NORTHERN IROQUOIAN MAIZE REMAINS

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ABSTRACT

Results of the analysis of maize remains from three archaeological sites in southern Ontario provide the first detailed description of late-period Indian maize in the province. This data and the scant earlier evidence is considered in light of its importance to the introduction, character and development of maize cultivation in Ontario.

INTRODUCTION

All archaeological specimens of maize in Ontario appear to belong to a race variously classified as Northern or Eastern Flint (Brown and Anderson 1947), Maize de Ocho (Galinat and Gunnerson 1963), Eastern Complex (Carter 1945; Carter and Anderson 1945), or more recently, Eastern Eight Row (Cutler and Blake 1973). Northern Flint maize was the type cultivated not only by the Iroquois, but by nearly every native horticultural society throughout eastern North America (Brown and Anderson 1947; Yarnell 1964). Moreover, Northern Flint maize was widely adopted by early European colonists in the Northeast. It continued to be the primary race grown there until around the mid-nineteenth century, when extensive hybridization with Mexican Dent corn resulted in the modern corn Belt varieties (Anderson and Brown 1952; Wallace and Brown 1956; Zirkle 1969). Today it has all but disappeared from use.

Northern Flint maize has as its primary morphological characteristics ears which are long, slender and straight, usually bearing eight but sometimes ten rows of grain. Rows are moderately to strongly paired, often with a prominent groove separating the row pairs. Frequently, the cobs are broader at the butt than along the rest of their length, and gradually taper towards the tip. Kernels are crescent-shaped, wider than they are long, and relatively thin. In the fresh state the pericarp usually is extremely hard (flinty), yellow or white in colour but sometimes bright red, red-striped, blue, or speckled. Endosperms (grain contents) are yellow or white, dense and starchy but rarely sweet (Brown and Anderson 1947; Cutler and Blake 1971; 1973).

The Northern Flint maize plant produces a leafy central stalk bearing two or three ears relatively close to the ground, as well as several tillers or "suckers" (extra stalks). The latter are always smaller than the main stalk and commonly yield diminutive and malformed ears or "nubbins" (Brown and Anderson 1947; Galinat 1967). The plants are early flowering; consequently, seed growth is rapid and the ears mature at an early date. These developmental features are thought to be adaptations to the cool spring temperatures and short growing seasons which are characteristic of the northern latitudes (Galinat 1967:4).

Although maize from Ontario sites, and many other archaeological sites throughout the East, has been identified as the race Northern Flint (or Eastern Eight Row), there has been little attempt to quantify geographical and temporal variation within this broad taxonomic group. One might predict that considerable variability would be evident given the diverse character of eastern North American physiography and climate, and the apparently long temporal duration of maize culture in the East. Maize from Ontario sites is of particular interest in this regard since the southern part of the province is at the northernmost limits of reliable corn horticulture (Brown et al. 1968; Chapman and Brown 1966; Moodie and Kaye 1969). The

relatively large collections of maize from protohistoric and early historic Ontario Iroquoian sites housed at the Department of Anthropology, University of Toronto, provided the opportunity to quantify some of this variability at a similar point in space and time. It also provided the basis for a comparison with other collections of maize from both near and more distant temporal and spatial locations.

THREE SITES

The Cahiague, or Warminister, site is an early historic Huron Indian village located on the west halves of Lots 9 and 10, Concession XIV, in Medonte Township, some nine miles northwest of Orillia, Ontario (Fig. 1). A sample of maize from this site which was examined consisted of 323 carbonized cobs and cob segments (6.1%), 867 cob fragments (primarily lengths of fused cupules, 22.7%), 87 shank or peduncle fragments (23%), and 2,629 carbonized kernels and kernel fragments (68.9%).

The Graham-Rogers site is a protohistoric or early historic Huron/Petun village located at the headwaters of the Nottawasaga River, just west of Lake Simcoe. Maize remains were represented by 1,332 kernels (87.6%), 114 cob fragments (mostly cupules, 7.5%), 49 whole and segmentary cobs (3.2%), and 26 fragments of the ear shank or peduncle (1.7%).

The MacMurchy site is a protohistoric Huron/Petun village on Lot 12, Concession I, Collingwood Township, Grey County, Ontario. Bell (1954:68-71) reported cobs and kernels to be "very frequent" in his excavations at MacMurchy, and also mentioned fragments of braided corn husk. Unfortunately, few of these items were preserved in the archaeological collections at the University of Toronto. Maize remains from MacMurchy consist of 32 peduncle fragments (71.1%), 11 whole and segmentary cobs (24.4%), 9 kernels (20%), and 4 cob fragments (cupules, 8.9%), for a total of 45 items.

