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SHORT COMMUNICATION

RELATIONSHIP BETWEEN PHYSIOLOGICAL TRAITS IN CHICKPEA (*CICER ARIETINUM* L.) UNDER RAINFED CONDITION

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Biological yield and seed yield had significant positive correlation with primary branches, relative growth rate, net assimilation rate, total chlorophyll content and with relative water content (RWC) and significant negative correlation with membrane injury index (MII). Production of high biomass was significantly and positively correlated with seed yield (r=0.639).**

Key words: **Biological yield, chlorophyll content, correlation coefficient, membrane injury index, relative water content, seed yield**

In India, chickpea crop ranks in the first position among pulses, occupying about 30% of total cultivated area of pulses and contributing 40% total pulse production (Reddy *et al.* 2007). More than 85% of chickpea is grown as rainfed mostly on the residual soil moisture after the harvest of *kharif* crops. Chickpea is preferred under rainfed conditions because of its higher yields and greater profitability. India contributes 64% to the global production of chickpea (Reddy *et al.* 2007). This crop is very important from the point of view of nutritional security, sustainable agriculture, improving soil fertility and diversification of rice-wheat system to rice-chickpea system. The planting of chickpea is usually delayed in north-western parts of India due to cultivation of rice in which high yielding basmati rice varieties are often late maturing. Under such situations, the crop has to be sown by the end of December. This late sown crop experiences very low temperatures at initial stages of crop growth, resulting in poor and slow vegetative growth. The high temperatures at post flowering phase result in forced maturity and problems of poor biomass production (Chaturvedi and Dua 2003). Considering the above points, a need has been felt to evaluate the relationship between physiological, growth and yield traits in promising chickpea genotypes and advanced breeding lines under rainfed condition.

A field experiment was conducted at the Indian Agricultural Research Institute, New Delhi. The soil was sandy loam with pH- 7.8 and contained organic carbon 0.4% and available P 12.8 kg/ha. The treatments consisting of dates of planting (15th November, 30th November and 15th December) as main plots and 6 genotypes including 3 released varieties (‘Pusa 256’, ‘Pusa 362’ and ‘BGD 72’) and three advance lines (‘DG 36’, ‘DG 46’ and ‘DG 51’) as sub plots were replicated thrice in split-plot design. A basal dose of 20 kg N and 60 kg P_2O_5/ha was applied at sowing.

The traits were categorized in to physiological traits, growth traits and yield traits. Leaf area index had significant positive correlation with total dry matter, total chlorophyll content, seed yield and harvest index. Growing Degree Days (GDD) at flowering stage had significant positive correlation with primary branches, days to 50% flowering, relative growth rate, net

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Table 1. Correlation coefficient among different traits in chickpea

S. No.	Characters	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Primary branches	1.000	-0.192	0.785**	0.760**	-0.201	0.617**	0.642**	0.126	-0.440	0.562*	0.659**	0.733**	-0.488*
2.	Leaf area index (%)		1.000	-0.343	-0.392	0.867**	-0.038	-0.065	0.763**	-0.365	-0.209	0.627**	-0.008	0.854**
3.	50% flowering (days)			1.000	0.990*	-0.249	0.834**	0.829**	0.047	-0.553*	0.823**	0.116	0.680**	-0.638**
4.	GDD at flowering				1.000	-0.318	0.783**	-0.764**	-0.058	-0.531*	0.822**	0.032	0.620**	-0.677**
5.	Total dry wt. (g/m^2)					1.000	0.097	0.146	0.823**	-0.292	-0.238	0.699**	0.175	0.736**
6.	RGR ($g\ g^{-1}\ day^{-1}$)						1.000	0.975**	0.368	-0.687**	0.827**	0.462*	0.730**	-0.348
7.	NAR ($mg\ dm^{-2}\ day^{-1}$)							1.000	0.411	-0.599**	0.730**	0.486*	0.776**	-0.348
8.	Total chl. content ($mg\ g^{-1}$ fw.)								1.000	-0.361	0.261	0.830**	0.452*	0.557*
9.	Membrane injury index (%)									1.000	-0.745**	-0.454*	-0.454*	-0.034
10.	RWC (%)										1.000	0.502*	0.487*	-0.468*
11.	Seed yield (g/plant)											1.000	0.693**	0.518*
12.	Biological yield (g/plant)												1.000	-0.251
13.	Harvest index (%)													1.000

* significant at 5% level, ** significant at 1% level

assimilation rate, relative water content, seed yield, biological yield and significant negative correlation with membrane injury index. Total chlorophyll content had significant positive correlation with leaf area index, total dry weight, seed yield, biological yield and harvest index. Membrane injury index had significant negative correlation with days to 50% flowering, GDD at flowering, net assimilation rate (NAR), relative growth rate (RGR), relative water content (RWC), seed yield and biological yield (Table 1). Biological yield had positive correlation with primary branches, days to 50% flowering, GDD at flowering, RGR, NAR, total chlorophyll content, RWC and seed yield. Seed yield had significant positive correlation with, primary branches, leaf area index, total dry weight, relative growth rate, net assimilation rate, total chlorophyll content, relative water content, biological yield and harvest index and significant negative correlation with membrane injury index.

On the basis of these results, it was observed that physiological traits (RWC, MII and chlorophyll content) were closely associated with growth parameters (RGR, NAR and LAI), consequently higher biomass production, which is a prerequisite for any successful genotype under rainfed environment as also advocated by Singh *et al.* (2005).

The attainment of high biomass was significantly and positively correlated with seed yield (r=0.693**). It could be suggested from the present study that simple traits like chlorophyll content, biological yield, LAI, MII and RWC may be used for screening the genotypes for successful cultivation in low input conditions as suggested by Singh *et al.* (2004) and Kumar *et al.* (2001). The emphasis may also be given to significance of temperature on duration of phenophases for evaluation of suitable genotypes, having more elasticity and less damage to biomass production. Variety Pusa 362, BGD 72 and advanced line DG 36 performed better under rainfed conditions. Fast growing and early maturing chickpea genotypes are better for resource limited condition. In north-western plains zones, 30th November planting was found better for late sown under rainfed conditions. It gives 10% higher yield than 15th November planting and 22% higher yield than 15th Dec planting. Continuous growing of Rice-wheat cropping system has created imbalances of nutrients and soil health problems. Diversification of rice-wheat cropping system to rice-chickpea cropping system is essential for sustainable agriculture production and more remunerative in late planting and resource limited environments.

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