The Andhra Agric. J 56(3):353-359, 2009

Effect of Curing and Preservation of Aonla During Storage at Ambient Temperature

V Bali Reddy , G Bindu Madhavi and C F Sikindar
Department of Horticulture, Regional Agricultural Research Station, Lam, Guntur

ABSTRACT

The present investigation was conducted during 2003-04 with the objective of studying the effect of curing and preservation of aonla storage at ambient temperature on TSS, PH, ascorbic acid, total sugars, non-reducing sugars, organoleptic compounds and its economics. Maximum quantity of TSS (72.11%), ascorbic acid (96.62 mg/100g) and total sugars(67.88%) were found in treatment of aonla with salt+turmeric+ centrifuging ($C_2T_1F_1$). Highest amount of non-reducing sugars was observed in treatment of aonla with salt+turmeric +with out centrifuging ($C_2T_1F_0$). A declining trend was observed in the organoleptic rating in all the treatments during storage. Treatment of salt+turmeric+centrifuging ($C_2T_1F_1$) showed maximum score (7.00), while treatment of salt+without turmeric +without centrifuging ($C_1T_0F_0$) (5.84) showed minimum score. The treatment with salt+ turmeric+centrifuging ($C_1T_1F_1$) proved most economical (1: 1.06) as compared to others.

Key words : Aonla, Curing, Preservation

Aonla or Indian gooseberry *(Emblica officinalis* Geartn) is an indigenous and nontraditional fruit to Indian subcontinent having immense potentiality of cultivation in wasteland. Owing to hardy nature, high productivity/unit area (15-20 t/ha) nutritive and therapeutic value, aonla has become an important fruit. It is acrid, cooling refrigerant, diueretic and laxative.The edible fruit tissues of aonla contain about 3 times more protein and 160 times more vitamin 'C' as compared to apple. Normally single aonla fruit contains 20 times more vitamin 'C' as two oranges. Aonla is not consumed fresh in raw state as it is highly acidic and stringent and it is therefore, not popular as table fruit. To remove the bitter acrid, pungent and acidic principles from aonla fruit certain pre-treatments are followed which render the fruit soft and better sugar penetration takes place in the fruits. After pricking, curing is done either by salt or lime. Salt when used as curing material improves texture, flavour and induces translucency. Sugar is added to minimize the bitterness of turmeric.

The joint FAO / WHO expert committee on food additives (1974) included turmeric in the provisional list and has temporally recommended the Acceptable Daily Intake (ADI) for turmeric and curcumin as 2.5 and0.1 mg/kg body weight, respectively. Thus it will be a boon for consumers that they can get both i.e. turmeric and aonla in one product (Murabba) which is of great nutritional importance to the mankind. Therefore, the present investigation was taken up to study the effect of curing, turmeric and centrifuging on fruit diameter, total soluble solids (TSS), acidity, pH of aonla preserve during storage at ambient temperature.

MATERIAL AND METHODS

The present investigation was carried out at Allahabad Agricultural Institute, Allahabad during mid November 2003 to mid April of 2004 in 2^3 – factorial design with 3 replications. The average annual rainfall was 85 cm, concentrated mostly during the monsoon season i.e., July to September with occasional showers in winters. Aonla fruits of Chakaiya cultivar were harvested from the orchard Horticulture Section, Agricultural Farm, Naini, Allahabad and used as experimental material.

Factors	Treatments	Notation
1.Curing	a) Lime (2.5 %)	C_1
	b) Salt (2%)	C_2
2.Turmeric	a) without turmeric	T_0
	b) with turmeric	T_1
3.Centrifuging	a)without centrifuging	F_0
	b) with centrifuging	F_1

Treatment combinations

1. $C_1T_0F_0$ (Lime + without turmeric + without centrifuging)
2. $C_1T_0F_1$ (lime+ without turmeric + with centrifuging)
3. $C_1T_1F_0$ (lime +with turmeric + without centrifuging)

Table 1. Effect of curing, turmeric and centrifuging treatments on T.S.S (%), acidity (%) and active acidity of aonla preserve during storage at ambient temperature.

