Biological Forum – An International Journal **14(4): 468-471(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of Harvesting Dates on Cotton Pink Bollworm Infestation and Sowing Dates on Chickpea Yield in Cotton-chickpea Cropping Sequence

K. Rajashekar[1], D. Mohan Das[2*] and Sreedhar Chauhan[3]
[1]Scientist (Ento.), Agricultural Research Station, Adilabad (Telangana), India.
[2] Scientist (Agro.) Agricultural Research Station, Adilabad (Telangana), India.
[3]Principal Scientist (Agro.), Agricultural Research Station, Adilabad (Telangana), India.

(Corresponding author: D. Mohan Das)*
(Received 03 September 2022, Accepted 13 October, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: An experiment was conducted at Agricultural research station, Adilabad, to assess the effect of harvesting dates on PBW infestation and economy of hybrid cotton and different sowing dates on yield of chickpea. The pooled results indicated that among different harvesting dates *viz*., 15th November, 15th December, 30th December, 15th January and 30th January during 2018-19 and 2019-20 maximum seed cotton yield (2065 kg/ha) was noticed in 15th December 30th January and 15th November recorded minimum pink bollworm infestation (9.5%), minimum locule damage (8.8) and highest BC ratio (1.78) was noticed on 15th November and found at par with 15th December and 30th December Similarly in *Rabi* chickpea among different sowing dates *viz*., 16th November, 16th December, 31st December, 16th January and 31st January the maximum seed yield and highest BC ratio was noticed in 16th November in both varieties JG-14 and NBeG-3 (2250, 2187 kg/ha and 2.59, 2.52, respectively).

Keywords: Harvesting date, Sowing date, Pink bollworm, Cotton, Chickpea, Cropping sequence, Seed yield, locule damage.

INTRODUCTION

The cropping sequence is a rotation system approach in crop production that enabling the available natural resources to be preserved and more efficiently utilized. It is the growing of the succession of crops in time on one field in particular time. Intensive land uses with continuous growing of similar crops significantly affect soil health, crop growth whereas crop rotation helps in pest management (weed, insect and diseases), reduce soil erosion, maintain soil organic matter (OM), provide biologically fixed nitrogen (N) when legumes are part of the rotation scheme, manage overall nutritional levels (Singer and Bauer 2009) and has raised concerns about the long term adverse effects on environmental pollution. To change this situation, use of intensive cropping system like sequencing crops in defined patterns based on scientific knowledge is highly important.

One of the most important agronomic considerations for growers to optimize yield and quality is to select an appropriate sowing time for cotton crop. Optimum sowing time for different genotypes varies with regions depending on the environmental conditions of the area. Most favourable sowing time provides favourable situation for adequate crop growth as it escorts to the realization of the productivity potential of the crop (Sankaranarayanan *et al*., 2011). Harvesting of cotton crop play an important role for the growers as its quality and market price is directly influenced. However some factors affecting earlier stages must be taken into consideration as it influence on the succeeding ones.

Chickpea (*Cicer arietinum* L.) is the most important legume in the world and occupies fifth place on the basis of total production. Globally, Chickpea is cultivated over an area of 11.1 million hectares with a production of 9.2 million tones and an average productivity of 826 kg/ha (FAO, 2006). Gram contain good amount of protein (18-22%), carbohydrate (52-70%), fat (4-10%), minerals (calcium, phosphorous, iron) and vitamins. Productivity of chickpea is influenced by several environmental and genetic variables interaction. The yield of chickpea is highly influenced by sowing time which is the single most important factor among the various agronomic practices (Reddy *et al.*, 2003). The primary and secondary stages of the plant is subjected to various temperature, solar radiation and day length by different sowing dates (Yadav *et al.*, 1999). Usually chickpea is sown between mid October to mid November. Late sowing, after November 18 reduced yield by 28 per cent for every 10 day interval delay sowing time. However, sowings are often delayed when grown in sequence with kharif crops. However, earlier or late sowing caused drastic reduction in yield and net profit compared with timely sowing (Gurung *et al*., 1996).

Hence the present study was undertaken to know the effect of harvesting dates and sowing dates on the incidence of pink bollworm and their effect on seed cotton yield and overall effect of economy on chickpea varieties in cotton-chickpea cropping sequence.

MATERIALS AND METHODS

The present experiment was carried out at Agriculture research station, Adilabad, in order to evaluate the effect of harvesting dates on pink bollworm infestation in cotton based cropping system and to find out the effect of sowing dates on seed yield of two chickpea varieties JG-14 and NBeG-3 during *Rabi* season.

