Indian Journal of Agronomy **67** (3): 324–326 (September 2022)

Research Communication

Effect of sowing date and inter-row annual legume green-manuring on growth, yield and quality of *desi* cotton (*Gossypium arboreum*)

BALWANT SINGH[1], R.N. MEENA[2], ASHVIN KUMAR MEENA[3], KAMLESH MEENA[4], A. AKASH[5], R. MEENA[6] AND SANJAY KUMAR[7]

Institute of Agricultural Sciences, Banaras Hindu University Varanasi, Uttar Pradesh 221 005

Received: October 2020; Revised accepted: July 2022

ABSTRACT

A field experiment was conducted during the rainy (*kharif*) season of 2018 at the Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, to study the effect of sowing date and inter-row annual legume green-manuring on *desi* cotton (*Gossypium arboreum* L). The experiment comprised 5 sowing dates, viz. 20 April, 5 May, 20 May, 5 June, 20 June, in main plot and 4 inter-row legume green-manuring, viz. dhaincha [*Sesbania bispinosa* (Jacq.) Wight], sunnhemp (*Crotalaria juncea* L.), clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.] and cowpea [*Vigna unguiculata* (L.) Walp.] in subplot. The results indicated that, growth parameters, yield attributes and quality parameters were found maximum in *desi* cotton when sown on 20 April and minimum when sown on 20 June. Amongst inter-row legume green-manuring, sunnhemp resulted in significantly maximum growth, yield and quality parameters. Thus, d*esi* cotton sown on 20 April with inter-row legume green-manuring of sunnhemp was found better for improving the growth, yield and quality.

Key words: Annual legume, Cotton, Green-manuring, Sowing date

Cotton (*Gossypium* sp.) is a principal commercial crop of the country. In India, it is grown over an area of 12.43 million ha with a production of 34.8 m bales (DES 2017–18). The average yield of cotton (524 lint kg/ha) is still far below the world average of 792 lint kg/ha. India ranks first in the world in respect of area and second in production of cotton. Sowing time is an important agronomic variable that greatly affects yield and quality of cotton. Thus, selection of an optimum sowing time can improve yield and promote growth and it is significant for maintaining a sustainable local agriculture economy as reported by Soomro *et al*., (2007). Early sowing results in higher yield, whereas late planting of cotton lowers vegetative growth resulting in lower seed-cotton yield as well (Ali *et al.,* 2009). Green-manuring is the process of turning of green plants into the soil either by raising them in same field or plants grown elsewhere at the green stage before flowering and incorporated into the soil. Cotton is widely spaced, initially slow-growing crop and therefore susceptible to infestation of weeds. Cotton is inseparable from plant protection. The quick-growing green-manuring leguminous crop can be grown in inter-row spaces as an intercrop to suppress the weed growth and add nutrients to soil (Venugopalan *et al.,* 2012).

The field experiment was carried out at the Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, during rainy (*kharif*) season of 2018. Research farm is situated geographically in the Northern Gangetic Alluvial plain at 28°18' N, 80°03' E with an altitude of 76.5 m above means sea-level. The location falls under the climate of subtropical, with the mean annual rainfall of 1,081.4 mm and the mean maximum and minimum temperature of 41.0°C and 28.01°C respectively. The mean daily pan evaporation and relative humidity recorded during the crop season were 4.56 mm and 80.8% respectively. An amount of rainfall 804.9 mm was received during the experimental period. The soil was well-drained and sandy clay loam. It was neutral in reaction and low in available nitrogen (154.39 kg/ha), medium in available phosphorus (18.23 kg/ha) and available potassium (187.23 kg/ha). *Desi* cotton variety 'SR 271' of 150–160 days duration was chosen for this study. The experiment was laid out in a split-plot design having 3 replications. The treatments were 5 sowing dates i.e., 20 April, 5 May, 20 May, 5 June

Based on a part of M.Sc. Thesis of the first author submitted to the Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh in 2018 (unpublished)

[1]**Corresponding author's Email:** ramnarayanbhu@gmail.com
[1]M.Sc. Student; [3,4,5,7]Ph.D. Scholar; [2]Associate Professor, [6]Assistant Professor, Department of Soil Science and Agricultural Chemistry, Department of Agronomy, Institute of Agricultural Sciences Banaras Hindu University, Varanasi, Uttar Pradesh 221 005

and 20 June, with 4 inter-row legume green-manuring, viz. dhaincha [*Sesbania bispinosa* (Jacq.) Wight], sunnhemp (*Crotalaria juncea* L.), clustarbean [*Cyamposis tetragonoloba* (L.) Taub.] and cowpea [*Vigna unguiculata* (L.) Walp.]. The crop was sown uniformly at 60 cm × 45 cm apart in rows using 2.5 kg/ha seed rate with a single row hand drill. All the other cultural practices such as hoeing, irrigation, and plant protection measures were kept normal for the crop. The green-manuring crops were sown in the interspace, i.e. 60 cm between 2 cotton rows for single row spacing. For 2 rows, they were sown at 30-cm interval in the interspaces.

