International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(5): 3187-3189

Received: 16-07-2019
Accepted: 18-08-2019

Suganthi S
Ph.D. Scholar, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Raja D
Principal, Adhiparasakthi Horticultural College, Vellore, Tamil Nadu, India

Corresponding Author:
Raja D
Principal, Adhiparasakthi Horticultural College, Vellore, Tamil Nadu, India

Effect of supplemental irrigation and cotton based intercropping systems on weed control and cotton equivalent yield under rainfed condition

Suganthi S and Raja D

Abstract
A field trial was conducted in farmer's field to evaluate the supplemental irrigation of cotton based intercropping system on weed dynamics under rainfed *Vertisols* during *Kharif* season of 2018-19. The treatments in vertical strip plot includes no supplemental irrigation (SI_0) (rainfed), supplemental irrigation at vegetative stage (SI_1), supplemental irrigation at squaring to peak flowering stage (SI_2), supplemental irrigation at boll formation stage (SI_3), supplemental irrigation at above mentioned all stages of cotton (SI_4) and supplemental irrigation at wilting symptom appearance (SI_5). Horizontal strip includes cotton alone (IC_0), cotton + blackgram (1:3) (IC_1), cotton + clusterbean (1:3) (IC_2) and cotton + coriander (1:4) (IC_3). Depending on the time of irrigation, the cotton equivalent yield, weed density and weed dry weight differed among supplemental irrigation treatments. But, lower value of cotton equivalent yield, weed density and dry weight was observed in control (No supplemental irrigation). Higher value of cotton equivalent yield, weed density was observed in supplemental irrigation at wilting symptom appearance. Lower weed density and weed dry weight was recorded in cotton + clusterbean (1:3) at 30 DAS and 60 DAS. Increase in plant population and canopy coverage caused increased weed smothering in cotton + clusterbean (1:3) by 25.3 to 39.5 per cent.

Keywords: Cotton, intercropping, supplemental irrigation, weed density, weed dry weight and WSE

Introduction
Cotton is known as white gold which satisfies one of our basic needs in our daily life. India ranks first largest producer and the second largest exporter in the world. Thirty two per cent of the world's area is in India. It attributes for the production of 36.1 m bale which is 21 per cent of the world's production. The average productivity of cotton in India is 31.1 per cent lesser than world's productivity. Sixty five per cent of cotton cultivation under rainfed accounts for 62 per cent of cotton yield in India (Malavath *et al.,* 2014) [8]. In Tamil Nadu, cotton cultivation under varied climatic condition covers 1.1 per cent of India's cotton acreage with a production of 0.6 m t and the average productivity is 729 kg ha^{-1} which is higher than national average productivity of 502 kg ha^{-1} (Indiastat, 2018) [5]. Forty to fifty million people utilize cotton trade and processing to generate income for the livelihood and nearly 6.0 million farmers involved in cultivation of cotton for survival (CICR, 2011) [3]. When cotton plant subjected to water stress at flowering stage for 20 days, reduced the yield upto 42 per cent. Similarly, water stress occurred at boll development causes 31 per cent losses from irrigated condition (Luo *et al.,* 2015) [7]. Fortyseven per cent of yield being reducing under summer cotton compared to irrigated cotton (Usman *et al.,* 2010) [13]. Rainfall distribution was lesser due to sudden outburst of cloud and also having high water demand due to more evaporation in arid and semiarid region in turn causes severe yield fluctuation. To reduce the risk of rainfed crop, supplemental irrigation at critical growth stages of crop has to done.
Reluctance of the farmer to cultivate cotton underneath rainfed situation is due to water stress led to decline the yield. The yield reduction can be managed with the addition of suitable intercropping system lead to generate the income in the midway of the season. It also helps to utilize the inter row space of the cotton and other natural resources. The base crop and the intercrops differs in utilizing the natural resource such as light, nutrient and water effectively due to different growing habit with root attributes (Sankaranarayanan *et al.,* 2012) [11]. Hence, the topic is necessary to select an optimum stage of irrigation with suitable intercropping system on weed studies which helps to improve the yield of both the crop in the system.

Material and methods

The experimental trail was carried out at farmer's field in Thittacheri (Village) of Thalaivasal block, Tamil Nadu during *Kharif* 2018. The farm falls under North western Agro-climatic Zone of Tamil Nadu with the altitude of 160 m above mean sea level and situated at the latitude and longitude of (11°26'N and 78°44'E, respectively). Clayey loam soil had low level of available nitrogen and phosphorus; and medium level of potassium (143.0, 10.9 and 253.4 kg ha^{-1}, respectively) was available for conducting the trial. The amount of rainfall received was 449 mm. The distribution of rainfall by number of rainy days was 25 rainy days. The trail was carried out in strip plot design with three replication and the treatments are in the following table.

The trail was carried out in strip plot design with three replication and the treatments are in the following table.