The study was carried out in randomized block design (RBD) in kharif cotton hybrid RCH-659 sown on 25th June during 2019 and 2020 crop season over 1000 sq mtr of total plot size containing five different harvesting dates *i.e*. 15th November, 15th December, 30th December, 15th January and 30th January replicated thrice using standard package of agronomical practices under unsprayed conditions. Observation on pink bollworm infestation were recorded from bolls and locules of 20 plants selected randomly per each plot. Bolls were plucked from randomly selected 20 plants per replication per treatment and infestation of pink bollworm on boll and locule basis was recorded.

Damage on boll basis

Harvest damage was recorded in open bolls from randomly selected 20 plants taken from each plot and examined critically for pink bollworm infestation. The per cent damage in bolls was calculated by following formula:

Per cent pink bollworm infestation (boll basis)

$$= \frac{\text{Number of damaged bolls}}{\text{Total number of bolls}} \times 100$$

Damage on locule basis. To record observation of bollworm damage on locule basis, the total number of locule of all the open bolls of twenty plants taken as above, counted and examined carefully for bollworm damage. Presence of holes in the septa of the locule was considered as damaged.

Yield of seed cotton. The yield of seed cotton was recorded on whole plot basis and later converted to kg/hectare in all the sets of experiments.

Chickpea seed yield. Immediately after cotton harvesting, on same land succeeding chickpea crop sown during rabi 2018-19. The present experiment was laid out in split plot design with three replications and allocating five dates of sowing (16th November, 16th December, 31st December, 16th January and 31st January) to sub plots and two varieties (JG-14 and NBeG-3) to main plots and data was recorded on seed yield per replication per treatment.

RESULTS AND DISCUSSION

The data presented in (table 1) showed the significant difference for pink bollworm infestation in different dates of harvesting in cotton hybrid. The pooled data of 2018-19 and 2019-20 shows that significantly minimum pink bollworm infestation (9.5%) was observed during crop harvested on 30th January and it was statistically found at par with 15th November (9.7%) and 30th December (10.8%). Significantly maximum pink bollworm infestation was recorded in crop harvested on 15th December (12.5%) and found at par with 15th January (12.4%). The present findings are in relation to Muttappa and Patil (2019) reported that the pink bollworm larvae incidence on hybrid cotton green bolls was noticed from second fortnight of September and increased gradually to reach its peak activity during second fortnight of December 15th December (51 larvae/50 bolls). Thereafter the larval population was declined. The probable reasons for the higher incidence of PBW during this period might be due to availability of tender green bolls in abundance and favourable weather conditions. The present results are also in correlation with Patil *et al.* (2007); Verma *et al.* (2017).

On locule basis significantly lowest number of locule damaged by pink bollworm was noticed in crop harvested on 15th November (8.8) and found at par with 30th January (8.9) and 30th December (10.9). Significantly highest number of locule damage was observed on 15th December (12.1) and found at par with 15th January (11).The data in (Table 1) showed yield of seed cotton in different harvesting dates. Maximum seed cotton yield was realized from crop harvested on 15th December (2065 kg/ha) though the per cent infestation and locule damage by pink bollworm is high and it was statistically found at par with 15th November(2045 kg/ha) and 30th December (2015 kg/ha). Minimum yield of seed cotton was observed on 30th January (1692 kg/ha) and found at par with 15th January (1775 kg/ha). The present findings are correlated with the report of Udikeri *et al.* (2003); Kengegowda (2003); Surulivelu *et al*. (2004a & 2004b); Wu *et al*. (2003); Ingole (2018) explained that the seed yield from *Bt.* cotton hybrids was significantly maximum in any environment without insecticidal spray.

Data presented in (Table 2) revealed that cost of cultivation (Rs./ha), gross return (Rs./ha) and net return (Rs./ha) were significantly influenced by date of harvesting in two years of experimentation. The significant lowest cost of cultivation (Rs. 62,500/ha) with highest gross return (Rs.1,11,452/ha) and net return (Rs. 48,952/ha) were registered on 15th November and found at par with 15th December and 30th December. A successive delay in harvesting from 15th November to 30th January has shown decreased cost benefit ratio. Among different harvesting dates of cotton crop sown as succeeding and preceeding to chickpea crop, highest cost benefit ratio was observed in 15th November (1.78) followed by 15th December (1.76) and 30th December (1.68). Lowest cost benefit ratio was observed as harvesting date was delayed on 30th January (1.34) followed by 15th January (1.43).

