

**GLADSTONE ROAD AGRICULTURAL CENTRE
CROP RESEARCH REPORT NO. 23**

EVALUATION OF THE BROCCOLI (*Brassica oleraceae* L. var. *italica*) VARIETY IMPERIAL

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ABSTRACT

*The evaluation of the broccoli (*Brassica oleraceae* L. var. *italica*) variety 'Imperial' was conducted in a replicated small plot trial at the Gladstone Road Agricultural Centre during 2016, to examine yield and quality under local field conditions. Yield responses for the broccoli variety were fairly consistent over the harvest period. The 'Imperial' variety displayed heads that were uniform and attractive in appearance, with thick, sturdy stems. The final harvest saw an increase in broccoli head weight and head size. Head width, or diameter, increased by 3-4 cm from the first harvests to the last harvest. The potential yield for 'Imperial' was determined at 35 tonnes per hectare.*



Developing head of broccoli variety Imperial at the Gladstone Road Agricultural Centre, 2016.

Introduction:

Broccoli (*Brassica oleraceae* L. var. *italica*) belongs to the Brassicaceae family and is closely related to the cabbage, cauliflower and brussels sprouts. Broccoli is one of the most important of vegetables grown under temperate to tropical climate conditions (Gray, 1982). According to worldwide estimates, there were more than 22 million hectares of broccoli, combined with cauliflower, under production (FAOSTAT, 2013). Broccoli is a crop plant that is easily grown on a wide range of soil types and is adaptable to many different climatic conditions (Erdem *et al.*, 2010). It is high in water content, fibre, protein, calcium and iron, and is a rich source of vitamin A and vitamin C, among other health promoting and anti-cancer properties (Acikgoz, 2011; Kandil and Gad, 2012; Mahn *et al.*, 2012; Ávila, *et al.*, 2013). This vegetable is used in salads, as a fresh food item, but is also steamed with other vegetables as a cooked food item. It is suitable for processing into frozen vegetable products.

Objective:

This study evaluated the performance of the broccoli variety ‘Imperial’ under local growing conditions.

Materials and Methods:

This experiment was conducted at the Gladstone Road Agricultural Centre, New Providence, during the 2015-2016 winter vegetable growing season. The broccoli variety ‘Imperial’ is a product of Sakata Seed America, Inc., a division of Sakata Seed Corporation, Japan. It is a moderately heat tolerant vegetable, producing a tight dome with small, dark green heads on a firm stalk.

The variety ‘Imperial’ was planted in a field seedbed on the 9th October, 2015 and transplanted to field plots on the 1st November 2015 after 23 days of growth. The experiment was established in the field in a completely randomised design with three replications. Each replicate consisted of a single row with a total of twenty plants per plot. Plant to plant spacing was 45 cm (18 inches) with a spacing of 1.5 m (60 inches) between the rows.

The usual cultural practices were observed to ensure that an even stand of plants was maintained in the field plots. Three weeks after transplanting, fertiliser of the formulation 8-18-8 was banded along the growing plants in one application. Weeds were controlled by hand cultivation. The broccoli plots were sprayed on a weekly basis with a combination of Xentari[®] and Bravo[®], with Nutrileaf[®] liquid fertiliser in a 20-20-20 formulation. The plots were irrigated with a drip irrigation system which supplied water throughout the growing season.

Harvesting extended from 15th January to 6th March, 2016 as the broccoli heads reached their optimum maturity. Five heads were sampled from each of three plots on three different occasions during January, February and March. Only heads of marketable size were harvested. Outer leaves were stripped from the heads and the weights recorded. Head width (diameter) was measured with a ruler across the horizontal section of the broccoli head. Head length was measured longitudinally from the top of the broccoli head to the bottom stem portion. Plate 1 illustrates the method used to determine the head width and head length of the broccoli variety.



Plate 1. Mature compact heads of broccoli showing how measurements were calculated; head width (diameter) on the left and head length on the right.

The mean daily maximum and minimum temperatures for the trial period were 28.0°C (82.4°F) and 19.7°C (67.5°F), respectively. The total rainfall for the period was 314.5 mm (12.4 in). Mean monthly sunshine duration for the period was 9.2 h. Weather data (Table 1) was obtained from the Meteorological Department of The Bahamas.

