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Studies on intercropping in winter irrigated cotton

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Abstract : Field experiments were conducted during 1994-95 and 1995-96 at the Cotton Breeding Station, Tamil Nadu Agricultural University, Coimbatore to study the suitable intercrops (cowpea, blackgram, greengram and soybean) for winter irrigated cotton (MCU.5). The intercrops were sown on two dates viz., 20 days in advance and sown simultaneously with cotton. Soybean (Co. 2) recorded the highest grain yield (1483 kg/ha) when sown 20 days in advance to cotton followed by cowpea (Co. 6). When intercrops were sown simultaneously, cowpea recorded the highest grain yield (1108 kg/ha) followed by soybean (1099 kg/ha). Under both advance and simultaneous sowing, blackgram (Co. 5) and greengram (Co. 5) recorded lesser grain yield than soybean and cowpea. The kapas yield of cotton was reduced drastically by soybean compared to that of sole of cotton. The intercrops viz., cowpea, blackgram and greengram increased the kapas yield compared to that of sole of cotton, when they were sown in advance. When sown simultaneously with cotton, the seed cotton yield was increased by cowpea and blackgram. Based on net return and benefit cost ratio, cowpea was found to be the best suited intercrop for MCU.5 cotton.
(Key Words : Cotton, Cowpea, Blackgram, Greengram, Soybean, Intercrops)

Cotton is an important commercial fibre crop in India. In Tamil Nadu, the cotton area has come down from about 8.0 lakh hectares to 2.68 lakh hectares within two decades since 1970's. This is mainly due to increase in the cost of cultivation and also replacement of cotton by other crops. To make the cotton cualtivation economically viable, intercropping seems to be a viable proposition. Blackgram and greengram were found to have no adverse effects on cotton yields (Singh and Chauhan, 1981; Chellaiah, 1996). When blackgram was sown three weeks in advance to cotton, the growth and yield of cotton was increased (Robinson, 1973). Hence, the present investigation was contemplated to find out the suitable intercrop for winter irrigated cotton and to see their effect on cotton when sown 20 days in advance and sown simultaneously.

Materials and Methods

Field experiments were conducted for two years (1994-95 and 1995-96) at the Cotton Breeding Station, Tamil Nadu Agricultural University, Coimbatore with cotton (MCU.5) as main crop and cowpea (Co. 6), greengram (Co. 5), blackgram (C0.5) and soybean (Co.2) as intercrops. Intercrops were sown in two different dates viz., 20 days in advance to cotton (3.8.94 and 4.8.95) and sowing simultaneously (23.8.94 and 24.8.95) with cotton. Cotton was planted in normal rows with 75 x 30 cm spacing. One row of intercops were sown in between cotton rows. The intercrops viz., soybean, greengram and blackgram were sown with an intrarow spacing of 10cm while cowpea was sown with 15 cm. The trial was laid out in RBD with three replications. The soil type of the experimental field was clay loam with low available N (303 kg/ha), medium P (20 kg/ha) and high K (603 g/ha). The soil pH was 7.4 with an EC of 0.4 dSm^{-1}. The crops were raised under irrigated condition. The different intercrops were harvested after pod

maturation (70 to 90 days after sowing). Plant protection measures were given as and when required.

The recommended dose of fertilizers for pulses (25:50:0 kg NPK/ha for greengram, blackgram and cowpea; 20:80:40 kg NPK/ha for soybean) were applied as basal. The recommended dose of fertilizer for MCU.5 cotton (80:40:40 kg NPK/ha) was applied in split doses of 40:40:40 kg NPK/ha as basal and 40 kg N/ha as top dress on 45th day of sowing.

Data on plant height of cotton at first picking (144th day of sowing), number of symbodial branches per plant, number of bolls per plant and *kapas* yield per plot were recorded. The grain yield of intercrops per plot was also recorded. After converting the plot yields of *kapas* and intercrops into hectare yields, the conomics of intercropping of cotton was worked out.

Results and Discussion

Growth and yield attributes of cotton

The variations in plant height of cotton recorded at first picking was not significant due to the intercrops tried compared to sole cotton crop, irrespective of advanced and simultaneous sowing of intercrops. More sympodial branches and higher boll numbers per plants were observed due to intercropping of cowpea and blackgram compared to sole cotton. The number of sympodial branches and boll number per plant were fairly lesser due to intercropping of soybean and greengram compared to intercropping of cowpea and blackgram (Table 1). However, there were no significant differences in respect of boll number and sympodial branches per plant, due to advanced or simultaneous sowing of intercrops.

