

## Quality evaluation of organic amaranth

■ AGEY PAPACHAN AND SUMA DIVAKAR

Received: 11.09.2012; Revised: 28.10.2012; Accepted: 29.11.2012

See end of the paper for authors' affiliations

Correspondence to :

**SUMA DIVAKAR**

Department of Home Science,  
College of Agriculture,  
Vellayani,  
THIRUVANANTHAPURAM  
(KERALA) INDIA

Email: divakarsuma67@gmail.com

■ **ABSTRACT** : This study envisaged a comparison between organic and inorganic amaranth. Parameters like physical characteristics, nutrient comparison, anti-nutrient profile, shelf-life, sensory quality and pesticide residues were analysed. Fresh weight was seen to be higher for organic amaranth (85.48 g). Appearance scores showed higher values for organically cultivated amaranth and the difference in values were significant. Highest moisture content was observed in organically cultivated amaranth. Vitamin C levels were found to be at par. Calcium levels were seen to be higher in organically cultivated amaranth (261.6 mg). Phenol content of organic amaranth was found to be lower than inorganically cultivated ones. Pesticide residue analysis gave negative results.

■ **KEY WORDS** : Organically cultivated amaranth, Sensory evaluation, Nutrient composition, Pesticide residue

■ **HOW TO CITE THIS PAPER** : Papachan, Agey and Divakar, Suma (2012). Quality evaluation of organic amaranth. *Asian J. Home Sci.*, 7 (2): 482-486.

Organic farming is today's answer not only for higher and sustained productivity, but also for safe and nutritious food. Organic food is increasingly demanded by the enlightened consumers all round the world. Organically grown agricultural product fetches a higher premium in the market. A scientific backing for the superior quality of organically cultivated produce would be more convincing to the consumers at large.

Vegetables are the integral part of a balanced diet and are considered inevitable, as their consumption prevents many diseases. Role of vegetables as a source of anti oxidants in prevention of new generation disease and delaying aging is well recognized.

Out of the common leafy vegetables, amaranth is the most popular vegetable consumed by most people all over India (Akbugro *et al.*, 2007). It is a high yielding nutritious tropical leafy vegetable. It is the only commercially grown leafy vegetable in Kerala. It is cultivated in an area of 1035 ha in this state. This crop has been an attractive option for farmers because of its very short duration high productivity, drought tolerance and relatively low incidence of pests and disease. Amaranth is often referred to as the poor man's spinach as it is a rich source of proteins, vitamins and

minerals.

Limited number of studies have systematically compared the quality of organically and conventionally produced vegetables, in this state. Hence, a study was taken up, to compare the quality of this popular leafy vegetable.

### ■ RESEARCH METHODS

This study was aimed to compare the quality characteristics of amaranth (variety-Arun) cultivated using organic and conventional methods.

#### Selection of locale :

Samples for the experiment were collected from the organic bazaar being operated by an NGO in the heart of the city. This is the only organic market prevalent in Thiruvananthapuram district. This organic market is issuing the 'PGS' certification for the organic practices prescribed by the NGO.

The conventional samples were collected from local farmers of Kalliyoor panchayath.

#### Selection of treatments:

Three types of farming practices were identified as the

treatment for the study.

T<sub>1</sub>- Organic vegetables (PGS certified – the cultivation area meeting all the requirements prescribed by the NGO.

T<sub>2</sub>- Organic input vegetables (PGS certified – the cultivation area meeting all the requirements prescribed by the NGO, but the surrounding areas not following similar practices).

T<sub>1</sub> and T<sub>2</sub>- Treatments emphasized the use of organic manures, green manures and organic pest management practices. There was no use of growth regulators and chemical fertilizers.

T<sub>3</sub> – Conventionally grown vegetables (obtained from the farmers of Kalliyoor Panchayath), which were grown using chemical fertilizers.

### Quality parameters selected for the study:

Evaluation of organic vegetables with respect to the following parameters was conducted:

#### Physical quality:

Colours – Colour of amaranth was compared by direct observation of 5 units of the sample of each treatment and then rated on a score card.

Fresh weight – Fresh weight of amaranth was taken on the second day of harvest. Five stalks of amaranth were weighed from each treatment.

Leaf stem ratio – This ratio was obtained by dividing the weight of leaves by weight of stem of five stalks of the sample from each treatment.

#### Sensory quality:

Since sensory quality plays an important role in deciding the quality of any food, the sensory quality was assessed using a score card. The colour, flavour, texture and taste of the vegetable was ascertained. This was done by a semi trained panel of 10 members using a 5 point rating scale.