Table 1. Weather data on rainfall, hours of sunshine and mean maximum and minimum temperatures for New Providence for the period of November 2015 to March 2016, courtesy of the Meteorological Department of The Bahamas.

Month	Total rainfall (mm/inches)	Mean monthly radiation (h)	Mean maximum temperature (°C/°F)	Mean minimum temperature (°C/°F)
November	69.3/2.73	10.5	29.7/85.4	22.3/72.1
December	86.9/3.42	9.8	28.8/83.9	21.6/70.8
January	105.2/4.14	10.0	26.9/80.5	16.8/62.2
February	36.6/1.44 in	7.4	26.1/79.0	17.6/63.6
March	16.5/0.65	8.3	28.4/83.1	20.3/68.5

Note: Monthly mean values have been rounded up to the nearest tenth

Statistical Analyses:

All experimental results were analysed using Instat+™. Instat is an interactive statistical package, copyright © 2006, Statistical Services Centre, The University of Reading, UK. All rights reserved.

Results:

The analysis of variance (Table 2) revealed significant differences for broccoli head weight, head width and head length at a 1.0 % level of confidence over the different harvest dates.

Table 2. Analysis of variance (ANOVA) for head weight, head width and head length for the broccoli variety 'Imperial' harvested at three different dates. Standard error is for each treatment mean. Error mean square has 44 df. *, ** and *** denote statistical significance at 5, 1 and 0.1% level of confidence, respectively. NS indicates differences between means not significant.

Source	df	Significance levels		
		Head weight (g)	Head width (cm)	Head length (cm)
Harvest date	2	**	**	**
Error	42			
Std. Err.		27.9	0.79	0.67

Mean values for for head weight, head width and head length for the different harvest dates are shown in Table 3. There was a significant increase in broccoli head weight, head width and head length for the final harvest in March.

Table 3. Mean values of yield responses of broccoli var. 'Imperial', harvested at three different dates.

Harvest date	Head weight (g)	Head width (cm)	Head length (cm)
15 January	609.4a	12.1a	10.4a
19 February	718.9b	11.1a	9.9a
6 March	787.3b	15.9b	13.6b
Mean	705.2	13.0	11.3

The t-test at a level of 5% probability was applied. Means with different letters differ significantly.

The broccoli mean head weight for each of the three harvest dates was 705.2 g, expressed as g per head. Based on an optimal plant population of about 50,000 plants per hectare (approximately 20,000 plants per acre), these figures when extrapolated reveal a yield potential of the variety 'Imperial', at 35.3 tonnes per hectare (31 thousand pounds per acre). Post-harvest quality characteristics are outlined in table 4. The broccoli variety displayed an acceptable head and sturdy stalk and general appearance. There was no evidence of any serious pest or disease problems.

Table 4. Post-harvest quality characteristics of broccoli variety 'Imperial' evaluated at the Gladstone Road Agricultural Centre during 2016.

Stated number of days to maturity from transplanting	Actual number of days to maturity from transplanting	Colour	Head	Visible signs of disease or chlorosis
71	75	Dark green head	Semi-dome shaped	None

Discussion:

Yield responses for the broccoli variety were fairly consistent over the harvest period. The 'Imperial' variety displayed heads that were uniform and attractive in appearance, with thick, sturdy stems. The experimental plots were free of diseases and insect pests, the result of pesticide spraying to avert any potential problems. The cool season may have also contributed to the low insect pest populations. The final harvest saw an increase in broccoli head weight and head size. Head width, or diameter, increased by 3-4 cm from the first harvests to the last harvest. This may be attributed to the warmer temperatures promoting faster growth. Kałużewicz, *et al.*, (2010) have determined that temperature is a factor that strongly affects not only growth and development, but yield and head quality of broccoli.

Based on the findings of this research paper, the broccoli variety 'Imperial' is a promising vegetable crop, with respect to its yields and quality characteristics. This variety may be considered for further evaluation, along with other broccoli varieties. With proper management practices, a successful crop can be obtained by local farmers. Further studies are required in order to make a more detailed assessment of the effects of temperature on vegetative growth and the development of broccoli heads.

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