Growth Dynamics of *Deshi* Cotton in Skip Row Intercropping Systems

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Abstract— *Field experiment was conducted during kharif season of 2018-19 at Agronomy Farm, College of Agriculture, Dhule with the objective of studying the growth parameters of deshi cotton in skip row planting with intercrops. Results showed that plant height of cotton was influenced due to different intercrops at all the growth stages, except at 30 DAS. Skip row planting of cotton + sesamum (2:1) recorded significantly the maximum plant height (150.20 cm) and was on par with remaining intercrops of green gram, black gram, soybean and sesamum except pearl millet. However, pearl millet reduced plant height of cotton (106.73 cm) drastically and shown its dominance. Leaf area per plant of cotton at flowering stage (60 DAS), sole cotton recorded the highest leaf area than with green gram and pearl millet as an intercrop. However, at fruiting stage (90 DAS), there was no difference in leaf area among both the sole cotton and with intercrop, except with pearl millet. In later stage (120 DAS), similar results were noticed with reduced leaf area with soybean as intercrop as compared to other intercrops and sole cotton. At the time of harvest, sesamum was the superior intercrop for sustaining cotton leaf area (322.07). However, both sole cotton and cotton intercropped with green gram and black gram were equally effective in maintaining the leaf area of cotton. Number of sympodial branches per plant was highest (20.40) under skip row planting of cotton + intercropping of black gram (2:1) and lowest (13.33) under skip row planting of cotton + intercropping of pearl millet (2:1). Flower initiation was earlier under sole skip row planting of cotton and 2-3 days late with the growing of intercrops in skip row planting.*

Keywords— deshi cotton, growth, intercropping, pearl millet.

I. INTRODUCTION

Cotton is a crucial fiber and cash crop in India, significantly influencing the nation's industrial and agricultural economy. It supplies the essential raw material, cotton fiber, to the cotton textile industry. In India, cotton directly supports the livelihoods of 6 million farmers and employs approximately 40-50 million people in its trade and processing. Cotton is known as the "King of Fibers" and is also referred to as "White Gold." Deshi cotton species produce high yields and need minimal chemical inputs, like fertilizers and pesticides, to achieve yields comparable to or better than American cotton.

Intercropping is a traditional and widespread practice in India and many other developing countries where farm sizes are generally small. Such cropping system is more relevant in rainfed farming as there is risk of crop failure either due to changes in seasonal climate or rainfall patterns. If two or more crops are simultaneously grown in same field, at least one may give something if the other fails. Consequently, intercropping offers a form of insurance against complete crop failure. In cotton a long duration widely spaced crop, the vacant interspaces between the rows during initial growth period can be utilized in better way by growing suitable short duration intercrops. It shows slow initial growth stage and takes 60-75 days to cover the interspaces by its canopy. This period offers excellent opportunity to exploit the conditions for raising an intercrop. Widely planted long duration crop like cotton along with its slow growth habit during initial stage allows enough time and space for growing short duration intercrops which can lead to increased production by proper utilization of resources and inputs. The main compulsion of intercropping is to make best and efficient use of natural resources for getting maximum return per unit area and time. In this system larger total yields are generally obtained than any of the pure crops. Productivity of the intercropping system can be substantially enhanced by proper selection of crops and their suitable varieties which may differ

in duration, morphology and growth pattern from the principal crop so that peak requirements for moisture, nutrients, solar radiation etc. are met with steadily throughout the growing season.