#### Shelf-life:

Duration with respect to onset of visible marks of deterioration was noted on five units of each sample from each treatment

The physiological loss of water (PLW): The weight of the vegetables was taken daily under ambient condition and the percentage of loss of water was noted. This procedure was continued till the manifestation of change in colour, appearance, texture or setting of decay.

#### Nutrient and chemical composition:

The details of methods adopted to study the nutrients are as given below:

| Nutrient /chemical | Method                       |
|--------------------|------------------------------|
| Moisture           | AOAC (1990)                  |
| Fibre              | Sadasivam and Manikam (1992) |
| Total minerals     | AOAC (1984)                  |
| Acidity            | Sadasivam Manikam (1992)     |
| Vitamin C          | Srivastava and Kumar (1998)  |
| β-carotene         | Jackson (1973)               |
| Calcium            | ----do-----                  |
| Iron               | ----do-----                  |

#### Anti nutrient composition:

The details of procedures followed to analyse anti nutrients are as detailed below:

| Antinutrient | Method                       |
|--------------|------------------------------|
| Oxalate      | AOAC (1984)                  |
| Phylate      | Sadasivam and Manikam (1992) |
| Phenol       | Sharma (2004)                |
| Tannin       | Ranganna (2001)              |

#### Pesticide residue:

Pesticide residue was estimated using the schimatzug chromatograph (Anastassiades *et al.*, 2003).

#### Statistical analysis :

2 factor ANOVA (CRD) was employed for comparison among treatment (Snedcor and Cochran, 1968). For a commutative evaluation of the quality of amaranth based on sensory evaluation of scores, given by the 10 judges, non parametric ANOVA (Kruskal values) were done.

## RESEARCH FINDINGS AND DISCUSSION

The findings obtained from the present study have been discussed under the following sub-heads:

#### Physical characteristics:

The physical characteristics of amaranth is depicted in Table 1. In the present study, all the treatments of amaranth were found to be dark pink in colour. Score card revealed higher values of colour for conventionally cultivated amaranth. Fresh weight was seen to be higher for organic amaranth T<sub>2</sub> (85.48 g) when compared to other treatments. As

| Treatments     | Colour (ranked mean) | Fresh weight (g)   | Leaf stem ratio    |
|----------------|----------------------|--------------------|--------------------|
| T <sub>1</sub> | 6.50                 | 84.32              | 0.59               |
| T <sub>2</sub> | 8.0                  | 85.48              | 0.59               |
| T <sub>3</sub> | 9.50                 | 85.2               | 0.58               |
| Mean           | 8.0                  | 85                 | 0.59               |
| F value        | 1.55                 | 0.24 <sup>NS</sup> | 1.98 <sup>NS</sup> |

NS=Non-significant

far leaf stem ratio, all the treatments gave similar values.

The processed data on sensory evaluation of amaranth in different treatments are shown in Table 2. The ranked means of the observation are also depicted in the table.

| Quality attribute | Amaranth treatments |                |                | $\chi^2$ |
|-------------------|---------------------|----------------|----------------|----------|
|                   | T <sub>1</sub>      | T <sub>2</sub> | T <sub>3</sub> |          |
| Appearance        | 21.20               | 12.10          | 13.20          | 6.89     |
| Colour            | 16.20               | 14.30          | 16.0           | 0.30     |
| Flavour           | 12.85               | 19.05          | 14.60          | 3.24     |
| Texture           | 11.20               | 19.15          | 16.15          | 4.61     |
| Taste             | 13.05               | 18.75          | 14.70          | 2.51     |

CV = 7.717

**Sensory qualities:**

Results revealed that appearance and colour were higher in organically cultivated amaranth (21.2 and 16.20, respectively). Significant difference was observed in the appearance among treatments. Flavour, texture and taste were superior for organic treatment T<sub>2</sub>

**Shelf-life:**

As revealed in Table 3, on an average, all the treatments of amaranth kept well for three days.

| Quality attribute                   | T <sub>1</sub> | T <sub>2</sub> | T <sub>3</sub> | Mean  |
|-------------------------------------|----------------|----------------|----------------|-------|
| No. of days till onset of visible   | 3              | 3              | 3              | 3     |
| PLW-Physiological loss of water (%) | 71.2           | 70.54          | 70.63          | 70.79 |

**Chemical and nutrient composition:**

The various parameters analysed were, moisture, fibre, total minerals, acidity, vitamin C,  $\beta$ -carotene and minerals like calcium. The results are presented in Table 4.

