

1 **Table 1.** Physico-chemical and heavy metal analysis of soil

Parameters	Wastewater irrigated soil	Ground water irrigated soil
pH	8.36 ± 0.12	7.97 ± 0.12
EC (dS/m)	1.2 ± 0.21	1.3 ± 0.25
Texture	Loamy	Loamy
Carbonate (mg/kg)	147.8 ± 10.16	154 ± 6.84
Bicarbonate	129.13 ± 7.02	114.4 ± 15.2
Organic carbon (%)	1.13 ± 0.12	0.15 ± 0.01
Chloride (mg/kg)	42.7 ± 1.03	24.7 ± 3.13
Phosphorus (mg/kg)	20.55 ± 1.4	18.71 ± 1.1
Potassium (mg/kg)	174.87 ± 15.24	95.8 ± 11.6
Sulphur (mg/kg)	12.64 ± 0.98	10.8 ± 1.1
Ni (mg/kg)	12.57 ± 0.98	1.41 ± 0.12
Cd (mg/kg)	3.33 ± 1.24	0.16 ± 0.02
Pb (mg/kg)	22.95 ± 2.67	1.29 ± 0.14
Cu (mg/kg)	17.6 ± 0.78	0.98 ± 0.19
Cr (mg/kg)	33.35 ± 1.98	2.78 ± 0.35
Zn (mg/kg)	11.86 ± 0.61	1.64 ± 0.22
Fe (mg/kg)	14.06 ± 2.95	9.12 ± 0.88
Mn (mg/kg)	15.13 ± 1.76	4.24 ± 0.55

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Table 2. Concentration of pesticides in wastewater and groundwater irrigated soil samples determined by Gas Chromatography

Organochlorine (OC)	Concentration in wastewater irrigated soil ($\mu\text{g/g}$)	Concentration in ground water irrigated soil ($\mu\text{g/g}$)	Organophosphate (OP)	Concentration ($\mu\text{g/g}$) in wastewater irrigated soil ($\mu\text{g/g}$)	Concentration in ground water irrigated soil ($\mu\text{g/g}$)
α -BHC	31.44 ± 6.80	0.55 ± 0.1	Dichlorvos	4.45 ± 0.81	1.51 ± 0.25
β -BHC	6.21 ± 1.01	0.34 ± 0.05	Ethoprophos	ND	ND
Lindane	44.26 ± 6.56	1.3 ± 0.2	Disulfoton	43.53 ± 1.5	1.24 ± 0.07
σ -BHC	ND	ND	Parathion-methyl	14.39 ± 4.48	ND
Heptachlor	16.75 ± 3.26	0.22 ± 0.05	Fenchlorphos	ND	ND
Aldrin	9.42 ± 1.95	ND	Chlorpyrifos	4.69 ± 1.11	ND
Heptachlor epoxide	ND	ND	Prothiofos	41.31 ± 9.89	7.55 ± 1.05
γ -Chlordane	ND	2.2 ± 0.3	Azinphos-methyl	14.93 ± 1.61	3.95 ± 0.3
α -Chlordane	ND	ND	Malathion	ND	ND
α -Endosulfan	30.7 ± 7.20	0.18 ± 0.02			
4-4'' DDE	29.45 ± 5.51	ND			
Dieldrin	114.18 ± 12.08	20.59 ± 3.6			
Endrin	ND	ND			
β -Endosulfan	60.61 ± 13.06	0.35 ± 0.04			
4-4'' DDD	ND	0.32 ± 0.06			
Endrin aldehyde	12.22	ND			
Endosulfan sulfate	18.59 ± 1.76	0.49 ± 0.05			
4-4'' DDT	ND	ND			
Endrin Ketone	14.83 ± 2.90	ND			
Methoxychlor	ND	ND			

ND = Not detected

Table 3. Reversion of *Salmonella* tester strains in the presence of hexane extract of wastewater irrigated soil