There was a significant effect of sowing date on growth characters. Among the sowing dates, maximum growth parameters was recorded with 20 April (T_1)-sown *desi* cotton as compared to the other sowing dates. This showed 33.7, 95.5, 54.7 and 167.2% increase in plant height, dry-matter accumulation/plant, monopodial and sympodial branch/plant, respectively, over 20 June-sown crop. Timely crop sowing is important for root penetration and vegetative growth in order to optimize the harvest of accessible soil nutrients and solar radiation. Early cultivation may be challenging owing to low temperature and elevated insect-pest (Blaise, 2021). Similar results were also reported by Butter *et al*. (2004), Prakash *et al.* (2010) and Jamro *et al*. (2017). They found that, early sowing produced more monopodial and sympodial branches than late sowing.

Inter-row annual legume green-manuring crops significantly influenced growth parameters (Table 1). Sunnhemp green-manuring showed 12.9, 6.9, 47.3 and 22.9% increase in plant height, dry-matter accumulation/plant, monopodial and sympodial branch/plant, respectively, over clusterbean. Our findings confirm the results of Vaiyapuri *et al.* (2007). Sowing dates significantly influences the yield and yield attributes of *desi* cotton (Table 1). Significantly higher yield and yield attributes were recorded with 20th April sown crop as compared to other sowing dates. 20 April sown crop produced 167.4, 68.6 138.5 and 139.3% higher green boll/plant, boll weight, yield per plot and seed cotton yield, respectively as compared to 20 June sown crop. The planting date across the environmental variables indicates existence of variation for boll setting. However, further delay in sowing reduced these traits which might be attributed to the unfavorable photoperiod and high temperature conditions at early growth and development stage that forced the crop to end up the life cycle rapidly at the cost of reduction in yield and yield components (Butter *et al*., 2004; Jamro *et al*., 2017; Ali *et al*., 2009; Prakash *et al.,* 2010). Among the inter-row annual legume green-manuring crops, the maximum yield and yield attributes, viz. number of green bolls/plant, bolls weight, seed-cotton yield kg/plot seed-cotton yield kg/ha and harvest index, were re-

Table 1. Effect of sowing date and inter-row annual legume green manuring on growth, yield and yield attributes and quality parameters of *desi* cotton at harvesting

Treatment	Growth parameter				Yield attribute				Quality parameter			
	Plant height (cm)	Dry matter at accumulation (kg/ha)	Monopodial branch/ plant	Sympodial branch/ plant	Green bolls/ plant	Boll weight (g)	Yield/ plot (kg)	Seed cotton yield (kg/ha)	Ginning (%)	Seed index (g)	Lint index (g)	Fibre strength (g/tex)
Main plot: Sowing date												
T_1, 20 April	148.9	300.9	3.11	32.58	49.2	4.08	2.79	2582.9	40.2	3.63	2.36	24.2
T_2, 5 May	140.0	282.0	2.61	30.39	44.6	3.38	2.53	2338.5	38.5	3.35	2.01	23.2
T_3, 20 May	127.8	263.6	2.31	25.61	41.5	2.91	2.35	2177.1	36.5	2.63	1.71	22.4
T_4, 5 June	124.3	169.2	2.28	15.36	23.5	2.53	1.70	1576.3	33.5	2.02	1.23	21.4
T_5, 20 June	111.3	153.9	2.01	12.19	18.4	2.42	1.17	1079.4	32.7	1.58	0.77	21.4
SEm±	2.26	5.42	0.07	0.53	0.84	0.08	0.05	41.71	0.44	0.08	0.05	0.37
CD (P=0.05)	7.37	17.67	0.24	1.74	2.75	0.25	0.15	136.02	1.42	0.27	0.16	1.21
Sub plot: Green manuring												
M_1, *Dhaincha*	135.6	239.6	2.73	24.64	37.7	3.20	2.27	2106.3	36.0	2.75	1.76	22.6
M_2, Sunnhemp	136.7	241.2	2.80	25.96	38.9	3.26	2.32	2147.4	36.8	2.83	1.79	22.9
M_3, Clusterbean	121.0	225.9	1.95	21.11	32.3	2.89	1.90	1758.0	35.6	2.47	1.38	22.3
M_4, Cowpea	128.6	228.9	2.38	21.20	32.9	2.90	1.94	1791.8	35.7	2.53	1.53	22.2
SEm±	2.18	2.94	0.10	0.56	0.97	0.10	0.06	57.56	0.35	0.06	0.07	0.33
CD (P=0.05)	6.29	8.50	0.29	1.61	2.79	0.29	0.18	166.24	NS	0.18	0.21	NS