II. MATERIAL AND METHODS

Field experiment was carried out during *kharif* season of 2018 at Agronomy section, College of Agriculture, Dhule. The experiment was laid out in randomized block design with seven treatments and three replications with gross and net plot size of 3.60 X 4.50 m^2 and 2.70 X 3.60 m^2, respectively. The seven treatments consisted of T_1: Sole cotton, T_2: Sole skip row planting of cotton, T_3: Skip row planting of cotton + intercropping of green gram (2:1), T_4: Skip row planting of cotton + intercropping of black gram (2:1), T_5: Skip row planting of cotton + intercropping of soybean (2:1), T_6: Skip row planting of cotton + intercropping of sesamum (2:1) and T_7: Skip row planting of cotton + intercropping of pearl millet (2:1). *Deshi* cotton variety JLA-505, green gram variety BM 2003-02, black gram variety TAU-1, soybean variety JS-335, sesamum variety JLT-408 and pearl millet hybrid Adishakti were used in experiment. Sole crop of cotton was sown at 45 x 22.5 cm, skip row planting of cotton was sown at 45 x 15 – 90 – 45 x 15 cm and all intercrops in the skip row pattern were sown at a distance of 10 cm from each other. The recommended fertilizer rate for *deshi* cotton (50:25:25 N: P_2O_5: K_2O kg/ha) was used for all treatments. Observations on growth parameters of *deshi* cotton were recorded. The data gathered from the experimental field were analyzed statistically. Standard statistical methods were used.

III. RESULTS AND DISCUSSION

3.1 Plant height:

Skip row planting of cotton + sesamum (2:1) recorded significantly the maximum plant height (150.20 cm) than skip row planting of cotton + pearl millet (2:1), however, it was on par with the rest of the treatments. This might be due to availability of optimum space to utilize the soil and environmental resources to the maximum extent due to less competition among crop plants. However, adverse effect of pearl millet may be due to its dominance and hybrid nature. Sharma *et al.* (2000) concluded that more plant height was from skip row spacing as compared to regular row spacing of the same plant population.

TABLE 1
PLANT HEIGHT OF COTTON AS INFLUENCED PERIODICALLY BY DIFFERENT TREATMENTS

Treatments	30 DAS	60 DAS	90 DAS	120 DAS	At Harvest
T_1:Sole cotton	29.72	104.93	134.00	136.87	142.93
T_2: Sole skip row planting of cotton	32.20	114.93	140.83	143.10	149.70
T_3:Skip row planting of cotton + green gram (2:1)	29.69	104.13	136.40	141.07	148.53
T_4:Skip row planting of cotton +black gram (2:1)	27.78	105.93	136.23	142.23	148.57
T_5:Skip row planting of cotton +soybean (2:1)	29.77	108.67	135.03	139.63	144.87
T_6:Skip row planting of cotton + sesamum (2:1)	29.79	113.33	141.80	146.13	150.20
T_7:Skip row planting of cotton + pearl millet (2:1)	27.69	76.40	94.67	98.13	106.73
SEm ±	1.40	4.12	4.19	3.90	3.44
CD (P=0.05)	NS	12.68	12.92	12.01	10.60

DAS- Days after sowing

3.2 Leaf area per plant:

Skip row planting of cotton + sesamum (2:1) recorded significantly the highest leaf area per plant than all the treatments. Minimum leaf area per plant was observed at treatment of skip row planting of cotton + pearl millet (2:1). Pearl millet grown alongside cotton significantly competed with it, resulting in a substantial reduction in the leaf area per plant. This may be due to the exhaustive nature of hybrid pearl millet. Singh *et al.* (2017) reported that the various treatments tried under study showed that the leaf area per plant was recorded higher in sole cotton than rest of the treatments.

TABLE 2

LEAF AREA PER PLANT OF COTTON AS INFLUENCED PERIODICALLY BY DIFFERENT TREATMENTS

Treatments	30 DAS	60 DAS	90 DAS	120 DAS	At Harvest
T_1:Sole cotton	20.27	151.64	272.17	281.58	284.14
T_2:Sole skip row planting of cotton	21.27	129.34	265.52	275.53	269.25
T_3:Skip row planting of cotton + green gram (2:1)	21.13	123.64	263.87	268.69	264.45
T_4:Skip row planting of cotton + black gram (2:1)	22.44	134.21	292.88	296.12	283.46
T_5:Skip row planting of cotton + soybean (2:1)	20.06	131.54	237.37	242.99	252.12
T_6:Skip row planting of cotton + sesamum (2:1)	23.56	139.5	287.33	311.83	322.07
T_7:Skip row planting of cotton + pearl millet (2:1)	22.8	91.34	164.35	181.83	183.05
SEm ±	2.05	7.46	19.71	16.82	9.15
CD (P=0.05)	NS	22.99	60.73	51.82	28.19

