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PHYSIOLOGICAL APPROACH FOR MEASURING THE EFFECTS OF ENVIRONMENTAL CHANGE IN CHICKPEA GENOTYPES

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About 90% of chickpea *(Cicer arietinum* L.) in the world is grown under rainfed conditions where it is subjected to heat stress. A field experiment was, therefore conducted to know the effect of rising temperature on crop growth rate and membrane injury index of twenty chickpea genotypes and thence to screen tolerant and susceptible genotypes grown under different planting dates. Pusa-1103 from north zone, KWR-108 from east zone, RSG-963 form west zone and BDG-72 from south zones showed higher crop growth rates (CGR) and have less membrane injury index (MII) as compared to other genotypes. The variations in MII were noticed among different plantings dates *i.e.* 61.8, 64.6 and 69.4 % in planting I, II and III, respectively. This clearly indicated that there exists a negative relationship between these two important parameters. It is therefore emphasized that the productivity of chickpea could be enhanced by selecting genotypes from different zones on the basis of MII as this is very simple parameter, less expensive and a large number of breeding populations could be screened for stress tolerance in less time.

Keywords: Chickpea; Crop growth rate; High temperature stress; Membrane injury index.

Introduction

India predominates in chickpea supply and it has the distinction of being the largest producer and consumer in the world. Latest estimate according to Statistics DAC, 2010 indicate that the production of pulses in the country is 7.38 million tonnes from an area of 7.97 million hectares which contributes 36 and 50% to the national pulse acreage and production, respectively. Inspite of having largest area under chickpea in the world India's position in average productivity is relatively low as compared to other countries. The main cause for this as even today large area of crop is grown under rainfed conditions. So the severe stress during reproductive development, particularly after the commencement of pod set, causes significant pod abortion and decreased seed filling which ultimately reduces yield.

Material and Method

In the present experiment twenty chickpea genotypes collected from different chickpea growing zones of the country in consultation with project coordinator and plant breeders, were grown under different planting conditions to impose temperature stress during post flowering phase. These were evaluated to establish the relationship between crop growth rate and membrane injury index. Deshmukh *et al.*[1] and Deshmukh and Kushwaha[2] emphasized the importance of membrane injury index in grouping of genotypes in different categories in wheat and chickpea crop. Chaturvedi and Dua[3] clearly mentioned that chickpea crop gets exposed to high temperatures which causes significant reductions in crop growth rates. The plant samples were collected at 90 and 105 DAS from all twenty chickpea genotypes for estimation of CGR and MII according to method followed by Blackman and Black[4] and Deshmukh *et al.*[1].

Result and Discussion

The membrane injury index is a parameter which measures relative injury of leaf tissues in an individual material under defined set of environment condition and on the basis of relative injury crop/ crop genotypes could be categorized in different groups. The data revealed that genotypes having less membrane injury were having more growth rate (Table 1). Genotypes sown during planting I were having more crop growth rate followed by second and least by third planting as there were less injury during Ist plating whereas, maximum injury was recorded in IIIrd planting. This clearly indicated realization of temperature during late plantings. The variations in MII were noticed among the plantings *i.e.* 61.8, 64.6 and 69.4 % in planting

Table.1. Relationship between Crop growth rate (90-105 DAS) and membrane injury index (90 DAS) in twenty chickpea genotypes at 90 -105 DAS.

