adras Agric. J. 91 (1-3) : 83-85 January-March 2004
https://doi.org/10.29321/MAJ.10.A00073

Correlation and path analysis of physiological characters in greengram under moisture stress in vegetative stage

. ANDERSON AMALAN KUMAR
epartment of Crop Physiology, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu

Abstract : Correlation and path coefficients were worked out for physiological characters in greengram under moisture stress in vegetative stage. Leaf area, dry matter, relative water content, soluble protein, nitrate reductase activity, catalase activity and peroxidase activity were positively and significantly correlated with seed yield. Proline content showed a negatively significant association with yield. The nature and form of association with each other manifest by relative water content, soluble protein, nitrate reductase activity, catalase activity and peroxidase activity with particular reference to the direction and magnitude and the direct and indirect effects where similar and resembled each other. These five characters influenced the observed associations with the yield through their direct and indirect effects and hence found important in the improvement of greengram under moisture stress situations.

Key Words: Greengram, Moisture stress, Physiological characters, Correlation, Path analysis.

ntroduction

Mungbean (*Vigna radiata* (L.) Wilczek), otherwise known as greengram is an important grain legume of the arid and semi-arid regions. Being rainfed, the crop is prone to the incidence of drought in any growth stage causing low yield. Moisture stress effects on growth and physio-bio-chemical characters in greengram exposed to moisture stress in the vegetative, flowering and pod development stages have been reported by Sadasivam *et al.* (1988) and Anderson Amalan Kumar (1998). Characters' like leaf area, dry matter, transpiration rate, leaf water potential, protein content, nitrate reductase activity, peroxidase activity etc. have been found to be important from the view point of drought resistance in greengram. A knowledge on the association of characters contributing to drought resistance with yield *per se* and the characters *inter se* together with their direct and indirect effects on the observed association with yield will help in formulating suitable selection indices for drought resistance in greengram and hence this study.

Materials and Methods

Ten different greengram genotypes were studied in a pot culture experiment during summer 1997 in the Department of Crop Physiology, Tamil Nadu Agricultural University, Coimbatore, in a completely randomized factorial design with three replications. Normal irrigation was given upto 15 DAS after which moisture stress was imposed by means of maintaining the ASM at 40 per cent for a further period of 15 days. Observations on leaf area (LA), dry matter (DM), transpiration rate (TR), Leaf water potential (LP), relative water content (RW), proline content (PC), soluble protein (SP), nitrate reductase activity (NR), catalase activity (CA) and peroxidase activity (PO) were recorded just prior to termination of moisture stress. Seed yield was recorded at the time of harvest. Correlation and path analysis were carried out following the method of Panse and Sukhatme (1961).

Results and Discussion

The correlation coefficients are furnished in Table 1. The seed yield was positively and significantly correlated with LA, DM, RW, SP, NR, CA and PO offering scope of improvement in yield through selection on physiological and biochemical characters. Both TR and LP showed non-significant negative association with seed yield. PC was negatively and significantly correlated

Table 1. Correlation coefficients for morpho-physiological characters in greengram under moisture stress in vegetative stage

	DM	TR	LP	RW	PC	SP	NR	CA	PO	SY
LA	0.90**	0.09	-0.17	0.98**	-0.91**	0.93**	0.84**	0.94**	0.74**	0.86**
DM		0.01	-0.43	0.92**	-0.85**	0.88**	0.81**	0.78**	0.68**	0.88**
TR			-0.12	0.17	0.03	0.13	0.17	0.11	0.06	-0.26
LP				-0.19	0.08	-0.35	-0.55	-0.02	-0.12	-0.24
RW					-0.92**	0.92**	0.86**	0.90**	0.71**	-0.89**
PC						-0.89**	-0.76**	-0.90**	-0.75	-0.89**
SP							0.89**	0.87**	0.82**	0.88**
NR								0.77**	0.70**	0.75**
CA									0.82**	0.74**
PO										0.64**

** Significant at 1% level

Table 2. Path analysis showing the direct (bold) and indirect effects of morpho-physiological characters in greengram under moisture stress in vegetative stage

	LA	DM	TR	LP	RW	PC	SP	NR	CA	PC
LA	-0.21	-1.37	-0.18	0.45	0.13	0.03	2.37	0.64	-1.26	0.5(
DM	-0.19	-1.53	-0.01	1.19	0.12	0.03	2.25	0.62	-1.05	0.4(
TR	-0.02	-0.01	-1.91	0.33	0.01	-0.01	0.33	0.13	-0.14	0.0
LP	0.04	0.66	0.23	-2.74	-0.03	-0.01	-0.90	-0.42	0.03	-0.0
RW	-0.21	-1.40	-0.13	0.53	0.14	0.33	2.33	0.66	-1.21	0.4
PC	0.19	1.30	-0.06	-0.21	-0.13	-0.03	-2.27	-0.57	1.21	-0.51
SP	-0.20	-1.35	-0.25	0.97	0.013	0.03	2.55	0.69	-1.17	0.55
NR	-0.18	-1.24	-0.32	1.51	0.12	0.02	2.28	0.77	-1.04	0.48
CA	-0.20	-1.20	-0.20	0.06	0.12	0.03	2.21	0.59	-1.35	0.56
PO	-0.16	-1.03	-0.11	0.34	0.10	0.02	2.06	0.54	-1.10	0.68