Samples of maize from these three sites were obtained through visual sighting and hand picking. None, apparently, was derived from sieving or flotation devices. Specific intra-site provenience data was unavailable for Graham-Rogers and MacMurchy. However, at the Cahiague Site the maize is known to have been collected from numerous features, middens, and general occupational fill. Detailed comparisons of these various samples of maize from Cahiague did not indicate significant variation within the total population. Therefore, the Cahiague data presented in this report is treated as a single sample.

ANALYSIS

While carbonized maize remains from archaeological sites in Ontario consist of a variety of plant parts (kernels, cobs, stalks, husks, etc.), kernels and cobs are by far the more numerous and, fortunately, the most diagnostic. "Natural" classifications of maize into races rely very heavily upon those morphological attributes of the ear which have a broad genetic background; that is, those expressed by combinations of two or more genes. Many of these attributes are preserved in carbonized archaeological specimens of maize and can be measured easily. Other characteristics such as endosperm composition, colour, and pericarp texture, which are used to distinguish ethnological maize "varieties" (Waugh 1916; Will and Hyde 1917) depend only upon a single gene for their expression. These features are rarely, if ever, preserved in the carbonized state. Contrary to Heidenreich (1971:173), it is not possible to distinquish sweet from flint, and other varieties of maize in archaeological collections in Eastern North America since they differ only in endosperm composition.

Table 1 presents the mean cob row number at Cahiague, MacMurchy, and Graham-Rogers. It is notable that at each site over 70% of the cobs are eight-rowed, with a smaller but significant representation of ten-rowed ears. This is an entirely predictable pattern in populations o

Northern Flint maize, which is characterized by a predominance of eight-rowed ears, with occasional ten-rowed specimens (Brown and Anderson 1947).

Four-and six-rowed maize cobs are not common to the Northern Flints and appear to be restricted both geographically and temporally. In addition to their low row number, these cobs are anomalous in several other ways that suggest growth irregularities. It is likely that the four-and six-rowed cobs represent "nubbin" ears either from tiller stalks or malformed ears on the main stalk of the maize plant, rather than the development of any new variety of corn as Noble (1975) has suggested. These nubbin ears are best represented at Cahiague where they comprise 14% of the total cob complement. Differences in occurrence at other sites probably relate to small sample sizes.

Twelve-rowed cobs turn up infrequently at Lake Woodland sites in the Northeast (Blake n.d.; Cutler and Blake 1973) but they are common in earlier Middle Woodland (300 B.C. to A.D. 500) contexts (Yarnell 1964). The presence of twelve-row cobs at Late Iroquoian sites in Ontario and New York might be interpreted to represent survivals from these earlier periods. Many ethnic groups in the Eastern Woodlands cultivated many-rowed popcorns in historic times, which they often considered to be their "ancestral" form (Waugh 1916; Will and Hyde 1917). Twelve-row cobs were found only at Cahiague but their absence at Graham-Rogers and MacMurchy may be attributable to limited sample sizes from these sites. The poor representation of twelve-row cobs in the Cahiague collections (2.7%) suggests that in samples of less than 60 specimens, such as are Graham-Rogers and MacMurchy, chances of recovering twelve-row ears are slight.

TABLE 1
MEAN VALUES (IN MM) OF IROQUOIAN MAIZE COB MEASUREMENTS

Variables		Cahiague	Graham-Rogers	MacMurchy	Mean
Max. Cob Diameter	x	13.4	12.8	16.3	14.2
	s	3.1	3.0	0.8	2.3
Min. Cob Diameter	x	11.3	11.2	14.2	12.2
	s	2.6	2.7	2.7	2.7
Cupule Width	x	8.3	7.6	9.2	8.7
	s	1.6	1.8	1.7	1.7
Cupule Thickness	x	3.6	3.5	4.0	3.7
	s	0.5	0.6	0.7	0.6
Cob Row Number	x	7.9	8.1	8.2	8.1
	s	1.6	0.9	1.1	1.2

Brown and Anderson (1947:1) and other researchers have pointed out that variation in row number sometimes occurs at the butt and tip of the ear in the Northern Flints because of growth irregularities. Such variation occurs with a frequency of 30% at Cahiague, 50% at MacMurchy, but not at all at Graham-Rogers, (Table 2). Row number for the cob as a whole, therefore, should be counted at or near its middle. Failure to realize this may lead to erroneous conclusions in botanical analyses of maize.

