Journal of Agrometeorology 4 (2) : 187 -190 (Dec 2002)

Short communication

Effect of intercropping on reflected photo-synthetically active radiation in rainfed crops

P. K. SINGH*, A. S. JADHAV AND M. C. VARSHNEYA
Department of Agricultural Meteorology, Mahatma Phule Krishi, Vidyapeeth, College of Agriculture, Pune-411005.

Intercropping systems have built-in mechanism of risk bearing against bad weather conditions (Raheja, 1973). Experimental evidence has also proved that yield stability is greater with intercropping than sole cropping (Rao and Willey, 1980). In intercropping, the competition for light in component crop can be minimized (Okigbo, 1981) by proper choice of crop and genotypes. Shade tolerant, short duration crop is recommended so that late harvested component is not much affected and light interception within the crop canopy is improved which finally leads to higher efficiency. Bandhopadhyay (1987), observed that sole sorghum canopy intercepted less amount of incident solar radiation than that of intercropped sorghum canopy. This was due to higher LAI under intercropped situation compared to the sole sorghum situation.

In this paper the reflected photo synthetically active radiation under sorghum based intercropping system is presented. The experiment was conducted at CASAM, Pune during *kharif* season of 1996. The incident PAR and reflected radiation were measured at solar noon between 11.30 - 1300 hrs with the help of line quantum sensor always held horizontal and leveled to eliminate the effect of solar elevation. Observations were recorded at 14 day interval from 28 DAS after sufficient development of leaf area. The line quantum sensor was connected to a data logger and two values were recorded from each site for accuracy and their average was considered.

Total reflected PAR by canopy + soil (RPARc) was measured by inverting the line quantum sensor and holding it 30cm above the canopy across the rows and instantaneous value was recorded. The percentage value was calculated by dividing it with incident PAR and multiplying by 100. Similarly the reflected PAR by soil (RPARs) was measured by holding the inverted line quantum sensor at 15cm above the soil across the rows. RPAR by canopy was determined by deducting the RPARs from RPARc.

The results indicated that RPARc values increased with increase in crop age up to 42nd day and decreased with increase in crop age (56 and 70 DAS) and again increased (Table 1) by the 98th day. They slightly decreased at harvest of sorghum (112th day). RPARc value was significantly the lowest under sorghum + pigeonpea intercropping; whereas it was significantly the highest under sole soybean around the 28th day except in sole sorghum which was on par with sole pigeon pea. The

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

Table 1: Mean reflected PAR (%) of canopy and soil in different treatments.

Treatments	Day after sowing									
	28	42	56	72	84	96	112	126	140	156
SR + PP	4.3	6.4	4.8	5.0	5.8	7.4	7.8	8.6	7.8	8.6
SR+GN	5.5	7.1	4.2	4.5	5.2	6.7	6.8			
SR+SB	5.7	6.4	5.0	4.2	5.4	7.3	6.7			
Sole SR	6.2	6.6	4.9	4.9	6.3	6.7	6.6			
Sole PP	5.8	6.2	5.7	5.3	5.2	6.3	6.9	7.4	6.9	7.4
Sole GN	5.1	6.0	5.4	4.6	5.6	7.5	-			
Sole SB	6.9	5.9	4.9	4.8	5.8	7.6	-			
SE ±	0.3	0.2	0.2	0.1	0.3	0.3	0.5	0.7	0.5	0.5
C.D at 5%	0.8	0.6	0.7	0.3	-	-	-	-	-	-
Mean	5.6	6.4	5.0	4.8	5.6	7.1	7.0	8.0	8.0	7.1

SR - Sorghum, PP- Pigeonpea, GN- Groundnut and SB- Soybean

Table 2: Mean reflected PAR (%) of canopy in different treatments.

Treatments	Day after sowing									
	28	42	56	72	84	96	112	126	140	156
SR + PP	2.5	4.6	4.0	4.0	4.5	4.8	5.0	4.9	5.1	4.4
SR+GN	3.6	5.3	3.5	3.6	4.0	4.4	4.3			
SR+SB	3.9	4.4	3.9	3.4	4.1	4.9	4.3			
Sole SR	4.4	4.8	4.0	3.8	4.9	4.4	4.3			
Sole PP	3.8	4.5	4.4	3.9	3.9	4.2	4.4	4.5	4.0	3.9
Sole GN	3.2	4.2	4.4	3.7	4.2	5.1	-			
Sole SB	4.9	4.2	4.3	4.	4.3	5.4	-			
SE ±	0.1	0.2	0.2	0.1	0.2	0.2	0.3	0.5	0.3	0.2
C.D at 5%	0.6	0.6	-	0.3	-	0.5	-	-	-	-
Mean	3.4	4.6	4.1	4.8	4.3	4.8	4.4	4.7	4.5	4.1

RPARc values were significantly more under sorghum + pigeon pea and sole sorghum than other cropping systems on the 70th DAS. Similar results were reported by Rosenthal *et.al* (1985) in sorghum, Gallo and Daughtry (1986) in corn canopies and Srinivas (1995) in Pearl Millet + Pigeonpea, Sunflower + Pigeonpea intercropping.