		CGR				MII			
	Genotypes	I	II	III	M	I	II	III	M
North Zone	Pusa-256	4.34	6.87	5.61	5.60	44.78	48.64	52.21	48.54
	C-235	4.57	5.37	4.24	4.73	65.98	69.96	74.53	70.16
	Pusa-362	6.03	3.48	4.29	4.60	47.98	50.96	55.53	51.49
	Pusa-372	5.90	4.58	3.73	4.74	53.98	57.97	62.54	58.16
	Pusa-1103	7.19	6.83	3.96	5.99	45.33	48.16	52.73	48.74
	BG-3004	5.34	4.87	4.31	4.84	58.03	60.80	65.37	61.40
	ZM	5.81	5.02	4.11	4.98	54.26	57.57	62.14	57.99
East Zone	KWR-108	4.52	3.51	4.07	4.03	72.88	74.94	79.51	75.78
	Radhey	5.20	5.15	5.03	5.12	56.26	58.34	62.91	59.17
	Pant G-186	10.05	3.91	4.21	6.06	45.83	47.94	62.43	52.07
	ZM	6.59	4.19	4.43	5.07	58.32	60.41	68.28	62.34
West Zone	RSG-143-1	7.20	4.73	4.28	5.40	61.86	63.86	68.43	64.72
	RSG-888	8.43	4.58	4.30	5.77	49.33	66.17	71.34	62.28
	RSG-963	7.17	4.45	4.75	5.46	71.20	73.27	77.84	74.10
	Pusa-261	5.49	3.85	3.65	4.33	74.86	77.29	81.86	78.00
	GNG-459	6.77	4.12	3.29	4.73	72.78	75.78	80.35	76.30
	ZM	7.01	4.35	4.05	5.14	66.01	71.28	75.96	71.08
South Zone	ICCV-10	6.71	4.59	4.36	5.22	59.28	62.19	66.76	62.74
	Chaffa	4.32	5.93	3.44	4.56	55.08	58.40	62.97	58.82
	BGD-72	8.85	4.90	4.26	6.00	53.06	57.30	62.97	57.78
	JG-11	7.78	3.98	4.49	5.42	69.86	70.85	75.42	72.04
	Vijay	9.97	4.22	3.41	5.87	66.98	69.96	74.53	70.49
	Phule-G 96006	9.23	4.21	3.73	5.72	66.98	69.18	73.75	69.97
	ZM	7.81	4.64	3.95	5.47	61.87	64.65	69.40	65.31
	Mean	6.31	5.01	4.43		57.05	60.51	65.60	
CD at 5%	Planting time (P)		0.224				2.39		
	Genotypes (G)		0.189				2.25		
	P × G		0.33				NS		

I= Oct. 23rd, II=Nov. 21st, III=Dec.18th planting date.

I, II and III, respectively and similar trend was observed at genotypic levels.

Among the zones west zone genotypes were having more membrane injury and least was seen in genotypes from north. In general the genotype Pusa-1103 from north, Radhey from east, GNG-469 from west and BGD-72 from south zone have shown relatively less membrane injury as compared to Pusa-256 (national check). This indicated that these genotypes are relatively more tolerant to high temperature stress.

The data on CGR, during 90-105 DAS varied from 4.03 to 6.06 among the genotypes and from 4.98 (north Zone) to 5.87 (south zone) among the zones. Significantly higher CGR was recorded in first planting (6.31) followed by second (5.01) and third planting (4.43), respectively. In the genotypes studied, higher CGR was recorded in Pant G-186 (6.06) followed by BGD-72 (6.00) and Pusa-1103 (5.99) whereas least was recorded in KWR-108 (4.03). In general Pusa-1103 from north zone, Pant-G 186 from east zone, RSG-143-1, RSG-888, RSG-963 from west zone and BGD-72, Vijay from south zone, retained comparatively higher CGR values than other genotypes. It confirms that genotypes which have higher CGR have less membrane injury also. This clearly

indicated that there exists a negative relationship between these two important parameters. This positive association between crop growth rate and membrane injury index was also reported by Singh *et al.*[5] in chickpea. So, it is emphasized that the productivity of chickpea could be enhanced by selecting genotypes from different zones on the basis of MII as this is very simple parameter, less expensive and a large number of breeding populations could be screened by using this.

References

1. Deshmukh P S, Sairam R K and Shukla D S 1991, Measurement of ion leakage as a screening technique for drought resistance in wheat genotypes. *Indian J. Plant Physiol.* **34** 89-91.
2. Deshmukh P S and Kushwaha S R 2002, Variability in membrane injury index in chickpea genotypes. *Indian J. Plant Physiol.* **7**(3) 285-287.
3. Chaturvedi S K and Dua R P 2003, *Breeding chickpea for late sown conditions in northern India.* International Chickpea Conference, Raipur, India, January, 20-22, pp. 11.
4. Blackman G E, Black J N and Kemp A W 1955, Physiological and ecological studies in the analysis of plant environment. X. An analysis of the effects of seasonal variation in daylight and temperature on the growth of *Helianthus annuus* in the vegetative phase. *Ann. Bot.* **19** 527-548.
5. Singh T P, Deshmukh P S, Srivastava G C, Kushwaha S R and Mishra S K 2005, Growth rate of chickpea *(Cicer arietinum* L.) genotypes under different planting dates. *Indian J. Plant Physiol.* **10**(3) 254-259.