

Effect of organic and conventional cultivation techniques on yield, phenolic content, and sensory parameters in two carrot varieties

K. Reilly¹, M. Gaffney¹, and N. Brunton²

¹Teagasc, H.D.U., Kinsealy Research Centre, Dublin 17, Ireland, ²Teagasc A..F.R.C., Dublin 15, Ireland

Introduction

Carrots are one of the most important field grown vegetables in Ireland with a farm gate value of 16 million euros in 2007. They contain health promoting bioactive compounds including carotenoids, phenolics and polyacetylenes. Organically grown vegetables are often perceived as healthier and to have better flavour. The objective of this study was to determine levels of phenolics and flavonoids in organic and conventionally grown carrots, and to determine if they can be distinguished by taste.

Materials and Methods

Carrot cv. Nairobi and cv. Flyaway were grown in a long term systems comparison field trial at Teagasc, Kinsealy (53° 25' N Lat 6° 10' W). The trial is a 2x2x2 factorial split plot design (n=4) and follows commercial vegetable production practices. Two varieties of carrot, broccoli and onion are grown each year and are assigned as the main plot. There are 2 levels of soil treatment – an organic soil treatment (OS) and a conventional soil treatment (CS); and 2 levels of pest control – an organic pest control treatment (OP) and a conventional pest control treatment (CP). OS treatment comprises certified organic fertilizer inputs, crop rotation, cover crops; CS comprises mineral fertilizers, no set crop rotation. Equivalent rates of N, P and K were applied to both CS and OS treatments. Fertilizer was applied as CAN, single super-phosphate and sulphate of potash for CS, or Greenvale (3:3:1) and ProKali for OS. For the determination of total phenolics the Folin-Ciocalteu method was used (Singleton & Rossi, 1965). Determination of flavonoids was according to Marinova *et al.* (2005). Data from 2009 were analysed using an ANOVA mixed model (SAS 9.1). Taste panel triangle tests were carried out in 2010 in a classroom but were otherwise according to ISO4120:2004. Panellists were presented with three samples of cooked pureed carrot (two alike, one different) coded with unique random numbers. Panellists were asked to taste samples from left to right and select the odd sample.

Results and Discussion

Results from the systems comparison trial are shown in Figure 1. Statistically significant effects ($p < 0.05$) on yield were found for variety, soil and pest control treatments, with higher yields found for CS and CP treatments, and in cv. Nairobi. Soil treatment showed a significant effect on flavonoid but not total phenolic content, with higher levels of flavonoids found for carrots grown under the OS treatment ($p < 0.05$). A significant variety x pest control interaction was observed with levels of total phenolics and total flavonoids higher in variety Flyaway grown under CP treatments ($p < 0.05$). Triangle tests were carried out to determine whether panellists could distinguish between a) organic and conventional carrots, and b) between two

varieties. Results from triangle tests one and two (Table 1) indicate that there was no significant difference between organic and conventionally grown carrots. Similarly, no significant difference was found when panellists were asked to compare these varieties (triangle test three).

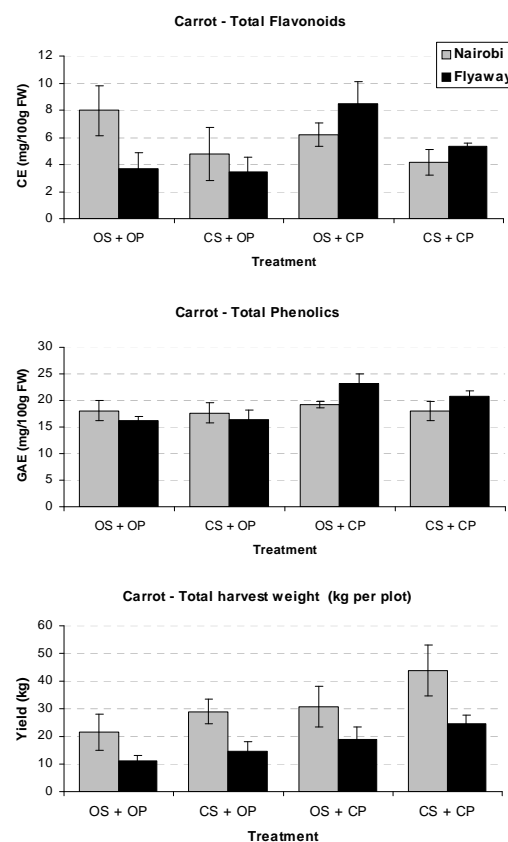


Figure 1. Total flavonoids, total phenolic content and yield in carrot cv. Nairobi and cv. Flyaway under different treatment combinations. Bar charts show mean and standard error (n=4).

Table 1. Triangle test results.

Triangle Test	Samples compared	Number of judgements	Number of correct judgements	Number required to establish significance ($p=0.05$)
Test 1	ON vs. CN	23	10	12
Test 2	OF vs. CF	24	9	13
Test 3	CN vs. CF	24	9	13

ON = organic Nairobi (OS+OP), CN = conventional Nairobi (CS+CP), OF = organic Flyaway (OS+OP) and CF= conventional Flyaway (CS+CP)

Conclusions

Data indicate that organic soil treatment can increase the levels of total flavonoids in carrot. However yields were higher for conventionally grown carrots. No perceptible taste difference between organic and conventional, or between varieties, was found.

Acknowledgements

The Department of Agriculture, Fisheries and Food (FIRM 06/NITARFC6) is gratefully acknowledged for financial support of this work

References

- Singleton V. L. & Rossi, J. A. (1965). *Am. J. Enol. Vitic.*, 16 (3): 144-158.
 Marinova, D., & Atanassova, F.R. (2005). *J. Univ. Chem. Tech. Met.*, 40(3): 255-260.