DAS- Days after sowing

3.3 Number of sympodial branches per plant:

Number of sympodial branches was significantly influenced due to different treatments. Skip row planting of cotton + black gram (2:1) recorded significantly the highest number of sympodial branches per plant than skip row planting of cotton + pearl millet (2:1) and skip row planting of cotton + soybean (2:1), however, it was on par with rest of the treatments. During this period soybean was in pod filling stage and more moisture extraction by soybean in this stage might have affected the growth of cotton The lowest number of sympodial branches per plant was observed in skip row planting of cotton + pearl millet (2:1), likely due to the competitive nature of the pearl millet intercrop. Deshmukh *et al.* (1987) reported the highest number of sympodial branches per plant under skip row method of planting than other planting patterns at Cotton Research Station, Khandawa, Madhya Pradesh.

TABLE 3

NUMBER OF SYMPODIAL BRANCHES PER PLANT OF COTTON AS INFLUENCED PERIODICALLY BY DIFFERENT TREATMENTS

Treatments	60 DAS	90 DAS	120 DAS	At Harvest
T_1: Sole cotton	12.93	17.93	18.53	19.07
T_2:Sole skip row planting of cotton	13.93	17.6	18.93	19.2
T_3:Skip row planting of Cotton + green gram (2:1)	12.8	17.8	19.2	19.53
T_4:Skip row planting of cotton + black gram (2:1)	13.13	19.13	19.93	20.4
T_5:Skip row planting of cotton + soybean (2:1)	12.27	16.47	18	18.53
T_6:Skip row planting of cotton + sesamum (2:1)	13.47	18	18.47	19.07
T_7:Skip row planting of cotton + pearl millet (2:1)	8.27	9.87	12.13	13.33
SEm ±	0.7	0.55	0.48	0.44
CD (P=0.05)	2.15	1.71	1.47	1.36

DAS- Days after sowing

3.4 Dry matter accumulation:

Dry matter accumulation was found to be non significant for all stages of crop growth due to different treatments. However, no pronounced effect of intercrops was observed on dry matter accumulation per plant. It may due to no excessive vegetative growth under rainfed condition. Similar results were also obtained by Kumar *et al.* (2017).

TABLE 4

DRY MATTER PER PLANT OF COTTON AS INFLUENCED PERIODICALLY BY DIFFERENT TREATMENTS

Treatments	30 DAS	60 DAS	90 DAS	120 DAS	At Harvest
T_1: Sole cotton	2.33	32.67	77.03	85.1	90.93
T_2:Sole skip row planting of cotton	2.87	25.2	78	89.93	97.53
T_3:Skip row planting of cotton + green gram (2:1)	2.27	21.27	73.97	90.03	118.27
T_4:Skip row planting of cotton + black gram (2:1)	2.73	22.93	71.77	81.87	101.27
T_5:Skip row planting of cotton + soybean (2:1)	2.2	22.13	74.27	83.47	110.07
T_6:Skip row planting of cotton + sesamum(2:1)	3.13	20.87	75.43	87.7	123.57
T_7: Skip row planting of cotton + pearl millet (2:1)	2.8	15.07	57.8	71.73	72.2
SEm ±	0.28	2.75	4.09	4.03	10.37
CD (P=0.05)	NS	8.47	NS	NS	NS

