

Final Report

To

University Grant Commission (UGC)
Bahadur Shah Zafar Marg,
New Delhi, Pin - 110 002, India

On

Studies on pesticide residues in major commercial vegetables of Assam

Submitted By:



Dr. Sankar C. Deka (Principal Investigator)
Professor & Head
Department of Food Processing Technology
Tezpur University
Napaam, Tezpur – 784028
Assam, India

Detailed Project Report

Annexure – I

Objective of the Project

- (a) To monitor the compliance of major commercial vegetables grown in different agro-climatic zones of Assam to the pesticides' maximum residue limit (MRLs) as specified in the Food Standards Code
- (b) To study the effect of different processing methods/decontamination processes of major commercial vegetables for the removal of the pesticide residues
- (c) To generate and maintain up-to-date information on pesticide residues and to provide guidelines in this regard to research and extension workers of Assam

Annexure – II

Methodology

Sample Collection:

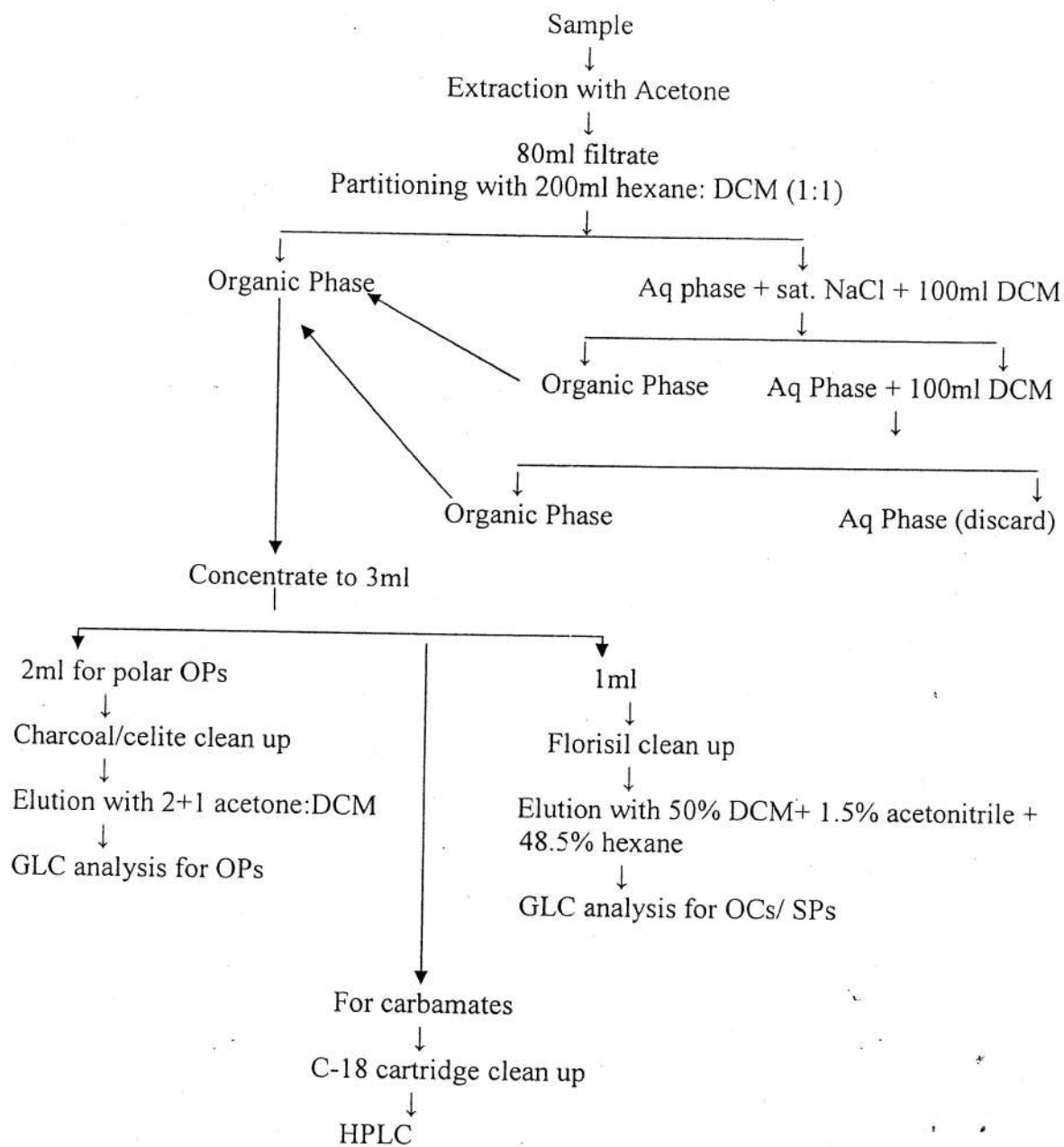
Samples were collected from various six agro-climatic zones viz., North Bank Plain Zone, Central Brahmaputra Valley Zone, Upper Brahmaputra Valley Zone, Lower Brahmaputra Valley Zone, Barak Valley and Hill Zone

Almost all the major vegetables were collected from the various parts of the state.

Standards Used:

- α -HCH
- γ -HCH
- β - HCH
- δ -HCH
- Chlordane
- Dicofol
- α -Endosulphan
- P-P DDD
- P-P DDE
- O-P -DDD
- β - Endosulphan
- P-P-DDT
- Endosulphan sulphate
- Chlorpyrifos methyl
- Chlorthalonil
- Chlorpyrifos
- Pendimethalin
- Butachlor
- λ -cyhalothrin
- Permethrin
- β -cyfuthrin
- Cypermethrin
- Fenvelerate
- Deltamethrin

1. Method Followed (BIS):



Annexure – III
Work done
(in details)

Purchase of Chemicals and Glasswares:

Chemicals and Glasswares required for the carrying out of the work has been purchased through **Order No: TU/ 11-46 (Pur)/ FPT/ 2008/ 663 dated 6/05/2009** from North East Chemicals Corporation, Guwahati (P/ 292/ 09-10 dated 11/08/09).

Fellow Appointment:

(i) Miss Dimpi Kotoki was appointed as Project Fellow vide Memo No: F.43-119/2008 (GA-I)/7130-A. wef 27.3.2009 to 17.6.2010

(ii) Mr. Jayabrata Saha was appointed as Project Fellow vide Memo No: F.43-119/2008 (GA-I)/3051 Dated 04.08.2010. wef 06.8.2010 to till date

Purchase of Equipment:

For analysis of samples, Nucon Series 5700 Digital Dual Column Gas Chromatograph has been purchased from Nucon Engineers, New Delhi through P.O. No: **TU/ 11-46 (Pur)/ FPT/ 2008/ 1087 dated 26/05/09.**

Analysis:

Analysis of different pesticides in the above mentioned samples have been carried out in the GC and their quantities have been calculated.

Experiment No GLC analysis for multi residues of pesticides

Pesticide analyzed

α -HCH, β -HCH, γ -HCH, δ -HCH, Dicofol, Chlordane, p,p-DDE, o,p-DDD, p,p-DDT, α -Endosulphan, β -endosulphan and Endosulphan sulphate.

Analytical Method:

The above Pesticides were analyzed by using GLC (Nucon-5700) equipped with electron capture detector. The operating parameters were as follows-

Column: Glass column (6x 1/8)"OD packed with 1.5% OV-17&1.95% OV-210 coated on chromosorb W-HP (80-100) Mesh)

Temperature: Oven = 160-220°C @3°C/min.

Injector= 265°C

Detector= 300°C

Carrier Gas flow (Nitrogen) =50ml/min

The retention Time are Presented in Table

Table Retention time of different pesticides

Sl No	Name of pesticide	Retention time(min)
1.	α -HCH	3.68
2.	γ -HCH	4.82
3.	β - HCH	5.58
4.	δ -HCH	6.28
5.	Chlordane	8.82
6.	Dicofol	9.63
7.	α -Endosulphan	10.30
8.	P-P DDD	11.42
9.	P-P DDE	12.43
10.	O-P -DDD	13.65
11.	β - Endosulphan	14.63
12.	P-P-DDT	15.27
13.	Endosulphan sulphate	17.05

Experiment No

GLC analysis for multiresidue of pesticides.