Higher moisture content was observed in organically cultivated amaranth (93.5%). Statistically too was found to be significantly high. With respect to total minerals, amaranth

(T<sub>2</sub>) showed higher values (3.04). Acidity of amaranth ranged between 4.18 and 5.24, per cent, vitamin C levels of all treatments were found to be at par.  $\beta$ -carotene level of amaranth was however highest in T<sub>2</sub> (6024 mcg). As far iron content, organically cultivated amaranth showed higher values.

**Antinutrient status:**

The oxalate and phytate levels did not show any significant difference among the treatments (Table 5). As far tannin content, T<sub>3</sub> observation showed the highest level, levels were lowest in organic amaranth. Phenol context was lowest in T<sub>2</sub> treatment.

**Pesticide residue analysis revealed no residue in any of the treatments:**

In the present study, the physical characteristics studied for amaranthus were colours, leaf stem ratio and fresh weight. These are important characteristics from the consumer point of view. All the samples were dark pink in colour, since all of them were of the same variety, variation in colour is not expected. Similarly fresh weight of all samples were also found to be on par, this could be owing to the homogenous cultivating and storage conditions. The mean value of leaf stem ratio matched the values observed by Shankaran (2006) ranging between 0.53-2.38. Mohana Lekshmi *et al.* (1998) to reported optimum value of leaf stem ratio between 1.0-1.5.

On analyzing the sensory qualities, colour and appearance was higher in organic treatment (T<sub>1</sub>), whereas other characteristics like taste, texture and flavours were superior in organic amaranth (T<sub>2</sub>). Smith *et al.* (2002) after reviewing several studies reported that organic vegetables are claimed to be better tasting and fresher. There have been many comparative studies of organoleptic quality of organic and conventional fruits and vegetables. The result consistently showed enhanced organoleptic quality in organic produce. ([www.organiccentre.org](http://www.organiccentre.org)). However, Woese *et al.* (1997) found that in sensory tests performed with potatoes, differences could be found between varieties, but not between cultivators systems.

| Parameters       | T <sub>1</sub> | T <sub>2</sub> | T <sub>3</sub> | C.D. (P=0.05) |
|------------------|----------------|----------------|----------------|---------------|
| Moisture (%)     | 93.5           | 91.5           | 86.21          | 1.338         |
| Fibre (%)        | 0.88           | 6.94           | 0.96           | -             |
| Total mineral(%) | 2.42           | 3.04           | 2.5            | 0.361         |
| Acidity(%)       | 4.18           | 5.20           | 5.24           | 0.369         |
| Vitamin C (mg)   | 43.36          | 43.18          | 43.24          | -             |
| -carotene (mcg)  | 5494.2         | 5372           | 6024           | 429.956       |
| Calcium (mg)     | 261.6          | 233.4          | 259            | 4.365         |
| Iron (mg)        | 2.24           | 2.42           | 2.18           | 0.11          |

- indicates that the 'f' ratio was not seen to be significant even at P=0.05

**Table 5 : Antinutrient composition of amaranth**

| Antinutrients | T <sub>1</sub> | T <sub>2</sub> | T <sub>3</sub> | C.D. (P=0.05) |
|---------------|----------------|----------------|----------------|---------------|
| Oxalate (%)   | 2.02           | 2              | 1.98           | -             |
| Phylate (%)   | 0.53           | 0.53           | 0.52           | -             |
| Phenol (mg)   | 0.26           | 0.35           | 0.39           | 0.45          |
| Tannin (mg)   | 43.56          | 50.76          | 55.18          | 2.04          |

Shelf-life of the vegetables were determined with respect to 2 parameters; duration with respect to onset of visible marks of deteriorations and physiological loss of water (PLW). Both the parameters did not show any difference among the treatments. This was in contrast to the observation of Krishna (2005) and Khamkar (1993).

Moisture content was observed to be higher in organically cultivated amaranth (93.5%). But reported that there was not much variation in moisture content with respect to cultivation practices. Fibre content of the vegetables amongst all treatments were at par. However Neelam *et al.* (2009) revealed higher fibre content in organically grown brinjal.

Total minerals were observed to be highest in organically treated (T<sub>2</sub>) amaranth. Studies by Akenkora *et al.* (1998) too made similar observations. Vitamin 'C' content of the treatments were more or less at par.  $\beta$ -carotene levels of amaranth was highest in T<sub>3</sub>, which was significantly different from other treatments. In contrary highest level of calcium was recorded in organic treatment (T<sub>1</sub>).

