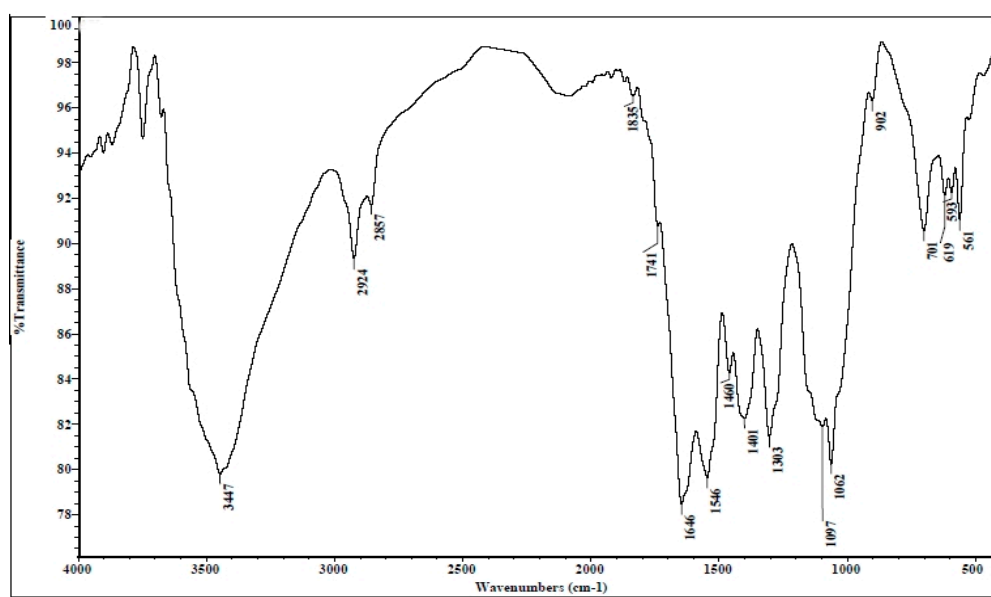


Supplementary Figure S1. Transmission electron micrograph of chitosan nanoparticles (CsNPs).



Supplementary Figure S2. FT-IR spectrum of pure solid chitosan nanoparticles (CsNPs).

Supplementary Table S1: Effects of exogenous application of chitosan or chitosan nanoparticles on Na⁺, K⁺ contents and Na⁺/K⁺ ratio in shoots and roots of salt stressed common bean plants at flowering stage.

Treatments	Shoot			Root		
	Na ⁺ (mg/ g DW)	K ⁺ (mg/ g DW)	Na ⁺ /K ⁺ ratio	Na ⁺ (mg/ g DW)	K ⁺ (mg/ g DW)	Na ⁺ /K ⁺ ratio
Control	0.29 ^l ±0.03	1.45 ^{cd} ±0.04	0.20 ^l ±0.04	0.62 ^l ±0.04	0.58 ^{cd} ±0.02	1.07 ^k ±0.02
S1	0.33 ⁱ ±0.02	1.42 ^{def} ±0.06	0.23 ^j ±0.03	0.71 ⁱ ±0.02	0.55 ^{de} ±0.05	1.29 ⁱ ±0.03
S2	0.48 ^g ±0.04	1.37 ^{gh} ±0.05	0.35 ^g ±0.05	0.85 ^g ±0.06	0.52 ^e ±0.04	1.63 ^g ±0.05
S3	0.63 ^d ±0.04	1.28 ⁱ ±0.04	0.49 ^d ±0.03	1.36 ^d ±0.04	0.45 ^{fg} ±0.04	3.02 ^d ±0.03
S4	0.76 ^a ±0.03	1.19 ^k ±0.04	0.64 ^a ±0.04	1.62 ^a ±0.04	0.38 ⁱ ±0.04	4.26 ^a ±0.04
Cs	0.28 ^m ±0.02	1.47 ^{bc} ±0.05	0.19 ^m ±0.05	0.60 ^l ±0.03	0.61 ^{bc} ±0.03	0.98 ^l ±0.03
S1 +Cs	0.33 ⁱ ±0.01	1.44 ^{cde} ±0.04	0.23 ^j ±0.04	0.66 ^k ±0.03	0.58 ^{cd} ±0.06	1.14 ^j ±0.02
S2 +Cs	0.45 ^h ±0.05	1.40 ^{fg} ±0.02	0.32 ^h ±0.07	0.81 ^h ±0.06	0.55 ^{de} ±0.05	1.47 ^h ±0.04
S3 +Cs	0.60 ^e ±0.04	1.34 ^h ±0.06	0.45 ^e ±0.03	1.31 ^e ±0.03	0.48 ^f ±0.04	2.73 ^e ±0.02
S4 +Cs	0.74 ^b ±0.04	1.24 ^j ±0.04	0.60 ^b ±0.04	1.58 ^b ±0.03	0.41 ^{hi} ±0.05	3.67 ^b ±0.05
CsNPs	0.24 ⁿ ±0.03	1.51 ^a ±0.05	0.16 ⁿ ±0.06	0.55 ^m ±0.03	0.65 ^a ±0.04	0.85 ^m ±0.04
S1 +CsNPs	0.31 ^k ±0.03	1.49 ^{ab} ±0.03	0.21 ^k ±0.04	0.61 ^l ±0.04	0.62 ^{ab} ±0.03	0.98 ^l ±0.04
S2 +CsNPs	0.41 ⁱ ±0.06	1.45 ^{cd} ±0.05	0.28 ⁱ ±0.04	0.77 ⁱ ±0.05	0.59 ^{bc} ±0.03	1.31 ⁱ ±0.05
S3 +CsNPs	0.55 ^f ±0.05	1.41 ^{ef} ±0.03	0.39 ^f ±0.02	1.26 ^f ±0.05	0.54 ^c ±0.03	2.33 ^f ±0.05
S4 +CsNPs	0.72 ^c ±0.05	1.35 ^h ±0.03	0.53 ^c ±0.06	1.46 ^c ±0.02	0.43 ^{gh} ±0.05	3.56 ^c ±0.06

Means (of three replicates ± standard error) in each column followed by a similar letter are not significantly different at $P \leq 0.05$ using Duncan test.