The frequency of these irregularities appears to increase with the increase in row number. None of the four-rowed cobs displays any differences in row number from butt to tip, but differences do occur in 25% of the six-row cobs, 30% of the eight-row cobs, 44% of the ten-row, and 68% of the twelve-row cobs. Because the maximum diameter of the cobs also appears to increase in row number, the growth irregularities at the tip and butt may be partly the result of an overall broadening of the ear.

Table 1 displays the frequencies of maximum and minimum cob diameters. Mean maximum diameter 14.2 mm and mean minimum diameter 12.2 mm for the three sites, suggesting that

the average Huron/Petun cob was narrow and thin, and ovate in cross section. The slightly larger size of the MacMurchy cobs may relate to better local growing conditions allowing a larger and more productive maize plant.

As expected, there is a close relationship between cob row number and cob diameter. The mean width of the Cahiague site four-rowed cobs is 11 mm, of the six-row cobs 11.3 mm, for the eight-row cobs 13.5 mm, for the ten-row cobs 16 mm, and for the twelve-row cobs 14.5 mm. Generally, the lower the row number the smaller the cob diameter. The reduced size of the four-and six-rowed cobs strongly indicates that they are "nubbins" either from tiller stalks or from malformed ears high up on the main stalk.

TABLE 2
COMPARISONS OF COB ROW NUMBER (CENTRE PORTIONS)
WITH ROW NUMBER AT BUTT AND TIP OF COBS
FROM CAHIAGUE, MACMURCHY, AND GRAHAM-ROGERS SITES

No. of rows at cob centre	Number of rows at butt or tip of cob					
	4 Row	6 Row	8 Row	10 Row	12 Row	Row Totals
4 Row	2	0	0	0	0	2
6 Row	1	3	0	0	0	4
8 Row	3	5	42	3	0	50
10 Row	0	1	3	6	0	10
12 Row	0	0	0	2	1	3
Column Totals	6	9	45	11	1	69

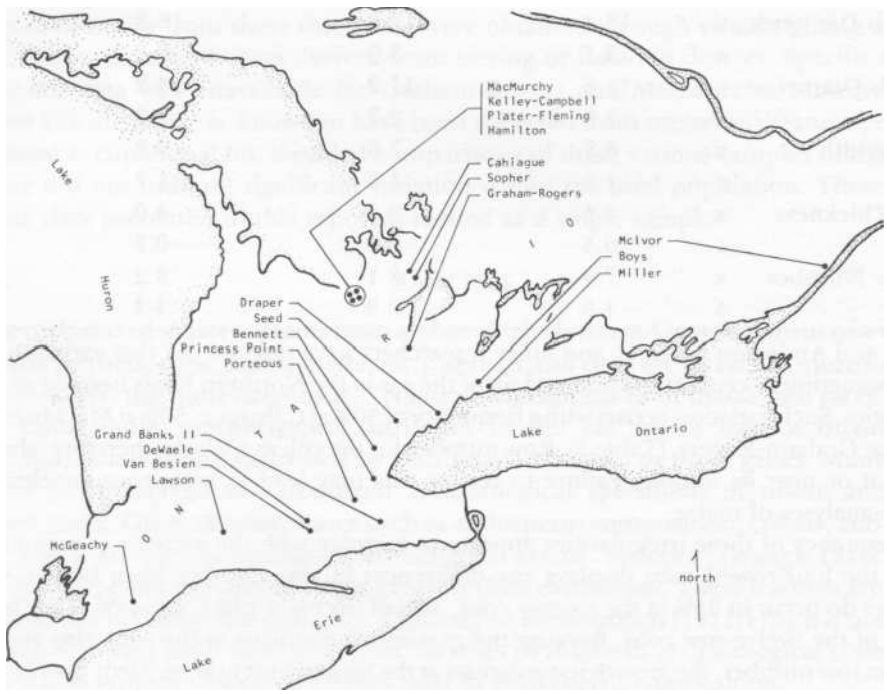

Fig. 1. Ontario sites referred to in the text.

Jones (1949;1968) suggested that cobs with diameters of less than 10 mm probably are nubbins. If we consider these two factors together, then fully *20%* of all analysed cobs from Cahiague and 15% of the cobs from Graham-Rogers are nubbins. From what is known of Northern Flint maize, a ratio of 1:5 for nubbins to regular ears is somewhat low for modern collections (Brown and Anderson 1947; Galinat 1967), but about average for archaeological collections of maize. The presence of carbonized nubbin ears at these sites indicates, however, that they were allowed to mature and were collected for consumption along with the regular ears. It further attests that tiller stalks were not removed before maturation as they were by certain other Eastern Woodland horticulturalists (Ford 1973:191).