S.No	Treatments	TSS (%)						Mean	pH						Mean
		storage period (Months)							storage period (Months)						
		0	1	2	3	4	5		0	1	2	3	4	5	
1	$C_1T_0F_0$	66.00	66.00	65.67	66.00	65.67	66.67	66.00	3.30	3.33	3.37	3.40	3.46	3.48	3.39
2	$C_1T_0F_1$	68.00	70.00	69.00	70.00	70.00	70.00	69.50	3.35	3.36	3.42	3.47	3.50	3.56	3.44
3	$C_1T_1F_0$	67.33	68.00	68.33	68.00	69.00	69.00	68.28	3.34	3.37	3.41	3.46	3.46	3.53	3.43
4	$C_1T_1F_1$	68.33	69.00	69.67	69.00	69.67	69.00	69.11	3.35	3.37	3.42	3.47	3.51	3.56	3.45
5	$C_2T_0F_0$	66.00	69.00	68.00	69.00	69.00	70.00	68.50	3.11	3.15	3.17	3.20	3.24	3.29	3.19
6	$C_2T_0F_1$	68.67	70.00	70.00	69.00	70.67	71.00	69.89	3.14	3.14	3.18	3.21	3.22	3.27	3.19
7	$C_2T_1F_0$	70.00	71.00	71.00	72.00	73.00	72.00	71.50	3.11	3.13	3.15	3.19	3.24	3.25	3.18
8	$C_2T_1F_1$	70.00	71.00	71.67	73.00	73.00	74.00	72.11	3.07	3.10	3.15	3.17	3.16	3.20	3.14

		Storage period (Months)						Storage period (Months)					
		0	1	2	3	4	5	0	1	2	3	4	5
Curing (C)	S.Em	0.0210	0.0313	0.0313	0.1500	0.0322	0.1507	0.0029	0.0311	0.0028	0.0031	0.0033	0.0074
Turmeric (T)	C.D (5%)	0.0451	0.0672	0.0672	0.3217	0.0692	0.3134	0.0063	NS	0.0060	0.0067	0.0071	0.0159
Centrifuging (F)													
C x T	S.Em	0.0297	0.0443	0.0443	0.2121	0.0456	0.2132	0.0041	0.0440	0.0039	0.0044	0.0046	0.0105
	C.D (5%)	0.0638	0.0950	0.0950	0.4550	0.0979	0.4574	0.0089	0.0945	0.0084	0.0095	0.0100	0.0225
C x T x F	S.Em	0.0420	0.0626	0.0626	0.3000	0.0645	0.3015	0.0058	0.0623	0.0055	0.0062	0.0066	00148
	C.D (5%)	0.0902	0.1344	0.1344	0.6435	0.1384	0.6468	0.0126	NS	0.0120	NS	0.0142	NS

Table 2. Effect of curing, turmeric and centrifuging treatments on ascorbic acid (%), total sugars (%) and reducing sugars of aonla preserve during storage at ambient temperature.

