

Table 1: Effect of application methods, concentration of chitosan and their interactions on growth of sweet potato during 2013 and 2014 seasons under sandy soil conditions

Treatments	Vine length (cm)		Number of branches/ plant		Leaf area/ plant (m ²)		Dry weight of shoots (g/plant)		Relative increases in dry weight of shoot (%)	
	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season
	Effect of application methods									
DSC	94.20	97.21	10.72	10.21	0.58	0.66	54.47	51.04	0.0	0.0
FS	97.45	97.52	11.98	10.78	0.62	0.62	58.19	54.91	6.82	5.62
DSC+FS	104.5									21.7
	6	103.66	13.83	12.95	0.71	0.73	69.20	62.12	27.04	0
LSD at 5 % level	2.72	3.21	1.35	1.23	0.03	0.06	3.49	4.07	--	--
	Effect of chitosan concentration									
Tap water (control)	92.98	94.18	9.45	9.24	0.52	0.57	47.18	46.30	0.0	0.0
Chitosan 0.025 %	98.44	98.23	11.75	11.13	0.61	0.67	59.76	53.17	26.66	14.83
Chitosan 0.075 %	100.81	100.92	13.28	12.08	0.66	0.70	66.17	56.55	40.23	22.13
Chitosan 0.125 %	102.70	104.53	14.22	12.82	0.75	0.74	69.36	63.39	47.01	36.91
LSD at 5 % level	2.39	2.82	1.19	1.08	0.03	0.05	3.06	3.57	--	--
	Effect of interaction treatments									
DSC in tap water	92.10	93.14	9.22	9.01	0.51	0.54	47.18	45.50	0.0	0.0
DSC in 0.025% chitosan	94.20	97.28	10.20	10.18	0.57	0.60	54.25	49.21	14.48	8.75
DSC in 0.075% chitosan	90.26	99.18	11.18	10.47	0.61	0.71	57.18	52.31	21.19	14.46
DSC in 0.125% chitosan	90.14	99.20	12.24	11.19	0.62	0.74	59.25	57.12	25.58	25.53
FS in tap water	93.10	90.19	9.42	9.01	0.52	0.58	48.18	46.50	0.0	0.0
FS with 0.025% chitosan	97.20	90.38	11.14	10.34	0.56	0.64	55.15	50.12	14.46	7.78
FS with 0.075% chitosan	98.31	97.38	13.12	11.18	0.60	0.63	63.16	56.18	31.10	20.81
FS with 0.125% chitosan	101.13	102.14	14.22	12.10	0.81	0.63	66.25	66.84	37.46	43.74
DSC in tap water +FS in tap water	93.70	94.22	9.72	9.20	0.53	0.59	46.18	46.90	0.0	0.0
DSC in 0.025% chitosan + FS with 0.025% chitosan	103.83	102.02	13.85	12.86	0.70	0.71	69.87	60.19	51.29	28.33
DSC in 0.075% chitosan + FS with 0.075% chitosan	108.87	106.19	15.54	14.58	0.78	0.77	78.18	65.17	69.29	38.95
DSC in 0.125% chitosan + FS with 0.125% chitosan	111.84	112.21	16.20	15.17	0.83	0.84	82.58	76.20	78.82	62.47
LSD at 5 % level	4.20	4.95	NS	1.90	0.05	NS	5.36	6.27	--	--

DSC: dipping stem cutting, FS: foliar spraying, DSC+FS: dipping stem cutting+ foliar spraying

Table 2: Effect of application methods, concentration of chitosan and their interactions on leaf pigments (mg/gm DW) of sweet potato during 2013 and 2014 seasons under sandy soil conditions