Strain	S9	Control	Soil extract ($\mu\text{l}/\text{plate}$)						Mi	m	LSD ($p \leq 0.05$)	F value
			2.5	5	10	20	40					
TA97a	-	87 \pm 9	113 \pm 11 (1.3)	162 \pm 15 (1.86)	254 \pm 18 (2.93)	359 \pm 15 (4.15)	263 \pm 20 (3.03)	1.14	4.73	26.3	90.5	
	+	93 \pm 7	129 \pm 10 (1.39)	174 \pm 14 (1.87)	277 \pm 16 (2.97)	388 \pm 22 (4.17)	288 \pm 17 (3.10)	1.15	5.15	11.3	110.4	
TA98	-	32 \pm 5	129 \pm 14 (4.03)	225 \pm 19 (7.02)	346 \pm 18 (10.80)	429 \pm 23 (13.41)	321 \pm 19 (10.04)	2.52	6.37	24.3	145.9	
	+	37 \pm 7	154 \pm 20 (4.16)	267 \pm 23 (7.21)	403 \pm 21 (10.90)	498 \pm 17 (13.46)	390 \pm 14 (10.54)	2.53	7.72	13.3	184.9	
TA100	-	133 \pm 19	234 \pm 16 (1.75)	370 \pm 22 (2.78)	441 \pm 20 (3.31)	502 \pm 24 (3.77)	404 \pm 26 (3.03)	1.02	5.40	33.6	83.3	
	+	147 \pm 17	261 \pm 19 (1.78)	411 \pm 21 (2.79)	489 \pm 22 (3.32)	556 \pm 23 (3.78)	451 \pm 20 (3.07)	1.02	6.07	37.6	113.4	
TA102	-	213 \pm 13	319 \pm 16 (1.49)	443 \pm 20 (2.07)	507 \pm 17 (2.38)	569 \pm 22 (2.67)	468 \pm 21 (2.19)	0.51	5.01	25.6	101.1	
	+	227 \pm 19	341 \pm 20 (1.50)	472 \pm 23 (2.07)	543 \pm 26 (2.39)	611 \pm 25 (2.69)	507 \pm 27 (2.23)	0.52	5.50	35.3	71.3	
TA104	-	301 \pm 14	348 \pm 18 (1.16)	402 \pm 20 (1.33)	498 \pm 23 (1.65)	577 \pm 20 (1.97)	501 \pm 21 (1.66)	-0.08	4.86	2.67	57.6	
	+	316 \pm 18	379 \pm 20 (1.20)	452 \pm 18 (1.43)	528 \pm 16 (1.67)	610 \pm 18 (1.93)	544 \pm 21 (1.72)	-0.07	5.20	15.7	69.4	

Values in parentheses are mutagenic index; Mi = induction factor; m = mutagenic potential; LSD = least significant difference.

Table 4. Reversion of *Salmonella* tester strains in the presence of hexane extract of ground water irrigated soil

Strain	S9	Soil extract (µl/plate)								LSD ($p \leq 0.05$)	F value
		Control	2.5	5	10	20	40	Mi	m		
TA97a	-	91±8	108±13 (1.19)	125±19 (1.38)	152±21 (1.38)	183±23 (2.01)	170±20 (1.87)	0.02	1.92	17.3	8.34
	+	96±10	124±15 (1.28)	135±16 (1.41)	161±13 (1.68)	200±18 (2.08)	185±15 (1.93)	0.08	2.10	11.6	14.1
TA98	-	32±7	46±12 (1.44)	56±11 (1.77)	71±15 (2.25)	96±15 (3.03)	80±14 (2.53)	0.71	1.16	9.0	7.18
	+	39±8	59±10 (1.52)	72±16 (1.84)	98±11 (2.51)	120±14 (3.07)	103±13 (2.63)	0.73	1.46	4.7	12.3
TA100	-	122±11	142±14 (1.16)	171±16 (1.40)	202±19 (1.65)	234±20 (1.92)	190±25 (1.56)	-0.08	1.60	12.0	10.3
	+	137±15	174±16 (1.27)	214±13 (1.56)	244±19 (1.78)	265±24 (1.93)	231±19 (1.68)	-0.07	1.90	12.7	13.8
TA102	-	215±16	240±19 (1.12)	260±15 (1.21)	279±19 (1.29)	307±13 (1.42)	291±20 (1.35)	-0.86	1.67	12.0	7.87
	+	228±17	255±16 (1.12)	285±15 (1.25)	309±19 (1.36)	342±14 (1.49)	319±18 (1.40)	-0.69	2.03	9.7	13.1
TA104	-	300±16	321±21 (1.06)	347±20 (1.55)	369±14 (1.23)	419±14 (1.39)	401±19 (1.33)	-0.93	2.46	18.0	13.8
	+	317±16	341±16 (1.07)	368±20 (1.16)	395±19 (1.24)	444±18 (1.40)	423±22 (1.33)	-0.92	2.54	21.0	15.6

Values in parentheses are mutagenic index; Mi = induction factor; m = mutagenic potential; LSD = least significant difference.