S.No.	Treatments	Ascorbic Acid (%)							Total Sugars (%)							Reducing sugars (%)						
		Storage period (Months)						Mean	Storage period (Months)						Mean	Storage period (Months)						Mean
		0	1	2	3	4	5		0	1	2	3	4	5		0	1	2	3	4	5	
1	$C_1T_0F_0$	106.95	101.73	95.14	86.34	82.50	75.95	91.43	63.80	64.04	64.33	64.33	64.64	64.72	64.31	33.20	36.62	40.60	43.87	48.74	56.31	43.22
2	$C_1T_0F_1$	107.76	102.12	96.74	87.73	83.76	77.10	92.53	64.05	64.25	64.61	64.99	65.02	65.21	64.69	33.90	37.14	40.95	43.60	48.33	57.13	43.51
3	$C_1T_1F_0$	107.36	101.80	95.07	86.37	82.37	76.62	91.59	64.59	64.81	65.03	65.21	65.16	65.38	65.03	33.51	36.40	40.46	43.75	49.90	57.67	43.61
4	$C_1T_1F_1$	108.94	102.65	96.62	88.12	84.15	77.62	93.02	65.35	65.54	65.77	66.01	65.99	66.05	65.79	34.58	37.34	40.36	43.90	49.47	57.13	43.80
5	$C_2T_0F_0$	109.14	106.86	100.92	86.62	85.10	78.35	94.50	65.71	66.04	66.17	66.33	66.59	66.75	66.27	34.80	37.94	41.20	44.71	49.69	58.31	44.44
6	$C_2T_0F_1$	108.96	106.13	100.12	90.61	85.31	78.30	94.91	66.80	67.09	67.35	67.62	67.88	67.82	67.43	34.55	37.73	41.91	45.38	49.26	57.90	44.46
7	$C_2T_1F_0$	110.12	107.36	101.46	91.09	87.07	79.31	96.07	66.97	67.37	67.69	68.01	68.20	68.24	67.75	34.81	38.53	41.74	44.99	51.34	59.25	45.11
8	$C_2T_1F_1$	111.62	107.18	101.59	92.46	87.22	79.64	96.82	67.23	67.51	67.76	68.04	68.31	68.42	67.88	34.91	38.97	42.62	45.74	51.74	59.57	45.59
		Storage Period (Months)							Storage Period (Months)							Storage Period (Months)						
		0	1	2	3	4	5		0	1	2	3	4	5		0	1	2	3	4	5	
	Curing (C)	S.Em	0.2775	0.1460	0.0379	0.1537	0..0226	0.0345	0.0361	0.0374	0.0378	0.0295	0.0261	0.040		0.034	0.006	0.0165	0.018	0.023	0.0344	
	Turmeric (T)	C.D (5%)	NS	0.3132	0.0814	0.3298	0.0484	0.0740	0.0776	0.0802	0.0812	0.0633	0.0561	00867		0.073	0.013	0.0354	0.039	0.049	0.0739	
	Centrifuging(F)																					
	C x T	S.Em	0.3924	0.2065	0.0536	0.2174	0.0319	0.0488	0.0511	0.0528	0.0535	0.0417	0.0370	0.057		0.048	0.008	0.0233	0.025	0.032	0.0487	
	C x F	C.D (5%)	0.8417	NS	0.1151	0.4665	0.0685	0.1047	0.1097	0.1134	NS	NS	0.0793	0.122		0.104	0.018	0.0501	0.055	0.069	0.1045	
	T x F																					
	C x T x F	S.Em	0.5549	0.2921	0.0758	0.3075	0.0452	0.0690	0.0723	0.0748	0.0757	0.0590	0.0523	0.080		0.068	0.01	0.0330	0.036	0.046	0.0689	
		C.D (5%)	NS	NS	0.1628	0.6597	0.0969	0.1481	0.1552	0.1604	0.1625	0.1266	0.1122	0.173		NS	0.026	0.0709	0.078	0.098	0.1478	

Table 3. Effect of curing, turmeric and centrifuging treatments on non-reducing sugars (%), and organoleptic of aonla preserve during storage at ambient temperature.

S.No	Treatments	Non-reducing sugars (%)						Mean	Organoleptic						Mean
		Storage period (Months)							Storage period (Months)						
		0	1	2	3	4	5		0	1	2	3	4	5	
1	$C_1T_0F_0$	30.60	27.38	23.73	20.46	15.90	8.41	21.08	8.27	6.96	6.06	5.18	4.70	3.87	5.84
2	$C_1T_0F_1$	30.15	27.11	23.66	21.39	16.69	8.08	21.18	8.32	7.04	6.16	5.29	4.85	3.95	5.93
3	$C_1T_1F_0$	31.08	28.41	24.57	21.46	15.26	7.71	21.18	8.38	7.13	6.31	5.47	4.97	3.73	5.99
4	$C_1T_1F_1$	30.77	28.20	25.41	22.11	16.52	8.92	21.41	8.43	7.18	6.48	5.62	5.08	3.99	6.13
5	$C_2T_0F_0$	30.91	28.10	24.97	21.62	16.90	8.44	21.99	8.59	7.67	6.86	6.04	5.22	4.79	6.52
6	$C_2T_0F_1$	32.25	29.36	25.44	22.24	18.62	9.92	21.82	8.62	7.74	6.93	6.10	5.32	4.94	6.60
7	$C_2T_1F_0$	32.16	28.84	25.95	23.02	16.86	8.99	22.97	8.66	7.86	7.08	6.24	5.52	5.12	6.74
8	$C_2T_1F_1$	32.32	28.54	25.14	22.30	16.57	8.85	22.64	8.69	8.01	7.22	6.62	6.08	5.41	7.00