Kapas Yield

Soybean as intercrop reduced the kapas yield drastically compared to sole cotton yield (Table 2). The reduction in kapas yield was 25.8 and 28.3 per cent, respectively, due to advance sowing of soybean prior to cotton and simultaneous sowing of it with cotton. Reduction in kapas yield due to soybean has reported by Wankhade (1994). The intercrops viz., cowpea and blackgram markedly increased the kapas yield when they were sown 20 days in advance to cotton. However, when all the three intercrops were sown simultaneously with cotton, only the green gram reduced kapas yield slightly (6.4 per cent lesses than sole cotton) and the reduction being not significant statistically. This corroborated with the findings of Singh and Chauhan (1981). It may be inferred that soybean as intercrop reduced the seed cotton yield while cowpea and blackgram as intercrops increased the seed cotton yield compared to that of sole cottor both under advanced and simultaneous sowing.

The increase in kapas yield was 22.0, 15.7 and 4.9 per cent, respectively, over sole cotton yield, due to intercropping of cowpea, blackgram and greengram when they were sown 20 days in advance to cotton. When they were sown simultaneously, the increase in kapas yield was 11.1 and 11.6 per cent respectively, over sole cotton yield, due to intercropping cowpea and blackgram. The highest kapas yield (1636 kg/ha) and net return (Rs.27467 ha^{-1}) were obtained in cotton + cowpea intercrop system where cowpea was sown 20 days in advance.

The increase in kapas yield due to cowpea, blackgram and greengram sown 20 days in advance may be attributed to their complementary effect by way of lesser competition for light, nutrients, moisutre on the one hand and supply of nitrogen in view of their N fixation on the other hand. The highest kapas yield due to advanced and simultaneous sowing of cowpea, compared to other intercrops, may also be attributed to its shortest duration among the intercrops tried. The yield increase in any intercropping system in general was ascribed to better interception of light (Reddy and Chatterjee, 1975) and increased efficiency in the conversion of solar energy into dry matter (Reddy and Willey, 1981).

The reduction in kapas yield due to soybean might be attributed to its suppressing effect on the growth and yield of cotton crop (Gode *et al.*, 1992). In the present investigation also the number of sympodial branches and boll numbers per plant were lesser under cotton + soybean treatments (T4 and T9) compared to that of cotton + cowpea (T3 and T8) and cotton + blackgram (T2 and T7) treatments, indicating the suppressing effect of soybean on cotton.

Intercrop yield

Among the intercrops tried, soybean recorded the highest grain yield (1483 kg/ha) followed by cowpea (1039 kg/ha), blackgram (746 kg/ha) and greengram (660 kg/ha) when they were sown 20 days in advance to cotton. However, when sown simultaneously, the trend was quite reverse. i.e., cowpea recorded the highest grain yield (1108 kg/ha), followed by soybean (1099 kg/ha), greengram (783 kg/ha) and blackgram (783 kg/ha) (Table 2). It may be inferred that under both advanced and simultaenous sowing, cowpea and soybean gave

Table 1. Effect of intercropping on plant height, number of sympodial branches and boll number per plant in cotton (mean of two years data)

Treatments	Plant height at first picking (cm)	Number of Sympodial branches plant $^{-1}$	Number of bolls plant $^{-1}$
Advance sowing			
T1. Cotton + Greengram	82.6	13.2	13.8
T2. Cotton + Blackgram	86.7	15.1	17.2
T3. Cotton + Cowpea	84.4	15.5	18.2
T4. Cotton + Soybean	81.6	14.9	15.0
T5. Cotton alone	83.4	10.7	14.7
Simultaneous sowing			
T6. Cotton + Greengram	82.9	13.0	13.9
T7. Cotton + Blackgram	82.1	14.7	16.4
T8. Cotton + Cowpea	83.8	15.2	17.1
T9. Cotton + Soybean	85.4	14.1	14.3
T10. Cotton alone	84.1	11.6	14.8
SEd	2.9	1.0	0.8
CD (P=0.05)	NS	3.0	2.5

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Table 2. Effect of intercropping in cotton on the kapas yield and economics (mean of two years data)

