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Effect of intercropping and foliar nutrition on the productivity of summer irrigated cotton

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Abstract : Field experiments were conducted during the summer season of 1994 and 1995 at Cotton Research Station, Srivilliputtur to study the effect of intercropping and foliar nutrition on the productivity of summer irrigated cotton. Cotton + blackgram raised in paired row system (2:1) produced higher mean seed cotton yield equivalent (1815 kg/ha), mean net return (Rs. 17,724/ha) and mean benefit cost ratio (1.96). Spraying DAP two per cent + KCI one per cent (1:1) solution was found more economical. Raising cotton + blackgram in paired row 2:1 ratio and spraying DAP two per cent + KCI one per cent (1:1) solution resulted in the highest net return of Rs. 20,225 and benefit cost ratio of 2.12. (*Key Words : Cotton, Intercropping, Paired row, Foliar nutrition).*

Cotton, being a longer duration and widely spaced crop having slow growth rate in the initial stages, is ideally suited for raising intercrops in between. Adjusting the method of planting without reducing the base crop population, will ensure possibilities for introducing a legume with cotton. Intercropping would have adverse effect on plant height, number of symbodial branches and dry matter accumulation per plant of cotton (Sethi *et al.*, 1992). Earlier studies indicated that intercropping of cotton with short duration legumes, cereals and oilseed to be more remunerative than sole cotton (Tomar *et al.*, 1994 and Sarkar *et al.*, 1995). A long duration crop like cotton would have responded well to foliar nutrition, especially under intensive cropping system. Wankhade *et al.*, (1994) observed yield improvement in cotton through foliar spray of DAP two per cent peak squaring and peak flowering stages. The present study was undertaken to find out the effect of foliar nutrition in a cotton based intercropping system under summer irrigated situation.

Materials and Methods

Field trials were conducted during summer season of 1994 and 1995 at Cotton Research Station, Srivilliputtur. The experimental site was sandy clay loam in texture having low available N (196.0 kg/ha), medium available P (18.5 kg/ha) and high available K (642.5 kg/ha) with 7.9 pH. The experiments were laid out in a split plot design with three replications. The treatment combinations comprised of four intercropping systems viz., cotton pure stand (S_1), cotton + blackgram (S_2), cotton + greengram (S_3) and cotton + soybean (S_4) in the main plot and eight foliar nutrient spray treatments viz., untreated control (T_1), water spray (T_2), DAP two per cent (T_3), KCI one per cent (T_4), humic acid one per cent (T_5), DAP two per cent + KCI one per cent (1:1) (T_6), DAP two per cent + humic acid one per cent (1:1) (T_7) and KCI one per cent + humic acid one per cent (1:1) (T_8) in the sub-plots. The foliar sprays were given twice on 60 and 75 days after sowing (DAS).

Sole crop of cotton was sown at 75 x 30 cm spacing and paired row system of 90/60 x 30 cm was followed for intercropping system. The cotton (SVPR 2), blackgram (ADT 5), greengram (KM 2) and soybean (CO 1) were chosen as test crops. The main and intercrops were sown during the second fortnight of March. An uniform fertilizer dose of 60:30:30 kg NPK per hectare was adopted for all the treatments. Nitrogen was applied in two equal splits, first at the time of sowing and second on 40 DAS while entire P and K were applied as basal at the time of sowing.

Results and Discussion

Effect of intercropping

The seed cotton yield, seed cotton yield equivalent, land equivalent ratio and economics as influenced by intercropping are presented in Table 1 and 2. During summer '94, the sole cotton crop recorded significantly higher seed cotton yield of 1388 kg/ha and it was on par with cotton + blackgram intercropping system (1374 kg/ha). During summer '95 cotton + greengram intercropping system registered higher seed cotton yield (1502 kg/ha) but there was no significant differences among the system of cropping. The increase in yield of cotton under intercropping situation was due to better nodulation of legume

intercrops and fixation of N in the soil, which was available to the cotton crop over and above the applied N as reported by Maragathamani (1993). Cotton + blackgram intercropping system recorded the highest seed cotton yield equivalent of 1736 and 1895 kg/ha during 1994 and 1995 respectively. The increase in cotton yield equivalent was due to higher additional yield from blackgram intercrop. Prasad *et al.*, (1993) reported higher seed cotton yield equivalent in cotton intercropping systems.