The overall size of the cob, and by extension the total productivity of an ear of maize, is difficult to determine because of the fragmentary nature of most archaeological specimens. Only nine whole cobs were preserved at the three Ontario sites. Three of these are "nubbins" and therefore shall not be used to estimate the original average mature ear length. The other six complete specimens have a mean length of *54.6* mm, with a range of from *40.5* mm. to *83* mm. Six of these whole cobs are eight-rowed, one is ten-rowed, one twelve-rowed, and one is four-rowed. However, length does not appear to be related to row number.

However, *32* cob segments from Cahiague, Graham-Rogers, and MacMurchy were complete enough to permit estimations of their total original length. These range in size from 44 mm to *90* mm, and have a mean value of *65.8* mm. These estimates, if reliable (and I believe that they are), indicate a slightly larger ear than do the whole cobs from the same sites. Taking into account an estimated *20%* reduction in overall cob size due to carbonization (Winters 1971:3), the average Huron/Petun maize ear in protohistoric and early historic times was about *82* mm long, with some ears reaching a length of 113 mm. This is a significantly smaller size ear than Heidenreich (1971:173) reported, but his estimates are based on isolated historic descriptions and nineteenth century farm records.

Table 1 shows the variations in size of cupule (kernel) widths and thickness for each of the three Ontario sites. There appears to be significant variability in kernel size on a common time horizon which, perhaps, can best be attributed to diverse growing conditions characterizing the environments surrounding each site. There is no significant difference in kernel (cupule) size which can be related to ear row number, except in the case of the twelve-rowed cobs which have a mean cupule width of *6.8* mm. Because twelve-rowed maize cobs also consistently have a significantly smaller cob diameter than its fewer-rowed counterparts, and since its overall outline is more "cigar-shaped" than the others, a case can be made for identifying twelve-rowed archaeological specimens as a distinct variety of maize. As was suggested earlier, it may be one of the forms of popcorn that was grown by the historic Iroquois (Waugh 1916).

In summary, the average archaeological maize cob from Ontario appears to have been eight-rowed, approximately 13 mm in diameter, *66* mm long, with a broad flaring butt and tapering towards the tip, roughly ovate in cross-section, and with moderately-to strongly-paired rows of grain. Cupule measurements show that the grains are much wider than they are thick. In profile the charred kernels are crescent-shaped. Such characteristics typify the Northern Flints (Brown and Anderson 1947). In general, however, cobs from Cahiague, Graham-Rogers, and MacMurchy are smaller than those described elsewhere for this race (Winters 1971). However, reduced ear and plant size is to be expected near the northernmost limit of aboriginal maize horticulture (Jones *1948).*

A HISTORY OF MAIZE IN ONTARIO

Maize in Ontario is of considerable antiquity, dating back to approximately A.D. *600* when it first appears associated with the Princess Point complex (Strothers 1977). Maize becomes increasingly more important after this date until by late prehistoric times it is the dominant

food staple of the Ontario Iroquois. Between A.D. 1300 and 1400 beans and squash are added to the prehistoric menu of cultivated plants (Wright 1966).

W. C. Noble (1975) reviewed the history of corn in Ontario and concluded that eight-rowed Northern Flint was the first to appear, and remained the only "variety" cultivated until ca. A.D. 1400 when four-, six-, ten-, and twelve-rowed maize appeared. Thus Noble (1975:44):

> "Eight row Northern Flint of the Eastern complex definitely represents the earliest corn in southern Ontario, and once it genetically adjusted to this environment, it continued to be the most important variety throughout the Ontario Iroquois sequence. The 4 and 6 row varieties appear to be post-Middleport hybrids or genetic freaks, while 10-row, which never attains a dominant position, decreases in its incidence after Middleport times in the Huron sequence . . . . Twelve-row Northern Flint is noticeably restricted, for unexplained reasons, to the St. Lawrence Iroquois villages of southeastern Ontario."

Noble also points out that the new corn "varieties" appear at about the same time as beans and squash, and that these new crops are "causally related" to major population increases and town growth after A.D. 1400 (Noble 1975:42-44).