Pesticide analysed

Chloropyriphos methyl, Chlothalonil, Choropyriphos , pendimethalin, Butachlor λ -cyclothrin, Permethrin, β -cyflutrin, Cypermethrin, Fenvalerate and deltamethrin

Analytical Method:

The above Pesticides were analysed by using GLC (Nucron-5700), equipped with electron capture detector. The operating parameter was as follows-

Column: Glass Column (6x1/4)"OD Packed with 1.5% OV-17 & 1.95%ov-210 coated on chromosorb W-HP(80-100 mesh)

Temperature: Oven=200-250 $^{\circ}$ c @3 $^{\circ}$ c/min
Injector= 265 $^{\circ}$ c

Carrier gas flow (Nitrogen)=50ml/min

The retention time are presented below.

Table2. Retention time of different Pesticides

Sl No	Name of the pesticide	Retention time(min)
1.	Chlorpyrifos methyl	2.18
2.	Chlorthalonil	2.40
3.	Chlorpyrifos	2.62
4.	Pendimethalin	3.25
5.	Butachlor	3.58
6.	λ -cyhalothrin	9.80
7.	Permethrin	11.72
8.	β -cyfuthrin	14.47
9.	Cypermethrin	15.30
10.	Fenvelerate	17.47&18.17
11.	Deltamethrin	20.25s

Experiment: Monitoring of pesticide residue (ppm) in Vegetables.

Table: Monitoring of pesticide residues (ppm) in vegetables.

Name of Vegetable	Pesticides Detected	Analyzed	Contaminated	Range of residue (Mean)	>MRL
1.Okra	Endosulphate	4x2	4(100%)	0.1095	
2.Cucumber	Endosulfan sulphate	6x2	4(100%)	--	
	α -HCH	6x2	--	--	
3.Culinary banana	P-P-DDD	2X2	1(50%)	0.0812	
	Endosulphan sulphate	2X2			
4.Tomato	α -HCH	3x2	1(33%)	--	
	Endosulphate	3x2	1(33%)	--	
5.Ridge gourd	α -HCH	4x2	1(25%)	0.0197	
	Lindane	4x2	1(25%)	0.0169	
	β -HCH	4x2	1(25%)	0.0492	
	p,p-DDD	4x2	1(25%)	0.0542	
6.Papaya	NIL	4x2	--	--	
7.Potato	α -HCH	5x2	2(40%)		
	Lindane	5x2	2(40%)		
	o.p-DDD	5x2	1(20%)		
	Endosulphate	5x2	1(20%)		
8.Chilli	α -HCH	4x2	1(25%)	0.0576	
	Lindane	4x2	1(25%)	0.389	
	B-HCH		1(25%)	0.0214	
	p,p-DDD		1(25%)	0.0957	
9. Carrot	Nil	3x2	--	--	
	Nil	4x2	--	--	

Residue of triazophos in / on brinjal fruits

Results

- 1) Limit of detection: 0.05 ppm
- 2) Recovery : 79.5%
- 3) Residue Level : The residue in /on brinjal fruits are presented in the following Table. The samples were collected from an experimental plot of Sonitpur district and analysed.

Table . Residue of triazophos in / on brinjal fruits

Days after application	Mean residue (ppm)	(+)- SD
0	1.159+- 0.06	1.99+-0.03
1	0.932+-0.10	1.206+-0.05
5	0.463+-0.06	0.842+-0.07
10	0.163+-0.05	0.348+-0.15
15	0.063+-0.02	0.087+-0.01
20	BDL	0.057+-0.01

BDL: Below detectable level

Analysis of vegetables from Lower Brahmaputra valley

Vegetables analyzed were potato, tomato, brinjal, French bean, cauliflower, cabbage, knolkhol, carrot, ridge gourd, lady's finger, pointed gourd, cucumber and cowpea.

Vegetables (40 Samples)	Pesticide detected	Analysed	Contaminated	>MRL	Range of residues(Mean)
	1.Chloropyriphos	40	15(38%)	3	BDL- 0.9085
	2. Cypermethrin	-do-	13(13%)	3	(0.10801)
	3. Endosulphan	-do-	9(23%)	0	BDL- 0.5905
	4. Fenvelerate	-do-	5(13%)	0	(0.1792)
	5. HCH	-do-	10(25%)	0	BDL- 0.7319
	6.Monochrotophos	-do-	6(20%)	0	(0.4894)
				1	BDL- 0.9055
					(0.5820)
					BDL- 0.862
					(0.4772)
					BDL- 0.2510
					(0.1283)

Decontamination of Pesticide residue on vegetables

Vegetables analyzed were potato, tomato, brinjal, French bean, cauliflower, cabbage, knolkhol, carrot, ridge gourd, lady's finger, pointed gourd, cucumber and cowpea.

Vegetables	Pesticides	Decontamination (%)	
		After washing	After cooking
Vegetables 40 Samples	1. Chloropyriphos	29	62
	2. Cypermethrin	31	64
	3. Endosulphan	31	64
	4. Fenvelerate	28	64
	5. HCH	33	63
	6. Monochrotophos	33	66
		33	67

Monitoring of farm gate samples of vegetables from Upper Brahmaputra Valley

Samples were collected from various localities of upper brahmaputra valley. Thirty two samples of vegetables including cowpea, potato ridge gourd, cabbage and brinjal were collected. Samples were processed on the same day of collection and analysed only for those pesticide as indicated by their treatment history, viz Endosulphan, Malathion, Quinalophos, Chlorpyrifos and HCH.

Name of vegetable	Sample No	pesticide last sprayed	Interval between last application and harvest	Residue level(mg/Kg)
Cowpea	1	Malathion	15	0.053
	2	Qunalophos	25	ND
	3	Malathion	21	ND
	4	Chloropyrifos	19	0.012
	5	Endosulfan	18	0,025
	6	Endosulfan	30	ND
Potato	1	Malathion	108	ND
	2	Qunalophos	96	ND
	3	Malathion	101	ND
	4	Chloropyrifos	110	ND
	5	Endosulfan	98	ND
	6	Endosulfan	123	ND

Ridge gourd	1	Malathion	NA	ND
	2	Qunalophos	NA	ND
	3	Malathion	7	0.362
	4	Chloropyrifos	18	0.032
Cabbage	1	Qunalophos	NA	0.438
	2	Quinalophos	35	ND
	3	Endosulfan	25	ND
	4	Malathion	5	0.639
	5	Endosulphan	15	0.0363
	6	Chloropyriphos	NA	0.0758
	7	Chlorpyripfos	25	0.0135
Brinjal	1	Qunalophos	NA	ND
	2	Quinalophos	6	0.310
	3	Endosulfan	9	0.603
	4	Malathion	NA	ND
	5	Malathion	7	0.036
	6	Malathion	18	ND
	7	Endosulphan	23	0.006
	8	Chloropyriphos	NA	ND
	9	Chlorpyripfos	21	0.023

Frequency of various pesticide residues on different vegetables

Name of Vegetables	Insecticide	No of samples contaminated	MRL(mg /kg)	No of samples above MRL
Cowpea (6)	Malathion	1	3.0	NIL
	Quinalophos	Nil	0.25	NIL
	Chlorpyrifos	1	0.2	NIL
	Endosulfan	1	2.0	NIL
Potato (6)	Malathion	Nil	3.0	NIL
Ridgegourd (4)	Malathion	Nil	3.0	NIL
	Chlorpyrifos	Nil	0.2	NIL
	Endosulfan	1	2.0	NIL
	Qunalophos	1	0.25	NIL
Cabbage(7)	Quinalophos	1	0.25	NIL
	Malathion	Nil	3.0	NIL
	Endosulfan	2	2.0	NIL
	Chlorpyrifos	2	0.2	NIL
Brinjal(9)	Quinalophos	1	0.25	NIL
	Malathion	1	2.0	NIL
	Endosulfan	1	3.0	NIL
	Chlorpyrifos	1	0.2	NIL
	Lindane	1	0.25	NIL

Recoveries of Lindane from okra fruits.

