Journal of Agrometeorology 4 (1) : 93 - 96 (June 2002)

Short Communication

Light interception and light use efficiency in sorghum based intercropping system

P. K. SINGH*, A. S. JADHAV AND M. C. VARSHNEY

CASAM, College of Agriculture, Mahatma Phule Krishi Vidyapeeth, Pune-411005.

The light use efficiency is a function of interplant and intraplant spacing and their competition for light and water. Intercropping intercepts photosynthetically active radiation (PAR) more efficiently than does the sole crop under rainfed conditions. Intercepted radiation was observed to be significantly higher under intercropped sorghum than sole sorghum due to higher leaf area index under intercropping systems (Okibo, 1981; Bandopadhay, 1987). Keeping this in view, an experiment was conducted to study the intercepted photosynthetically active radiation (IPAR) and light use efficiency (LUE) of sorghum based intercropping systems under rainfed conditions.

The experiment was conducted on the farm of the Centre of Advanced Studies in Agricultural Meteorology (CASAM) at Pune during the monsoon season of 1996 in randomized block design with three replications. Seven treatments were under study. Sorghum was planted in paired rows 30-60 cm under intercropping systems. The seed was dibbled on 11th July 1996. Intercepted and transmitted PAR were measured periodically with the help of line quantum sensor between 1130 to1330h I.S.T. The incident PAR (PARo) was measured by facing the line quantum sensor skywards 30 cm above the canopy. The transmitted PAR (TPAR) was measured by placing the quantum sensor on the ground across the rows. The intercepted PAR (IPAR) was calculated as

$$IPAR = PARo - TPAR$$

Periodic samples of dry matter were taken. The light use efficiency was calculated by using formula.

$$LUE\ (gMJ^{-1}) = \frac{\text{Matter produced } (gm^{-2})}{\text{Cumulative APAR } (MJm^{-2})}$$

The IPAR values were the lowest (40%) on the 28th day owing to slow crop growth and more exposure of the soil. In general, the IPAR was the highest around 70 DAS in all treatments except under sole pigeonpea treatments. A general decrease is observed around 98 DAS in all treatments except under sole pigeonpea where it was the highest (92%). Nature of crop cover seems to have affected the values. It was significantly lower under sole pigeonpea and soybean at the time (Fig.1) because of their slow growth and less canopy development.

The IPAR under sorghum + pigeonpea intercropping was significantly lower than other intercropping systems and sole sorghum, sorghum + groundnut and sole soybean on the 70th day because of slow growth of

*Present address: Central Research Institute For Dryland Agriculture (CRIDA), Hyderabad-500059.

Table 1 : Mean light use efficiency (gMJ^{-1}) as influenced periodically by different treatments.

Treatments	Days after sowing									
	28	42	56	70	84	98	112	126	140	156
SR + PP	0.69	1.59	2.28	.41	2.39	2.37	2.29	0.46	0.46	0.56
SR + GN	1.13	2.09	2.48	2.73	2.36	2.39	1.84	-	-	-
SR + SB	0.96	2.04	2.42	2.69	2.41	2.44	1.83	-	-	-
Sole SR	0.57	1.48	1.86	2.16	2.01	1.95	1.73	-	-	-
Sole PP	1.11	1.61	1.58	1.31	1.71	1.90	2.04	2.03	1.89	1.92
Sole GN	0.88	1.32	1.62	1.39	1.20	1.13	-	-	-	-
Sole SB	1.63	1.61	1.84	1.46	1.69	1.73	-	-	-	-
SE ±	0.14	0.13	0.12	0.07	0.06	0.05	0.06	0.06	0.02	0.10
C.D. at 5%	0.43	0.39	0.36	0.22	0.20	0.16	0.17	0.20	0.13	0.60
Mean	0.99	1.65	2.01	2.02	1.97	1.99	1.95	1.25	1.17	1.19

pigeonpea. The IPAR was not significantly influenced on 84th day. The highest values of IPAR were recorded under sole pigeonpea on the 98th day since at this time it was in grand growth stage. Relatively high IPAR is noticed even after 112 DAS in both sole pigeonpea and sorghum + pigeonpea intercrop due to late maturity of pigeonpea compared to other crops. Similar results were reported by Natarajan and Willey (1980), Lakudzode *et.al* (1995).

Fig. 1 shows that lower IPAR in sole pigeonpea in the early stage (upto 70 DAS) can be improved if it is intercropped with sorghum or soybean because IPAR was significantly the lowest under sole pigeonpea on the 56th day and 70th day (flowering stage) due to its slow growth during initial period.

The intercropping of sorghum + groundnut and sole pigeonpea significantly increased LUE (Table 1) as compared to sole sorghum on the 28th day. The conversion efficiency of sorghum + pigeonpea, sorghum + groundnut and sorghum + soybean intercropping was significantly more than sole crops during the period between 42 to 98th day.

During the advanced crop growth stages, the light use efficiency of sole sorghum and its association with pigeonpea under different interrow spacing was not much different upto harvest.