While the importance of beans and squash to the prehistoric diet cannot be overestimated, the relative significance of the so-called new corn "varieties" are questioned in light of the data presented above. Recent research shows that twelve-rowed cobs are neither restricted to the St. Lawrence drainage, nor are they restricted in time to after A.D. 1400 (Table 3). Similarly, ten-rowed ears definitely appear as early as A.D. 1050 at DeWaele, and are possibly as early as A.D. 850 at Porteous. While we might expect four-and six-rowed cobs to be present along with the earliest maize, since they represent nubbin ears, they still have not been found earlier than A.D. 1400 in southern Ontario, as Noble observed.

In almost any area of eastern North America, the earliest maize is associated with the Hopewell culture after about 100 B.C. It is characterized by a small-cobbed, small-grained, usually twelve-or fourteen-rowed, flint or popcorn (Cutler 1965:107). Traditionally, Eastern Eight Row or Northern Flint maize has been seen as a later addition to Eastern maize culture, usually not appearing until after A.D. 700 to 1000 (Anderson and Brown 1947; Galinat and Gunnerson 1963). While there have been several more recent finds of maize with certain "Northern Flint-like" features at an earlier time level, notably at the Williams site, Georgia (Morse and Morse 1960) and the McGraw site, Ohio (Cutler 1965), either the dates have been of questionable nature or the samples too small to reliably indicate the total population. At present, the earliest appearance of eight-rowed Northern Flint maize is an open question. Few knowledgeable researchers would unequivocally put its appearance earlier than A.D. 700 to 800.

In view of these circumstances, it would be most unusual if eight-rowed Northern Flint were the only and earliest maize in southern Ontario. The simple fact is that present botanical collections from sites dating before A.D. 1000 are far too small to be of much use. Of the early (pre-1300) sites cited by Noble (1975), only Porteous has yielded a single cob, the rest having produced only a small number of carbonized kernels. It is impossible to make significant inferences about populations from a single cob, or to determine anything from a few carbonized, and mostly distorted, kernels. Moreover, row number is but one among many significant attributes characterizing maize populations.

The earliest substantial sample of maize in southern Ontario is from the DeWaele site (Fox 1976; Blake 1977), dating ca. A.D. 1050 (Fig. 1). Here eight-rowed Northern Flint accounts for 68% of the sample. These proportions are not unlike other collections of maize in the Northeast on a similar time horizon (Winters 1971). Significantly, twelve-rowed ears account

TABLE 3
COB ROW NUMBER FROM SELECTED IROQUOIAN SITES IN SOUTHERN ONTARIO

Site	Estimated Date A.D.	4 Rowed	6 Rowed	8 Rowed	10 Rowed	12 Rowed	No. of Cobs	No. of Kernels	Reference
Princess Point	500			X				4-5	Strothers 1977 Noble 1975
Grand Banks II	600				?			1	Cutler and Blake 1973
Miller	825			X(?)					Noble 1975
Porteous	700			X	X			1	Cutler and Blake 1973
				X(?)				4	Noble and Kenyon 1972
				X(?)			1	44	Strothers 1977
Van Besien	950			X				20	Noble 1975
Boys	1000			X					Noble 1975
Dewaele	1050			17 (68%)	5 (20%)	3 (12%)	25		Cutler and Blake 1975
Bennett	1250			X(?)					Cutler and Blake 1975
McGeachy	1400-1500			14 (75%)	4 (21%)	1 (5%)	19		Blake n.d.
McIvor	1500			25 (68%)	6 (16%)	6 (16%)	37		Cutler and Blake 1973
Lawson	1500	X	X	X	X	X	?	?	Wintemberg 1939
Draper	1500			5 (56%)	4 (44%)		9		Cutler and Blake 1973
MacMurchy	1580	1	1	8	2		11		this report
Sopher	1580			7 (78%)	2 (22%)		9		Noble 1968 1975
Graham-Rogers	1580	1 (2%)		36 (88%)	3 (10%)		40		this report
Cahiague	1615	10 (7%)	13 (9%)	105 (72%)	14 (10%)	2 (2%)	154		this report
Kelley-Campbell	1620		5 (4%)	103 (85%)	11 (9%)	2 (2%)	121		McAndrews n.d.a.
Plater-Fleming	1600			6			6		McAndrews n.d.b.

for fully 12% of the cobs at DeWaele, while at later sites their importance appears to be considerably reduced (Table 3). One might predict that twelve-rowed ears will be much more common on sites dating before A.D. 900-1000, when more early maize finally is recovered.