Treatments	Kapas Yield (kg/ ha)	Grain yield of intercrops (kg/ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B : C ratio
Advance sowing					
T1. Cotton + Greengram	1407	660	27685	19185	2.26
T2. Cotton + Blackgram	1551	746	30345	21845	2057
T3. Cotton + Cowpea	1636	1039	33467	27467	2.93
T4. Cotton + Soybean	995	1488	28440	19940	2.34
T5. Cotton alone	1341	--	20190	12190	1.43
Simultaneous sowing					
T6. Cotton + Greengram	1311	783	27475	19020	2.24
T7. Cotton + Blackgram	1563	702	30445	21945	2.58
T8. Cotton + Cowpea	1556	1108	43399	24897	2.90
T9. Cotton + Soybean	1004	1099	25173	16674	1.96
T10. Cotton alone	1400	--	21000	12750	1.60
SEd	70.7				
CD (P=0.05)	213.5				

Sale price of produce
Cotton kapas : Rs. 1,500/Q
Pulse grains : Rs. 1,000/Q
Soybean grains : Rs. 800/Q

Cost of cultivation
For sole cotton : Rs 8,000/ha
For cotton + intercrops : Rs.8,500/ha

higher grain yields than the blackgram and greengram.

The higher grian yield in cowpea compared to blackgram and greengram may be due to its high source sink relationship in view of its short duration (65-70 days) and architecture (compact plants) that helped to exploit the sunlight for better conversion / partitioning of drymatter. On the contrary, the higher grain yield of soybean compared to blackgram and greengram is attributed to its longest duration (85-90) among the intercrops that helped it to harvest more solar energy and consequently more dry matter accumulation. Since the leaves are green for longer period in soybean (Co.2) more photosynthates might have been diverted to grain formation.

Economics

The net return (Rs.27467/ ha) and benefit cost ratio (2.93) were the highest under cotton + cowpea intercrop system when cowpea was sown 20 days in advance to cotton. Under simultaneous sowing system also, cowpea gave a net return of Rs.24897/ha with a benefit cost ratio of 2.90. Next to cowpea in order was blackgram interms of net return and B:C ratio compared to that of sole cotton (Table 2).

From this study, it is concluded that cowpea as intercrop with cotton, irrespective of its sowing time, increased the kapas yield besides giving higher grain yields, net return and B:C ratio under winter irrigated condition of Coimbatore, Tamil Nadu.

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Interaction between *Macrophomina phaseolina* and *Heterodera cajani* in root disease complex of blackgram

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Abstract : Investigations were carried out on the root rot disease complex caused by the fungus *Macrophomina phaseoloina* (Tassi). Goid and the cyst nematode *Heterodera cajani* Koshy with reference to their interaction effect on root rot incidence, growth parameters and pod yield. When the cyst nematode was inoculated a week prior to the root rot pathogen, *Macrophomina phaseolina,* the onset of root rot disease was earlier by 15 days and the per cent disease incidence was 95 with maximum reduction in pod yield than when either of them was inoculated separately or simultaneously. *(Key Words : Root rot, Cyst nematode, Disease complex, Predisposition)*

Root rot is the most important soil borne disease of blackgram (*Vigna mungo* (L) Hepper) in India. Pigeonpea cyst nematode is also an important soil borne pest attacking many of the pulse crops including blackgram. Different parasites on the same plant interact which results in disease complex. In the presence of the nematode, the fungal incidence will be more as in the case of *Macrophomina phaseolina - Meloidogyne incognita* complex in cowpea (Devi and Goswami, 1992). Thus, major emphasis has been given to study the interaction effect of these organisms on root rot incidence and its damage on the crop growth parameters and yield.

Materials and Methods

Blackgram seeds (cv. T-9) were sown in 15 cm diameter pots with sterilized soil at 5 seeds / pot. Six treatments viz., fungal pathogen *(M. phaseolina)* alone inoculated, cyst nematode *(H. cajani)* alone inoculated, first and fungus inoculated 7 days later, nematode and fungus inoculated simultaneously and uninoculated control were laid out in a completely randomized block design under glass house condition. The pathogens were inoculated at the time of sowing.

The root rot incidence was observed at five days interval upto the crop maturity. The height of the plant, dry weights of root shoot and pod yield were measured at harvest.

Results and Discussion

The root rot incidence started appearing from 15 days after inoculation (DAI) of the fungal pathogen and reached the maximum at 60 (DAI). Inoculation of the cyst nematode first followed by the inoculation with the fungal pathogen seven days later recorded significantly the highest root rot