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EFFECT OF MATURITY, POSITION OF LEAVES AND POST HARVEST STORAGE ON THE NUTRITIONAL COMPOSITION AND ORGANOLEPTIC QUALITIES OF AMARANTHUS

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Abstract: A study was undertaken to estimate the nutritional composition and organoleptic qualities of red and green varieties of *Amaranthus tricolor* during rainy and summer seasons with respect to maturity, position of leaves and post harvest storage. The concentration of the nutrients was highest when harvested around 20 days after transplanting. The protein content of the leaves was not influenced by location of leaves, irrespective of seasons and varieties. Variation in concentration of fibre was observed in different parts of the plant during summer season. Contents of minerals and ascorbic acid were varying significantly in leaves located in different parts of the plant. The green variety retained higher level of nutrients during the two seasons. Red amaranthus grown during summer season was found to be more acceptable. Refrigeration was found to be the best method of storage compared to keeping in polythene bag, dipping the roots in water and wet doth storage for different duration. Storage for different durations had no effect on nutrients except ascorbic acid.

INTRODUCTION

Green leafy vegetables play a vital role in human nutrition and are considered to be the cheapest source of minerals and vitamins. Among leafy vegetables, amaranthus is rich in protein, iron, calcium, vitamin A and C and is a rare example of a vegetable where all these essential dietary components are combined in one. Earlier studies had indicated that maturity and leaf position are major factors influencing the nutritional composition and organoleptic qualities.

MATERIALS AND METHODS

The red and green varieties of *Amaranthus tricolor* were raised during the rainy and summer season as per the package of practices recommendations (KAU, 1987). Leaves were collected at random from eighty plants between 7 am and 8 am from the tip, middle and basal portion of the plant on 10, 20 and 30 days after transplanting to study the effect of different maturity levels and position of leaves on the nutrient composition, during rainy and summer seasons. The methods of storage tried are (1) storing in refrigerator, (2) in polythene bag, (3) wrapping in wet cloth and (4) dipping the roots in water and keeping it open under room temperature. The leaves were packed in polythene cover and then placed in the refrigerator. Prior to storing in polythene bags, the leaves were sprinkled with water. Influence of storage for 24, 48 and 72 hours was assessed. Leaves for the study were collected at random from eighty plants (20 days old).

Protein content in the leaves were estimated by following the standard macrokjeldhal method of Hawk and Oser (1965). Ascorbic acid in leaves was estimated according to the method of AOAC (1955) using 2, 6 dichlorophenol

indophenol dye. Estimation of calcium and iron in leaves was done in diacid extract of fresh leaves using an atomic absorption spectrophotometer. Crude fibre was estimated by acid and alkali digestion method as suggested by Chopra and Kanwar (1978). The organoleptic qualities and acceptability trials on panel members were done using the scoring method.

RESULTS AND DISCUSSION

The protein and fibre content was found to increase with the age of the plant. It was higher in 30 day old plants compared to 10 and 20 days in both the seasons. Unlike protein and crude fibre, calcium and iron content in the two varieties increased up to 20th day and thereafter declined. The ascorbic acid content of the two varieties of amaranthus was found to increase from the initial stage to 20th day and after that there was no change up to 30th day in the seasons. Subbiah (1979) reported high ascorbic acid content on 27th day in Co 1 and Co 2 amaranthus, whereas Abe and Imbamba (1977) observed high content on 50th day in *Amaranthus lividus*.

The leaves were found to be nutritionally richer on 20th day of its maturity. Protein, fibre, calcium and iron were higher in green amaranthus when compared to red amaranthus during the two seasons and a comparison of the seasons indicated that, in general, the quality of the leaves was better during summer season. Th is is in agreement with the study of Mohideen and Muthukrishnan conducted on several varieties of amaranthus (1981). Ascorbic acid and fibre were found to be higher during rainy season in both the varieties. There was no significant difference in protein content among the leaves collected from different parts of the plant in the two varieties of amaranthus grown during rainy and summer seasons (Table 2). The same trend was observed in the concentration of the fibre in the two varieties at rainy season. However, during summer season, significant difference was observed among the different parts in green amaranthus. It was found that the concentration of protein and fibre was higher in the leaves collected from the middle portion of the plant. Leaves from the middle portion gave higher values for calcium, iron and ascorbic acid, during the two seasons. It was also noticed that the leaves collected from the tip portion of the plant gave considerably low value for all the nutrients when compared to the leaves collected from the base and middle portions. It can be concluded that, the leaves collected from the middle portion of the red and green amaranthus leaves at the two seasons were nutritionally richer than the leaves at the other parts of the plant.

Protein and fibre contents of the leaves of amaranthus were not affected by storage for different durations. However, calcium content of the two varieties was slightly affected during storage for differentdurations.

Iron content of the two varieties of amaranthus leaves grown during the two

seasons was found to be not affected significantly due to storage for different durations. Unlike minerals, the ascorbic acid content of stored amaranthus leaves decreased as the storage period increased (Table 3). Among the different methods evaluated, highest loss of ascorbic acid was observed in the leaves stored in wet cloth, while these losses were found to be least in the leaves stored in refrigerator. The loss of ascorbic acid from the leaves stored in polythene bag, open storage in water and wet cloth was found to be significantly higher than that in refrigerator. Thus it can be concluded that, among the various methods of storage tried, keeping in refrigerator was found to be the most ideal. However, even in refrigerated storage, the variation in nutrients increased as the storage period increased and the loss of nutrients was higher when stored for 72 hours in all these storage methods.