Treatments	Chlorophyll (a)		Chlorophyll (b)		Total chlorophyll (a+b)		Carotenoides	
	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season
	<i>Effect of application methods</i>							
DSC	2.37	2.36	1.30	1.37	3.67	3.73	1.86	1.62
FS	2.61	2.48	1.36	1.31	3.95	3.79	1.72	1.67
DSC+FS	2.90	2.86	1.57	1.54	4.45	4.40	1.86	1.85
LSD at 5 % level	0.21	0.17	NS	NS	0.13	0.16	NS	NS
	<i>Effect of chitosan concentration</i>							
Tap water (control)	2.30	2.21	1.20	1.26	3.46	3.47	1.76	1.56
Chitosan 0.025 %	2.64	2.47	1.37	1.36	4.01	3.83	1.84	1.68
Chitosan 0.075 %	2.69	2.71	1.45	1.43	4.15	4.15	1.79	1.74
Chitosan 0.125 %	2.87	2.87	1.61	1.56	4.48	4.43	1.85	1.87
LSD at 5 % level	0.18	0.15	0.08	0.09	0.11	0.14	NS	0.13
	<i>Effect of interaction treatments</i>							
DSC in tap water	2.28	2.20	1.18	1.26	3.46	3.47	1.76	1.56
DSC in 0.025% chitosan	2.40	2.13	1.29	1.33	3.79	3.46	1.81	1.58
DSC in 0.075%chitosan	2.41	2.51	1.31	1.36	3.72	3.87	1.90	1.73
DSC in 0.125%chitosan	2.40	2.70	1.42	1.51	3.82	4.11	1.90	1.70
FS in tap water	2.32	2.21	1.20	1.26	3.46	3.47	1.76	1.56
FS with 0.025%chitosan	2.71	2.19	1.23	1.28	3.84	3.47	1.87	1.73
FS with 0.075%chitosan	2.70	2.73	1.37	1.28	3.97	3.91	1.86	1.59
FS with 0.125%chitosan	2.89	2.90	1.63	1.41	4.52	4.31	1.71	1.90
DSC in tap water +FS in tap water	2.31	2.23	1.21	1.26	3.46	3.47	1.76	1.56
DSC in 0.025% chitosan +FS with 0.025%chitosan	2.90	3.10	1.59	1.47	4.49	4.57	1.84	1.82
DSC in 0.075% chitosan + FS with 0.075%chitosan	3.07	3.00	1.68	1.66	4.75	4.66	1.92	2.00
DSC in 0.125% chitosan+ FS with 0.125%chitosan	3.32	3.11	1.78	1.77	5.10	4.88	1.90	2.01
LSD at 5 % level	0.32	0.26	NS	NS	0.19	0.24	NS	NS

DSC: dipping stem cutting, FS: foliar spraying, DSC+FS: dipping stem cutting+ foliar spraying

Table 3:Effect of application methods, concentration of chitosan and their interactions on N,P and K uptake (mg) by shoot of sweet potato during 2013 and 2014 seasons under sandy soil conditions

Treatments	N		P		K	
	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season
	<i>Effect of application methods</i>					
DSC	1418	1309	274	261	971	956
FS	1483	1257	251	238	1030	945
DSC+FS	2065	1840	339	310	1399	1336
LSD at 5 % level	159.2	153.9	12.0	9.3	71.2	86.9
	<i>Effect of chitosan concentration</i>					
Tap water (control)	1076	1055	223	225	770	783
Chitosan 0.025 %	1569	1349	282	256	1038	995
Chitosan 0.075 %	1876	1578	321	290	1248	1128
Chitosan 0.125 %	2100	1893	326	309	1479	1411
LSD at 5 % level	139.7	135.0	10.6	8.2	62.7	76.4
	<i>Effect of interaction treatments</i>					
DSC in tap water	1068	1031	225	223	765	772
DSC in 0.025% chitosan	1317	1131	270	246	896	856
DSC in 0.075%chitosan	1520	1478	297	276	1060	1009
DSC in 0.125%chitosan	1767	1596	305	301	1164	1190
FS in tap water	1150	1073	227	224	795	786
FS with 0.025%chitosan	1376	1219	246	232	901	806
FS with 0.075%chitosan	1702	1211	280	264	1004	916
FS with 0.125%chitosan	1705	1527	251	234	1423	1272
DSC in tap water +FS in tap water	1011	1061	218	228	751	792
DSC in 0.025% chitosan + FS with 0.025%chitosan	2016	1697	330	290	1318	1323
DSC in 0.075% chitosan+ FS with 0.075%chitosan	2408	2045	386	330	1680	1461
DSC in 0.125% chitosan+ FS with 0.125%chitosan	2828	2558	424	393	1850	1771
LSD at 5 % level	245	237	18	14	110	134