Amount added ($\mu\text{g/g}$)	Amount recovered ($\mu\text{g/g}$)	Percent recovery	Mean Recovery percent
0.1	0.0856	85.6	88.11
0.1	0.0921	92.1	
0.5	0.4211	84.22	
0.5	0.4526	90.52	

The average recovery percentage were 88.11

Decontamination processes:

Table: Effect of decontamination processes on the residues of various vegetables collected from North Bank Plain Zone, Assam

Vegetables	Samples	Without processing	After washing	%Removal	After washing and cooking	% Removal
Potato	Sample I	0.4646	0.2320	50.06	0.2104	54.71
	Sample II	0.1529	0.1053	31.13	0.0721	52.84
Tomato	Sample I	0.8828	0.3934	55.43	0.3628	58.90
	Sample II	0.5206	0.2692	48.29	0.1893	63.64
Brinjal	Sample I	0.7756	0.3254	58.05	0.2356	69.62
	Sample II	0.6201	0.3010	51.46	0.2514	59.45
Bitter gourd	Sample I	0.8825	0.4120	53.31	0.2534	71.29
	Sample II	0.6524	0.3212	50.77	0.1252	80.80
Corriander	Sample I	0.5624	0.2141	61.93	0.1254	77.70
	Sample II	0.4523	0.2132	52.86	0.1654	63.43
Cabbage	Sample I	0.6542	0.3100	52.61	0.1478	77.41
	Sample II	0.5635	0.2341	58.46	0.1587	71.84
Capsicum	Sample I	0.4325	0.2140	50.52	0.1689	60.95
	Sample II	0.5325	0.2356	55.76	0.1684	68.38
Carrot	Sample I	0.4231	0.2141	49.40	0.1698	59.86
	Sample II	0.4523	0.2154	52.38	0.1589	64.87
Ridge gourd	Sample I	0.5214	0.2610	49.94	0.1587	69.56
	Sample II	0.5412	0.2512	53.58	0.1489	72.51
Lady's finger	Sample I	0.5321	0.2354	55.76	0.1247	61.57
	Sample II	0.4526	0.2135	52.83	0.1125	75.14
Pointed gourd	Sample I	0.4523	0.2141	52.66	0.1158	74.40
	Sample II	0.4125	0.2141	48.09	0.1489	63.90
Cucumber	Sample I	0.4812	0.2358	51.00	0.1587	67.02
	Sample II	0.4712	0.2415	48.75	0.1655	64.88
Cowpea	Sample I	0.5874	0.2641	55.01	0.1889	67.84
	Sample II	0.4587	0.2547	44.47	0.1669	63.61
Colocassia	Sample I	0.6541	0.3125	52.22	0.1333	79.62
	Sample II	0.5632	0.2358	58.13	0.1322	76.53

Table: Effect of decontamination processes on the residues of various vegetables collected from Central Brahmaputra Valley Zone, Assam

Vegetables	Samples	Without processing	After washing	%Removal	After washing and cooking	% Removal
Cabbage	Sample I	0.4568	0.2514	44.96	0.1654	63.79
	Sample II	0.4789	0.2314	51.68	0.1147	76.05
Tomato	Sample I	0.4231	0.2589	38.80	0.1258	70.26
	Sample II	0.4589	0.2458	46.44	0.1247	72.82
Brinjal	Sample I	0.4569	0.2159	52.75	0.1489	67.41
	Sample II	0.4562	0.2356	48.35	0.1334	70.75
French bean	Sample I	0.4898	0.2589	47.14	0.1236	74.76
	Sample II	0.4879	0.2478	49.21	0.1258	74.21
Cauliflower	Sample I	0.4587	0.2587	43.60	0.1421	69.02
	Sample II	0.4314	0.2541	41.09	0.1212	71.90
Potato	Sample I	0.4566	0.2232	51.11	0.1215	73.39
	Sample II	0.4111	0.2213	46.16	0.1365	66.79
Knolkhol,	Sample I	0.4888	0.2585	47.11	0.1369	71.99
	Sample II	0.4741	0.2587	45.43	0.1364	71.22
Carrot	Sample I	0.4878	0.2354	51.74	0.1487	69.51
	Sample II	0.4477	0.2125	52.53	0.1254	71.99
Ridge gourd	Sample I	0.4556	0.2355	48.30	0.1488	67.33
	Sample II	0.4888	0.2585	47.11	0.1545	68.36
Lady's finger	Sample I	0.4658	0.2512	46.07	0.1481	68.20
	Sample II	0.4877	0.2510	48.53	0.1410	71.08
Pointed gourd	Sample I	0.4710	0.2120	54.98	0.1402	70.23
	Sample II	0.4210	0.2470	41.33	0.1401	66.72
Pumpkin	Sample I	0.4588	0.2102	54.18	0.1487	67.58
	Sample II	0.4810	0.2103	56.27	0.1471	69.41
Cowpea	Sample I	0.4896	0.2581	47.28	0.1477	69.83
	Sample II	0.4875	0.2587	46.93	0.1478	69.68
Cucumber	Sample I	0.4529	0.2513	44.51	0.1541	65.97
	Sample II	0.4712	0.231	50.97	0.1547	67.16

Table: Effect of decontamination processes on the residues of various vegetables collected from Upper Brahmaputra Valley Zone, Assam

Vegetables	Samples	Without processing	After washing	%Removal	After washing and cooking	% Removal
Potato	Sample I	0.4589	0.2356	48.65	0.1259	72.56
	Sample II	0.5100	0.2351	53.90	0.1587	68.88
Tomato	Sample I	0.4781	0.2587	45.88	0.1584	66.86
	Sample II	0.4129	0.2351	43.06	0.1563	62.14
Brinjal	Sample I	0.4586	0.2351	48.73	0.1477	67.79
	Sample II	0.4785	0.2319	51.53	0.1420	70.32
Beet root	Sample I	0.4874	0.2698	44.64	0.1587	67.43
	Sample II	0.4961	0.2645	46.68	0.1521	69.34
Water gourd	Sample I	0.4852	0.2635	45.69	0.1589	67.25
	Sample II	0.4836	0.2357	51.26	0.1547	68.01
Cabbage	Sample I	0.4596	0.2587	43.71	0.1256	72.67
	Sample II	0.5810	0.2698	53.56	0.1263	78.26
Pointed gourd	Sample I	0.4596	0.2635	42.66	0.1563	65.99
	Sample II	0.4597	0.2681	41.67	0.1532	66.67
Carrot	Sample I	0.4587	0.2635	42.55	0.1263	72.46
	Sample II	0.4598	0.2364	48.58	0.1257	72.66
Ridge gourd	Sample I	0.4577	0.2365	48.32	0.1263	72.40
	Sample II	0.5100	0.2387	53.19	0.1247	75.54
Lady's finger	Sample I	0.4589	0.2369	48.37	0.1241	72.95
	Sample II	0.4781	0.2587	45.88	0.1256	73.72
Colocassia	Sample I	0.4589	0.2361	48.55	0.1247	72.82
	Sample II	0.4789	0.2341	51.11	0.1236	74.19
Cucumber	Sample I	0.4769	0.2587	45.75	0.1369	71.29
	Sample II	0.4897	0.2549	47.94	0.1387	71.67
Cowpea	Sample I	0.4987	0.2589	48.08	0.1397	71.98
	Sample II	0.9687	0.2567	45.23	0.1396	70.21
Capsicum	Sample I	0.4367	0.2699	38.19	0.1288	70.50
	Sample II	0.4358	0.2687	38.34	0.1283	70.55

Table: Effect of decontamination processes on the residues of various vegetables collected from Lower Brahmaputra Valley Zone, Assam

Vegetables	Samples	Without processing	After washing	%Removal	After washing and cooking	% Removal
Potato	Sample I	0.5089	0.2587	49.16	0.1487	70.78
	Sample II	0.5123	0.2514	50.92	0.1258	75.44
Tomato	Sample I	0.5212	0.2561	50.86	0.1489	71.43
	Sample II	0.5471	0.2560	53.20	0.1457	73.36
Brinjal	Sample I	0.5874	0.2365	59.73	0.1258	78.58
	Sample II	0.5641	0.2478	56.07	0.1247	77.89
French bean	Sample I	0.5614	0.2369	57.80	0.1354	75.88
	Sample II	0.5632	0.2589	54.03	0.1324	76.49
Cauliflower	Sample I	0.5412	0.2412	55.43	0.1254	76.82
	Sample II	0.5325	0.2411	54.72	0.1247	76.58
Cabbage	Sample I	0.5365	0.2356	56.08	0.1247	76.75
	Sample II	0.5612	0.2341	58.28	0.1248	77.76
Knolkhol,	Sample I	0.5547	0.2365	57.36	0.1248	77.50
	Sample II	0.5563	0.2544	54.26	0.1310	76.45
Carrot	Sample I	0.5874	0.2510	57.26	0.1354	76.94
	Sample II	0.5847	0.2544	56.49	0.1249	78.63
Ridge gourd	Sample I	0.5681	0.2614	53.98	0.1141	79.91
	Sample II	0.5694	0.2611	54.14	0.1154	79.93
Lady's finger	Sample I	0.5489	0.2578	53.03	0.1354	75.33
	Sample II	0.5638	0.2541	54.93	0.1352	76.01
Pointed gourd	Sample I	0.5698	0.2641	53.65	0.1354	76.23
	Sample II	0.5687	0.2633	53.70	0.1332	76.57
Cucumber	Sample I	0.5682	0.2547	55.17	0.1341	76.39
	Sample II	0.5589	0.2555	54.28	0.1342	75.98
Cowpea	Sample I	0.5788	0.2351	59.38	0.1320	77.19
	Sample II	0.5748	0.2345	59.20	0.1328	76.89
Pumpkin	Sample I	0.5687	0.2347	58.73	0.1258	77.87
	Sample II	0.5612	0.2340	58.30	0.1269	77.38

