CHEMICAL COMPOSITION OF OKLAHOMA-GROWN CARROTS

JAMES E. WEBSTER and HOWARD B. CORDNER
Oklahoma Agricultural Experiment Station, Stillwater

The production of carrots for home consumption in Oklahoma has been hampered somewhat by the fact that such carrots often have a high percentage of core, may be relatively pale in color, and generally are not as sweet as are the shipped-in carrots. These differences are undoubtedly reflected in the chemical composition of the carrots and some preliminary tests were run to find, in general, what chemical differences occur between varieties and between the Oklahoma-grown and the shipped-in product. Such information might be useful in selecting the best varieties for planting in Oklahoma gardens; in planning a breeding program, and in indicating the direction that chemical research should take to aid such a program.

MATERIALS AND METHODS

Several varieties of carrots were grown at Perkins, Oklahoma, in a sandy-loam soil and were harvested at two times during the year—once in midsummer and once in the late fall. The growth stage of the roots at harvest is probably best shown by the average size as given in Table I. The roots were harvested one day, placed in cold storage over night, and then brought to the laboratory and finely ground in a food chopper. The ground material was mixed thoroughly and then aliquots were taken for moisture, ash, and nitrogen determination, for preservation in alcohol, and to be dried for approximate food analysis. Similar samples were prepared from carrots bearing a California label, secured at a local market. Moisture was determined by drying at 105° C, ash was secured by incinerating at 650° C, nitrogen was determined by the Kjeldahl-Gunning method, and the other determinations were run as directed in the A. O. A. C. methods (Anon. 1940) under *Grains and Stock Feeds*.

DISCUSSION AND RESULTS

There is a rather remarkable uniformity of composition shown by the varieties grown in Oklahoma and a noteworthy difference between these and those purchased on the open market (see Table I). The market samples were much lower in ash and protein and considerably higher in carbohydrates (N.F.E.). The protein content of varieties grown in Oklahoma was so much higher that it merits special mention as being an outstanding difference. When these analyses are compared with data reported by Platenius (1934), Oklahoma-grown carrots appear to have a much higher protein content than Northern-grown carrots. He reported a protein content of slightly over 4 percent which is about what the market or California sample contained. No explanation can be given for this great difference; but such a difference, although not so marked, has been noted in another crop (sweet potatoes) grown in Oklahoma. It is known that the soil in which the Oklahoma crop was grown was well supplied with nitrogen and other nutrients. This difference also may be associated with a greater amount of xylem tissue, for there was relatively more core material in the locally grown carrots as compared to the market samples.

Greater differences were expected in the crude-fiber content than are shown in the table, therefore fiber would not seem to be a contributing factor to the lower quality of the local product. Obviously, the relatively greater sweetness, to taste, of the market carrots is explained by the considerably higher amounts of nitrogen-free extract. Some carbohydrate analyses

(not given) indicate that there may be as much as 50 percent more total sugars in the market samples.

Data (not included here) for carrots grown in another section of Oklahoma where commercial vegetable growing is practiced confirm these results, although in some varieties the protein is only twice as high and the nitrogen-free extract intermediate between the results for the Perkins samples and the market samples.

In Table II are given some averages comparing the composition of the spring- and fall-harvested carrots from the same plots. These data indicate that although the roots had tripled in weight between harvests there was no marked change in food value as shown by the proximate analyses. This is particularly true for crude fiber, the percentage of which has remained remarkably constant, and for nitrogen-free extract, which has decreased a relatively small amount. These figures are of interest because they indicate that spring-seeded carrots harvested in the fall for immediate consumption or for storage have about the same food value as those harvested earlier when in the best market condition.

TABLE I

Chemical composition of Oklahoma-grown roots for several varieties of carrots of summer and fall harvests in comparison with the composition of shipped-in (California-grown) carrots

Variety	Av. wt. in grams	Percent of fresh weight			Percent of dry weight				
		Solids	Ash	N	Ash	Ether extract	Protein	Crude Fiber	N.F.E.
		Perkins, July 24, 1945							
Danvers	34.3	10.95	1.42	.188	12.97	2.00	10.88	10.80	63.35
Oxheart	38.4	10.38	1.23	.196	11.85	1.37	13.81	10.35	62.62
Chatenay	40.0	11.36	1.35	.210	11.88	1.50	11.56	10.32	64.74
Streamliner	25.5	11.82	1.50	.252	12.69	2.17	13.31	11.37	60.46
St. Valery	30.0	12.98	1.39	.255	10.71	2.17	12.94	10.59	63.59
Touchon	19.5	10.63	1.09	.214	10.25	2.29	12.56	10.00	64.90
Nantes	31.9	10.42	1.27	.200	12.19	1.46	11.94	9.08	65.33
Chatenay R. Core Canner	34.5	10.49	1.37	.214	13.06	1.90	12.88	10.95	61.21
Luc	32.4	10.74	1.18	.218	10.99	1.76	12.75	10.07	64.43
Market sample[a]	42.0	12.40	.85	.085	6.85	1.26	4.69	10.05	77.15
		Perkins, November 3, 1945							
Danvers	91.6	6.20	1.30	.243	20.97	1.80	14.02	10.97	52.42
Oxheart	144.4	8.83	1.15	.223	13.02	1.45	14.02	9.82	61.69
Chatenay R. Core	79.4	9.29	1.22	.164	13.13	2.08	11.02	10.71	63.06
Streamliner	88.1	10.39	1.29	.251	12.42	2.20	13.06	10.51	61.81
St. Valery	91.0	10.12	1.73	.266	17.09	2.01	14.22	10.25	56.43
Touchon	87.8	8.91	1.16	.207	13.01	1.27	14.23	11.08	60.41
Long Orange	136.0	10.12	1.34	.280	13.24	2.19	14.31	10.92	59.34
Morse Bunching	98.2	10.40	1.23	.236	11.83	1.42	14.17	10.42	62.16
Market sample[a]		10.59	.76	.069	7.18	1.11	4.28	12.34	75.09

[a]These two samples, bought on the open market, were labeled as California-grown carrots and were of similar varietal characteristics.

TABLE II

Composition of Oklahoma-grown carrots for summer and fall harvests (Averages for the first six varieties listed in Table 1)

Variety	Av. wt. in grams	Percent of fresh weight			Percent of dry weight				
		Solids	Ash	N	Ash	Ether extract	Protein	Crude Fiber	N.F.E.
Summer (July 24)	31.3	11.34	1.33	.219	11.69	1.92	12.51	10.57	63.27
Fall (November 3)	97.1	8.96	1.31	.226	14.94	1.80	13.42	10.53	59.30

LITERATURE CITED

Anonymous. 1940. Official and tentative methods of analysis. 5th ed. Washington: Association of Official Agricultural Chemists.

Platenius, H. 1934. Physiological and chemical changes in carrots during growth and storage. Cornell Memoir *161*.