



Stress Combination and their Interaction in Plants (SCIP) Database

Website link- <http://www.nipgr.ac.in/scipdb.php>

Effect on chickpea genotypes (*Cicer arietinum* L.)

The net impact of individual and combined stress on plant growth

Table showing impact of individual and combined stress on plant growth, physiological and biochemical traits

Stress	Genotypes	Treatments	Plant response to stress (reduction over control %)																			
			Type A parameters *					Type B parameters*							Type C parameters*							
			Aboveground biomass	Filled pod number per plant	Seed number per plant	Individual seed weight	Seed weight per plant	Electrolyte conductivity **	Days to flowering	Days to podding	Days to maturity	Cell oxidizing ability	PSII function	Stomatal conductance	Rubisco activity	Chlorophyll	Starch content in leaf	Starch content in seed	Sucrose content in leaf	Starch content in seed	Reducing sugars in leaf	Reducing sugars in seed
Combined stress	ICC1356	50% RLWC + 30-39/22-24 °C	60.08	73.14	53.32	59.63	48.75	-49.72	27.87	45.95	50.32	34.40	69.95	91.46	58.56	31.97	-40.27	36.18	63.80	68.46	18.34	-8.01
	ICC15614	50% RLWC + 30-39/22-24 °C	53.17	57.23	52.93	60.26	50.62	-58.76	28.81	46.79	50.32	27.14	76.21	93.87	67.09	25.80	-34.58	41.38	61.07	64.34	5.37	-5.02
	ICC4567	50% RLWC + 30-39/22-24 °C	70.19	75.08	72.47	67.07	75.63	-98.13	26.23	47.75	52.60	56.87	78.07	98.74	79.74	58.11	-18.43	55.29	77.70	71.68	31.68	28.93
	ICC5912	50% RLWC + 30-39/22-24 °C	70.78	72.13	68.92	63.90	78.57	-111.54	25.86	46.30	53.25	50.16	84.40	98.24	80.77	56.78	-10.13	59.47	80.55	79.59	27.18	20.94
	ICC8950	50% RLWC + 30-39/22-24 °C	60.68	54.41	46.01	44.75	28.15	-65.71	30.00	45.45	49.04	25.10	59.81	88.18	49.32	27.73	-34.49	56.97	51.62	54.47	91.36	-17.20
Heat stress	ICC3776	50% RLWC + 30-39/22-24 °C	83.27	80.80	72.85	64.40	79.58	-148.90	32.26	46.36	55.19	50.68	81.83	97.79	86.13	61.23	27.25	62.39	81.48	85.00	9.02	56.42
	ICC1356	30-39/22-24 °C for 7 days	49.65	36.26	26.66	35.73	25.38	-20.27	27.87	45.95	45.22	-55.95	16.12	17.14	-35.73	10.03	-40.27	15.45	31.51	19.81	-51.39	-28.79
	ICC15614	30-39/22-24 °C for 7 days	41.51	36.60	23.87	35.39	29.48	-20.79	28.81	46.79	46.50	-75.24	25.06	28.88	-38.85	-3.62	-46.89	12.50	39.19	16.57	-55.61	-28.52
	ICC4567	30-39/22-24 °C for 7 days	52.90	60.74	43.42	50.24	52.96	-55.14	26.23	47.75	44.81	-77.90	42.56	72.65	-15.94	41.50	-23.55	26.83	59.95	34.27	-44.08	89.37
	ICC5912	30-39/22-24 °C for 7 days	54.66	53.27	51.16	52.73	45.97	-84.39	25.86	46.30	46.75	-106.95	47.71	69.75	-11.51	34.75	-36.44	26.87	68.19	48.30	-33.98	4.72
Drought stress	ICC8950	30-39/22-24 °C for 7 days	23.96	24.17	31.01	30.19	11.85	-36.19	30.00	45.45	45.22	-90.79	10.22	50.34	-52.02	14.29	-38.18	18.85	30.92	22.00	-47.33	-34.93
	ICC3776	30-39/22-24 °C for 7 days	61.94	61.21	50.76	56.21	53.50	-60.15	32.26	46.36	44.81	-121.14	51.46	47.33	-6.53	39.20	-23.91	30.28	59.53	50.91	8.57	9.55
	ICC1356	50% RLWC	23.84	28.09	43.89	42.92	45.74	-32.40	0	0	21.66	-10.59	62.16	88.96	37.17	24.52	14.92	18.29	35.94	37.66	-79.38	-38.98
	ICC15614	50% RLWC	24.53	21.78	42.80	44.62	51.69	-38.74	0	0	22.93	-36.19	54.58	92.43	44.08	19.46	16.63	22.84	35.12	33.80	-41.46	-39.01
	ICC4567	50% RLWC	34.58	50.50	62.10	55.29	64.47	-71.03	0	0	18.18	8.54	71.02	97.91	58.74	51.78	16.03	24.80	55.40	47.00	-23.28	-0.44
ICC5912	50% RLWC	36.90	34.47	59.33	51.95	58.24	-69.68	0	0	20.13	10.01	74.44	97.17	51.53	49.58	21.28	21.15	60.19	60.77	-32.53	-6.81	
ICC8950	50% RLWC	14.32	19.04	30.06	27.49	28.52	-47.62	0	0	19.75	-30.61	55.38	85.48	28.91	17.65	28.60	22.13	35.16	36.60	-69.55	-21.82	
ICC3776	50% RLWC	52.09	49.67	66.80	52.82	66.35	-96.82	0	0	20.78	36.67	70.42	98.21	59.13	49.78	40.92	49.08	62.70	66.14	11.27	34.43	

RLWC- relative leaf water content

For raw data – Click here (.xlsx file)

Reference- Awasthi *et al.*, 2014

Note: Values presented in the table were calculated using the formula described below.

$$\text{Reduction over control (\%)} = \frac{(\text{Value Control} - \text{Value Stress})}{\text{Value Control}} \times 100$$

1) '0' - indicates plant was not affected by stress.



- 2) 'Positive sign' - indicates plant parameters affected by stress that lead to high susceptibility (higher the value more the damage).
- 3) 'Negative sign' - indicates plant parameters less/not affected by stress leading to improved resistance (higher the value lesser the damage).
- 4) Control plants maintained at 30 °C/22 °C day/night temperature and 80-90% relative leaf water content.
RLWC? Temperature range D/N?
*' - For more information on parameters classification, please refer to 'methodology' tab.
***- In case of the electrolyte leakage negative value indicates an increase in membrane damage over control (higher the negative value more the damage caused by the stress)

The inference from the study: Awasthi *et al.*, 2014 study aimed to assess the effect of individual and combined drought and heat stress on growth and biochemical seed-filling process in chickpea and also determine the genotypic difference in combined stress tolerance. Results showed a decrease in aboveground biomass, filled pod number, seed number, seed weight, cell oxidizing ability, PSII function, chlorophyll stomatal conductance, rubisco activity and increase in membrane damage under all stresses and the effect was more severe under combined stress. Similarly, sucrose and starch concentrations in both leaf and seed also decreased under combined stress as compared to individual stresses. Among the individual stresses, drought stress had a more significant effect on growth and biochemical seed-filling process compared to heat stress. The effects were more severe in drought sensitive (ICC3776) and heat sensitive (ICC4567, ICC5912) genotypes compared to drought tolerant (ICC8950) and heat tolerant (ICC1356, ICC15614) genotypes. **Overall results showed that combined drought and heat stress resulted in a decrease in growth and yield in chickpea genotypes susceptible to heat and drought stress as compared to tolerant genotypes.**