At harvest of sorghum (112th day), LUE was significantly the highest under sorghum + pigeonpea intercropping owing to flowering

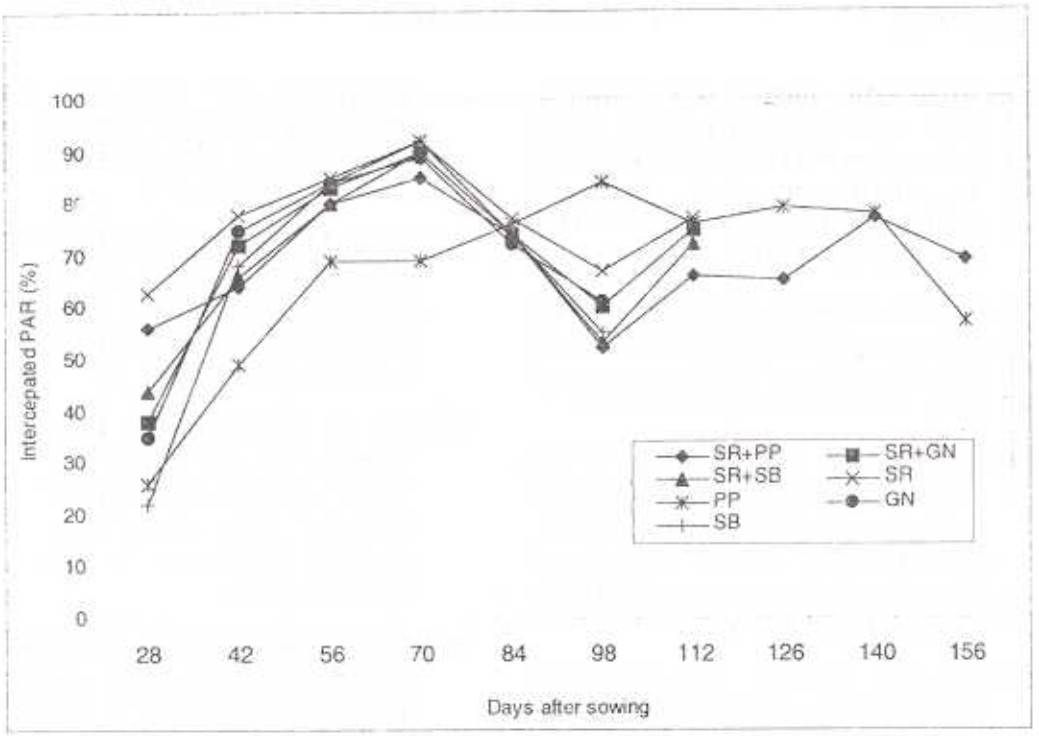

Fig. 1 : Mean intercepted PAR as influenced periodically by treatments (SR = Sorguhm, PP = Pigeaonpea, GN = Groundnut, SB = Soybean).

period of pigeonpea. It was observed that sole pigeonpea also gave significantly more light use efficiency than sorghum + groundnut and sorghum + soybean intercropped and sole sorghum at this time. These results are similar to Willey and Natarajan (1978) in sorghum + groundnut, Sivakumar and Viramani (1980) in maize + pigeonpea, Srinivas *et al.* (1995) in pearmillet + pigeonpea and sunflower + pigeonpea, Lakudzode *et al.* (1995) and Shinde *et al.* (1996) in sunflower + pigeonpea intercropping.

ACKNOWLEDGMENTS

The authors are grateful to Dr. Y. S. Ramakrishna, Project Coordinator, AICRPAM and Dr.A.V.R.Kesava Rao Sr.Scientist (Ag.Met.), CRIDA, Hyderabad for their valuable support and encouragement.

REFERENCES

Bandopadhay, S.K. 1987. Solar radiation interception, soil water and nitrogen use in sorghum based intercropping system with legumes. *Indian J. Agron.*, 33(1): 31-36.

Lakudzode, P.S., Jadhav, A.S., Varshney, M.C. and Bote, N.L.1995. Light interception and radiation use efficiency in sunflower and pigeonpea intercropping. *J. Maharashtra Agri. Univ.*, 20 (3): 464-465.

Natarajan, M. and Willey, R.W.1980. Sorghum pigeonpea intercropping and effects of plant population. I. Resource use. *J. Agri. Sci. (Cambridge)*. 95:51-58.

Okibo, B.N.1981. Evaluation of plants interactions and productivity in complex mixture as a basis for improved cropping system designs. *In.* Proc. International Workshop on Intercropping. ICRISAT, Patancheru, Hyderabad.pp.155-179.

Shinde, S.B., Jadhav, A.S., Varshney, M.C.and Naidu, T.R.V. 1996. Light use efficiency of sunflower based intercropping systems under rainfed conditions. *J. Maharashtra Agri. Univ.*, 21 (2): 268-271.

Sivakumar, M.V.K. and Viramani, S.M.1980. Growth and resource use of maize, pigeonpea and maize / pigeonpea intercrop in an operational research watershed. *Exper. Agri.*,16: 377-386.

Srinivas, K., Varshney, M.C., Jadhav, A.S., Thakur, S.S. and Naidu, T.R.V.1995. Studies on interception of radiation and light use efficiency in intercropping systems. *J. Maharashtra Agri. Univ.*, 20 (2): 269-273.

Willey, R.W. and Natarajan, M.1978. Some aspects of resource use in sorghum pigeonpea intercropping. IARI, New Delhi.