DSC: dipping stem cutting, FS: foliar spraying, DSC+FS: dipping stem cutting+ foliar spraying

Table 4:Effect of application methods, concentration of chitosan and their interactions of chitosan on yield and its components of sweet potato during 2013 and 2014 seasons under sandy soil conditions

Treatments	Average weight of tuber root (g)		Unmarketable yield (ton/fad.)		Marketable yield (ton/fad.)		Total yield (ton/fad.)		Relative increases in total yield (%)	
	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season
	<i>Effect of application methods</i>									
DSC	129.3	138.0	2.636	3.242	8.043	8.030	10.679	11.272	000	000
FS	131.3	137.0	2.437	2.440	8.344	9.025	10.781	11.465	1.00	1.7
DSC+FS	148.5	152.5	2.311	2.399	9.418	9.748	11.730	12.147	9.8	7.8
LSD at 5 % level	NS	NS	NS	NS	0.436	0.463	0.690	0.602	--	--
	<i>Effect of chitosan concentration</i>									
Tap water (control)	119.0	123.0	3.337	3.698	6.625	6.726	9.962	10.424	00	00
Chitosan 0.025 %	130.7	141.7	2.519	3.218	8.027	8.386	10.546	11.604	5.9	11.3
Chitosan 0.075 %	143.0	149.0	2.367	2.154	9.272	9.981	11.639	12.134	16.8	16.4
Chitosan 0.125 %	152.7	156.3	1.624	1.705	10.483	10.644	12.107	12.349	21.5	18.5
LSD at 5 % level	17.7	14.4	0.213	0.235	0.383	0.407	0.606	0.616	--	--
	<i>Effect of interaction treatments</i>									
DSC in tap water	118	123	3.296	3.757	6.644	6.706	9.940	10.463	00	00
DSC in 0.025% chitosan	120	138	2.606	3.382	7.484	7.652	10.090	11.034	1.5	5.5
DSC in 0.075% chitosan	133	146	2.663	3.533	8.347	8.010	11.010	11.543	10.8	10.3
DSC in 0.125% chitosan	141	140	1.979	2.295	9.698	9.752	11.677	12.047	17.5	15.1
FS in tap water	120	121	3.411	3.635	6.574	6.776	9.985	10.411	00	00
FS with 0.025% chitosan	121	130	2.897	3.711	7.173	7.639	10.070	11.350	1.3	8.5
FS with 0.075% chitosan	139	141	2.149	1.088	9.221	10.942	11.370	12.030	14.4	15.0
FS with 0.125% chitosan	140	101	1.291	1.326	10.409	10.744	11.700	12.070	17.7	15.4
DSC in tap water +FS in tap water	119	125	3.303	3.703	6.657	6.696	9.960	10.399	00	00
DSC in 0.025% chitosan +FS with 0.025% chitosan	146	152	2.053	2.56	9.424	9.867	11.477	12.427	15.5	18.8
DSC in 0.075% chitosan +FS with 0.075% chitosan	157	160	2.288	1.84	10.249	10.99	12.537	12.830	26.1	22.6
DSC in 0.125% chitosan +FS with 0.125% chitosan	172	173	1.601	1.493	11.343	11.437	12.944	12.930	30.2	23.6
LSD at 5 % level	31.2	25.2	0.375	0.412	0.672	0.715	1.064	1.080	--	--

DSC: Dipping stem cutting, FS: Foliar spraying, DSC+FS: Dipping stem cutting+ foliar spraying

Table 5: Effect of application methods, concentration of chitosan and their interactions on tuber root quality of sweet potato at harvest during 2013 and 2014 seasons under sandy soil conditions