A non significant reduction was recorded in chickpea seed yield with successive delay in sowing time in cotton-chickpea cropping sequence. Effect of different sowing dates on seed yield (kg/ha) was shown in (Table 3). In Table 3, data reveals that seed yield (kg/ha) was noticed to be non significantly affected by different sowing dates and varieties. Among the different sowing dates, crop sown on 16th November shown with maximum seed yield (2218.5kg/ha) which is followed by 16th December (2101.5 kg/ha) and 31st December (2020 kg/ha) sowing dates. Lowest seed yield was observed in crop sown on 31st January (894 kg/ha) followed by 16th January (907.5 kg/ha). A successive delay in sowing from 16th November to 31st December and from 16th January to 31st January eventually the seed yield is decreased. Among the two varieties JG-14 shown non significantly maximum seed yield (1662 kg/ha) followed by NBeG-3 (1593.4 kg/ha). The present findings are in correlate with Dhote *et al.* (2019) noticed that a successive delay in sowing from 24th October to 3rd December. the seed yield was decreased. Among the varieties JG-16 exhibited maximum yield than L-550 and G-63. Mohammad *et al.* (2018) observed that in chickpea cropping sequence, crop sown on 20th November was recorded higher seed yield. Neenu *et al.* (2017) recorded that the seed yield obtained in first fortnight of November was better and would give 14-29% more yield in chickpea late sowing reduce the nutrient uptake, dry matter production and yield irrespective of the varieties. Deepika and Meena (2014) observed that crop sown 25th November was produced higher grain and straw yield (1475 and 3354 kg/ha).

A successive delay in sowing from 16th November to 31st January has shown decreased cost benefit ratio in both the varieties as detailed in (Table 4 and 5). The highest cost benefit ratio was observed in crop sown on 16th November of variety (JG-11, 2.59 and NBeG-3, 2.52) followed by 16th December (JG-11, 2.51 and NBeG-3, 2.45) and 31st December (JG-11, 2.46 and NBeG-3, 2.38). Lowest cost benefit ratio was observed in crop sown on 31st January (JG-11, 1.15 and NBeG-3, 1.07) followed by 16th January (JG-11, 1.9 and NBeG-3, 1.08). The above results are in close agreement with the Solunke (2015) reported that higher seed yield and economy was noticed in chickpea crop sown on 15th November (1296 kg/ha) and highest B:C ratio of (2.40) followed by 20th November, 15th December and 30th December in paddy-chickpea cropping sequences.

Table 1: Effect of harvesting dates on percent pink bollworm infestation and yield of preceeding and succeeding cotton hybrid in cotton-chickpea cropping sequence.

Treatments Pooled (2018-19 & 2019-20)	Percent PBW infestation	No. of Locule damage	Yield (Kg/ha)
15th November	9.7	8.8	2045
15th December	12.5	12.1	2065
30th December	10.8	10.9	2015
15th January	12.4	11	1775
30th January	9.5	8.9	1692
SE (m)±	0.67	0.48	111.77
CD at 5%	1.5	1.08	232.97

Table 2: Effect of different harvesting dates on pooled gross, net monetary returns and B:C ratio of cotton.

Treatments	Yield (Kg/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net income (Rs/ha)	B:C ratio
15th November	2045	62500	111452	48952	1:1.78
15th December	2065	63750	112542	48792	1:1.76
30th December	2015	65000	109817	44817	1:1.68
15th January	1775	67500	96737	29237	1:1.43
30th January	1692	68750	92214	23464	1:1.34

Table 3: Effect of different sowing dates on chickpea seed yield (kg/ha) among the variety JG-14 and NBeG-3 during rabi 2018-19.

Treatments	Seed yield (Kg/ha)		
	Varieties		
Sowing dates	**JG-11**	**NBeG-3**	**Mean**
16th November	2250	2187	2218.5
16th December	2128	2075	2101.5
31st December	2054	1986	2020
16th January	958	857	907.5
31st January	920	862	894
Mean	1662	1593.4	
SE (m) ±		NS	
CD at 5%		261.5	

Table 4: Effect of different sowing dates on gross, net monetary returns and B:C ratio of chickpea var. JG-14 during rabi 2018-19.

Treatments	Yield (Kg/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net income (Rs/ha)	B:C ratio
16th November	2250	31610	82125	50515	1:2.59
16th December	2128	30875	77672	46797	1:2.51
31st December	2054	30425	74971	44546	1:2.46
16th January	958	29205	34967	5762	1:1.19
31st January	920	29000	33580	4580	1:1.15

Table 5: Gross, net monetary returns and B:C ratio of chickpea var.NBeG-3 influenced by different sowing dates during rabi 2018-19.

Treatments	Yield (Kg/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net income (Rs/ha)	B:C ratio
16th November	2187	31610	79825	48215	1:2.52
16th December	2075	30875	75737	44820	1:2.45
31st December	1986	30425	72489	42064	1:2.38
16th January	857	29205	31280	2075	1:1.07
31st January	862	29000	31463	2463	1:1.08

CONCLUSION

From above experiment it was concluded that in cotton-chickpea cropping sequence harvesting of cotton and sowing of succeeding chickpea crop is founded to be most suitable and economical upto 30th December. In this trial, there is no variation of pink bollworm reduction in succeeding cotton crop after chickpea cultivation but in cropping system point of view, cotton followed by chickpea is suitable.