DAS- Days after sowing

3.5 Days to initiation of squares, flowering and first boll opening of cotton:

Days to initiation squares and first boll opening of cotton was found to be non-significant, however, days to initiation of flowering was found to be significant. Flowering began earlier in sole skip row planting of cotton compared to other treatments. There was a three-day delay in skip row planting for cotton + black gram (2:1), cotton + soybean (2:1), and cotton + sesamum (2:1), however, it was on par with the treatment of skip row planting of cotton + pearl millet (2:1) and skip row planting of cotton + green gram (2:1). Singh and Singh (2015) findings indicated that the Bt cotton and summer moong (1+1 and 1+2), Bt cotton and bajra fodder (1+1), and Bt cotton and cowpea fodder (1+2) combinations required more days to begin flowering in both years.

TABLE 5

DAYS TO INITIATION OF SQUARES, INITIATION OF FLOWERING AND FIRST BOLL OPENING OF COTTON AS INFLUENCED BY DIFFERENT TREATMENTS

Treatment	Days to initiation of squares	Days to initiation of flowering	Days to first boll opening
T_1: Sole cotton	45.67	61.67	100
T_2:Sole skip row planting of cotton	44.67	60.33	100.67
T_3:Skip row planting of cotton + green gram (2:1)	46.67	62.67	101.33
T_4:Skip row planting of cotton + black gram (2:1)	46.67	63	101
T_5:Skip row planting of cotton + soybean (2:1)	46	63	101.33
T_6:Skip row planting of cotton + sesamum (2:1)	46.67	63	100.67
T_7:Skip row planting of cotton + pearl millet (2:1)	45.67	62.33	100.67
SEm ±	0.47	0.43	0.47
CD (P=0.05)	NS	1.33	NS

FIGURE 1: Skip row planting of cotton + green gram (2:1)

FIGURE 2: Skip row planting of cotton + black gram (2:1)

FIGURE 3: Skip row planting of cotton + soybean (2:1)

FIGURE 4: Skip row planting of cotton + sesamum (2:1)

FIGURE 5: Skip row planting of cotton + pearl millet (2:1)

FIGURE 6: Sole skip row plating of cotton

IV. CONCLUSION

From the study, it can be concluded that plant height of cotton was influenced due to different intercrops at all the growth stages, except at 30 DAS. Intercrops viz., green gram, black gram, soybean and sesamum did not show any influence on plant height of cotton. However, pearl millet reduced plant height of cotton drastically and shown its dominance. Similar trend was observed in respect of leaf area per plant of cotton as regards to pearl millet as intercrop at all the growth stages, except at 30 DAS. Number of sympodial branches per plant was higher under skip row planting of cotton with black gam. There was no significance difference with the dry matter per plant, days to initiation of squares and first boll opening.

REFERENCES

[1] Deshmukh S.C., Sisodiasand R.I. and Mandloi K.C. 1987. Studies on planting patterns and intercropping in cotton. *Journal of Cotton Research and development*. 1(2):124-130.

[2] Kumar R., Turkhede A.B., Nagar R.K. and Nath A. 2017. Effect of Different Intercrops on Growth and Yield Attributes of American Cotton under Dryland Condition. *International Journal of Current Microbiology and Applied Sciences*. 6(4): 754-761.

[3] Sharma J.K., Khamparia S.K., Parsal G.S., Mishtra U.S. and Mandloi K.C. 2000. Performance of cotton genotype in relation of spacing and fertility levels in East Nimar. *Journal of Cotton Research and Development*. 14(2):235-237.

[4] Singh A. and Singh T. 2015. Phenology, growth and yield of Bt cotton as influenced by different intercrops. *Journal of Cotton Research and Development*. 29 (2): 255-259.

[5] Singh G., Choudhary P., D., Saini D. and Jat B.L. 2017. Effects of legume intercrops on growth, yield and economics of hybrid American cotton under controlled condition, Department of Agriculture, Bhagwant University Ajmer, Rajasthan. *Global Journal of Bio-Science and Biotechnology*. 6(1):61-82.