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LIGHT INTERCEPTION AND PRODUCTIVITY IN RICE

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ABSTRACT

A study was carried out to determine the relationship between light interception and productivity in rice. Cultivar difference could be observed in leaf area index, leaf angle, light extinction co-efficient (k), dry matter production grain yield. The study suggests that the rice cultivar with optimum leaf area index, upright leaves (low leaf angle) and lower light extinction co-efficient should be screened for higher production potential. Grain yield had negative and significant correlation with leaf angle (r = -0.3710*) and light interception r = -0.3889*), the dry matter production was found to have positive and significant (r = 0.3214*) association with grain yield.

Crop growth and productivity is mainly decided by the efficiency in utilisation of solar radiation by the green leaf area. Crop photosynthesis is a measure of light utilisation by leaf area. Photosynthesis in the field is primarily dependent upon the incident solar radiation, leaf angle or leaf orientation, and

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leaf area index. The association of light interception and crop productivity has been studied by Monteith (1965). Earlier studies on the relationship between light interception and productivity in rice revealed that the leaf orientation affects the productivity because it determines the light distribution and further utilisation (Uchijma, 1976). However studies on the inter association of light utilising attributes in relation to production potential of rice has not been attempted so far. Hence a study was undertaken to findout the relationship between light utilisation attributes and productivity in rice.

MATERIALS AND METHODS

A field experiment was conducted during samba season of 1987-88 with thirty rice cultivars in a randomised block design with three replications at paddy breeding station Coimbatore. The recommended dose of fertilizer (NPK : 100 : 50 : 50 kg/ha) was also applied. The crop was transplanted with a spacing of 20 x 10 cm. The leaf area was measured by leaf area meter at flowering phase and leaf area index was worked out. The leaf angle was measured as per the method suggested by (Alluri and Vergara 1975). The incident solar radiation falling on the canopy and also below the canopy -was measured at flowering stage with integrated quantum Radio meter/photometer and expressed as microeinstein/sec/m^2. The light interception (Balakrishnan and Natarajaratnam 1987) and light extinction co-efficient (k) (Monsi and Saeki, 1953) were worked out. The data were subjected to correlation co-efficient. The yield of grain and straw were estimated at harvest stage.

RESULTS AND DISCUSSION

Data on the leaf area index, incident radiation falling on the canopy, within the canopy, light interception, leaf angle, light extinction co-efficient, dry matter production and grain yield were presented (Table 1). The leaf area index differ significantly among-cultivars. It ranged from 2.89 to 6.74 The highest leaf area index was recorded in 6.74 in IR 54 followed by 5.41 in ASD 5. Cultivar difference in leaf area index also leads to variations in light absorption. The variations in light intensity within the canopy reveals the difference in light absorption by varieties. It leads to the difference in light interception among varieties. The highest light interception of 96.5% was recorded in ASD 5 at leaf area index 5.41. The lowest light interception of 80.6% was observed at leaf area index 2.89 in Ponni. The higher light interception represents the poor transmittance of light to the lower canopy inturn decides the efficient utilisation of light for photosynthesis. The lower light interception indicates the high transmittance of light to the lower canopy and thus poor utilisation of highest for photosynthesis. Leaf angle, as a measure of leaf orientation also varied among cultivars. It ranged from 11.3 to 50.3. The lowest angle (11.3°) represents the upright leave was recorded in MDU 2. The light extinction coefficient also

TABLE 1 : Light utilising attributes.

Rice genotypes	Leaf area Index	Light Incidence upper cropping (μE/s/m²)	Light Incidence lower cropping	Light Inter ception (percent)	Leaf Angle	K	Dry matter produc tion (g/m²)	Grain yield (g/m²)
Co 30	3.54	280	50	82.1	38.1	0.48	1612	419
Co 36	4.24	350	50	85.7	20.0	0.45	776	173
Co 38	4.75	310	30	90.3	40.0	0.49	1305	385
Co 42	3.93	330	40	87.8	20.0	0.53	1357	385
Co 43	4.63	340	50	85.3	18.7	0.41	1402	524
Co 44	3.15	350	50	85.7	18.7	0.62	1357	479
TNAU 4372	3.00	360	40	88.9	14.0	0.73	1422	522
TNAU 80030	4.66	490	70	85.7	13.0	0.42	1483	453
TNAU 80042	4.82	330	80	75.7	18.7	0.30	1380	480
TNAU 831520	4.64	420	50	88.1	20.0	0.45	1188	448
TNAU 831521	4.84	420	50	88.1	16.0	0.43	1357	522
IR 20	5.20	310	40	87.0	14.3	0.39	1596	541
IR 42	4.24	360	50	86.1	14.7	0.46	1450	257
IR 54	6.70	280	40	85.7	19.0	0.29	1420	535
IR 62	4.31	370	50	86.5	14.3	0.46	1475	422
IR 64	3.95	370	60	83.7	19.3	0.46	1232	335
IET 7301	3.74	410	70	82.9	20.0	0.47	1438	573
IET 7303	3.02	410	60	85.4	18.7	0.64	1406	569
IET 7590	3.17	400	60	85.0	21.0	0.59	1737	514
AS 781/1	3.61	360	70	83.4	40.3	0.45	1478	388
AD 9408	3.81	480	50	89.6	17.7	0.59	974	379
ADT 38	4.30	320	40	87.5	20.7	0.48	1083	275
ASD 5	5.41	530	20	96.2	40.0	0060	1322	264
ASD 11	2.89	460	50	89.1	50.3	0.76	1519	227
Bhavani	5.18	390	40	89.7	46.3	0.44	1425	320
Ponni	2.89	310	60	80.6	29.7	0.56	1488	448
White Ponni	5.09	360	30	91.6	40.0	0.49	1586	429
Paiyur	4.55	420	60	85.7	14.3	0.43	1304	294
PY 1	4.45	410	40	90.2	17.3	0.52	1448	228
MDU 2	3.87	440	80	81.8	11.3	0.44	1548	543
Mean	4.219	379	51	86.37	23.54	0.494	1385.6	412.9
SE	0.1569	-	-	-	-	-	34.486	20.097
CD	0.2772	-	-	-	-	-	57.592	47.463