Table 5. Reversion of *Salmonella* tester strains in the presence of DCM extract of wastewater irrigated soil

Strain	S9	Soil extract (µl/plate)								LSD ($p \leq 0.05$)	F value
		Control	2.5	5	10	20	40	Mi	m		
TA97a	-	90±11	102±16 (1.13)	152±19 (1.68)	243±17 (2.70)	338±15 (3.75)	247±24 (2.74)	1.01	4.36	3.3	59.6
	+	97±15	112±18 (1.15)	167±17 (1.72)	263±17 (2.71)	365±21 (3.76)	270±18 (2.78)	1.02	4.76	6.7	68.8
TA98	-	32±6	101±14 (3.15)	189±19 (5.91)	269±17 (8.41)	353±19 (11.03)	248±20 (7.76)	2.30	4.84	20.7	98.8
	+	37±6	118±16 (3.18)	219±16 (5.93)	311±21 (8.48)	411±23 (11.11)	288±19 (7.77)	2.31	5.62	23.6	118.8
TA100	-	133±13	236±17 (1.77)	345±14 (2.58)	402±19 (3.01)	500±23 (3.75)	408±22 (3.05)	1.01	5.74	6.0	104.6
	+	146±16	259±20 (1.77)	378±23 (2.59)	441±23 (3.02)	549±26 (3.76)	447±24 (3.06)	1.01	6.30	5.7	86.5
TA102	-	221±18	303±17 (1.37)	369±19 (1.67)	450±24 (2.03)	523±26 (2.37)	427±17 (1.93)	0.31	4.44	22.3	56.6
	+	244±15	337±19 (1.38)	414±23 (1.70)	513±20 (2.10)	579±24 (2.37)	493±22 (2.02)	0.32	5.32	20.0	72.0
TA104	-	297±16	343±19 (1.16)	410±17 (1.38)	505±27 (1.70)	564±24 (1.90)	486±25 (1.63)	-0.11	4.45	19.0	44.1
	+	316±16	371±20 (1.17)	440±23 (1.39)	539±24 (1.71)	601±25 (1.90)	518±27 (1.64)	-0.10	4.68	21.0	45.1

Values in parentheses are mutagenic index; Mi = induction factor; m = mutagenic potential; LSD = least significant difference.

Table 6. Reversion of *Salmonella* tester strains in the presence of DCM extract of ground water irrigated soil

Strain	S9	Soil extract (µl/plate)							Mi	m	LSD ($p \leq 0.05$)	F value
		Control	2.5	5	10	20	40					
TA97a	-	91±12	107±14 (1.17)	139±12 (1.53)	148±13 (1.62)	169±18 (1.86)	154±16 (1.70)	-0.14	1.38	6.7	8.8	
	+	98±9	126±12 (1.28)	151±18 (1.54)	170±12 (1.73)	210±18 (2.14)	175±14 (1.78)	0.13	1.74	5.7	14.8	
TA98	-	31±4	42±16 (1.35)	54±8 (1.71)	66±9 (2.09)	102±11 (3.24)	81±7 (2.57)	0.81	1.27	11.3	21.9	
	+	37±8	55±11 (1.47)	69±8 (1.86)	93±10 (2.50)	125±15 (3.39)	101±13 (2.72)	0.87	1.55	8.0	17.1	
TA100	-	126±11	138±16 (1.10)	152±18 (1.21)	177±15 (1.41)	217±18 (1.72)	196±17 (1.56)	-0.32	1.83	12.0	9.6	
	+	139±18	161±16 (1.15)	177±15 (1.27)	211±19 (1.51)	242±22 (1.73)	224±14 (1.61)	-0.30	2.03	10.1	15.3	
TA102	-	231±16	257±20 (1.11)	284±15 (1.22)	311±21 (1.34)	332±23 (1.43)	315±16 (1.36)	-0.83	1.83	4.3	8.4	
	+	254±20	285±23 (1.12)	313±24 (1.23)	344±17 (1.35)	365±26 (1.43)	347±19 (1.37)	-0.83	1.99	3.6	7.5	
TA104	-	326±18	345±20 (1.05)	368±22 (1.12)	382±24 (1.17)	415±22 (1.27)	390±16 (1.20)	-1.29	1.49	8.0	4.9	
	+	347±18	369±21 (1.06)	392±19 (1.13)	427±22 (1.23)	448±25 (1.29)	419±26 (1.21)	-1.23	1.63	8.3	6.0	