		Storage period (Months)						Storage period (Months)					
		0	1	2	3	4	5	0	1	2	3	4	5
Curing (C)	S.Em	0.0259	0.0245	0.0344	0.0394	0.0357	0.0357	0.0058	0.0050	0.0096	0.0150	0.0151	0.0195
Turmeric (T)	C.D (5%)	0.0555	0.0526	0.0738	0.0846	0.0767	0.0766	0.0126	0.0107	0.0207	0.0322	0.0325	0.0419
Centrifuging (F)													
C x T	S.Em	0.0366	0.0347	0.0487	0.0557	0.0505	0.0505	0.0083	0.0070	0.0136	0.0212	0.0214	0.0276
C x F	C.D (5%)	0.0786	0.0744	0.1044	0.1196	0.1085	0.1083	NS	0.0151	NS	0.0455	0.0460	0.0592
T x F													
C x T x F	S.Em	0.0518	0.0490	0.0688	0.0788	0.0715	0.0714	0.0117	0.0100	0.0193	0.0300	0.0303	0.0390
	C.D (5%)	0.111	0.1053	0.1477	0.1692	0.1534	0.1532	NS	0.0214	NS	0.0644	0.0651	NS

Table 4. Cost- benefit ratio of 100 Kg of aonla fruits

Treat-ments	Variable cost (A) (Rs)	Interest on V.C@5% per annum (B) (Rs)	Total A +B (D) (Rs)	Fixed cost (D) (Rs)	Interest on F.C@ 10% annum (E) (Rs)	Total D+E=F (Rs)	Cost of production C + F=G (Rs)	Gross Return (Rs)	Net return (Rs)	C:B ratio
$C_1T_0F_0$	4930	1.34	4931.34	1240.50	0.67	1241.17	6172.51	12000	5827.49	1: 0.94
$C_1T_0F_1$	4930	1.34	4931.34	1340.50	0.73	1341.23	6272.57	12300	6027.43	1: 0.96
$C_1T_1F_0$	5130	1.40	5131.40	1240.50	0.67	1241.17	6372.57	12600	6227.43	1: 0.97
$C_1T_1F_1$	5130	1.40	5131.40	1340.50	0.73	1341.23	6472.63	12900	6427.37	1: 0.99
$C_2T_0F_0$	4704	1.28	4705.28	1240.50	0.67	1241.17	5946.45	12000	6053.54	1: 1.01
$C_2T_0F_1$	4704	1.28	4705.28	4705.28	0.73	1341.23	6046.51	12300	6253.49	1: 1.03
$C_2T_1F_0$	4904	1.34	4905.34	4905.34	0.67	1241.17	6146.51	12600	6453.48	1: 1.04
$C_2T_1F_1$	4904	1.34	4905.34	4905.34	0.73	1341.23	6246.57	12900	6653.43	1: 1.06

MARKET PRICE

1. Cost of fruits Rs. 12/kg = Rs. 1200
2. Cost of sugar Rs. 14/kg = Rs. 1680 (120 x 14)
3. Selling price of 1 bottle = Rs. 30, 31, 32,33

4. $C_1T_1F_1$ (lime +with turmeric + with centrifuging)
5. $C_2T_0F_0$ (salt + without turmeric + without centrifuging)
6. $C_2T_0F_1$ (salt + without turmeric + with centrifuging)
7. $C_2T_1F_0$ (salt + with turmeric + with out centrifuging)
8. $C_2T_1F_1$ (salt + with turmeric + with centrifuging)

Statistical design : 2^3 –factorial design
Number of treatments : 8
Number of replications : 3
Total number of treatments :24 (8 x 3 = 24)
Name of the cultivar : Chakaiya
Storage period : up to 5 months
Storage : At ambient temperature

The investigation comprised the following treatments

24 kg of fruits were taken for pricking. All the fruits were hand picked.

Curing treatment

The above pricked aonla fruits were taken for curing treatment. Half of the fruits i.e., 12 kg of hand picked fruits were soaked in 2.5% lime (C_1) for 24 hours and remaining 12 kg fruits were dipped in 2% salt (C_2) for 24 hours. Then the concentration of 2% salt was gradually raised 2 to 8 per cent in 4 days. On 5th day the fruits were dipped in freshly prepared 8 per cent salt concentration.

Turmeric treatment

2% turmeric solution was prepared and 6 kg fruits of lime soaked fruits were dipped in turmeric (T_1) solution while 6 kg were left as it is (T_0). 6 kg fruits, which were salt soaked, were dipped in turmeric (T_1) solution and 6 kg were left as it is (T_0).

Centrifuging treatment

3 kg fruits out of 6 kg which were given turmeric treatment were centrifuged (F_1) by fast rotating centrifuging machine of 480 rpm and 3 kg were left as it was (F_0) . In this way 12 kg fruits were centrifuged and 12 kg were left as it was. Total 8 treatments, were obtained which consists of Aonla 3 kg. These containers were used for each treatment. Each container has 1 kg amount of aonla preserve.

