National Seminar on Agrometeorology

Theme: Operational Agrometeorology for agricultural production

Diurnal variation in radiation, radiation balance and canopy temperature of Sesamum and Greengram under Sesamum-Greengram Intercropping system

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Introduction:

Radiation balance over a crop canopy indicates the partitioning of incoming radiation within a canopy. As absorption, transmission and reflection within a crop canopy determine the growth and productivity of the crop (Lindquist *et al*, 2005; Sharma *et al*, 2000 and Parya, 2009), the radiation balance becomes important in determining the growth and yield of the crop.

Moreover, radiation incident on leaf alters the leaf physiological processes regulating growth and yield (Chakraborty, 1994).

Intercropping, where two or more crops of different natures are grown together in different row ratios, alters the radiation balance in respect of the component crops.

Variations in canopy temperature may also take place under intercropping system and this has not been well documented.

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The present paper initiates a discussion on the diurnal variation of the radiation balance as well as canopy temperature in sesamum-greengram intercropping system, where sesamum and greengram were grown in 1:1, 2:1, 4:1 row ratios in a two year experiment.

Materials and methods

Location : BCKV Instructional Farm (22°56'N and 88°32'E, 9.75AMSL)
Year : 2007 and 2008 Season : Prekharif .
Experimental soil: Typical entisol having neutral pH.
Climate is sub humid tropical with an annual average rainfall of 1457mm, 85% of which is received during June to September.

The sesamum (cv. Rama) was grown with two greengram varieties (cv.B-105 and WBM-4-34-1-1) with different row ratios which had generated nine treatment combinations -

sole sesamum (cv. Rama),
sole greengram (cv. B-105),
sole green gram (cv. WBM-4-34-1-1),
sesamum : greengram (cv. B.-105) 1;1,
sesamum: green gram (cv. WBM-4-34-1-1) (1:1),
sesamum : green gram (cv. B-105) 2:1,
sesamum: greengram (WBM-4-34-1-1) 2:1,
sesamum: greengram (cv. B-105) 4:1
sesamum: greengram (cv. WBM-4-34-1-1) 4:1.

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The crop received N P K as 40, 20 and 40 kg N,P_2O_5 and K_2O per hectare where N,P and K were given as urea, single super phosphate and muriate of potash respectively.

The experiment was laid out in RBD having a plot size of 15m^2 with four replications. The PAR and canopy temperature were measured with the help line quantum sensor and Infra-red thermometer at 9.30, 11.30 and13.30 hours on 30th, 45th and 60th days after emergence. Radiation balance was computed following standard procedure. For brevity pooled mean of two years have been presented.

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Treatment	30 DAE					
	9.30h		11.30h		13.30h	
	S	G	S	G	S	G
T1	50		60		44	
T2		49		50		48
T3		48		50		48
T4	50	46	60	48	44	46
T5	50	48	60	50	44	47
T6	50	45	60	46	44	43
T7	50	46	60	47	44	44
T8	50	48	60	48	44	40
T9	50	49	60	48	44	42

45 DAE						
T1	202		423		333	
T2		166		414		319
T3		157		416		319
T4	202	149	423	405	333	306
T5	202	153	423	409	333	308
T6	202	144	423	396	333	279
T7	202	148	423	400	333	280
T8	202	153	423	405	333	270
T9	202	154	423	407	333	274

60 DAE						
T1	58		64		42	
T2		40		42		28
T3		40		43		30
T4	58	30	64	40	42	28
T5	58	31	64	40	42	29
T6	58	28	64	38	42	28
T7	58	31	64	39	42	26
T8	58	28	64	38	42	27
T9	58	29	64	37	42	25

Table 1 Diurnal variation in incident (PAR) under sesamum -greengram intercropping system in 30,45 and 60th days after emergence.

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30 DAE																
Treatment	Plant Absorbed (w/m^2)						Soil Absorbed (w/m^2)						Total Reflection (w/m			
	9.30h		11.30h		13.30h		9.30h		11.30h		13.30h		9.30h		11.30h	
	S	G	S	G	S	G	S	G	S	G	S	G	S	G	S	G
T1	20.1		28.5		18.5		22.8		26.5		20		7.1		5	
T2		28.5		30		28.2		14.6		15		14.5		5.9		4
T3		30.6		30.5		28.6		12.5		14.8		13		4.9		4.7
T4	27.2	28	34.5	30	20.5	26.5	15.5	13.9	18.8	14	16.8	13.8	7.3	4.1	6.7	4
T5	33.4	28.7	38.8	30.2	20.8	27.2	11.7	10.1	16.5	12.2	16	10.5	4.9	9.2	4.7	7.6
T6	29.7	19.9	34.4	28	24.5	20.5	13.1	11.1	18.6	13.8	12.8	12	7.2	14	7	4.2
T7	34.5	27.8	40	29.7	26.6	22.8	10.5	9.8	16	12	12.2	10	5	8.4	4	5.3
T8	30.5	19.2	36.5	25.7	25.5	19.8	12.5	10.8	16.8	12.5	11	10.8	7	18	6.7	9.8
T9	35.6	24.5	40.5	26.5	28.2	20.5	10	8.5	15.5	11	10	8.6	4.4	16	4	10.5