Table: Effect of decontamination processes on the residues of various vegetables collected from Barak Valley, Assam


Vegetables	Samples	Without processing	After washing	%Removal	After washing and cooking	% Removal
Potato	Sample I	0.6541	0.2321	64.51	0.1356	79.26
	Sample II	0.6110	0.2345	61.62	0.1325	78.31
Tomato	Sample I	0.6235	0.2354	62.24	0.1258	79.82
	Sample II	0.6214	0.2365	61.94	0.1241	80.02
Brinjal	Sample I	0.5641	0.2878	48.98	0.1355	75.97
	Sample II	0.5700	0.2873	49.59	0.1350	76.31
French bean	Sample I	0.5845	0.2562	56.16	0.1329	77.26
	Sample II	0.5823	0.2654	54.42	0.1321	77.31
Cauliflower	Sample I	0.6210	0.2547	58.98	0.1259	79.72
	Sample II	0.6240	0.2577	58.70	0.1230	80.28
Cabbage	Sample I	0.6231	0.2543	59.18	0.1355	78.25
	Sample II	0.6250	0.2633	57.87	0.1322	78.84
Knolkhol,	Sample I	0.5647	0.2588	54.17	0.1258	77.72
	Sample II	0.5870	0.2655	54.77	0.1287	78.07
Carrot	Sample I	0.5890	0.2645	55.09	0.1287	77.84
	Sample II	0.5897	0.2635	55.31	0.1355	77.02
Ridge gourd	Sample I	0.5879	0.2658	54.78	0.1358	76.90
	Sample II	0.5876	0.2599	55.76	0.1355	76.94
Lady's finger	Sample I	0.5836	0.2588	55.65	0.1258	78.44
	Sample II	0.5878	0.2610	55.59	0.1260	78.56
Pointed gourd	Sample I	0.5891	0.2641	55.16	0.1344	77.18
	Sample II	0.5697	0.2599	54.37	0.1350	76.30
Cucumber	Sample I	0.5869	0.2610	55.52	0.1298	77.88
	Sample II	0.5879	0.2545	56.71	0.1310	77.71
Cowpea	Sample I	0.5879	0.2699	54.09	0.1347	77.08
	Sample II	0.5896	0.2598	55.93	0.1310	77.78
Pumpkin	Sample I	0.5779	0.2645	54.23	0.1258	78.23
	Sample II	0.5878	0.2650	54.91	0.1322	77.50

Table: Effect of decontamination processes on the residues of various vegetables collected from Hill Zone, Assam

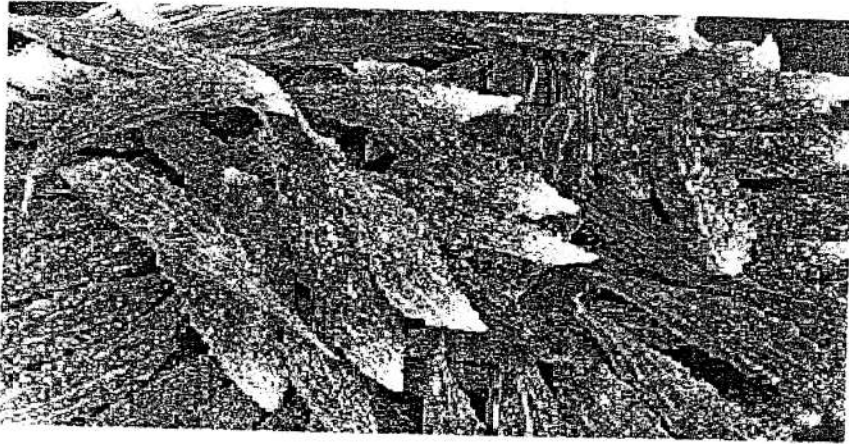
Vegetables	Samples	Without processing	After washing	%Removal	After washing and cooking	% Removal
Potato	Sample I	0.5974	0.2563	57.09	0.1325	77.82
	Sample II	0.5878	0.2533	56.90	0.1354	76.96
b	Sample I	0.5887	0.2456	58.28	0.1252	78.73
	Sample II	0.5896	0.2458	58.31	0.1236	79.03
Brinjal	Sample I	0.5966	0.2589	56.60	0.1364	77.13
	Sample II	0.5698	0.2561 *	55.05	0.1329	76.67
French bean	Sample I	0.5878	0.2641	55.06	0.1452	75.29
	Sample II	0.5894	0.2613	55.66	0.1422	75.87
Cauliflower	Sample I	0.5687	0.2546	55.23	0.1352	76.22
	Sample II	0.5688	0.2489	56.24	0.1326	76.68
Cabbage	Sample I	0.5636	0.2456	56.42	0.1456	74.16
	Sample II	0.5685	0.2466	56.62	0.1411	75.18
Knolkhol,	Sample I	0.5877	0.2433	58.60	0.1511	74.28
	Sample II	0.5821	0.2411	58.58	0.1513	74.00
Carrot	Sample I	0.5365	0.2314	56.86	0.1346	74.91
	Sample II	0.5346	0.2301	56.95	0.1358	74.59
Ridge gourd	Sample I	0.5487	0.2254	58.92	0.1455	73.48
	Sample II	0.5423	0.2249	58.52	0.1423	73.75
Lady's finger	Sample I	0.5788	0.2588	55.28	0.1532	73.53
	Sample II	0.5714	0.2568	55.05	0.1522	73.36
Pointed gourd	Sample I	0.5863	0.2645	54.88	0.1623	72.31
	Sample II	0.5845	0.2650	54.66	0.1654	71.70
Cucumber	Sample I	0.5747	0.2245	60.93	0.1458	74.63
	Sample II	0.5788	0.2247	61.17	0.1422	75.43
Cowpea	Sample I	0.5689	0.2364	58.44	0.1463	74.28
	Sample II	0.5632	0.2349	58.29	0.1435	74.52
Pumpkin	Sample I	0.5547	0.2588	53.34	0.1232	77.78
	Sample II	0.5544	0.2511	54.70	0.1211	78.15

Conclusion:

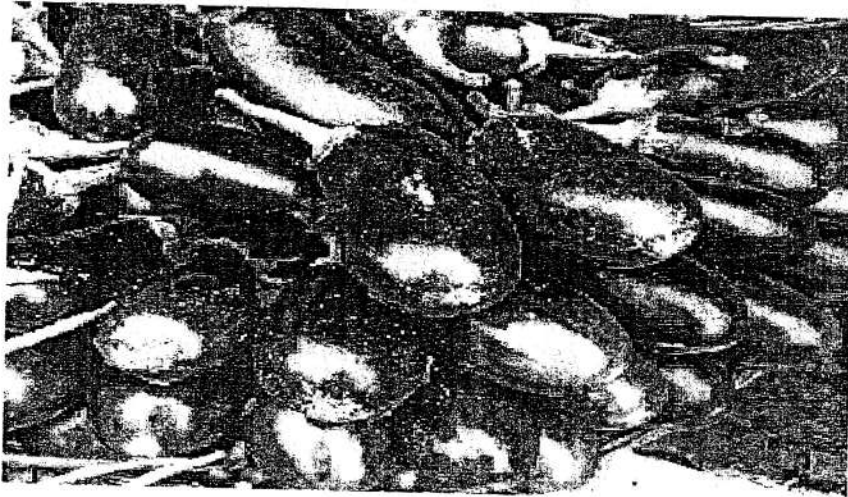
The major vegetables that was collected from various parts of Assam (different agro-climatic zones of Assam) has shown that almost all the vegetables were below the pesticides' maximum residue limit (MRLs) as specified in the Food Standards Code. The vegetables have clearly shown the marked decrease of pesticide residues upon its processing. This information will be useful to various workers of the state.