Vertical strips (Supplemental irrigation)		
SI_0	:	No supplemental irrigation (Control)
SI_1	:	Supplemental irrigation at vegetative stage (2-4weeks)
SI_2	:	Supplemental irrigation at squaring to peak flowering stage (5-8weeks)
SI_3	:	Supplemental irrigation at boll development stage (9-13weeks)
SI_4	:	Supplemental irrigation at vegetative, squaring to peak flowering and boll development stages (2-13 weeks)
SI_5	:	Supplemental irrigation at appearance of wilting symptom
Horizontal strips (Intercrop)		
IC_0	:	cotton alone (Control)
IC_1	:	cotton + blackgram (1:3)
IC_2	:	cotton + clusterbean (1:3)
IC_3	:	cotton + coriander (greens cum grains) (1:4)

The seeds were sown in flat bed method. The varieties and the spacing followed in the additive series trail was given below in the tabulation.

The varieties and the spacing followed in the additive series trail was given below in the tabulation.

Crop	Variety	Spacing
cotton	RCH *BG II* 659	100 cm × 60 cm
blackgram	VBN 6	30 cm × 10 cm
clusterbean	Darsha	30 cm × 15 cm
coriander	Aroma	20 cm × 15 cm

The fertilizer required for cotton was 125:60:75 kg NPK ha^{-1} and no fertilizer recommendation was followed for intercrops. On the receipt of rainfall, half the dose of nitrogen and potassium; full dose of phosphorus was applied as basal. Remaining half the quantity of N and K_2O splitted into two part. One part was applied at 45 DAS and next dose was given at 65 DAS.

Supplemental irrigation was done based on the moisture availability by measuring with the soil moisture meter. It was correlated with the available soil moisture for plant uptake (11.8 per cent) estimated by pressure plate apparatus. Irrigation water loss was reduced by irrigated through the pipe into the plot. To manage the weed, application of pendimethalin at 1 kg a.i. ha^{-1} on 3 DAS using hand operated knapsack sprayer with deflector nozzle and hand weeded at 30 DAS and 60 DAS done after observation of weed parameters.

Gomez and Gomez (2010) enumerated the procedure of statistical analysis for strip plot design. Critical difference values with 5 per cent level of significance were used to analyse the best treatment among various treatments.

Result and Discussion

Weed flora

Sixty-eight to seventy-five species of weeds were found in cotton field in common. Out of which nearly ten species of weeds were seen in the experimental trial. Weed flora observed in the experimental field were *Cyperus rotundus* as sedge and broad leaved weed consist of *Cyanotis cucullata, Merremia emarginata, Trianthema protulacastrum, Digera arvensis, Cleome viscosa, Corchorus acutangulus, Commelina benghalensis, Boerhaavia erecta and Vicoa indica*. Weed flora is mainly decided by the location, soil type and climatic condition of the area. Similar weed flora infestation was observed by Bharathi *et al.* (2011) [1] and Siddagangamma *et al.* (2018) [12].

Interaction of supplemental irrigation and intercropping system on weed density, weed dry weight

During 2018-19, the higher weed density (27.1 No. m^{-2}) and weed dry weight (6.66 g) were recorded in supplemental irrigation at wilting symptom appearance stage at 30 DAS. It was on par with supplemental irrigation at all the stages of crop and supplemental irrigation at vegetative stage alone. This might be due to additional irrigation caused increase weed emergence with higher weed dry weight. The lower weed density (21.6 No. m^{-2}) and weed dry weight (5.15 g) was noticed in supplemental irrigation at squaring to peak flowering stage. It was on par with no supplemental irrigation (rainfed condition) and supplemental irrigation at boll development stage. Though, the irrigation was not done in the above said treatments caused lesser weed density and weed dry weight. At 60 DAS, lower weed density of 13.7 No. m^{-2} and 3.92 g of weed dry weight was registered in no supplemental irrigation (rainfed). It was on par with supplemental irrigation at vegetative and supplemental irrigation at boll development stage. The higher weed density of 19.9 No. m^{-2} and weed dry weight of 4.98 g was registered in supplemental irrigation at wilting symptom appearance and was comparable with supplemental irrigation at all the stages of crop and supplemental irrigation at squaring to peak flowering stage. Similar to foresaid reason, additional supplemental irrigation causes variation in weed germination led to change in weed dry weight. The lower weed density of and dry weight of were noticed in cotton + clusterbean (1:3) at both 30 and 60 DAS. The higher weed density and weed dry weight was recorded in cotton alone at both 30 and 60 DAS. This might be due to lesser plant population in turn has no competition produces provide the way to increase the weed density and its dry weight. Hence, cotton + clusterbean provide lesser chance to utilize the resources by weeds resulted in lower weed dry weight than sole crop. Resource utilization can be analyse with the cotton equivalent yield which produce the higher compare to other intercropping system. Similar results were obtained by Marimuthu and Subbian (2013) [9].

