Peach (Prunus persica) and apricot (Prunus armeniaca) are two of the most consumed stone fruits worldwide. However, New York grown peaches and apricots have not enjoyed the same scale of cultivation and patronage relative to other production areas (e.g., California) or other local fruits (e.g. apples) owing to significant environmental and socio-economic challenges involved in their cultivation in this region (Merwin, 1994). The best argument for public attention to these fruits is the increasing evidence of the various health benefits of fruit and vegetables. The nutritional and commercial potential of both fruits warrant their consideration as high value specialty crops.

Both fruits are nutrient-rich reserves of healthful compounds, primarily antioxidants, polyphenolics and carotenoids, as well as vitamin C, iron, fiber and potassium (Gil et al., 2002; Dragovic-Uzelac et al., 2007).

Polyphenolics are widely distributed in plant tissue and play a role in fruit color and taste. Major polyphenolic compounds in both stone fruits include catechin, epicatechin and chlorogenic acid. Carotenoids are regarded as the most widespread pigments in nature and are responsible for colors ranging from yellow to red. Predominant carotenoids in these fruits are β-carotene, α-carotene, zeaxanthin and lutein.

The main health benefits of peaches and apricots are attributed to their antioxidant content. Antioxidants are compounds effective against free radical species that can damage DNA, proteins and lipids. Research thus far indicates that these compounds work against the incidence of cardiovascular diseases, cancers and aging. Antioxidant capacity in these fruits is derived from both polyphenolic and carotenoid compounds. For instance, chlorogenic and neochlorogenic acids have been found to be chemopreventive against breast cancer, while β-carotene has been suggested to have preventive benefits against lung and colorectal cancer (Fraser and Bramley, 2004; Noratto et al., 2009).

Peaches and apricots are also sources of vitamin A precursors, namely carotenoids β-carotene (primarily), α-carotene and β-cryptoxanthin. Vitamin A plays a role in vision and its deficiency can lead to xerophthalmia, blindness and premature death; it remains a leading cause of child mortality in developing countries. Zeaxanthin and lutein, although lacking provitamin A abilities, accumulate in the macular tissue of the eye and protect against age-related macular degeneration (Fraser and Bramley, 2004).

With current trends of increased consumption of fruits and vegetables, and greater awareness about health complications and diseases linked to poor diet choices, consumers are looking for good quality products with proven health benefits. This article shares some of our findings in an ongoing study to develop physical, chemical and nutritional profiles for peach and apricot varieties commercially available in NY, and to investigate the effects of production practices and processing procedures on these fruit characteristics. The primary aim of this project is to provide information about NY peach and apricot varieties, categorized as specialty crops, and increase knowledge about the health benefits of local varieties by assessing their nutritive value (polyphenolics, antioxidants and carotenoids). Qualitative and quantitative data obtained will be included in promotional information and contribute towards the appeal and marketability of NY varieties.

Experimental Procedures

Physical and chemical characterization

Nine peach and four apricot varieties were procured in 2010 from local orchards, between August 4 – August 29 for peaches, and July 16 – August 4 for apricots (Figure 1 and 2). Upon harvest, fruit was stored at 32-34 °F until analysis. All analysis was performed in triplicate, allotting 5 fruit per replicate. L, a and b color values were measured with a HunterLab UltraScan XE meter (Hunter Associates,) and ‘Vivid’ (I).

**Figure 1.** Peach varieties studied: ‘Bounty’ (A), ‘Harrow Beauty’ (B), ‘John Boy’ (C), ‘John Boy II’ (D), ‘PF 22007’ (E), ‘PF 23’ (F), ‘PF Lucky13’ (G), ‘RedHaven’ (H) and ‘Vivid’ (I).
Laboratory Inc., Reston, VA); two measurements each were taken of skin and flesh. Firmness readings were obtained using a TA-XT2 Texture Analyzer (Texture Technologies Corp., Scarsdale, NY). Soluble solids (Leica Auto ABBE refractometer; Leica Inc., Buffalo, NY), pH (Accumet Basic AB15 pH meter; Fisher Scientific, Waltham, MA) and titratable acidity in malic acid equivalents (Mettler Toledo 20 compact titrator; Mettler-Toledo Inc., Columbus OH) were measured from juice extracted using a food processor. Moisture content values were obtained from the weight difference before and after lyophilisation.