Review of literature in general reveals that organic produce have higher nutritive value though the biological mechanisms responsible for this have not been explained in most of the contexts. However, Lundegardh (2003) has concluded on the better nutritional value of organic produce owing to greater activation of plant defense mechanism (without pesticide), with active self-life comprising of interacting plants and microbes and balanced mineral intake (without excess of nutrients from fertilizers).

Antinutrient profile revealed significantly lower levels of phenol and tannin content in organic amaranth. This observation could be further investigated upon a larger trial for validation.

Pesticide residue analysis showed negative results as expected.

#### Acknowledgement:

This experiment was conducted with the research fund of Kerala Agricultural University. Hence, the facilities of the laboratory could be utilized. The analysis of data was undertaken under the supervision of Sri C.E. Ajithkumar, Programmer of the Department of Agricultural Extension. The whole hearted cooperation of the NGO housing the organic bazaar at Trivandrum, is thankfully acknowledged.

Authors' affiliations:

AGEY PAPACHAN, College of Agriculture, Vellayani, THIRUVANANTHAPURAM (KERALA) INDIA

#### ■ REFERENCES

- Akenkora, K., Adudapaah, H.K and Agyamany, A (1998). Selected nutritional components and sensory attributes of cowpea. *Plant Food for Human Nutrition*
- Akubugwo, I.E., Obasi, N.A., Chionyere, G.C and Vgbogo, A.E (2007). Nutritional and chemical value of *Amaranthus hybridus* L. leaves from Afikpo, Nigeria. *African J. Bio Technol.*, **6** (24) : 2833-2839.
- Anastassiades, Lehotay, S.J., Stajnbaher, O. and Schenck, F.J. (2003). *J. AOAC.Internat.*, **86**:422-431.
- AOAC (1990). *Official methods of analysis*. (5th Ed.). Association of Official Analytical Chemist, Inc., Arlington, V.A. p. 381.
- Jackson, M.L. (1973). *Soil chemists analysis*. (2nd Ed.). Prentice Hall of India (Pvt.) Ltd., New Delhi. pp. 498.
- Khamkar, M.G. (1993). Vegetable farming using vermi compost. *Proc. Congr. Traditional Sci. Technol India*, 28<sup>th</sup> November to 3<sup>rd</sup> December, 1993, Bombay. p. 48.
- Krishna, D. (2005). Impact of organic farming practices on soil health, yield and quality of cowpea. M.Sc. (Ag.) Thesis, Kerala Agricultural University, Thrissur, KERALA (INDIA).
- Lundegardh, B. (2003). Organically produced plant foods. Evidence of health benefits, *Acta Agriculture Scandinavica B. Soil & Plant / Sci.*, **53** (1) : 5-7
- Mohana Lekshmi, M., Mohideen, K.M. and Thamburaj, S. (1998). Studies on variability in relation to stage of growth in amaranthus. *Indian Hort.*, **46** : 28-29.
- Neelam, P., Chitale, R. and Dhupal, K.M. (2009). Soil amendment using oxygenated peptone for quantitative and qualitative enhancement in the yield of organically grown brinjal. *Indian J. Plant Pathol.*, **14** (1) : 10-17.
- Ranganna, S. (2001). *Handbook of analysis and quality of fruits and vegetable products*. (2nd Ed.). Tata. McGraw Hill Publishing Company Ltd. India. p:112.
- Sadasivam, S. and Manikam, A. (1992). *Biochemical methods for agricultural sciences*. Wiley Eastern Limited and Tamilnadu Agricultural University Publication. Coimbatore. pp. 11-20.
- Shankaran, S. (2006). Characterization and evaluation of land races of amaranthus. M.S.c (Ag.) Thesis. Kerala Agricultural University, Thrissur, KERALA (INDIA).

**Sharma, B.R.** (2004). Human acetyl cholinesterase inhibition by pesticide exposure. JCCM.

**Smith, M.M.,** Anderzeg, S. and Isla, M. (2002). Food quality. A comparison of organic and conventional fruits and vegetables. Ecological Agriculture.

**Snedcor, G.W.** and Cochran, W.G. (1968). *Statistical methods*. (6th Ed.). Allied Pacific Bombay. p. 381.

**Srivastava, R.P.** and Kumar, S. (1998). *Fruit and vegetable preservation principles and practices*. Second edition. International Book Distributing Comp., Lucknow, p. 444.

**Woese, K.,** Lange, D., Boess, C. and Bol, K.W. (1997). A comparison of organically grown foods. *J. Sci. Food. Agr.*, **74**: 281-293.

■ **WEBLIOGRAPHY**

[www.organic-centre.org](http://www.organic-centre.org)

\*\*\*\*\*