Table 2. Effect of sowing date and inter-row annual legume green-manure on economics of *desi* cotton

Treatment	Cost of cultivation (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	Benefit: cost
Main plot: Sowing date				
T_1, 20 April	38,650	132,973	94,323	2.44
T_2, 5 May	38,650	120,098	81,448	2.11
T_3, 20 May	38,650	112,116	73,466	1.90
T_4, 5 June	38,650	78,847	40,197	1.04
T_5, 20 June	38,650	63,809	25,159	0.65
SEm±	–	4,063	4,063	0.10
CD (P=0.05)	–	12,200	12,200	0.29
Subplot: Green manuring				
M_1, *Dhaincha*	35,875	108,459	72,584	2.02
M_2, Sunnhemp	35,875	110,571	74,696	2.08
M_3, Clusterbean	35,475	90,537	55,062	1.55
M_4, Cowpea	35,208	92,237	57,029	1.62
SEm±	–	6,475	6,271	0.15
CD (P=0.05)	–	19,421	18,822	0.48

corded in sunnhemp, which was at par with *dhaincha* followed by cowpea and clusterbean (Table 1). Ginning percentage, lint index, seed index and fibre strength were significantly affected by sowing date and inter-row green-manuring (Table 1). Among the sowing dates 20 April-sown crop revealed significant higher ginning percentage, seed index and lint index over rest of the treatments. An increment of 22.9, 129.7, 206.5 and 13.1% in ginning percentage, lint index, seed index and fibre strength was observed in crop crop sown on 20 April over the 20 June-season crop. In case of green-manuring the sunnhemp showed 3.4, 14.6, 29.7 and 2.7% increase in ginning percentage, seed index, lint index and fibre strength, respectively over clusterbean. Vaiyapuri *et al.* (2009) also reported similar findings. In case of economics of *desi* cotton, 20 April-sown crop recorded significant higher gross returns, net returns and benefit: cost (B: C) ratio than 20 June-sown crop (Table 2). Among the different inter-row green-manuring, sunnhemp fetched 22.1, 35.6 and 34.1% more gross returns, net returns and B:C respectively, than clusterbean. Similar findings were also reported by Ahuja (2006).

It can be concluded from this study that, for getting the maximum growth, seed-cotton yield with best fibre quality and better economics the crop should be sown on 20th April. In addition, inter-row annual green-manuring crop sunnhemp or *dhaincha* may be preferred for achieving higher seed-cotton yield.

REFERENCES

Ahuja, S.L. 2006. Evaluation for the retention of reproductive structures by Bt and non-Bt intra-*hirsutum* cotton hybrids in different sowing dates and spacing. *African Journal of Biotechnology* **5**(10): 862–865.

Ali, H., Afzal, M.N., Ahmad, S. and Muhammad, D. 2009. Effect of cultivars and sowing dates on yield and quality of cotton (*Gossypium hirsutum* L.) crop. *Journal of Food, Agriculture and Environment* **7**(3–4): 244–247.

Blaise, D. 2021. Cotton (*Gossypium species*) production systems of India: Historical perspective, achievements and challenges. *Indian Journal of Agronomy* **66**: 125–134.

Butter, G.S., Aggarwal, N. and Singh, S. 2004. Productivity of American cotton as influenced by sowing date. *Haryana Journal of Agronomy* **20**(1–2): 101–102.

DOAC&FW. 2018. Department of Agriculture Cooperation and Farmers Welfare Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi.

Jamro, S.A., Ali, M.U., Buriro, M., Ahmad, M.I., Jamro, G.M., Khan, A. and Jakhro, M.I. 2017. Impact of various sowing dates on growth and yield parameters of different cotton varieties, *Journal of Applied Environmental and Biological Sciences* **7**(8): 135–143.

Prakash, A.H., Bandyopadhyay, K.K., Gopalakrishnan, N. and Kumar, A.A.A. 2010. Interaction of thermal time and nitrogen levels on growth and productivity of cotton (*Gossypium hirsutum*). *Indian Journal of Agricultural Sciences* **80**(8): 704–709.

Soomro, A.R., Anjum, R., Soomro, A.W., Memmon, A.M. and Bano, S. 2007. Optimum sowing time for new commercial cotton variety, Marvi (CRIS-5A). *The Pakistan Cottons* **45**: 25–28.

Vaiyapuri, K., Amanullah, M.M., Somasundaram, E., Sathyamoorthi, K. and Pazhaznivelan, S. 2009. Quality parameters of cotton as influenced by intercropping unconventional green manures. *International Journal of Agricultural Sciences* **5**(1): 103–107.

Venugopalan, M.V., Blaise, D., Yadav, M.S. and Satish, V. 2012. Advances and milestones in agronomic research on cotton in India. *Indian Journal of Agronomy* **57**: 64–71.