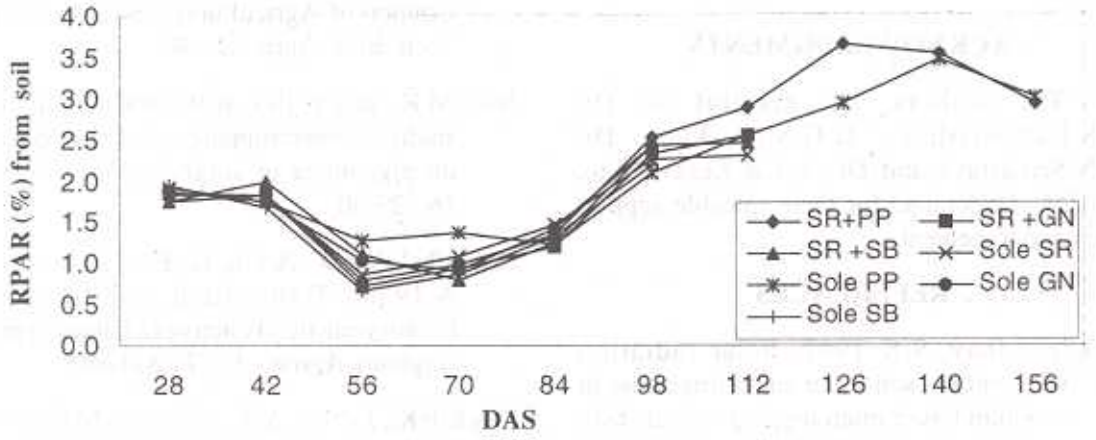

Fig. 1 : Mean reflected PAR (%) by soil under different treatments.

In general, RPARs values were the highest during the initial stages of crop growth (Fig 1) owing to more exposure of soil due to less leaf area index. With the advancement in the crop age, leaf area index (Singh *et al*, 2001) increased up to flowering period of respective crops, which caused reduction in the RPARs values. However they showed an increasing trend again due to senescence of leaves as the crop approached maturity.

The values were not significantly influenced throughout crop growth period except around 56th and 70th DAS. RPARs values were significantly more under sole pigeonpea than sorghum + pigeonpea and sorghum + groundnut intercropping and sole crops of sorghum and soybean around the 56th day, because of slow crop growth in pigeonpea. It was also observed that RPARs values were significantly more under sorghum + soybean intercropping also around the 56th day.

In general, RPAR increased with increase in crop age up to 42nd day because of increase in leaf area and leaf area index. This parameter also showed a decrease around 56 DAS and again increased by the 70 DAS. The RPAR values were not influenced significantly on the 56, 84,112th day onward (Table 2). They were significantly the lowest under sorghum + pigeon pea intercropping and significantly the highest under sole soybean around 28 DAS. RPAR values increased significantly under sole sorghum and sole pigeon pea as compared to sole groundnut at the same time (112 DAS) because of dense canopy and small size of leaves of groundnut. RPAR values were significantly the highest under

sorghum + groundnut intercropping at 42nd DAS. The lowest value of RPAR (3.4%) was recorded under sorghum + soybean intercropping by 70DAS.

ACKNOWLEDGMENTS

The authors are grateful to Dr. Y.S.Ramakrishna, G.G.S.N Rao, Dr. N.N.Srivastava and Dr. A.V.R.Kesava Rao, 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.

Gallo, K.P. and Daughtry, C.S.T.1986. Technique for measuring intercepted and absorbed photosynthatically active radiation in corn canopies. *Agron. J.*, 78 : 752-756.

Okigbo, B.N.1981. Evaluation of plants interactions and productivity in complex mixture as a basis for improved cropping systems designs. In. Proc. International Workshop on Intercropping. ICRISAT, Patancheru, Hyderabad. 10-13 January 1979, pp.155-179.

Raheja, P.C.1973. Mixed Cropping. Indian Council of Agricultural Research (ICAR) Tech. Bull. Agric.42 : 40 .

Rao, M.R., and Willey, R.W.1980. Preliminary studies of intercropping, combination based on pigeonpea or sorghum. *Expt. Agric.*, 16 : 29-30.

Rosenthal, W. D., Arkin, G. F. and Howell, T. A.1985. Transmitted and absorbed Photosynthetically active radiation in grain sorghum. *Agron. J.*, 77 : 841-845.

Singh, P.K., Jadhav, A.S., Varshney, M.C., Bote, N.L.and Khanadgonda 2000. Performance of Radiation use efficiency of sorghum based intercropping. *Indian J. Dryland Agric. Res. & Dev.*, 15(2) : 104-109.

Singh, P.K., Jadhav, A.S., Varshney, M.C., Bote, N.L.and Naidu, T.R.V. 2001. Effect on Area Development for different Sorghum Based Intercropping systems under Rainfed Conditions. *Indian J. Dryland Agric. Res. & Dev.*, 16 (2) : 162-164.