Professor S. C. Deka
Dept. of Food Processing Technology
TEZPUR UNIVERSITY
Tezpur-784028, Assam, India

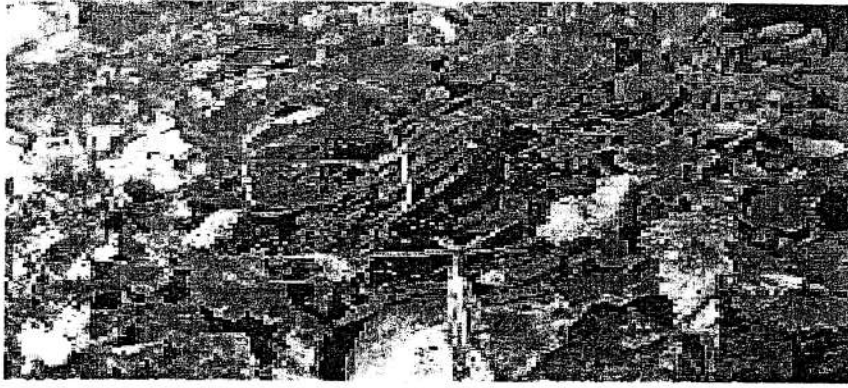
Some of the important vegetables collected from various parts of Assam