Weed Smothering Efficiency

Higher value of weed smothering efficiency of cotton was observed in supplemental irrigation at squaring to flowering stage at 30 DAS of 21.9 per cent. At 60 DAS, higher value of weed smothering efficiency of cotton was observed in supplemental irrigation at boll developmental stage of 32.3 per cent. This might be varied due to the irrigation applied in each plot with varied weed seed bank during in between time of weed management practices.

In, cotton + clusterbean (1:3) recorded higher value of weed smothering efficiency of 25.3 per cent and 39.5 per cent at both 30 and 60 DAS than Cotton alone. This might be due to fast growing of various cover crop in intercropping system causes reduction in growth of other plant species within the system. Similar result of weed control was obtained in Pearlmillet + Clusterbean/ Mothbean than other intercropping system by Kiroriwal and Yadav (2013) [6].

Cotton equivalent yield

Higher cotton equivalent yield was observed in supplemental irrigation at wilting symptom appearance; and was on par with supplemental irrigation at vegetative, squaring to peak flowering and boll development stage. This might be due to increased application of supplemental irrigation causes increased yield of intercrops and base crops. The lower cotton equivalent yield was recorded in the supplemental irrigation at vegetative stage and was on par with no supplemental irrigation (control) in supplemental irrigation treatments. Lowest yield might be due to lack of irrigation reduced the yield, pave the way for reduction in weed density and weed dry weight also. This was similar to the result reviewed by Ramamoorthy *et al*. (2004) [10].

Higher cotton equivalent yield was recorded in cotton + clusterbean (1:3) among intercropping system. Increased plant population per unit area might hinder the growth causes decrease in weed density and also effective utilization of resource by cotton + clusterbean causes increase in cotton equivalent yield. The lower cotton equivalent yield was recorded in sole cotton. It might be no competition in sole cotton and had no additional yield. Higher increase in intercrop yield was recorded in clusterbean compared to other crops.

Conclusion

It was concluded that application of supplemental irrigation increases the weed density and dry weight. But, intercropping of cotton + clusterbean (1:3) had higher weed smothering efficiency. The other intercrops also have smothering efficiency compare to cotton alone.

References

1. Bharathi S, Pavani M, Narayana E. Response of Bt. cotton to post emergence herbicides in vertisols of Krishna zone. International Journal of Applied Biology and Pharmaceutical Technology. 2011; 2(1):504-510.
2. Carson AG. Weed competition and control in cotton (*Gossypium hirsutum* L.) Ghana Journal of Agricultural Science. 2010; 8(3):219-222.
3. CICR. http://www.cicr.org.in/cicr_glance_2011/47_52.pdf. 2011
4. Gomez KA, Gomez AA. Statistical procedure for agricultural research. 2nd Edn., John Wiley and Sons, New York, USA. 2010, 680.
5. Indiastat. https:\\www.indiastat.com/. 2018.
6. Kiroriwal A, Yadav RS. Effect of intercropping systems on intercrops and weeds. International Journal of Agriculture and Food Science Techonology. 2013; 4(7):643-646.
7. Luo HH, Zhang YL, Zhang WF. Effects of water stress and rewatering on photosynthesis, root activity, and yield of cotton with drip irrigation under mulch. Photosynthetica. 2016; 54(1):65-73.
8. Malavath R, Naik R, Pradeep T, Chuhan S. Performance of Bt cotton hybrids to plant population and soil types under rainfed condition. Agrotechnol. 2014; 3(1):120. Doi: 10.4172/2168-9881.1000120
9. Marimuthu S, Subbian P. Integrated nutrient management on weed dynamics of cotton based cropping systems in South India. SAARC J Agri. 2013; 11(1):7-22.
10. Ramamoorthy K, Lourduraj AC, Thiyagarajan TM, Prem sekhar M, Stewart BA. Weeds and weed control in dryland agriculture- A review. Agricultural reviews. 2004; 25(2):79-99.
11. Sankaranarayanan K., Nalayini P, Praharaj CS. Multi-tier cropping system to enhance resource utilization, profitablity and sustainability of *Bt* cotton (*Gossypium hirsutum*) production system. Indian Journal of Agricultural Sciences. 2012; 82(12):1044-50.
12. Siddagangamma KR, Channabasavanna AS. A review on weed management in *Bt*- Cotton. International journal of current microbiology and applied sciences. 2018; 7:900-913.
13. Usman M, Arshad M, Ahmad A, Ahmad N, Zia-ul-haq, Wajid A, Khaliq T, Naseem W, Hasnain Z, Ali H, Ahmad S. Lower and upper baselines for crop water stress index and yield of *Gossypium hirsutum* L. under variable irrigation regimes in irrigated semiarid environment. Pak. J Bot. 2010; 42(4):2541-2550.