Chemical Analysis

For chemical analysis, stored, clear or filtered juice was used.

1. Total soluble solids (TSS)

TSS content was directly measured on the "Zeiss" hand refractometer (0-50 and 60-90) on 0 brix basis at 20^0C temperature.

2. pH

pH of juice was directly measured on the pH meter.

3. Ascorbic acid

The ascorbic acid (vitamin C) content of juice was determined by diluting the known volume of juice with 3% metaphosphoric acid and titrating it against 2, 6-dichlorophenol indophenol dye solution, (A.O.A.C., 1970) until a faint pink colour was obtained. The results were expressed as mg of vitamin C in 100 ml of juice.

4. Total sugars

Total sugar content was determined by using Anthrone reagent method (Dubois et al., 1951). The amount of non-reducing sugars was obtained by subtracting reducing sugars from the amount of total sugar and dividing the resultant by the factor 0.95.

5. Organoleptic compounds

The preserve prepared by different treatments were evaluated organoleptically by a panel of four judged by Hedonic rating test (Amerine *et al*., 1965). Regarding the colour, flavour, consistency (or texture) and taste of preserve was also evaluated. The score was expressed on 0-10 scale and averaged.

RESULTS AND DISCUSSION

Proximate physico- chemical composition of fresh aonla fruit juice.The juice was taken from 20 fruits of Aonla.

1 T.S.S (%)	14.0
2 pH	2.50
3 Ascorbic acid (mg/100g)	568

Total soluble solids

As the storage period progressed, the TSS content of aonla preserve increased significantly which ranged from 66 to74 % .In fresh aonla fruits an average 14.0 % of TSS was recorded. Further on mean value basis the highest TSS was observed in $C_2T_1F_1$ (72.11 %) and lowest was found in $C_1T_0F_0$ (66.00%). This finding is in close conformity with the earlier reports of Pathak (1988) and Bhagwan Deen (1992) in aonla candy during storage and Tripathi *et al*. (1988) in aonla preserve during storage in glass jar. Generally during storage, there was loss of moisture and due to this soluble solids showed an increasing trend (Kumar *et al*., 1992).

Active acidity

In fresh aonla fruits an average 2.50 of P^H was recoded. Mean values the pH was significantly lower in $C_2T_1F_1$ (3.14) as compared to $C_1T_1F_1$ (3.45) treatment. Increase in pH was observed by Tripathi et al., (1988) in aonla preserve, Rani and Bhatia (1986) in Bhaghugosha pear preserve and Sethi and Anand (1982) in carrot preserve.

Ascorbic acid

The treatments had significant effect on ascorbic acid content of the aonla preserve during storage except 0 month. Mean values presented in Table 3 show maximum content of ascorbic acid in $C_2T_1F_1$ (96.62 mg/100g) and the retention was lowest in $C_1T_0F_0$ (91.43 mg/100g) This result is in corroboration with the report of Pathak (1988) that aonla fruit should be pricked and soaked in 2 per cent salt for good quality of candy whereas Singh *et al.*, (1993) reported that pricking and soaking of Aonla fruit in 2 per cent salt solution followed by 2 per cent alum solution give better quality of candy.

Proximate chemical composition of fresh Aonla fruit juice was taken from 20 fruits of Aonla. Total sugars per cent was 3.11% and reducing sugars was 2.37%.

Total sugars

In fresh aonla fruits an average of 3.11% (Table 1) of total sugars were recorded. Over the mean value basis, the highest total sugars was obtained in $C_2T_1F_1$ (67.88 %) whereas lowest total sugars was obtained in $C_1T_0F_0$ (64.31%) treatment.

Reducing sugars

In fresh aonla fruits an average 2.37% of reducing sugar was recorded. Mean value basis the maximum content was recorded in $C_2T_1F_1$ (45.59%) treatment and minimum in $C_0T_0F_0$ (43.22%) (Table1) treatment.

Non-reducing sugars

On mean value basis the maximum non-reducing sugars was found in $C_2T_1F_0$ (22.97%) followed by $C_2T_1F_1$ (22.64%) and the lowest non-reducing sugars was found in $C_1T_0F_0$ (21.08%) (Table 2) treatment. The increase in total sugar might be due to the hydrolysis of polysaccharides like pectin, cellulose, starch etc, and its conversion in to simple sugars. The total sugars along with reducing sugar was found to increased during storage as observed by Tripathi *et al*., (1988). Similar observations were noticed by Sethi and Anand (1982), Karla (1988)

and Rani and Bhatia (1986). The increase in total and reducing sugars in aonla candy was observed by Pathak (1988), Kumar (1990) in papaya candy, Kumar et al., (1992) in ber candy and Sethi and Anand (1982) in intermediate aonla and carrot preserve.