Bitter Gourd



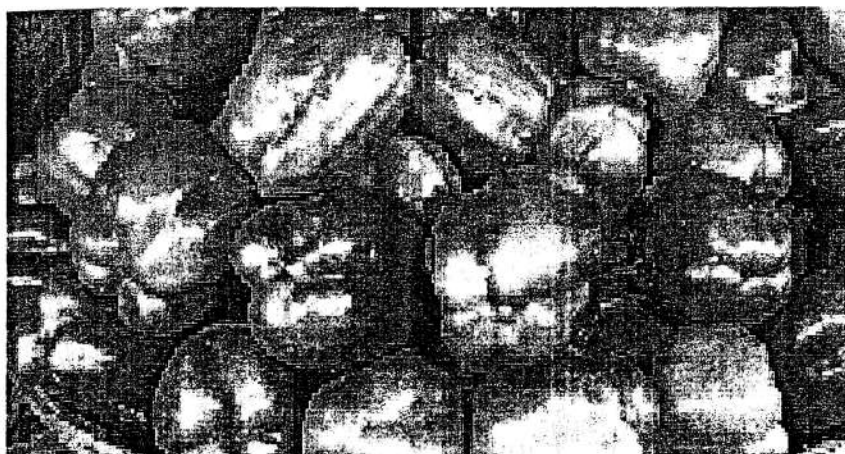
Brinjal



Corriander



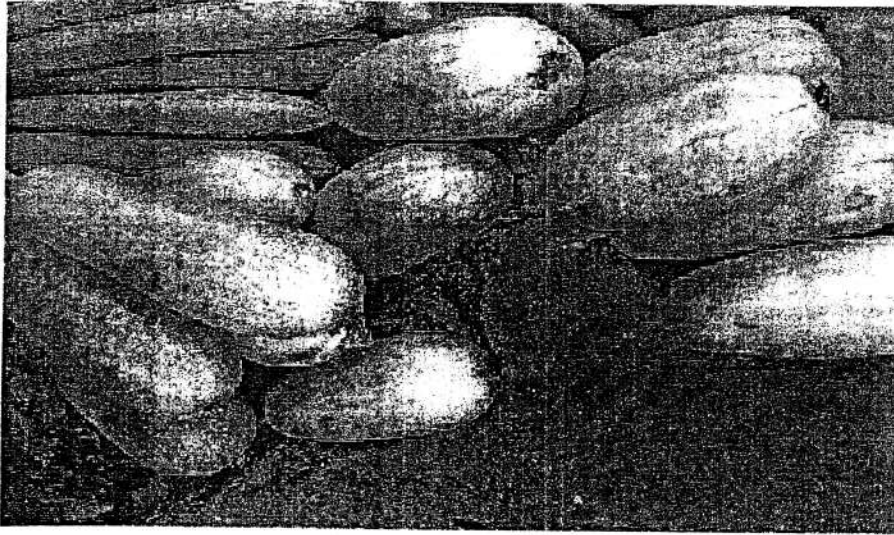
Cabbage



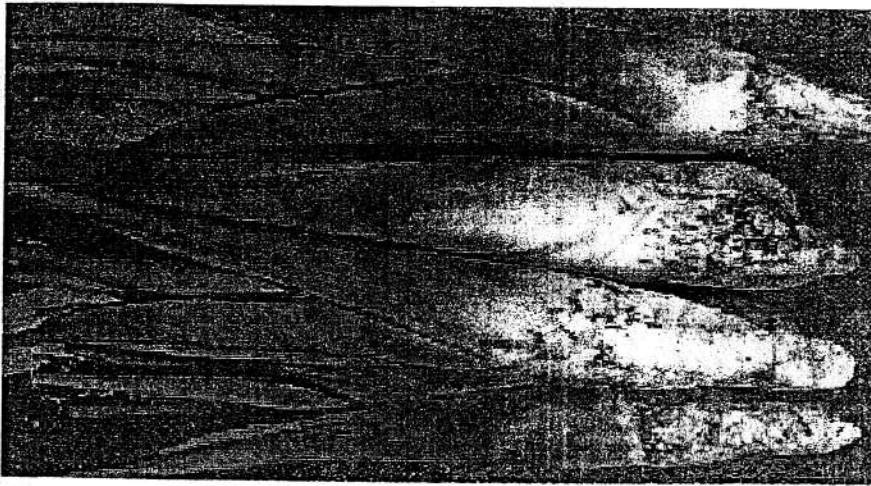
Capsicum



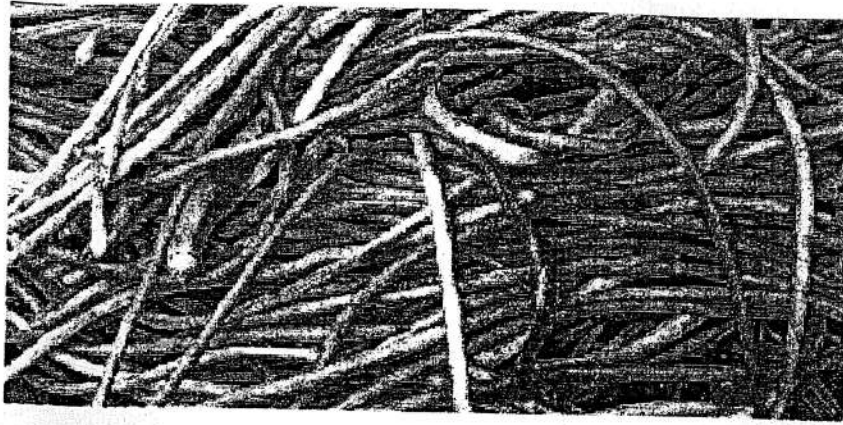
Carrot



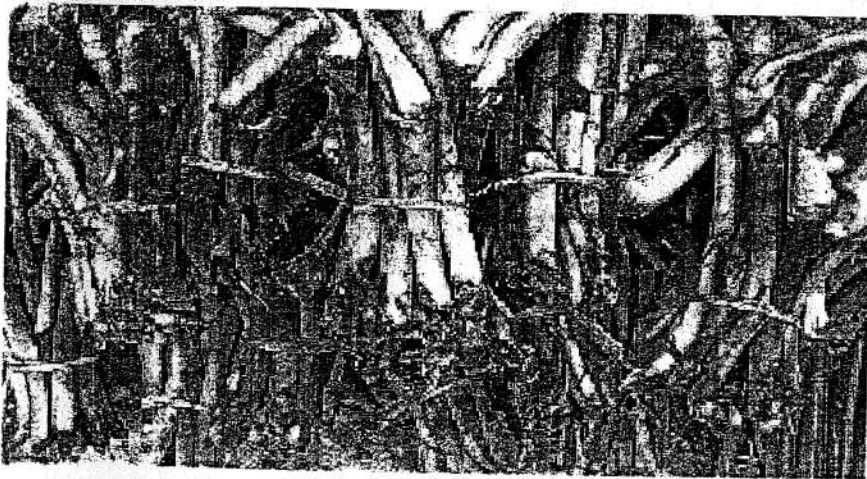
Sponge gourd and Ash gourd



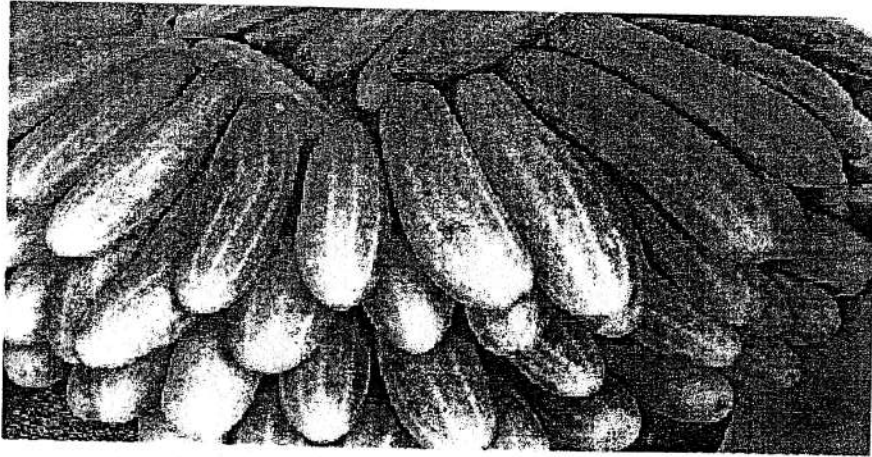
Collocassia



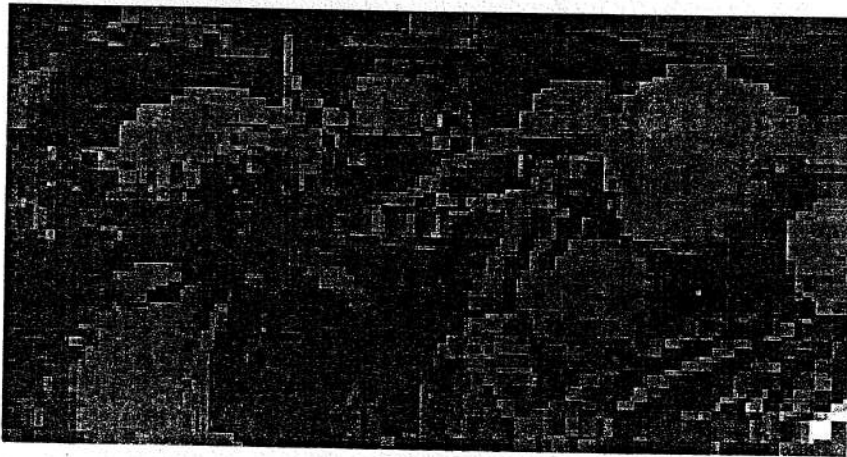
Cowpea (Green)



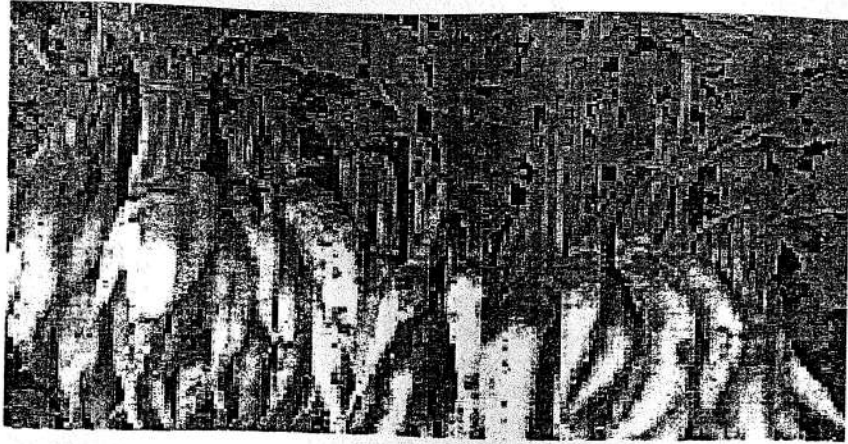
Collocassia Runner



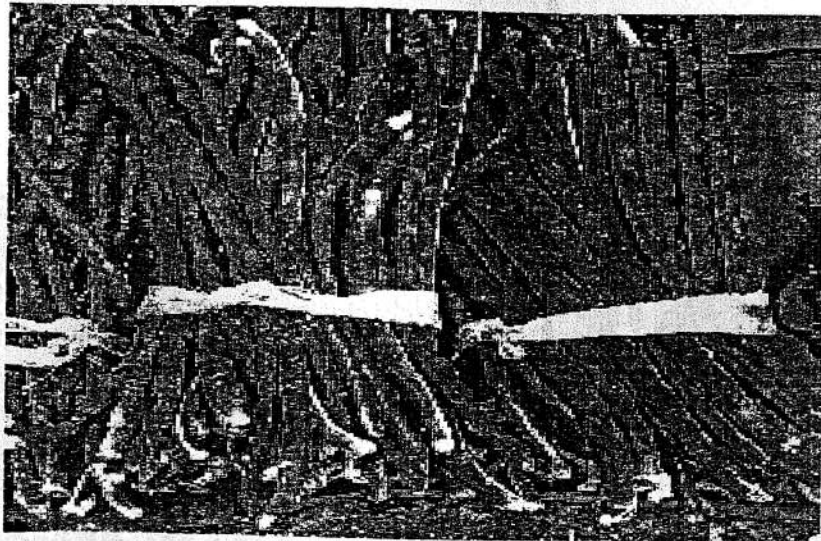
Cucumber



Beet Root



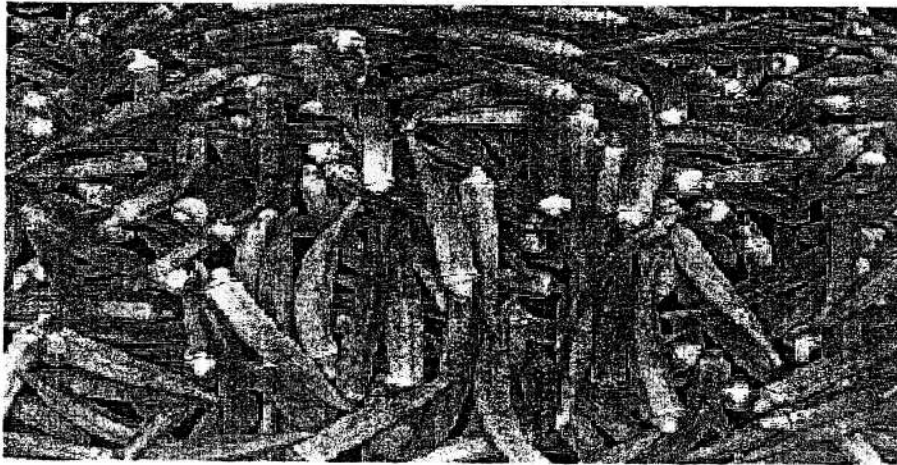
Raddish



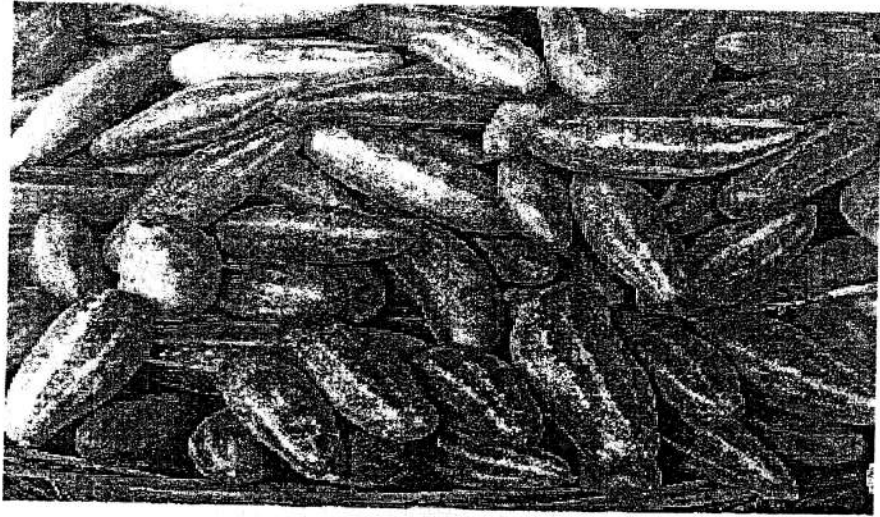
Cowpea (Purple)