The effective land use efficiency as reflected by the land equivalent ratio (LER) was higher in intercropping systems. The range of increase was 67 to 70 per cent over sole cotton. Cotton + blackgram intercropping system recorded maximum mean land equivalent ratio (1.71) followed by cotton + greengram intercropping system (1.68). This findings are in agreement with that of Borthakur and Barthakur (1992) who reported greater LER values in cotton intercropping systems.

Intercropping system gave maximum net return as compared to sole cotton during both the years. This might be due to higher monetary return from seed cotton and respective intercrops under the intercropping systems. Cotton + blackgram intercropping system registered the highest net return of Rs. 16,636 and Rs. 18,812/ha during summer 1994 and 1995 respectively. Higher net return in cotton + blackgram intercropping system was mainly due to higher seed cotton yield and higher price fetched by blackgram than greengram and soybean. Krishnasamy *et al.*, (1995) reported higher net return from cotton + blackgram intercropping system. Benefit-cost ratio, a tool for assessing the productivity, as well as efficiency of a treatment was higher in intercropping systems compared to sole cotton. Among the intercropping systems, cotton + blackgram showed the highest economic efficiency, with a benefit cost ratio of 1.92 and 1.99 during summer 1994 and 1995 respectively.

Effect of foliar nutrition

Foliar nutrition had a significant effect on seed cotton yield and its equivalent during both the years (Table 1 and 2). Spraying DAP two per cent + humic acid one per cent produced the highest seed cotton yield of 1456 and 1654 kg/ha and highest yield equivalent of 1704 and 1926 kg/ha during 1994 and 1995 respectively which were closely followed by foliar application DAP two per cent + KCl one per cent. This might be due to better absorption and utilization of foliar applied nutrients at critical stages of cotton growth. Yield increase in cotton due to foliar application of DAP and humic acid was also reported by Wankhade et al. (1994) and Solaiappan et al. (1995). The increase in seed cotton yield due to combined spray of DAP two per cent + humic acid one per cent were 15.5 and 11.7 per cent during 1994 and 35.0 and 30.0 per cent during 1995 over control. In the case of seed cotton yield equivalent, there was 13.6 and 30.1 per cent enhanced yield over control during 1994 and 1995 respectively.

The mean data on net return revealed that DAP two per cent + KCl one per cent spray recorded the highest net return of Rs. 17,169/ ha which was followed by DAP two per cent + humic acid one per cent spray (Rs. 17,118/ha). Application of DAP two per cent + KCl one per cent spray gave the highest benefit cost ratio, 1.89 and 2.01 during 1994 and 1995 respectively.

Thus, it can be concluded that raising of cotton + blackgram in paired row system (2:1) and foliar spraying of DAP two per cent + KCl one per cent (1:1) solution on 60 and 75 DAS was found to be a suitable remunerative technology for summer irrigated situation in Virudhunagar district of Tamil Nadu.

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Table 1. Effect of intercropping and foliar nutrition on seed cotton yield and seed cotton yield equivalent.

Treatments	Seed cotton yield (kg ha^{-1})		Seed cotton yield equivalent (kg ha^{-1})		Land Equivalent Ratio		
	1994	1995	1994	1995	1994	1995	Mean
Intercropping system							
S_1 - Cotton - pure stand	1388	1476	1388	1476	1.00	1.00	1.00
S_2 - Cotton + blackgram	1374	1495	1736	1895	1.79	1.63	1.71
S_3 - Cotton + greengram	1315	1502	1689	1870	1.79	1.56	1.68
S_4 - Cotton + soybean	1349	1481	1589	1772	1.69	1.65	1.67
SE_d	17.0	11.3	7.9	11.9	0.01	0.01	-
CD (P=0.05)	41.8	NS	19.5	29.3	0.02	0.02	-
Foliar nutrition							
T_1 - Control	1261	1225	1500	1481	1.25	1.47	1.34
T_2 - Water spray	1300	1340	1564	1599	1.23	1.44	1.34
T_3 - DAP 2.0%	1384	1546	1633	1816	1.23	1.45	1.35
T_4 - KCl 1.0%	1334	1445	1574	1707	1.24	1.48	1.36
T_5 - Humic acid 1.0%	1373	1534	1617	1798	1.23	1.45	1.34
T_6 - T_3+T_4 (1:1) spray	1408	1593	1649	1858	1.21	1.44	1.33
T_7 - T_3+T_5 (1:1) spray	1456	1654	1704	1926	1.19	1,48	1.34
T_8 - T_4+T_5 (1:1) spray	1335	1573	1582	1842	1.23	1.46	1.35
SE_d	36.6	21.4	18.7	22.2	0.02	0.02	-
CD (P=0.05)	73.4	43.0	37.5	44.5	NS	NS	-