Residual effect R = 0.004

LA = Leaf area (cm^2 $plant^{-1}$); DM = Dry matter production (g $plant^{-1}$); TR = Transpiration rate (µg H_2O cm^2 s^{-1}); LP = Leaf water potential (-MPa); RW = Relative water content (%); PC = Proline content (µmol g^{-1}); SP = Soluble protein (mg g^{-1}); NR = Nitrate reductase activity (µmol NO_2 $R^{-1}g^{-1}$); CA = Catalase activity (x 10^{-4} enzyme units g^{-1} min^{-1}); PO = Peroxidase activity (enzyme units mg^{-1} protein); SY = Seed yield (g)

with seed yield. Patil *et al.* (1996) reported a positive and significant association of DM with seed yield in greengram under saline water irrigation. Positive and significant association of DM with seed yield was observed by Maloo and Sharma (1987) in gram. Leaf area duration was positively and significantly correlated with seed yield in greengram (Patil *et al.* 1996). The association of leaf area with pod yield in groundnut was observed to be positive and significant (Chhonkar and Kumar, 1987; Arjunan *et al.* 1996). The observed negative association of transpiration rate with yield is in tune with the findings of Arjunan *et al.* (1988) and Arjunan *et al.* (1996) in groundnut.

As for the associations among the characters it was observed that LA with DM, RW, SP, NR, CA and PO; DM with RW, SP, NR, CA and PO; RW with SP, NR, CA and PO; SP with NR, CA and PO; NR with CA and PO; and CA with PO were all positive and significant. Five characters *viz.* RW, SP, NR, CA and PO appeared to function as one unit as if these were closely linked. When improvement is sought to be made on any one of the above five

haracters by selection, it is likely to result n simultaneous improvement of other characters long with seed yield. The form of associations n direction and magnitude, shown by each f these five characters with yield and within hemselves and the mutual direct and indirect ffects exerted through each other were similar n nature suggestive of resemblance of uniformity n physiological functions of these characters.

The results of path analysis are presented n Table 2. Soluble protein had the highest ositive direct effect (2.55) on seed yield, followed y NR (0.77), PO (0.68) and RW (0.14). The irect eitects of all the other characters were nly negative. The indirect effects of NR, PO nd RW through SP were all positive. Similarly, e indirect effects of SP, PO and RW through R; SP, NR and RW through PO and SP, R and PO through RW were all positive nd fairly high. It was apparent from the above hat the characters like SP, NR, PO and RW were very much important in selection programs for drought resistance and high yield in greengram under moisture stress situations. These characters were highly inter-related with each other through their positive associations.

References

Anderson Amalan Kumar, A. (1998). Physiological studies on water stress and its amelioration in greengram (*Vigna radiata* (L.) Wilczek) genotypes. *Ph.D. Thesis* submitted to Tamil Nadu Agricultural University, Coimbatore.

Arjunan, A., Srinivasan, P.S. and Vindiyavarman, P. (1988). Physiological aspects of drought tolerance in groundnut (*Arachis hypogaea* L.). *Madras Agric. J.* **75**: 5-8

Arjunan, A., Manoharan, V. and Senthil, V. (1996). Path analysis of characters contributing to drought resistance in groundnut. *Madras Agric. J.* **86**: 37-39.

Chhonkar, A.K. and Kumar, A. (1987). Correlation and regression studies between different physiological attributes and pod yield in groundnut. *J. Oilseeds Res.* **4**: 132-135.

Maloo, S.R. and Sharma, P.P. (1987). Estimates of variability parameters and path coefficient analysis in gram (*Cicer arietinum* L.). *Madras Agric. J.* **74**: 381-386.

Panse, V.G. and Sukhatme, P.V. (1961). Statistical methods for agricultural workers. ICAR, New Delhi.

Patil, S.L., Hunshal, C.S., Vishwanathan, D.P., Kubsad, V.S. and Chimad, V.P. (1996). Correlation and path coefficient analysis in greengram under saline water irrigation. *Madras Agric. J.* **83**: 560-562.

Sadasivam, R., Natarajaratnam, N., Chandra Babu, R., Muralidharan, V. and Sree Rangasamy, S.R. (1988). Response of mungbean cultivars to soil moisture stress at different growth stages. *In*: Mungbean proc. Second Intl. Symp. Bankok, Thailand, 16-20 November 1987, 260-262.

(Received: December 2002; Revised: September 2003)