Table 2 Diurnal variation in Radiation Balance (PAR) under sesamum-greengram intercropping system in 30,45 and 60th days after emergence (i)

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45 DAE																
Treatment	Plant Absorbed (w/m^2)						Soil Absorbed (w/m^2)						Total Reflection (w/m			
	9.30h		11.30h		13.30h		9.30h		11.30h		13.30h		9.30h		11.30h	
	S	G	S	G	S	G	S	G	S	G	S	G	S	G	S	G
T1	139		319		270		32.4		74.5		29.5		30.6		29.5	
T2		126		342		252		23.8		58.5		36		16.2		13.5
T3		130		346.5		270		10.8		56		18		16.2		13.5
T4	148	117.5	337.5	310	279	212.4	27	17.5	72	85.5	27.9	63	27	14	13.5	9.5
T5	151	121.5	342	336	280	215	25	18.9	71.1	64	27	63	26	12.6	9.9	9
T6	149	108	333	320.4	281.2	193.5	26	22.5	71.5	62.1	25.3	58.5	27	13.5	18.5	13.5
T7	153	114.3	344.2	328	283.5	193.5	23	21.1	69.3	63	25	59.5	26	12.6	9.5	9
T8	153	99	338.4	324	284.4	176.5	24	40.5	70.2	72	23.4	67.5	25	13.5	14.4	9
T9	155.7	102.6	345.6	324	288	182	22	37	67.5	74.5	21.6	66.5	24.3	14.4	10	9.5

Table 2 Diurnal variation in Radiation Balance (PAR) under sesamum-greengram intercropping system in 30,45 and 60th days after emergence (ii)

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60 DAE														
Treatme	Plant						Soil						Total	
	9.30h		11.30h		13.30h		9.30h		11.30h		13.30h		9.30h	
	S	G	S	G	S	G	S	G	S	G	S	G	S	G
T1	46.4		51.8		34		5.3		6.4		1.8		6.3	
T2		34.4		36.1		23.5		1.6		2.3		0.8		4
T3		35		37.8		25.5		1.2		1.7		0.9		3.8
T4	47.6	24.6	52.5	33.6	34.8	23.2	4.2	1.5	5.9	2	1.4	1.4	6.2	3.9
T5	48.1	25.7	53.1	34	35.3	23.8	3.9	1.5	5.5	3	1.1	2	6	3.8
T6	47.7	22.7	54.4	31.5	35.7	22.9	4.3	1.7	4.1	3.3	0.6	1.6	6	3.6
T7	49.8	25.4	55	33.1	36.2	21.8	2.4	2	3.5	2.8	0.2	1	5.8	3.6
T8	49.3	22.4	54.4	31.1	36.1	22.1	3.1	2.1	4.4	3.7	0.3	1.6	5.6	3.5
T9	50.4	23.5	55.7	32	36.9	21	2.1	2.1	3.5	1.8	0.1	1	5.5	3.4

Table 2 Diurnal variation in Radiation Balance (PAR) under sesamum-greengram intercropping system in 30,45 and 60th days after emergence (iii)

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Treatment	30 DAE						45 DAE						60 DAE			
	9.30h		11.30h		13.30h		9.30h		11.30h		13.30h		9.30h		11.30h	
	S	G	S	G	S	G	S	G	S	G	S	G	S	G	S	G
T1	33.25		33		35		29.5		34.2		31.5		34.5		34	
T2		32.25		33.5		36.25		29.7		33.75		32		36		35.5
T3		32.5		34.5		36.25		29.5		34.5		29.25		36		34.7
T4	33.25	32.25	33.5	32.75	32.25	30.75	27.5	32	32	28	31.5	30.75	29.5	28.5	33.7	35.2
T5	31.75	29.25	32.25	32.5	33	31.25	28.7	28.5	33	34.25	32	31.75	29.7	28.5	32.7	33.4
T6	30.75	31.25	31.75	31.5	34.75	35.5	28	28	34	34	31.25	32.75	30.2	28.7	33.5	33.4
T7	30.25	31.75	31	32	35.5	33	28	29	34.2	36	31.75	31.75	31.7	30.2	32.5	32.2
T8	32	32.5	34	33.5	33.5	35.75	28.5	29	34	35.75	31.75	32.25	33.7	33	32.5	33
T9	32.25	31.75	35	34	35	34.75	29	29	34.5	36.25	32	32	31.5	31.5	32	31.7

Table 3 Diurnal variation in canopy temperature under sesamum-greengram intercropping system in 30,45 and 60th days after emergence.

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Conclusion

Radiation balance over a crop canopy indicates the quantity of total radiation available for plant absorption; simultaneously reveals the amount of transmitted and reflected radiation. For this reason, it possesses its own importance.

In the present study of intercropping, it was proved that the tall crop (sesamum) is being more benefited with the presence of short stature crop.

Intercropping reduces transmission of radiation because of interception by component crops, thus reducing the availability of radiation to the ground level. In that sense, intercropping is helpful for absorption of radiation.

The canopy temperature of component crops was reduced under intercropping system, when compared to the sole stand situation. This indicated better moisture utilization under intercropping.

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Thank You

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