Organoleptic compounds:

The highest score was found in $C_2T_1F_1$ (5.41) treatment and lowest was found in $C_1T_1F_0$ (3.73) followed by $C_1T_0F_0$ (3.87) treatment (Table 2). Regarding colour, the aonla preserve prepared by the application of turmeric was more acceptable. This was due to curcumine the colouring pigment of turmeric. Salt treated fruits along with turmeric were the best, where as, lime treated fruits along with turmeric were red colour in appearance. This was due to the fact that when turmeric reacts with alkali red colour appears.Centrifuge improved the firmness of the anola preserve. Salt and turmeric treated fruits had better taste in comparison to that of lime treated ones. Bhagwan Deen (1992), Tripathi *et al.,* (1988) and Pathak (1988) found the deterioration in organoleptic quality of aonla preserve and candy during storage under glass jar packing. Similarly, reduction in organoleptic quality during storage has been reported in ber candy (Kumar et al., 1992) and citrus peel candy (Mehta and Bajaj, 1984) under glass jar packing and wax gourd candy (Siddiqui et al., 1990) under polythene pouch packing.

Economics of aonla preserve:

After calculating the expenditure per treatment, $C_2T_1F_1$ had maximum cost of production (Rs.6472.63/-) whereas $C_1T_0F_0$ (Rs.5946.45/-) had minimum (Table-4).Preserve prepared from $C_2T_1F_1$ fetched the highest market price whereas $C_1T_0F_0$ fetched the lowest. In the present findings no microbial activity or growth was noticed on aonla preserve packed in plastic container and stored at ambient temperature upto 5 months. Proper concentration of sugar in preserve might have inhibited the growth of micro-organisms. Hence, preserve was stored safely upto 5 months.

LITERATURE CITED

A O A C 1970. Official methods of analysis. Association of Analytical Chemists, Washington D.C

Amerine M A, Pangborn R M and Rocssler E B 1965. Principles of Sensory Evaluation of Food. Academic Press, London.

Bhagwan Deen 1992. Studies on screening of Aonla (*Emblica officinalis* Geartn) genotypes for processing M.Sc. (Ag.) Thesis , N.D.U.A.T, Faizabad.

Dubois M,Gilles K, Hammitton J K, Rolers P A and Smith F 1951. A calorimetric method for determination of sugar. Nature 16:167.

Kalra C L 1988. The chemistry and technology of aonla (*Phyllanthus emblica* L.) A Resume. Indian Food packers. 42 (4): 678-82.

Kumar S 1990. Studies on post harvest technology of papaya *(Carica papaya* L.) fruits. Ph.D. Thesis N.D.U.A.T, Faizabad.

Kumar S, Ojha C M, Dean B, Awasthi O P and Nainwal N C 1992. Potentiality of Ber *(Zizyphus mauritiana* Lamk) cultivars for candy making. Progressive Horticulture 24 (1-2): 74 - 78.

Mehta G L and Bajaj S 1984. Changes in the chemical composition and organoleptic quality of citruspeel candy during preparation and storage.Jouranal Food Science and Technology 21 (6):422

Pathak S 1988. Post harvest technology of aonla (*Emblica officialis* Geartn) fruits Ph.D thesis N.D.U.A.T. Faizabad.

Rani U and Bhatia B S 1986. Studies on baghugosha Pear for preserve and a ready to eat product. Indian Food Packer (3): 25-31.

Seddiqui M I, Ahmed M, Awan J A, Rahman S U and Ahmed A 1990. Production of wax gourd candy by using high fructose syrup. Journal of Food Science Technology 27 (4):205-208.

Sethi V and Anand J C 1982. Physico-chemical and microbiological quality of carrot and aonla preserves, Indian Food Packer (36): 38

Singh I S, Pathak R K, Diwedi R and Singh H K 1993. Aonla production and post harvest technology.Tech. Bull. Department of Horticulture, N.D.U.A.T., Faizabad.

Tripathi V K, Singh M B and Singh S 1988. Studies on comparative compositional changes in different preserved products of aonla (*Emblica officialis* Greartn) var. Banarasi, Indian Food Packer.

(Received on 28.06.2008 and revised on 08.06.2009)