Treatments	Starch (%)		TSS (%)		Total sugars		Carotene (mg/gm FW)	
	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season
<i>Effect of application methods</i>								
DSC	47.9	47.0	8.07	8.22	7.82	7.70	9.59	9.53
FS	48.4	49.5	8.15	8.22	7.68	8.11	9.56	9.43
DSC+FS	52.8	53.1	8.61	8.73	8.29	8.49	10.06	9.91
LSD at 5 % level	1.11	1.17	NS	NS	NS	0.15	NS	NS
<i>Effect of chitosan concentration</i>								
Tap water (control)	44.1	43.0	7.74	7.76	7.16	7.08	9.26	9.33
Chitosan 0.025 %	49.7	50.1	8.34	8.33	7.89	8.35	9.38	9.61
Chitosan 0.075 %	51.7	52.5	8.43	8.61	8.26	8.43	10.07	9.68
Chitosan 0.125 %	53.2	53.7	8.59	8.86	8.41	8.53	10.25	9.87
LSD at 5 % level	0.98	1.03	0.08	NS	0.08	0.13	NS	NS
<i>Effect of interaction treatments</i>								
DSC in tap water	44.10	43.20	7.74	7.79	7.21	7.06	9.11	9.29
DSC in 0.025% chitosan	46.18	46.10	8.22	8.11	7.71	7.61	9.18	9.40
DSC in 0.075% chitosan	50.22	49.10	8.19	8.39	8.10	8.00	9.90	9.00
DSC in 0.125% chitosan	51.13	49.28	8.20	8.61	8.21	8.10	10.20	9.93
FS in tap water	44.49	43.01	7.87	7.69	7.11	7.03	9.26	9.33
FS with 0.025% chitosan	49.38	50.23	8.26	8.01	7.63	8.68	9.10	9.00
FS with 0.075% chitosan	49.38	51.12	8.13	8.41	7.90	8.41	10.01	9.44
FS with 0.125% chitosan	50.19	53.44	8.37	8.77	8.11	8.32	9.90	9.48
DSC in tap water +FS in tap water	43.76	42.80	7.73	7.81	7.17	7.17	9.42	9.37
DSC in 0.025% chitosan + FS with 0.025% chitosan	53.55	53.87	8.56	8.88	8.34	8.76	9.87	9.95
DSC in 0.075% chitosan + FS with 0.075% chitosan	55.59	57.22	8.98	9.03	8.75	8.90	10.30	10.12
DSC in 0.125% chitosan + FS with 0.125% chitosan	58.31	58.38	9.17	9.22	8.93	9.13	10.67	10.22
LSD at 5 % level	1.72	1.82	NS	NS	0.14	0.22	NS	NS

DSC: Dipping stem cutting, FS: Foliar spraying, DSC+FS: Dipping stem cutting+ foliar spraying

Table 6: Effect of application methods, concentration of chitosan and their interactions on weight loss (%) of tuber roots during storage of sweet potato in 2013 and 2014 seasons

Treatments	Weight loss (%)							
	Days from storage							
	30		60		90		120	
	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season
	<i>Effect of application methods</i>							
DSC	8.59	8.08	16.53	18.65	32.49	32.78	48.18	48.01
FS	8.53	8.87	16.55	20.21	31.01	34.74	41.39	41.56
DSC+FS	6.93	7.59	14.47	16.99	26.45	30.48	38.19	38.23
LSD at 5 % level	NS	NS	1.41	1.66	1.40	1.87	2.02	2.33
	<i>Effect of chitosan concentration</i>							
Tap water (control)	9.39	10.16	19.57	21.30	35.29	37.34	53.46	51.45
Chitosan 0.025 %	8.21	8.56	15.87	19.78	30.35	33.58	42.13	42.51
Chitosan 0.075 %	7.62	7.48	14.33	17.45	27.55	30.47	38.58	39.79
Chitosan 0.125 %	6.85	6.52	13.63	15.93	26.74	29.26	36.16	36.67
LSD at 5 % level	0.66	1.07	1.24	1.46	1.23	1.64	1.77	2.04
	<i>Effect of interaction treatments</i>							
DSC in tap water	9.01	10.10	19.07	21.20	30.29	37.40	53.18	51.20
DSC in 0.025% chitosan	8.93	8.73	17.18	19.72	34.24	33.10	50.16	49.48
DSC in 0.075% chitosan	8.73	7.10	10.24	17.40	31.22	30.30	47.18	47.14
DSC in 0.125% chitosan	7.20	7.30	10.13	17.21	29.22	30.26	42.21	40.22
FS in tap water	9.47	10.31	19.01	21.37	30.41	37.26	53.72	51.70
FS with 0.025% chitosan	8.01	9.21	17.26	22.00	30.24	37.12	40.21	41.17
FS with 0.075% chitosan	8.00	8.01	10.22	19.12	29.20	34.20	37.18	40.28
FS with 0.125% chitosan	8.10	7.40	14.22	18.30	29.10	31.32	30.44	33.20
DSC in tap water +FS in tap water	9.18	10.07	19.74	21.29	30.18	37.37	53.49	51.04
DSC in 0.025% chitosan + FS with 0.025% chitosan	7.18	7.73	14.16	17.62	26.58	31.48	36.03	36.87
DSC in 0.075% chitosan + FS with 0.075% chitosan	6.13	6.79	12.52	15.82	22.19	26.87	32.38	32.94
DSC in 0.125% chitosan + FS with 0.125% chitosan	5.21	5.77	11.54	13.23	21.85	26.21	30.84	31.58
LSD at 5 % level	1.17	1.89	2.18	2.57	2.15	2.88	3.11	3.58