**Nutritional profiling** Total phenolic content was assessed by a colorimetric assay using the Folin-Ciocalteu (FC) reagent and expressed as mg gallic acid equivalents (mg GAE) (Kim and Lee, 2002). Individual phenolic compounds were identified via high performance liquid chromatography (HPLC) (Kim and Padilla-Zakour, 2004). Carotenoid profiles were developed by HPLC and reported as µg/100 g (Craft 2005; Kwasniewski et al., 2010). Total antioxidant capacity was assessed using the fluorometric oxygen radical absorbance capacity (ORAC) procedure (Huang et al., 2010).

**Effect of maturity at harvest** Three peach and three apricot cultivars of nutritional or commercial importance were selectively harvested at two stages – commercial and full maturity – in line with farmers’ schedules as well as established indicators of maturity (changes in size, color and firmness). The two points of harvest were 6 to 10 days apart, depending on variety. Fruit were analyzed as previously described.

**Statistical analysis** Tests were conducted in triplicate and analyzed with JMP 9.0 Statistical Software (SAS Institute Inc, Cary, NC). Data were subjected to analysis of variance (ANOVA) and means compared with the Tukey Significant Difference test at 95% confidence interval. Nutritional data were reported per 100 g edible portion (flesh and skin) of fresh fruit.

### Table 1. Range and average values of physical and chemical parameters of selected NY peaches and apricots harvested in 2010.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Peach</th>
<th>Apricot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soluble solids (%)</td>
<td>10.9 ± 1.2</td>
<td>13.7 ± 1.5</td>
</tr>
<tr>
<td>pH</td>
<td>3.6 ± 0.1</td>
<td>3.6 ± 0.1</td>
</tr>
<tr>
<td>Titratable acidity (g malic acid/ 100 mL)</td>
<td>0.6 ± 0.1</td>
<td>1.4 ± 0.4</td>
</tr>
<tr>
<td>Sugar-to-acid ratio</td>
<td>17.6 ± 3.6</td>
<td>10.5 ± 3.5</td>
</tr>
<tr>
<td>Moisture content (%)</td>
<td>87.9 ± 1.2</td>
<td>84.3 ± 2.6</td>
</tr>
<tr>
<td>Firmness (kg)</td>
<td>4.1 ± 1.2</td>
<td>1.0 ± 0.2</td>
</tr>
<tr>
<td>Unit weight (g)</td>
<td>180.7 ± 53.8</td>
<td>42.8 ± 11.2</td>
</tr>
<tr>
<td>Cross-sectional diameter (mm)</td>
<td>69.8 ± 7.2</td>
<td>42.8 ± 5.0</td>
</tr>
<tr>
<td>Edible portion (%)</td>
<td>95.3 ± 0.9</td>
<td>93.7 ± 1.2</td>
</tr>
<tr>
<td>Skin color (L)</td>
<td>46.0 ± 3.0</td>
<td>53.4 ± 2.9</td>
</tr>
<tr>
<td>Skin color (a)</td>
<td>23.3 ± 3.0</td>
<td>25.1 ± 3.5</td>
</tr>
<tr>
<td>Skin color (b)</td>
<td>23.3 ± 4.3</td>
<td>37.8 ± 3.7</td>
</tr>
<tr>
<td>Skin color (Hue angle)</td>
<td>41.7 ± 4.4</td>
<td>55.9 ± 5.1</td>
</tr>
<tr>
<td>Flesh color (L)</td>
<td>62.2 ± 3.7</td>
<td>50.0 ± 5.6</td>
</tr>
<tr>
<td>Flesh color (a)</td>
<td>11.3 ± 1.5</td>
<td>20.2 ± 1.4</td>
</tr>
<tr>
<td>Flesh color (b)</td>
<td>45.5 ± 3.2</td>
<td>36.5 ± 3.9</td>
</tr>
<tr>
<td>Flesh color (Hue angle)</td>
<td>75.8 ± 2.4</td>
<td>60.9 ± 3.0</td>
</tr>
</tbody>
</table>

### Results and Discussion

**Fruit and varietal characterization.** Soluble solid content was greater in apricots than in peaches, but a similarly high titratable acid content resulted in peaches possessing a higher sugar-to-acid ratio (Table 1). Since this influences the perception of sweetness of a fruit and its acceptability, this characteristic – together with the larger size and vivid color (blush) of peaches – provides insight into peaches’ greater appeal in the fresh market.