The absence of four- and six-rowed cobs from the earlier sites probably is attributable to poor sampling as well. Because they almost certainly represent nubbin ears, one would expect to find them on sites of all ages. However, their absence in the archaeological record may be partly attributable to maize having been of less importance as a food source in earlier time periods. As population increased through time, and as maize became of greater importance to the diet, there may have been an increased selection for *all* ears of the maize plant, including nubbins. Another possibility, although somewhat improbable, is that climatic deterioration after A.D. 1400 or 1450 (McAndrews, personal communication) made nubbin ears more significant sources of food as total productivity decreased.

Because of general sparcity of maize remains recovered from sites in southern Ontario dating before A.D. 1400, and the sporadic reporting of paleobotanical material, comparative data on attributes other than row number are difficult to assemble. However, from an examination of several unpublished reports on maize from Early and Middle Ontario Iroquois sites, and by comparison with the data presented in this report, a few tentative conclusions can be made.

There appears to have been a general broadening, and perhaps a corresponding thinning, of the maize kernel through time. Earlier forms of maize appear to have kernel-width to thickness ratios more nearly equal while later, more "typical" Northern Flint cobs have width-thickness ratio of about 2:1. In this regard it is interesting that twelve-rowed cobs from the three sites examined in this report exhibit a kernel width/thickness ratio close to 1:1. In other words, the twelve-rowed maize is characterized by what might be considered to be "primitive" (early) kernel features. It is noteworthy that Hopewell maize also appears to have had approximately equal kernal width/thickness ratios. I hypothesize that the Ontario twelve-rowed maize represents the historic survival of a more primitive form of popcorn.

Overall, the broadening and corresponding "thinning" of maize kernels through time exhibited on cobs from Ontario Iroquois sites accords well with what we know about the development of Northern Flint maize in the Northeast.

SUMMARY AND CONCLUSIONS

This analysis provides the first, quantitative assessment of morphological variation in maize populations dating to the late sixteenth and early seventeenth centuries in Ontario. Maize from Middle and Late Ontario Iroquois Stage sites appears to be broadly homogenous Northern Flint. However, there is considerable variability in many features of the ear which can be attributed to natural variation within the Northern Flint gene pool, environmental stress, and to the presence of a genetically distinct form of maize. The latter is represented in southern Ontario by twelve-rowed cobs which are suggested to be a primitive form of popcorn.

Four- and six-rowed ears account for approximately 14% of all maize cobs analysed from the Cahiague, MacMurchy, and Graham-Rogers sites. The small size of these cobs, combined with variations in other attributes indicative of growth irregularities, suggests that the four- and six-rowed specimens represent nubbin ears harvested from tiller stalks, or from high up on the main stalk.

Nearly 9% of the eight-rowed cobs from these three sites also are considered to be nubbins because of their diminutive size. Taken together, these figures suggest that approximately 20% of the carbonized maize cobs from early historic Huron/Petun sites represent nubbin ears. It further indicates that nubbins, although relatively unproductive compared to regular sized ears, were important sources of food. It might be hypothesized that such was the case because of the high demands placed upon agricultural lands by a greatly increased population in Huronia during late prehistoric to historic times.

This suggestion seems more likely when the relative productivity of "normal" Huron/Petun maize ears is considered. Since the average cob was 66 mm long, eight-rowed, and with kernel thicknesses of approximately 3.7 mm, average ear yields can be calculated at about 147 kernels. This is considerably less than the average of 200 kernels per ear suggested by Heidenreich (1971:191), and indicates that the average yield per acre, and hence total maize productivity, is diminished by an equal proportion. This seems particularly true when one takes into account the proportions of nubbin ears per maize plant. I suggest that total productivity on the best horticultural land in southern Ontario rarely exceeded 14.5 bushels of shelled maize per acre.

The history of maize in southern Ontario is all but well understood. The earliest maize is associated with the so-called Princess Point Complex (Strothers 1977) by around A.D. 500 or 600, and later, with the early Glen Meyer and Pickering cultures. The scarcity of carbonized corn from these early sites does not permit us to characterize the type of maize grown. However, the few scraps of data which are available, combined with our scanty knowledge of

maize history in contiguous areas of the East, suggest that it probably is more similar to small-grained, many-rowed, Middle Woodland maize found in the midwestern United States (Struever and Vickery 1973). I predict that in future, maize recovered from sites dating before ca. A.D. 800 will yield a relatively large proportion of ears of this type. Conversely, sites dating after A.D. 800 should produce greater amounts of cobs with eight rows, as well as attributes more characteristic of the Northern Flints.

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