DSC: Dipping stem cutting, FS: Foliar spraying, DSC+FS: Dipping stem cutting+ foliar spraying

Table 7: Effect of application methods, concentration of chitosan and their interactions on decay (%) of tuber roots during storage of sweet potato in 2013 and 2014 seasons

Treatments	Decay (%)							
	Days from storage							
	30		60		90		120	
	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season	2013 season	2014 season
	<i>Effect of application methods</i>							
DSC	0.00	0.00	1.42	1.52	5.05	6.50	8.52	9.37
FS	0.00	0.00	1.45	1.45	5.08	5.78	7.69	9.01
DSC+FS	0.00	0.00	1.29	1.36	4.43	4.47	6.67	7.69
LSD at 5 % level	---	--	NS	NS	NS	0.75	0.76	0.99
	<i>Effect of chitosan concentration</i>							
Tap water (control)	0.00	0.00	1.58	1.57	6.17	7.22	10.26	11.13
Chitosan 0.025 %	0.00	0.00	1.37	1.48	4.94	5.84	7.46	8.71
Chitosan 0.075 %	0.00	0.00	1.34	1.36	4.36	5.01	6.66	7.96
Chitosan 0.125 %	0.00	0.00	1.24	1.36	3.94	4.26	6.13	6.95
LSD at 5 % level	--	--	NS	NS	0.63	0.66	0.67	0.87
	<i>Effect of interaction treatments</i>							
DSC in tap water	0.0	0.0	1.59	1.69	6.21	7.19	10.50	11.30
DSC in 0.025% chitosan	0.0	0.0	1.40	1.55	5.30	7.04	8.20	9.19
DSC in 0.075%chitosan	0.0	0.0	1.39	1.40	4.40	6.35	8.12	8.98
DSC in 0.125%chitosan	0.0	0.0	1.30	1.44	4.30	5.40	7.25	8.00
FS in tap water	0.0	0.0	1.64	1.49	6.05	7.42	10.04	10.88
FS with 0.025%chitosan	0.0	0.0	1.41	1.51	5.19	6.17	8.30	9.45
FS with 0.075%chitosan	0.0	0.0	1.42	1.40	4.95	5.18	6.40	8.31
FS with 0.125%chitosan	0.0	0.0	1.31	1.40	4.12	4.36	6.03	7.40
DSC in tap water +FS in tap water	0.0	0.0	1.51	1.52	6.26	7.06	10.23	11.22
DSC in 0.025% chitosan + FS with 0.025%chitosan	0.00	0.00	1.31	1.38	4.33	4.30	5.89	7.50
DSC in 0.075% chitosan + FS with 0.075%chitosan	0.00	0.00	1.22	1.29	3.72	3.49	5.45	6.58
DSC in 0.125% chitosan+ FS with 0.125%chitosan	0.00	0.00	1.12	1.23	3.39	3.03	5.11	5.46
LSD at 5 % level	--	--	NS	NS	1.10	1.15	1.18	1.53

DSC: Dipping stem cutting, FS: Foliar spraying, DSC+FS: Dipping stem cutting+ Foliar spraying