Table 2. Effect of intercropping and foliar nutrition on net return (Rs. ha^{-1}) and Benefit cost Ratio

Treatments	Netreturn (Rs. ha^{-1})			Benefit cost Ratio		
	Summer 1994	Summer 1995	Mean	Summer 1994	Summer 1995	Mean
Intercropping system						
S_1 - Cotton - pure stand	10234	10849	10542	1.58	1.58	1.58
S_2 - Cotton + blackgram	16636	18812	17724	1.92	1.99	1.96
S_3 - Cotton + greengram	15711	18302	17006	1.87	1.96	1.92
S_4 - Cotton + soybean	13764	16407	15086	1.77	1.86	1.82
SE_d	-	-	-	-	-	-
CD (P=0.05)	-	-	-	-	-	-
Foliar nutrition						
T_1 - Control	12830	11360	12098	1.75	1.62	1.68
T_2 - Water spray	13662	13610	13636	1.79	1.74	1.76
T_3 - DAP 2.0%	15198	17840	16519	1.87	1.96	1.91
T_4 - KCl 1.0%	14148	15770	14959	1.81	1.86	1.83
T_5 - Humic acid 1.0%	12742	15240	13991	1.65	1.74	1.69
T_6 - T_3+T_4 (1:1) spray	15588	18750	17169	1.89	2.01	1.95
T_7 - T_3+T– (1:1) spray	15395	18840	17118	1.82	1.96	1.89
T_8 - T_4+T_5 (1:1) spray	13127	17325	15226	1.71	1.89	1.80
SE_d						
CD (P=0.05)						

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Influence of irrigation regimes and comrade cropping on biochemical composition and yield of cassava, groundnut and sesame

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Abstract : Field experiments were conducted at Tamil Nadu Agricultural University, Coimbatore to evaluate the influence of irrigation regimes and comrade cropping on biochemical composition and yield of cassava, groundnut and sesame. Frequent and adequate irrigation at 0.45 or 0.6 IW/CPE ratio increased the starch and total sugar content of cassava and also its tuber yield. The crude protein content of groundnut was significantly low in 0. IW/CPE ratio while its seed yield was maximum at this irrigation regime. The oil content of sesame was maximum at 0.6 IW/CPE ratio where as the seed yield was highest at optimum irrigation regime of 0.45 IW/CPE ratio. Comrade cropping of cassava with either groundnut or sesame did not significantly influence the biochemical composition of any of these crops. The yield of cassava was not affected when revised as comrade crop with groundnut but was drastically reduced when raised with sesame. (*Key Words : Irrigation regimes, comrade cropping, biochemical composition).*

Cassava is cultivated in about 0.48 lakh hectares in Tamil Nadu with a production of 1.5 million tonnes of tuber annually contributing about 42 per cent of the national production. Even with the higher contribution to the national cassava production, the productivity (10.25 tonnes ha^{-1}) is far below the normal productivity (19.33 tonnes ha^{-1}) (FAO, 1998) as well as the maximum (40 tonnes ha^{-1}) potential productivity. Inadequate provision of inputs like water and nutrients are the probable reasons for the low productivity. Any attempt to develop a package for efficient irrigation and moisture management may pave way for increasing the productivity of cassava. Cassava being a wide spaced crop with slow initial establishment and canopy coverage provides scope for raising short duration crops at early growth stages particularly under irrigated condition. With a view to accommodate the full population of cassava as well as intercrops, the concept of comrade cropping is being exploited. In this context an attempt has been made to combine scheduling of irrigation and comrade cropping and find its role on the biochemical composition and yield of cassava. groundnut and sesame.

Materials and Methods

The experiment was laid out during 1993 in Eastern Block of Tamil Nadu Agricultural University, Coimbatore. The soil of the experiment site was deep and clayey with moderately well drained condition. The soils were low in available N (103 kg ha^{-1}), medium in available P (18.7 kg ha^{-1}) and high in available K (360 kg ha^{-1}). Cassava variety Co 2 with a duration of nine month, groundnut Co 1 maturing in 105 days and sesame Co 1 with a duration of 90 days were taken up in this study. Treatments on irrigation regimes were designed by taking into account the limited water resource situations. Three irrigation regimes based on irrigation water requirement and pan evaporation values were fixed with a view to study the effect of moisture stress and to optimize the irrigation