Madras Agric. J. 79 (7) : 363 to 369 July 1992
https://doi.org/10.29321/MAJ.10.A01767

EVALUATION OF COTTON BASED MULTI-TIER CROPPING SYSTEM UNDER RAINFED CONDITIONS

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ABSTRACT

Field experiment was conducted at Tamil nadu Agricultural University, coimbatore during 1986-87 to evaluate the performance of multi-tier crop combinations under rainfed conditions. The results revealed that the physiological parameters viz., Net Assimilation Rate, Relative Growth Rate and Crop Growth Rate were more influenced by nitrogen levels than by crop combinations. Introduction of tall third tier crop was not found to be advantageous because of completion for resources particularly moisture, which was reflected in plant water relations. The highest yield in terms of cotton equivalent was recorded in cotton + redgram, the major contributing factors being the negative temperature differential, reduced transpiration rate and high temperature water content. The fertilizer level of 60-30-0 kg NPK / ha was found optimum.

Multi-tier crop combinations provide an efficient mean or harvesting solar energy. Besides, the root systems of the component crops are also located at distinct zones so as to explore the soil for moisture and nutrients (Palaniappan, 1985). The performance of multi-tier crop combinations under irrigated plantations crops have been well documented (Chatterjee and Maiti, 1984). The tall growing component crops in multi-tier crop combinations based on annual crops under dryland conditions act as microshelters thereby alter the microclimate. Investigations to find out the effect of multi-tier crops on the performance of base crop of cotton for increasing the productivity was taken up.

MATERIALS AND METHODS

Field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore during 1986-87 to study the competitive behaviour of different multi-tier component crops on the base crop of cotton and their influence on physiological parameters and plant water relations. The soil type of the experimental site is clay loam with the pH of 8.3 and electrical conductivity of 0.3 mmohs/cm. The total rainfall received during crop period was 340 mm. The crops and varieties used were cotton (cv.MCU 10), blackgram (cv.Co5), castor (cv.TMV5), redgram (cv.SA1), and sorghum (cv.Co25). The details of the treatments are furnished below.

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Treatments :

A. Cropping system

S1 - Cotton (sole crop)

S2 - Cotton + Blackgram (2:2)

S3 - Cotton + Castor (4:1)

S4 - Cotton + Redgram (4:1)

S5 - Cotton + Sorghum (4:1)

S6 - Cotton + Castor + Blackgram (2:1:2)

S7 - Cotton + Redgram + Blackgram (2:1:2)

S8 - Cotton + Sorghum + Blackgram (2:1:2)

B. Ferlilizer levels :

F1 - 40-20-0 kg NPK/ha

F2 - 60-30-0 kg NPK/ha

F3 - 80-40-0 kg NPK/ha

The observations on Net Assimil tion Rate (NAR), Relative Growth Ra (RGR), and Crop Growth Rate (CG were estimated between 45th and 60 day, 60th and 90th day and betwe 90th day and 120th day after sowir Observations on plant water relatio were recorded at flowering stage cotton.

Cotton equivalent was worked c by equating prices of component cr yields as suggested by De et.al., (197

RESULTS AND DISCUSSION

A. Net Assimilation Rate :

Net Assimilation Rate decreas with the advancement of crop duratic

Table - 1: Net assimilation Rate as influenced by cropping system and fertiliser levels

Treatments	Stage I 45-60 days	Stage II 60-90 days	Stage III 90-120 day
S1	0.41	0.16	0.085
S2	0.39	0.20	0.089
S3	0.44	0.27	0.149
S4	0.42	0.26	0.132
S5	0.40	0.22	0.132
S6	0.28	0.31	0.095
S7	0.41	0.22	0.126
S8	0.32	0.26	0.138
CD(P=0.05)	0.06	0.06	NS
F1	0.42	0.26	0.140
F2	0.38	0.24	0.120
F3	0.36	0.21	0.100
CD(P=0.05)	0.01	0.009	0.008

(Table - 1). This might be due to wide variations in leaf area between stages. The multi-tier cropping system involving cotton + castor + blackgram (S6) recorded the lowest NAR at stage 1. This might be due to the cumulative effect of lower leaf area development both in cotton and castor. However, the same system (S6), recorded the highest NAR at the stage 2. This was due to the exuberant growth of castor which was reflected in its drymatter (139,197 and 776 kg/ha on 45th, 60th and 90th day).

The fact that the nitrogen levels exerted a negative influence on NAR could be attributed to the reduced photosynthetic activity because of mutual shading that one could expect due to increase in nitrogen levels (Kunasekaran, 1978). Besides, the luxuriant vegetative growth due to increased nitrogen level increased the rate of transpiration.

B. Relative Growth Rate :

The reduction in relative growth rate with the advancement of crop duration (Table -2) could be attributed to the reduced rate of drymatter accumulation with the advancement of crop growth despite an increase in total drymatter. Relative growth rate of 0.015 g/g/day recorded under cotton + castor

Table - 2: Relative growth rate as influenced by cropping system and fertliser levesl (g g-1 day -1)

Treatments	Stage I	Stage II	Stage III
S1	0.055	0.014	0.009
S2	0.022	0.017	0.019
S3	0.022	0.024	0.015
S4	0.045	0.027	0.014
S5	0.020	0.019	0.015
S6	0.015	0.027	0.009
S7	0.049	0.016	0.013
S8	0.020	0.021	0.013
CD(P=0.05)	0.023	0.004	0.003
F1	0.033	0.021	0.014
F2	0.031	0.021	0.014
F3	0.032	0.020	0.013
CD(P=0.05)	NS	NS	NS

NS: Not significant

+ blackgram in stage 1 might be due to the slow establishment of cotton and castor at earlier stages.