Supplementary Table S2. Effects of exogenous application of chitosan or chitosan nanoparticles on proline, hydrogen peroxide, lipid peroxidation and electrolyte leakage content of salt-stressed common bean plants at flowering stage grown in clay-sandy soil

Treatments	Proline ($\mu\text{mol/g DW}$)	H ₂ O ₂ ($\mu\text{mol/g FW}$)	Lipid peroxidation ($\mu\text{mol MDA/g FW}$)	Electrolyte leakage (%)
Control	0.65 ⁱ ±0.02	18.75 ^k ±0.20	5.90 ^{ij} ±0.04	57.57 ^{gh} ±0.22
S1	1.22 ^g ±0.06	20.54 ⁱ ±0.43	6.42 ^{fg} ±0.03	59.67 ^e ±0.33
S2	1.32 ^{fg} ±0.05	38.21 ^g ±0.32	7.35 ^d ±0.04	61.90 ^d ±0.53
S3	1.57 ^d ±0.04	45.11 ^d ±0.34	8.06 ^c ±0.03	65.95 ^c ±0.23
S4	1.78 ^c ±0.02	60.46 ^a ±0.22	10.97 ^a ±0.04	71.72 ^a ±0.45
Cs	0.83 ^h ±0.03	15.05 ^m ±0.33	4.74 ^l ±0.03	56.84 ^{gh} ±0.12
S1 +Cs	1.38 ^{ef} ±0.03	16.61 ^l ±0.13	5.97 ^{hi} ±0.03	57.76 ^{fg} ±0.34
S2 +Cs	1.45 ^e ±0.05	32.20 ^h ±0.33	5.55 ^{jk} ±0.05	58.62 ^{fg} ±0.35
S3 +Cs	1.79 ^c ±0.03	40.11 ^e ±0.36	6.97 ^{de} ±0.04	60.97 ^{de} ±0.33
S4 +Cs	1.94 ^b ±0.04	59.68 ^b ±0.33	9.85 ^b ±0.05	69.52 ^b ±0.32
CsNPs	0.87 ^h ±0.04	13.30 ^a ±0.23	4.57 ^l ±0.05	56.17 ^{hi} ±0.23
S1 +CsNPs	1.44 ^{ef} ±0.04	14.54 ⁿ ±0.12	5.46 ^k ±0.02	57.35 ^{fg} ±0.44
S2 +CsNPs	1.61 ^d ±0.06	30.96 ⁱ ±0.43	5.21 ^k ±0.06	58.15 ^{fg} ±0.36
S3 +CsNPs	1.95 ^b ±0.03	38.96 ^f ±0.40	6.35 ^{gh} ±0.02	59.80 ^{ef} ±0.43
S4 +CsNPs	2.10 ^a ±0.03	55.98 ^c ±0.31	6.81 ^{ef} ±0.04	65.06 ^c ±0.22

Means (of three replicates \pm standard error) in each column followed by a similar letter are not significantly different at $P \leq 0.05$ using Duncan test.

Supplementary Table S3. Summary of the Two-way ANOVA showing the effect of the main factors: chitosan spray and salinity and their interaction on Na⁺, K⁺ contents and Na⁺/K⁺ ratio in shoots and roots of salt stressed common bean plants and proline, hydrogen peroxide, lipid peroxidation and electrolyte leakage content at flowering stage.

Variable and source of variation	df	F	P	Variable and source of variation	df	F	P
Shoot Na⁺				Root Na⁺/K⁺ ratio			
Chitosan	2	104.60	***	Chitosan	2	7577.60	***
Salinity	4	3376.30	***	Salinity	4	133239.70	***
Chitosan × Salinity	8	4.60	***	Chitosan × Salinity	8	532.60	***
Shoot K⁺				Proline			
Chitosan	2	320.67	***	Chitosan	2	925.52	***
Salinity	4	570.58	***	Salinity	4	5350.24	***
Chitosan × Salinity	8	12.33	***	Chitosan × Salinity	8	14.12	***
Shoot Na⁺/K⁺ ratio				Hydrogen peroxide			
Chitosan	2	178.40	***	Chitosan	2	9539.95	***
Salinity	4	2502.80	***	Salinity	4	205589.78	***
Chitosan × Salinity	8	11.15	***	Chitosan × Salinity	8	212.50	***
Root Na⁺				Lipid peroxidation			
Chitosan	2	396.20	***	Chitosan	2	1595.77	***
Salinity	4	16220.30	***	Salinity	4	2281.34	***
Chitosan × Salinity	8	12.20	***	Chitosan × Salinity	8	160.57	***
Root K⁺				Electrolyte leakage			
Chitosan	2	185.00	***	Chitosan	2	6344.41	***
Salinity	4	610.70	***	Salinity	4	19911.54	***
Chitosan × Salinity	8	2.00	ns	Chitosan × Salinity	8	542.16	***

*** $P \leq 0.001$, ns= non-significant