a factor of 2.5. Work will continue to bring yields to acceptable levels. Yields of marketable carrots, when harvested by row machines, can be expected to be from 5-8 tons per acre in organic soils.

Note on Product

Processors interested in baby carrots should investigate the requirements of their markets carefully. Research in Canada is aimed at a carrot 19 mm in diameter and no more than 100 mm long. Some markets require a true baby carrot even smaller. English baby carrots tend to be up to 31 mm in diameter and up to 120 mm long. Carrots are being imported from California that are obviously machine shaped to look like a whole baby carrot, and there is indication that some European carrots are made from long slender carrots cut into small pieces. Some of the worst product is packed domestically and is obviously broken carrot pieces and small carrots from a regular carrot grade-out.

Cost of Production

Table 1 is from Economic Information, Vegetable Production in Ontario, Economics Branch, Ontario Ministry of Agriculture and Food, Toronto M7A 1B6. The right hand table gives an indication of costs of production using production cost figures for processing carrots in Kent county. Additions are made for the extra labour requirements for baby carrots. The amount of labour, as indicated, is high, but it should be remembered that the yield is for graded product that must sell for a premium price. Thus, the carrots must be sorted and graded prior to delivery. Other inputs will remain substantially the same, but costs per ton of product are substantially higher due to less yield.

Table II gives capacities in acres per hour for each of the machines in the system.

Conclusion

Sufficient information is now available on Baby Carrot production that estimates of yields and machine efficiencies can be made. There are already large operations in Canada producing baby carrots on both mineral and organic soils. Yields are still low, but there is work going on to improve yields with the most likely improvements to be made in the bed production system.

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Gary Hergert,
Mechanization Technologist,
Engineering Research Service,
Agriculture Canada,
Ottawa, Ontario, K1A 0C6.

Table .--Production Costs for Fresh Market and Processing Carrots, Ontario, 1974

	Fresh carrots, Bradford marsh	Processing carrots, Kent County	Estimated baby carrot costs (Graded product)
Yield per acre, tons	27.5	27.6	10
Labor hours per acre	86.9	38.8	40 - 55
	dollars		
Preharvest costs per acre:			
Labor:			
Hired (operating)	17.50	4.87	*
Operator (fixed)	62.65	38.59	*
Total	80.15	43.46	43.46
Tractor:			
Operating	24.58	8.06	*
Fixed	36.87	12.10	*
Total	61.45	20.16	20.16
Machines:			
Operating	12.00	3.00	*
Fixed	47.99	11.99	*
Total	59.99	14.99	14.99
Custom work (operating)	—	1.85	1.85
Materials (operating)	234.59	118.90	125.00
TOTAL PREHARVEST COSTS	436.18	199.36	205.46
Harvesting & marketing costs per acre:			
Labor:			
Hired (operating)	165.00	28.96	100.00
Operator (fixed)	24.50	32.84	*
Total	189.50	61.80	132.84
Tractor:			
Operating	21.14	9.14	*
Fixed	31.71	13.70	*
Total	52.85	22.84	22.84
Machines:			
Operating	14.63	2.51	*
Fixed	58.52	10.03	12.00
Total	73.15	12.54	14.51
Materials (operating)	210.00	—	
Custom work (operating)	—	183.32	183.32
Other costs (operating)	—	4.84	4.84
TOTAL HARVESTING & MARKETING COSTS	525.50	285.34	358.35
Overhead costs:			
Int. on operating capital (operating)	26.85	6.19	*
Land, interest (fixed)	360.00	109.42	*
Taxes (fixed) [a/]	35.00	12.03	*
Custom storage (operating)	308.00	—	-
TOTAL	729.85	127.64	127.64
TOTAL COSTS:			
Operating	1,034.29	371.64	-
Fixed	657.24	240.70	-
All costs	1,691.53	612.34	691.45
Costs per ton	61.51	22.18	69.15

[a/] This figure does not include the Ontario farm tax rebate which accounts for 50 percent of the total land tax. If all the farmers on the study applied for and received the rebate, land charges and carrot production costs would have been reduced by $17.50 per acre in the Bradford marsh area and by $6.02 per acre in Kent County.

*Same as for processing carrots

TABLE II. CAPACITIES OF MACHINES FOR BABY CARROT PRODUCTION

MACHINE	WIDTH		SPEED	ACRES PER HR
	Working	Adjusted*		
6 Row Seeder 9" spacing	48"	60"	3 mph	1.8
5 Row Seeder 14" spacing	56"	68"	3 mph	2.0
Bed Former	1 M	60"	5 mph	3.0
Bed Seeder	1 M	60"	3 mph	1.8
Defoliator	1 M	60"	2.5 mph	1.5
Crowner	1 M	60"	2.5 mph	1.5
Tawco Combine 3 row	27"	30"	2.00 mph	.60
FMC Combine	14"	14"	4 mph	.58
Bed Harvester	1 M	60"	.8 mph	.48

*Adjusted width includes half of wheelings for capacity in acres per hour.