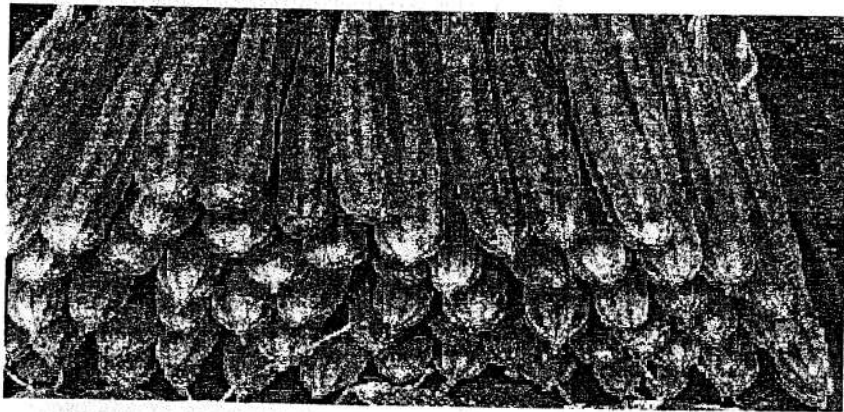
Water Gourd



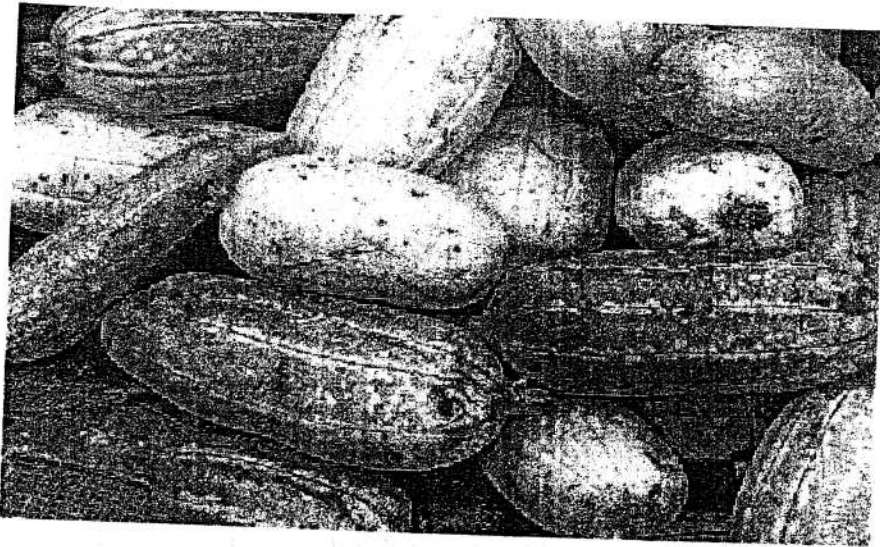
Ladies Finger



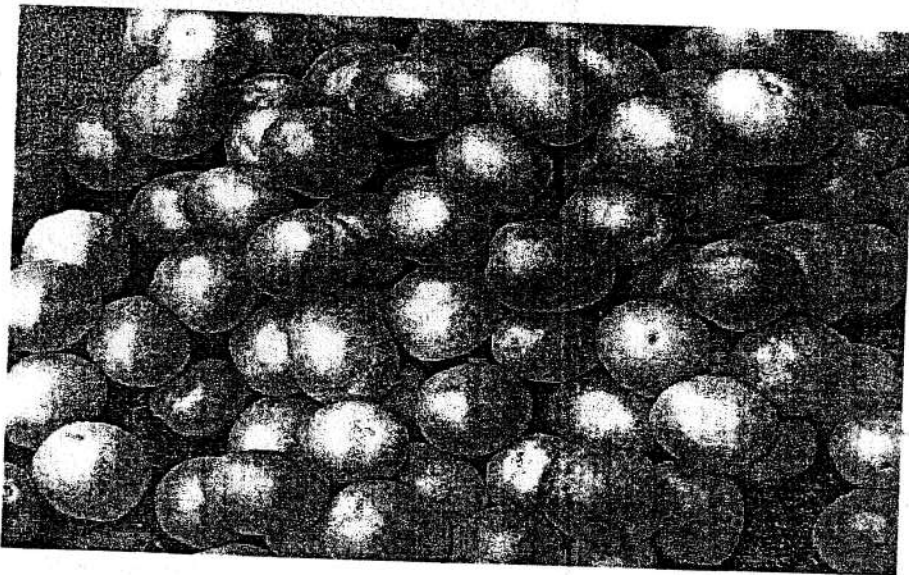
Pointed Gourd



Ridged Gourd



Sponge Gourd




Tomatoes

UNIVERSITY GRANTS COMMISSION
BAHADUR SHA,H ZAFAR MARG
NEW DELHI-110002


UTILIZATION CERTIFICATE (FINAL)

F.Y. 2012-2013


Certified that the grant of **Rs.8,92,007/-** received from the University Grants Commission under the scheme of Major research Project entitled "Studies on pesticide residues in major commercial vegetables of Assam", vide University Grants Commission letter F. No: 34-112/2008(SR) dated 26/12/2008 and an amount of unspent balance of previous year **Rs. NIL** out of which an amount of **Rs.8,92,007/-** (eight lakhs ninety two thousand and seven only) has been utilized for the purpose for which it was sanctioned and the balance of **Rs. NIL** for project works.


14/3/2013
Prof. S.C. Deka
Principal Investigator
Professor

Deptt. of Food Engineering & Technology
Tezpur University, Napaam-784028
Dist-Sonitpur (Assam)


14/3/13
O.S.D. (Finance)
Tezpur University

Tezpur University
Napaam, Sonitpur (Assam)


16/03/13
Registrar
Tezpur University
Registrar
Tezpur University

UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002

Final Statement of Expenditure in respect of major Research project under the scheme support of research in Major Research Project:

**Subject: UGC assistance for the Major Research Project entitled "Studies..... Assam"
 Dr. Sankar Chandra Deka, Department of Food Processing Tech, tenure of the project from 1.2.2009 to 31.1.2012**

1. Name of Principal Investigator : Prof. S.C. Deka
2. Dept of University/College: Food Processing Technology, Tezpur University
3. UGC approval No & Date: F No 34-112/2008 (SR) dated 26 Decenber 2008
4. Title of research project: "Studies on pesticide residues in major commercial Vegetables of Assam"
5. Effective date of Starting the project: 01/02/09
6. (a) Period of expenditure : F.Y. 2012-2013
 (b) Details of Expenditure

S No	Item	Amount Allocated	Amount Already Released	Amount being Released (12.11.2012)	Total Amount Released (Rs.)	Total expenditure Incurred (in Rs)
1	Books	-				-
2	Equipment	6,00,000/-				5,99,850/-
3	Contingency	-				-
4	Field work	-				-
5	Hiring service	-				-
6	Project Fellow	1,64,260/-				1,84,000/-
7	Chemicals/Glasswares	1,12,000/-				68,157/-
8	Overhead charges	40,000/-		3,373/-		40,000/-
9	Any other items	-				-
10	Honorarium to PI	-				-
Total		9,16,260/- (Amount Allocated)	8,88,634/-	3,373/-	8,92,007/-	8,92,007/-
Balance amount to be released					NIL	

draft

**UNIVERSITY GRANTS COMMISSION
BAHADUR SHA,H ZAFAR MARG
NEW DELHI-110002**

**UTILIZATION CERTIFICATE
F.Y. 2012-2013**

Certified that the grant of Rs.8,92,007/- received from the University Grants Commission under the scheme of Major research Project entitled "Studies on pesticide residues in major commercial vegetables of Assam" vide University Grants Commission letter F. No: 34-112/2008(SR) dated 26/12/2008 and an amount of unspent balance of previous year Rs. NIL out of which an amount of Rs.8,92,007/- (eight lakhs ninety two thousand and seven only) has been utilized for the purpose for which it was sanctioned and the balance of Rs. NIL for project works.



**Prof. S.C. Deka
Principal Investigator &
Head, Dept. of FET**

**Finance officer
Tezpur university**

**Registrar
Tezpur university**

draft

UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002

Statement of expenditure in respect of major Research project under the scheme support of research in Major Research Project:

1. Name of Principal Investigator : Prof. S.C. Deka
2. Dept of University/College: Food Processing Technology, Tezpur University
3. UGC approval No & Date: F No 34-112/2008 (SR) dated 26 Decenber 2008
4. Title of research project: "Studies on pesticide residues in major commercial vegetables of Assam"
5. Effective date of Starting the project: 01/02/09
6. (a) Period of expenditure : F.Y. 2012-2013
(b) Details of Expenditure

S No	Item	Amount Allocated	Amount Already Released	Amount being Released (12.11.2012)	Total expenditure Incurred (in Rs)
1	Books	-			-
2	Equipment	6,00,000/-			5,99,850/-
3	Contingency	-			-
4	Field work	-			-
5	Hiring service	-			-
6	Project Fellow	1,64,260/-			1,84,000/-
7	Chemicals/Glasswares	1,12,000/-			68,157/-
8	Overhead charges	40,000/-		3,373/-	40,000/-
9	Any other items	-			-
10	Honorarium to PI	-			-
Total		9,16,260/- (Amount Allocated)	8,88,634/-	3,373/-	8,92,007/-
Balance amount to be released					NIL

Contd →

deaf

Total grant sanctioned	Rs. 8,92,007/-
Fund actually released	Rs. 8,92,007/-
Actual expenditure incurred	Rs. 8,92,007/-
Balance	NIL

1. It is certified that the appointment has been made in accordance with the terms and conditions laid down by the commission.
2. If as a result of check or audit objective, some irregularity is noticed at a later date, action will be taken to refund adjust or regularized the objective amounts.
3. Payments @ revised rates shall be made with arrear on the availability of additional funds.