The marginal increase in RGR under S3, S6 and S8 was due to increased drymatter between 60th and 90th day after sowing.

The nitrogen levels failed to influence RGR and so also the interaction since RGR is an inherent character of the crop (Dastur and Narasimachar, 1962).

C. Crop Growth Rate :

In sole cotton, CGR was found to decrease with the advancement of crop growth (Table - 3). This could be due to the reduced rate of drymatter accumulation over stages. The temporal variations in the rate of drymatter accumulation of the component crops might have led to the increased CGR over stages. Within stages, lower CGR recorded under multi-tier system might be due to the adverse effect of component crops (Kunasekaran, 1978 and Robinson, 1973).

Table - 3 : Crop Rate as influenced by cropping system and fertilizer levels (gm-2 day -1)

Treatments	Stage I	Stage II	Stage III
S1	7.57	3.67	3.16
S2	3.06	3.10	5.40
S3	2.28	4.14	4.72
S4	4.92	6.34	5.61
S5	1.25	3.01	4.24
S6	1.65	4.29	2.80
S7	3.66	2.81	2.80
S8	1.95	2.99	3.10
CD(P=0.05)	1.82	0.60	0.41
F1	2.59	3.14	3.49
F2	3.50	3.91	3.79
F3	3.79	4.33	4.52
CD(P=0.05)	1.42	0.21	0.37

Table 4 : Plant water relations at flowering and cotton equivalent as influenced by cropping system and fertilizer levels

Treatments	Temperature differential Tc-Ta OC	Diffusion resistance cm S^{-1}	Transpiration rate kg/cm^{-1} s^{-1}	R.W.C. %	Cotton equivalent Kg/ha
S1	+0.87	0.28	42.41	68.84	1286
S2	+1.87	0.27	43.11	64.14	1255
S3	+1.30	0.24	46.49	61.95	1098
S4	-0.80	0.27	42.66	82.78	1502
S5	+0.77	0.27	44.63	60.54	1295
S6	+0.80	0.30	42.82	68.02	1153
S8	_0.17	0.21	55.49	62.73	1117
CD*(P=0.05)	NA	NA	NA	NA	NA
F1	+0.39	0.27	44.55	65.80	1156
F2	+0.53	0.25	45.10	69.09	1199
F3	+0.55	0.25	49.60	69.04	1342
CD (P=0.05)	NA	NA	NA	NA	69

*NA : data not analysed.

The positive influence of fertilizer levels on CGR might be the result of increased drymatter accumulation with increasing nitrogen levels.

The interaction between stages and cropping system revealed that at stage 1, the sole cotton attained maximum CGR while cotton + castor (S3) and cotton _ sorghum (S5) recorded lower values. However, in the final stage, the CGR values increased. This indicated that after harvest of the tall (component) crop and CGR improved considerably and compensated the loss that occured during earlier stages.

D. Cotton equivalent :

The yield in terms of cotton equivalent showed that the cotton + redgram (S4) system was superior followed by cotton + sorghum (S5). Fertilizer levels had a positive influence on cotton equivalent. The poor performance of multi-tier cropping system involving three crop combinations (S6, S7 and S8) might be due to poor plant-water relations.

E. Plant water relations :

The temperature differential was found to be less (more negative Tc-Ta) in cotton + blackgram (S2) and cotton + redgram (S4), both of which recorded lower canopy temperatures (data not furnished). Canopy temperature had a negative relationship with soil moisture retention (Muralidaran, 1987). High photosynthetic activity was observed under such conditions (Gardener et.al. 1981) which might have influenced the yield. The rest of the systems were on positive side indicating reduced plant water status, Diffusion resistance played a vital role in influencing the transpiration rate, which were negatively correlated (r=0.75**). This might be due to the increased stomatal conductance which resulted in an increase in the transpiration rate.

Increasing the fertilizer levels was found to increase the temperature differential on the positive side indicating its adverse effect on plant water status. This is understandable since the fertilization would result in luxuriant foliage which would have increased the transpiration rate thereby depleting the soil moisture.

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Madras Agric. J. 79 (7) : 369 to 373 July 1992

GERMINATION AND SEEDLING VIGOUR OF COCONUT CULTIVARS UNDER OPEN AND PARTIAL SHADE

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ABSTRACT

A trial was conducted to evaluate the rate of germination, vigour and recovery of quality seedlings with two cultivars of coconut, West Coast Tall and Komadan under open and partial shade in the Instructional farm attached to the College of Agriculture, Vellayani during 1986-87. Rate of germination of Komadan seednuts under open conditions was found to be significantly higher upto five months though West Coast Tall seednut registered the maximum germination percentage at eight months after sowing. More than 50 per cent of Komadan seednuts germinated within the first four months of sowing indicting its ability for early germination which revealed that Komadan cultivars of coconut possessed desirable economic characters such as precocity in flowering and higher nut production potential. Seedling characters such as height, girth at collar, number of leaves, plant spread and weight were found to be higher under open conditions irrespective of cultivars. The study also revealed that direct sunlight was essential for expressing seedling vigour. Though significant difference could not be observed between treatments with regard to recovery of quality seedlings, komadan cultivar produced the maximum number.

The seedlings in coconut nursery will vary in vigour and other growth characters. Careful selection of seedlings on the basis of certain recognised standards is necessary to ensure their better future performance (Thampan, 1982). Early germination and vigour of seedlings are the two main factors that are considered for selection. Menon and pandala (1957) reported that early