Overall, total phenolic content (Figure 3) and ORAC antioxidant capacity (Figure 4) for apricots were more than double that of peaches. Carotenoid concentration reported as β-concentration, was approximately 10 times as high in apricots as in peaches (Figure 5). ‘PF22007’ peach had the highest phenolic content and antioxidant capacity and average values per 100 g for both parameters were 60 mg GAE and 1990 µmol TE, respectively. ‘Harrow Beauty’ and ‘Bounty’ peaches showed highest carotenoid content with the overall average being 490 µg. In apricots, ‘Hargrand’ ranked highest in three categories, with average phenolic, ORAC antioxidant and carotenoid values being 170 mg GAE, 4100 µmol TE and 4030 µg respectively.

In peaches, the predominant phenolic compounds identified were cyanidin-3-glucoside and catechin, with significant amounts of epicatechin, kaemferol-3-rutinoside and chlorogenic acid, and relatively minor amounts of neochlorogenic acid and epigallocatechin. In apricots, the predominant phenolic compound was catechin, with significant amounts of epigallocatechin, neochlorogenic acid, chlorogenic acid, rutin and epicatechin, and relatively minor amounts of cyanidin-3-glucoside, quercetin-3-glucoside and a quercetin derivative. Extremely high values of catechin were noted in ‘Hargrand’ theorized to be the main factor behind its outstanding phenolic and antioxidant content. Beta-carotene was the main carotenoid in both fruit types, with other identified compounds being beta-cryptoxanthin, lutein, zeaxanthin and lycopene.

Because peaches are often consumed fresh, we also conducted sensory evaluations (n=20). On a hedonic scale, ‘Bounty’ and ‘PF 23’ were deemed most acceptable. Considering this together with their high nutritional content, these varieties could be promoted for fresh consumption. With apricots, ‘Hargrand’ proved superior across the board. Although nutritional value is just one factor driving the selection of fruit varieties by growers, ‘Hargrand’ shows great potential for promoting the NY apricot market from a health-benefit perspective.

**Effect of maturity at harvest** In practice, time of harvest depends on the intended purpose or target market fruit. Fruit intended for long-term storage or wide-range distribution is harvested earlier (at commercial maturity) while fruit intended for local markets or immediate consumption can be harvested later in the season (at full maturity). With this latter group, taste, juiciness, flavor and the aroma of fruit are at...
their peak but shelf-life is substantially reduced. Early harvest, on the other hand, sacrifices optimum aesthetic and eating quality for longer shelf-life. The impact of these practices on nutritional parameters remains a subject of considerable interest. Our study therefore compared fruits harvested at commercial maturity to those harvested at full maturity to investigate nutritional changes occurring with on-tree ripening.

Three peach (‘John Boy II’, ‘PF 23’ and ‘RedHaven’) and three apricot (‘Hargrand’, ‘Harogem’ and ‘Harlayne’) varieties were used for this section of the study. In both fruits, ripening was marked by an increase in Brix, pH, sugar-to-acid ratio, and a concomitant decrease in titratable acidity and firmness. In peaches, phenolic content decreased from commercial to full maturity. Average antioxidant capacity and carotenoid concentration remained statistically unchanged; however, the observed trend appeared to be a decrease in antioxidant capacity and an increase in carotenoid concentration with maturity (Figure 6). Apricots responded similarly, with the exception being that carotenoid increase with maturity was particularly pronounced in apricots, showing as much as a three-fold increase from commercial to full maturity.

The findings in this study were generally in agreement with earlier studies by Dragovic-Uzelac et al. (2007) and could potentially inform decisions concerning harvesting schedules, depending on the intended use or proposed promotion niche of fruit products.

Impact/Implications of research findings This study has provided useful information on a representative selection of local peach and apricot varieties. The discovery of exceptional varieties like ‘Hargrand’ could contribute to a renewed interest in these fruits in New York and the Northeast.
Apricots, which generally receive less attention than peaches in NY, proved to be nutritionally richer, possessing twice as much phenolic and antioxidant compounds and up to ten times higher carotenoid content than peaches evaluated in this study. On a 100 g weight basis, phenolic and antioxidant capacity of apricots and antioxidant capacity of peaches were equivalent to those reported for grapes, with 'Hargrand' having more than double the average phenolic and antioxidant content of grapes (USDA, 2010). Considering the additional presence of carotenoids, these fruits are more nutritionally diverse than either apples or grapes. Following current guidelines, apricots can be classified as good sources of vitamin A, providing on average 30% of the recommended daily intake for vitamin A per serving (1/2 cup) (USDA, 2011).

Summary
New York peaches and apricots are significant sources of antioxidants, polyphenolic compounds and carotenoids, with apricots ranking higher than peaches in all categories. Maturity at harvest has an effect on the levels of these healthful compounds. The nutritional and commercial potential of both fruits warrant their consideration as high value specialty crops.

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