The acceptability of the leaves collected from different parts of the plant, during the two seasons, revealed that the quality attribute, colour in the leaf samples collected from the tip portion of the plant had obtained significantly higher scores. But for doneness and taste, the leaf samples in the middle portion of the plant obtained significantly higher scores during summer season. While for tenderness and odour, leaf samples from the different parts of the amaranthus varieties during the two seasons, obtained more or less similar scores. A comparison of the two varieties indicated that scores obtained for all the quality parameters were found to be higher in red amaranthus even though significant variation did not exist. The poor acceptability of the green amaranthus was found to be due to the sliminess and the slight unpleasant taste of the leaves.

During storage, the acceptability of the leaves was adversely affected. The mean scores obtained for various quality attributes of the leaves stored for different durations revealed that the leaves stored in the refrigerator were more acceptable than any other method of storage and were significantly better in retaining the various quality attributes like colour and tenderness. Leaves stored by dipping the roots in water were found to be the least acceptable for qualities like colour, odour and taste. The scores obtained for all the qualities were high for leaf samples stored for 24 hours. For all quality parameters, the stored leaf samples grown during summer season got higher scores. Compared to green amaranthus, red amaranthus was better in retaining these qualities. In addition to the quality loss during storage, the leaves stored by open storage in water were having an objectionable odour which increased as the duration of storage increased. Compared to red amaranthus, green amaranthus was the most easily affected.

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Table 1. Influence of maturity and season on the ascorbic acid, calcium, iron, potassium and fibre contents of Amaranthus leaves of two varieties during rainy and summer season

Variety	Maturity level days	Ascorbic acid (mg)		Calcium (mg)		Iron (mg)		Protein (g)		Fibre (g)	
		R	S	R	S	R	S	R	S	R	S
Red amaranthus	10	49.5	40.0	322	333	14.1	15.20	3.40	3.50	0.70	0.50
	20	98.0	72.0	367	372	22.1	23.38	4.00	4.50	1.03	0.84
	30	98.0	72.0	360	365	20.7	21.90	4.50	4.60	1.20	1.05
Green amaranthus	10	56.0	44.80	340	353	17.0	18.90	3.60	3.70	0.90	0.80
	20	96.0	76.80	379	386	25.0	27.29	4.20	4.50	1.20	1.10
	30	96.0	76.80	371	378	23.40	25.20	4.30	4.80	1.35	1.25
CD (0.05) Variety		-	-	3.1	6.4	1.0	0.3	-	-	0.2	0.18
CD (0.05) Maturity		1.86	10.57	3.8	7.8	2.22	0.38	0.34	0.38	0.26	0.34

R = Rainy season S = Summer season

Table 2. Influence of different parts and season on the nutrient composition of amaranthus leaves

Varieties	Different parts	Protein (g)		Fibre (g)		Calcium (mg)		Iron (mg)		Ascorbic acid (mg)	
		RS	SS	RS	SS	RS	SS	RS	SS	RS	SS
Red amaranthus	Tip	4.20	4.30	1.04	0.97	288	318	10.3	11.7	56.0	34.0
	Middle	4.45	4.50	1.23	1.05	335	351	20.5	21.3	68.0	498.0
	Base	4.02	4.10	1.11	1.04	315	341	18.5	18.8	64.0	34.0
Green amaranthus	Tip	4.30	4.35	1.06	1.00	308	325	12.2	13.8	48.0	32.0
	Middle	4.60	4.65	1.16	1.20	350	364	21.1	22.3	68.0	47.5
	Base	4.10	4.20	1.08	1.11	334	352	19.1	60.0	40.0	
CD (0.05) Varieties					0.09	3.15	3.7379	0.48	0.31	-	-
CD (0.05) Parts					0.11	3.86	4.5779	0.59	0.38	6.92	1.80

RS = Rainy season SS = Summer season

Table 3. Effect of different storage methods and storage periods on ascorbic acid content of amaranthus leave, mg

Storage (M) methods	Rainy season						Summer season					
	Varieties (v)		Storage periods (p)			Mean	Varieties (v)		Storage periods (p)			Mean
	Red	Green	24h	48h	72h		Red	Green	24h	48h	72h	
Refrigerator	89.7	86.0	93.0	88.0	82.5	87.9	62.0	58	66.0	60.0	54.0	60.0
Wet cloth	62.0	60.0	79.0	61.0	43.0	61.0	42.7	39.3	54.0	38.0	31.0	41.0
Dipping the roots in water	73.3	65.3	84.0	71.0	56.0	69.3	48.0	43.3	58.0	45.0	34.0	45.7
Polythene bag	80.7	75.3	88.0	79.0	67.0	78.0	50.7	47.3	60.0	50.0	37.0	49.0
Mean	76.4	72.2	86.0	74.8	62.13	-	50.8	47.0	59.5	48.3	39.0	-
CD (0.05)	3.39		4.1			4.7	3.685		4.513			5.212

Table 4. Mean scores obtained for various quality parameters with respect to seasons and position of leaf

Varieties	Different parts	Colour		Doneness		Tenderness		Odour		Taste	
		RS	SS	RS	SS	RS	SS	RS	SS	RS	SS
Red amaranthus	Tip	4.83	5.00	4.67	4.83	3.50	4.83	4.50	5.00	4.33	4.83
	Middle	4.83	5.00	4.50	5.00	4.00	4.83	4.50	5.00	4.17	5.00
	Base	4.33	4.83	4.00	4.83	3.83	4.50	4.33	4.83	4.00	4.50
Green amaranthus	Tip	4.67	5.00	4.83	4.83	3.67	4.67	4.83	5.00	4.33	4.67
	Middle	4.33	4.83	4.33	5.00	4.00	4.67	4.50	4.83	3.67	5.00
	Base	4.17	4.50	4.17	4.50	3.83	4.67	4.00	5.00	3.83	4.17
CD (0.05) for parts		0.44	0.27	-	0.30	-	-	-	-	-	0.32

RS = Rainy season SS = Summer season

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