TABLE 2 : Correlation of light utilising attributes with dry matter production and grain yield.

Attributes	DMP	Grain yield
Leaf area index	-0.1034	+0.1944
Leaf angle	+0.1656	-0.371*
Light interception	-0.076	-0.3889*
'K' valve	+0.0539	-0.1578
Dry matter production	-	+0.3214*

* Significant at 5% level

TABLE 3 : Intercorrelation of light utilising attributes.

Attributes	Leaf area index	Leaf angle	Light interception	KK'valve
Leaf area index	-	-0.3839*	-0.3710*	-0.1578 NS
Leaf angle	-	-	+0.3644*	+0.2699 NS
Light interception	-	-	-	+0.3902*
'K' valve	-	-	-	-

* Significant at 5% level.

varied among varieties due to its difference in leaf area index and higher transmission among cultivars. The lowest light extinction coefficient indicates the efficient light utilisation (k = 0.29), was recorded in IR 54 at leaf area index 6.70 with lower leaf angle and (19.0^{o}) and higher light interception (85.7). The variety IR 54 also performed moderately better in drymatter production (1420 g/m^2) and grain yield (535 g/m^2). Yoshida (1981) also reported that erect leaves of optimum leaf area index (4-7) with low higher extinction coefficient are efficient in light utilisation for photosynthesis and resulted in higher productivity in rice. The superiority in grain yield and biological yield in crops with small and erect leaves has also been reported for crops such as barley and wheat (Tanner et. al. 1966). Eventhough the cultivar, ASD 5 is efficient in light interception (96.2) at optimum leaf area index (5.41), very low productivity was recorded (1322 g/m^2) dry matter, (264 g/m^2 grain yield). The reason may be attributed to its higher light extinction coefficient (0.48) and droppy nature of the leaves (leaf angle 40.0^{o}). This was in agreement with the findings of the Hayashi and Ito, (1969).

The dry matter production had week and positive association with leaf angle and k value (Table 2). Significant and negative correlations were obtained between grain yield with leaf angle (-0.3710*), light interception (-0.3889*) also had significant negative association with drymatter with grain yield was also obtained (+ 0.3214*). Yoshida (1972) also obtained similar such positive correlation between grain yield and dry matter production.

The inter association between light utilising attributes (Table 3), revealed that a significant negative correlations (0.3839*) was obtained between leaf angle with leaf area index. Light interception had negative significant association with (-0.3170*) with leaf area index. The positive and significant association of leaf angle with higher interception (-0.3644**) revealed that the linear relationship of increased leaf angle leads to higher light interception. However, this is not related to productivity, because eventhough light interception was more in droppy leaves, because of self shadding it negatively correlated with productivity. It is evident from the negative association of light interception with both dry matter and grain yield (Table 2). The positive association of light interception (+0.3902*) with k value is due to the negative association of leaf area index with leaf angle and light interception. This was in close conformity with the findings of Tanaka **et al.** (1969) and Tsunoda, (1959).

It was concluded from the study that the rice cultivars with optimum leaf area index, lower leaf angle and lower light extinction coefficient should be screened for higher production efficiency. It was also found out from the study that there was close association exists between light interception, leaf angle and leaf area index.

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ECONOMICS OF REARING AND MARKETING OF SHEEP IN NORTH-WESTERN ZONE

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ABSTRACT

A study was conducted in Salem and Dharmapuri districts with 100 sample respondents to find out the economics of sheep rearing. The study revealed that 73 per cent of the farmers tended macheri cross breed and on an average, each farmer tended 19.20 ewes and 1.39 rams. Annual addition of sheep per farm was 12.78 of which 6.11 were ewes. Maintenance cost per farm worked out to Rs. 1952.81, of which labour accounted for 75.04 per cent and feed cost 17.10 per cent. Income from sheep per farm amounted to Rs. 2699.33 of which 78 per cent by sale of sheep. Marketing cost per sheep worked out to Rs. 3-5 and marketing was mainly carried out in the nearby villages and in shandies.

Sheep population in North Western Zone comprising of Salem and Dharmapuri districts estimated to be 7.22 lakhs accounting for 13.18 per cent of Tamil Nadu. Among various subsidiary occupations, sheep rearing is found popular among the farming community in this region, particularly to small and marginal farmers. The objectives of the study were (i) to find out the farmers attitude, (ii) to examine economics of sheep rearing, (iii) to assess its contribution to farm income and (iv) to estimate

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