Values in parentheses are mutagenic index; Mi = induction factor; m = mutagenic potential; LSD = least significant difference.

Table 7. Effect of different concentrations of soil extract on mitotic index and mitotic phase of *Allium cepa* root meristematic cells

Samples	Concentration (% v/v)	Mitotic Phases (%)			Mitotic index (%±SD)
		Prophase	Metaphase	Anaphase-Telophase	
Wastewater irrigated soil	5	49.66	19.95	30.39	22.60 ± 0.89 ^{cd}
	10	53.3	19.18	27.52	19.45 ± 1.14 ^{de}
	25	54.87	19.71	25.42	16.53 ± 0.9 ^{ef}
	50	58.56	17.14	24.3	10.7 ± 0.32 ^g
	100	60.58	19.97	19.45	9.1 ± 0.72 ^g
Ground water irrigated soil	5	42.97	23.84	33.19	31.9 ± 2.14 ^a
	10	43.29	25.60	29.23	29.23 ± 0.52 ^{ab}
	25	43.45	26.41	30.14	26.4 ± 3.15 ^{bc}
	50	50.12	23.12	26.76	21.63 ± 3.44 ^{cd}
	100	58.84	17.50	23.66	14.93 ± 0.61 ^f
Positive control		61.44	18.53	20.03	9.1 ± 0.73 ^g
Negative control		48.81	20.22	30.97	31.47 ± 2.61 ^a

Means with the same letters do not significantly differ at 0.05 level (Duncan multiple range test); ±: Standard deviation.

Table 8. Chromosomal aberrations in the root meristematic cells of *Allium cepa* exposed to different concentrations of soil extract for 72 h

Sample	Concentration (% v/v)	Types of aberrations									Total aberrant cells (%±SD)
		VC	CM	LC	MA	DM	SC	BN	AB	DAT	
Wastewater irrigated soil	5	-	1	2	-	-	2	-	1	2	8.44 ± 1.3 ^f
	10	3	4	2	1	3	2	-	-	1	12.82 ± 1.55 ^e
	25	3	5	5	1	4	2	-	3	4	21.51 ± 2.74 ^d
	50	8	4	7	4	4	2	2	3	5	34.73 ± 3.27 ^{bc}
	100	12	9	5	7	8	2	3	9	8	39.95 ± 5.34 ^b
Ground water irrigated soil	5	2	1	2	-	1	-	-	-	1	4.99 ± 0.36 ^h
	10	1	2	2	-	2	-	-	-	2	6.83 ± 0.72 ^{fg}
	25	2	3	1	1	2	1	-	1	3	10.45 ± 1.2 ^{ef}
	50	2	1	2	1	3	1	-	2	4	13.91 ± 2.27 ^e
	100	4	4	3	2	2	2	-	2	3	17.81 ± 2.02 ^{de}
Positive control		14	9	11	6	7	13	5	10	17	44.45 ± 4.49 ^a
Negative control		1	1	1	-	2	-	-	1	1	4.72 ± 0.87 ^h

VC: vragrant chromosome CM: C-mitosis, LC: laggard chromosome, MA: multipolar anaphase, DM: disturbed metaphase, SC: sticky chromosome, BN: bi-nucleated cell, AB: anaphase bridge, DAT: disturbed anaphase-telophase,; Means with the same letters do not significantly differ at 0.05 level (Duncan multiple range test); ±: Standard deviation.