Annals of Arid Zone 30(2): 159-161, 1991

FRUITING PATTERN AND YIELD AS AFFECTED BY DIFFERENT TIME OF APPLIED WATER STRESS IN PIGEONPEA

A.S. NANDWAL AND S. BHARTI

Department of Botany, Haryana Agricultural University,
Hisar - 125 004

The water stress influences crop growth, development and economic yield (Begg and Turner 1976). Some studies have elucidated the adverse effect of water stress in various legumes (Wein et al. 1979; Pandey et al. 1984; Begg et al. 1985), and this effect varies with the duration of stress applied and stage of plant growth (Turk and Hall 1980; Kuhad et al. 1989). It is apparent, however, that the sensitivity of pigeonpea yield to water stress during different stages of growth has not been adequately established. Pot culture studies were conducted to determine pigeonpea responses to water stress for fruiting behaviour and yield.

Two cultivars of pigeonpea (*Cajanus cajan* L.), H-77-216 (indeterminate) and ICPL-151 (determinate) of same duration were sown on 25th June 1987 in earthenpots (diameter 30 cm) filled with 5.5 kg of yellow sand. The seeds before sowing were treated with effective *Rhizobium* culture. After thinning two plants per pot were maintained. The plants were supplied with nitrogen free nutrient solution at weekly interval. The plants were subjected to severe stress at soil water potential (ψ w) of -1.34 MPa corresponding to soil moisture content of 3.0 ± 0.5 per cent, by withholding the irrigation at vegetative and flowering stages i.e. 40 and 70 days after sowing. The stressed plants were revived by irrigation and maintained at soil water potential (ψ w) of -0.37 MPa corresponding to soil moisture content of 10 ± 0.5 per cent, similar to that of control plants i.e. 50% of soil saturation percentage. At maturity fruiting pattern was taken, i.e. nodewise in ascending order. The data from fifteen pots were analysed statistically. The revived plants of vegetative and flowering stage were designated as $RAS_{(v)}$ and $RAS_{(f)}$ respectively.

In control plants of cv. H-77-216, first pod was formed at the node number 16. Maximum pod setting were observed between the node numbers 31-35 (Table 1), and between the node numbers 41-45. In cv. ICPL-151 first pod was formed at node number 21, and maximum pod setting was obtained between nodes 31-40 (Table 1).

In plants $RAS_{(v)}$ it was found that in cv. H-77-216 pod formation started from 21 node. Maximum fruit setting was noticed between 31-35 node with 7.4 pods. The

Table 1. Effect of water stress on fruiting pattern in pigeonpea

Node	H-77-216			ICPL-151		
Number	Control	RAS(v)	RAS(f)	Control	RAS(v)	RAS(f)
16-20	0.70	—	—	—	0.15	—
21-25	1.20	1.60	—	0.84	0.25	—
26-30	4.70	4.70	—	2.40	0.88	—
31-35	6.50	7.40	1.30	5.88	4.97	—
36-40	5.13	2.60	9.13	5.50	3.50	3.44
41-45	6.80	1.20	2.90	1.90	0.09	5.00
46-50	1.10	0.50	—	0.12	—	—
51-55	0.40	—	—	—	—	—
Total	26.53	18.00	13.33	16.64	9.84	8.44

first pod formation was shifted to node 31 in plants RAS(f). Maximum of 9.1 pods was observed between nodes 36-40. However, in cv. ICPL-151, fiirst pod appeared on the same node in plants RAS(v) as in control. The number of pods gradually increased from bottom to middle, showing highest, 4.90 pods in between node 31-35. Interestingly, in the plants RAS(f) pod formation started from node 36 and maximnm pod formation 5.0 pods occurred between node 41-45. No pod formed after node 45.

The reduction in seed weight per plant was 32.44 per cent and 52.57 per cent in plant RAS(v) of cv. H-77-216 and cv. IPCL-151 respectively, however in plants RAS(f) the reduction was 63.39 per cent and 66.83 per cent respectively (Table 2). Seed yield per plant in cv. H-77-216 was significantly higher as compared to cv. ICPL-151 and the interaction between stress X cultivar was also significant.

Hundred seed weight on per cent basis to that of control decreased to 12 per cent and 39 per cent in plants RAS(v) and RAS(f) of cv. H-77-216 (Table 2). But in cv. ICPL-151 the plants of RAS(v) showed enhanced 100 seed weight by 1.36 per cent. In determinate cultivar RAS(v) the photosynthates were directed mainly

Table 2. Effect of water stress on econmic yield and 100 seed weight in pigeonpea

Treatment	Seed weight plant^{-1}(g)			100 seed weight (per cent over control)	
	H-77-216	ICPL-151	Mean	H-77-216	ICPL-151
Control	3.05	2.56	2.81	100	100
RAS(v)	2.06	1.21	1.64	88	101
RAS(f)	1.12	0.85	0.98	61	87
Mean	2.08	1.54			

CD 5% Stress = 0.29 cv. = 0.24

Stress X cv. = 0.42

towards the reproductive parts at faster rate and thus may be accumulated in the seeds, which could increase the 100 seed weight to some extent, while in indeterminate cultivar the photosynthates were partitioned in the vegetative and reproductive parts. In plants RAS(f) the the seed weight was reduced upto 13 per cent.

Yield in both the cultivars decreased linearly when water stress was given at vegetative and flowering stages. The effects of drought on yield at different stages of growth gave complete understanding of the concept of critical stage as it applied to these cultivars, plants were unable to show the rapid recovery of growth or efficient pod set when stress was given at flowering. It is suggested that yield potential of these cultivars is relatively resistant to drought during vegetative stage than flowering provided subsequent environmental conditions are conducive to rapid recovery of growth and efficient pod set. The revived plants of cv. ICPL-151 matured 7-10 days earlier as compared to control. In cv. H-77-216 the maturity period was delayed by 15 days as compared to control when stress was given at flowering and thus sustained greater water stress. It is concluded that indeterminate characteristics of food legume offer greater yield stability when drought of short period occurs during vegetative or flowering than with determinate characteristics.

Thanks are due to Dr. V.P. Singh, Professor and Head, Department of Plant Breeding, H.A.U., Hisar and Dr. Satish C. Gupta, Pigeonpea Breeder Research Coordinator, ICRISAT Sub Centre. H.A.U., Hisar, for providing the seed of cultivar H-77-216 and ICPL-151 respectively.

REFERENCES

Bagga, A.K., Bala, M. and Tomer, O.P.S. 1985. Effect of fluctuating moisture conditions on growth, yield and nitrogen status of two mungbean (*Vigna radiata* L.) varieties. Indian Journal of Plant Physiology 28 : 395-406.

Begg, J.E. and Turner, N.C. 1976. Crop water deficits. Advances in Agronomy 28 : 161-217.

Kuhad, M.S., Nandwal, A.S. and Kundu, B.S. 1989. Physiological responses of pigeonpea (*Cajanus cajan* L.) genotypes to water stress. Indian Journal of Plant Physiology 32 : 212-216.

Pandey, P.K., Nerrera, W.A.T. and Pendletoo, J.W. 1984. Drought response of grain legumes under irrigation gradient. Agronomy Journal 76 : 549-560.

Turk, K.J. and Hall, A.E. 1980. Drought adaptation of cowpea. Agronomy Journal 72 : 413-439.

Wein, H.C., Littleton, E.J. and Ayanaba, A. 1979. Drought stress of cowpea and soybean under tropical conditions. pp 283-301. In H. Mussell and R.C. Staples (ed) Stress Physiology in Crop Plants. Wiley Interscience, New York.