S.C. Deka

Prof. S.C. Deka

O.S.D.(Finance)

Registrar

Principal Investigator &

Tezpur university

Tezpur university

Head, Dept. of FET

UNIVERSITY GRANTS COMMISSION

BAHADUR SHAH ZAFAR MARG

NEW DELHI-110002

UTILIZATION CERTIFICATE

Certified that the grant of Rs 8, 88,634.00 received from the University Grants Commission under the scheme of Major Research Project entitled "Studies on pesticide residues in major commercial vegetables of Assam" vide University Grants Commission letter F. No: 34-112/2008(SR) dated 26/12/2008 and an amount of unspent balance of previous year Rs. NIL out of which an amount of Rs 8, 92,007.00(eight lakhs ninety two thousand and seven only) has been utilized for the purpose for which it was sanctioned and the balance of Rs. (-) 3373/- (three thousand and three hundred seventy three only) may be released.



Prof. S.C.Deka

Principal Investigator &

Head, Dept of FPT

Professor S. C. Deka
Dept. of Food Processing Technology
TEZPUR UNIVERSITY
Tezpur-784028, Assam, India



Finance Officer

Tezpur University



Registrar

Tezpur University
Registrar.
Tezpur University

UNIVERSITY GRANTS COMMISSION

BAHADUR SHAH ZAFAR MARG

NEW DELHI-110002

Statement of Expenditure in respect of major Research project under the scheme support of research in Major Research Project:

1. Name of Principal Investigator: Prof. S.C.Deka.
2. Dept of University/College : Food Processing Technology, Tezpur University
3. UGC approval No&Date: F No34-112/2008(SR) dated 26 December 2008
4. Title of research project: "Studies on pesticide residues in major commercial vegetables of Assam."
5. Effective date of Starting the project: 01/02/09
6. (a) Period of expenditure: 1.4.2011 to 31.1.2012 (Project closed on 31.1.12)
(b) Details of Expenditure

S No	Item	Amount Approved (in Rs)	Amount Received (in Rs)	Expenditure incurred (in Rs) From 1/4/09 to 31/03/10	Expenditure incurred (in Rs) From 1/4/10 to 31/03/11	Expenditure incurred (in Rs) From 1/4/11 to 31/1/12 (Project closed on 31.1.12)	Total expenditure (in Rs)
1	Books	-	-	-	-	-	-
2	Equipment	6,00,000/-	6,00,000/-	5,99,850/-	-	-	5,99,850/-
3	Contingency	-	-	-	-	-	-
4	Field work	-	-	-	-	-	-
5	Hiring service	-	-	-	-	-	-
6	Project Fellow	2,88,000/-	1,44,000/-	97,290/-	78,710/-	8000/-	1,84,000/-
7	Chemicals/ Glasswares	1,12,000/-	56,000/-	68,157/-	-	-	68,157/-

8	Overhead Charges	40,000/-	40,000/-	40,000/-	-	-	40,000/-
9	Any other items	-	-	-	-	-	-
10	Honorarium to PI	-	-	-	-	-	-
Total		8,88,634/-	8,88,634/-	8,05,297/-	86,710/-	-	8,92,007/-
Balance amount to be Released							3373/-

Total Fund sanctioned	Rs. 8,88,634.00
Fund actually released	Rs 8,40,000.00 (1 st installment) and Rs 48,634.00 (2 nd installment) Total Rs. 8,88,634.00
Actual expenditure incurred	Rs 8,92,007/-
Balance	(-) Rs 3373.00 Excess expenditure incurred


1. It is certified that the appointment has been made in accordance with the terms and conditions laid down by the Commission.
2. If as a result of check or audit objective, some irregularity is noticed at a later date, action will be taken to refund adjust or regularized the objective amounts.
3. Payment @ revised rates shall be made with arrear on the availability of additional funds.


Prof. S.C. Deka

Principal Investigator &
University

Head, Dept of FPT

Professor S. C. Deka
Dept. of Food Processing Technology
TEZPUR UNIVERSITY
Tezpur-784028, Assam, India


Finance Officer
Tezpur University


Registrar
Tezpur Registrar.
Tezpur University


UNIVERSITY GRANTS COMMISSION

BAHADUR SHAH ZAFAR MARG

NEW DELHI-110002

UTILIZATION CERTIFICATE

Certified that the grant of Rs 8, 88,634.00 received from the University Grants Commission under the scheme of Major Research Project entitled "Studies on pesticide residues in major commercial vegetables of Assam" vide University Grants Commission letter F. No: 34-112/2008(SR) dated 26/12/2008 and an amount of unspent balance of previous year Rs. NIL out of which an amount of Rs 8, 92,007.00(eight lakhs ninety two thousand and seven only) has been utilized for the purpose for which it was sanctioned and the balance of Rs. (-) 3373/- (three thousand and three hundred seventy three only) may be released.


Prof. S.C.Deka

Principal Investigator &
Head, Dept of FPT

Professor S. C. Deka
Dept. of Food Processing Technology
TEZPUR UNIVERSITY
Tezpur-784028, Assam, India


Finance Officer

Tezpur University


Registrar

Tezpur University
Registrar.
Tezpur University

UNIVERSITY GRANTS COMMISSION

BAHADUR SHAH ZAFAR MARG

NEW DELHI-110002

Statement of Expenditure in respect of major Research project under the scheme support of research in Major Research Project:

1. Name of Principal Investigator: **Prof. S.C.Deka.**
2. Dept of University/College : **Food Processing Technology, Tezpur University**
3. UGC approval No&Date: **F No34-112/2008(SR) dated 26 December 2008**
4. Title, of research project: **"Studies on pesticide residues in major commercial vegetables of Assam."**
5. Effective date of Starting the project: **01/02/09**
6. (a) Period of expenditure: **1.4.2011 to 31.1.2012 (Project closed on 31.1.12)**
(b) Details of Expenditure

S No	Item	Amount Approved (in Rs)	Amount Received (in Rs)	Expenditure incurred (in Rs) From 1/4/09 to 31/03/10	Expenditure incurred (in Rs) From 1/4/10 to 31/03/11	Expenditure incurred (in Rs) From 1/4/11 to 31/1/12 (Project closed on 31.1.12)	Total expenditure (in Rs)
1	Books	-	-	-	-	-	-
2	Equipment	6,00,000/-	6,00,000/-	5,99,850/-	-	-	5,99,850/-
3	Contingency	-	-	-	-	-	-
4	Field work	-	-	-	-	-	-
5	Hiring service	-	-	-	-	-	-
6	Project Fellow	2,88,000/-	1,44,000/-	97,290/-	78,710/-	8000/-	1,84,000/-
7	Chemicals/ Glasswares	1,12,000/-	56,000/-	68,157/-	-	-	68,157/-

8	Overhead Charges	40,000/-	40,000/-	40,000/-	-	-	40,000/-
9	Any other items	-	-	-	-	-	-
10	Honorarium to PI	-	-	-	-	-	-
To tal		8,88,634/-	8,88,634/-	8,05,297/-	86,710/-	-	8,92,007/-
Balance amount to be Released							3373/-

Total Fund sanctioned	Rs. 8,88,634.00
Fund actually released	Rs 8,40,000.00 (1 st installment) and Rs 48,634.00 (2 nd installment) Total Rs. 8,88,634.00
Actual expenditure incurred	Rs 8, 92,007/-
Balance	(-) Rs 3373.00 Excess expenditure incurred


1. It is certified that the appointment has been made in accordance with the terms and conditions laid down by the Commission.
2. If as a result of check or audit objective, some irregularity is noticed at a later date, action will be taken to refund adjust or regularized the objective amounts.
3. Payment @ revised rates shall be made with arrear on the availability of additional funds.


Prof. S.C.Deka

Principal Investigator &
University

Head, Dept of FPT

Professor S. C. Deka
Dept. of Food Processing Technology
TEZPUR UNIVERSITY
Tezpur-784028, Assam, India


Finance Officer
Tezpur University


Registrar
Tezpur Registrar.
Tezpur University