Acknowledgements. Authors thanks to Head and principal scientist (Agro.), Agriculture research station, Adilabad for providing necessary facilities.
Conflict of Interest. None.

REFERENCES

Deepika, T. and Meena, V. D. (2014). Effect of sowing dates and weed management on growth and yield of chickpea in Indo-Gangetic plains. Proceedings of the National Academy of Sciences, India Section B: *Biological Sciences, 86*, 33-38.

Dhote, P. P., Thaokar, A., Gawali, K. A., Sarda, A. and Nagmot, A. (2019). Effect of different sowing dates on growth and yield of chickpea (*Cicer arietinum* L.) under irrigated condition. *Journal of Pharmacognosy and Phytochemistry*, *8*(5): 1864-1867.

FAO (2006). FAOSTAT data.

Gurung, G. B., Rijal, D. K. and Gurung, B. D. (1996). Effect of sowing time on grain yield of chickpea under rainfed condition at Pakhribas, *PAC Technical Paper Pakhribas Agril. Centre, 172*: 222.

Ingole, J. S. (2018). Assesment of crop losses due to pink bollworm *Pectinophora gossypiella* in different types of cotton under different sowing dates unpub. Thesis submitted to department of entomology, Dr. Panjabrao Deshmukh Krishi Vidhyapeeth, Akola 27-42.

Kengegowda, N. (2003). Studies on the population dynamics and screening of *Bt* cotton hybrids against insect pests. M.Sc thesis (Agri.), Univ. Agric. Sci., Dharwad, Karnataka, India.

Mohammad, T., Bahram, M., Farhad, F., Mehrdad, Y., Ali, A. J. (2018). Effect of sowing date and different intercropping patterns on yield and yield components of rapeseed (*Brassica napus* L.) and chickpea (*Cicer arietinum* L.) *Legume Research-An International Journal,* (41): 578-583.

Muttappa Yalawar and Patil S. B. (2019). Seasonal Incidence of Pink Bollworm *Pectinophora gossypiella* (Saunders) on *Bt* Cotton. *International Journal of Current Microbiology and Applied Sciences*, *8*(12).

Neenu, S., Ramesh, K., Ramana, S. and Jayaraman, S. (2017). Effect of cultivars and sowing dates on nutrient uptake and yield of chickpea under aberrant climatic conditions in black soils of central India. *Advances in Research*, *12*(423): 1-11.

Patil, B. V., Bheemanna, M., Hanchinal, A. C., Hosmani, A. C. and Bansi, A. B. (2007). Studies of pink bollworm, *Pectinophora gossypiella* (Saunders) on cotton at Raichur, Karnataka. *J. Cotton Res. Dev., 21*(2): 224-226.

Reddy, B. V. S., Reddy, P. S., Bidinger, F., and Blummel, M. (2003). Crop management factors influencing yield and quality of crop residues. *Field Crops Research*, *84*: 57-77.

Solunka,P.S. (2015). Study of Climate Change Effect on Sowing Date for Chickpea after Paddy Crop in Eastern Vidarbha zone. *Journal of Agroecology and Natural Resource Management*, *2*(1): 70-72.

Sankaranarayanan, K., Praharaj, C. S., Nalayini, P. and Gopalakrishnan, N. (2011). Evaluation of *Bt* and non-*Bt* cotton hybrids under varied planting time. *Indian Journal of Agricultural Sciences*, *56*(1): 68-73.

Singer, J. and Bauer, P. (2009). Crop rotations for row crops. In Soil Quality for Environmental Health. NRCS East Technology Support Center. Retrieved from http:// soilquality.org/practices/row_crop_rotations.html accessed 13 March 2017.

Surulivelu, T., Sumanthi, E., Mathirajan, V. G. and Rajendran, T. P. (2004a). Temporal distribution of pink bollworm in *Bt* Cotton hybrids. Paper presented at International Symposium on "Strategies for Sustainable Cotton Production-A Global Vision"3. Crop Protection, 23-25 November, UAS, Dharwad, Karnataka, India, p-278.

Surulivelu, T., Sumanthi, E., Mathirajan, V. G., Rajendran, T. P. (2004b). Larval and damage reduction of bollworms in *Bt* Cotton hybrids. Paper presented at International Symposium on "Strategies for Sustainable Cotton Production-A Global Vision"3. Crop Protection, 23-25 November, UAS, Dharwad, Karnataka, India, p-278.

Udikeri, S. S., Patil, S. B., Nadaf, A. M. and Khadi, B. M. (2003). Performance of *Bt* cotton genotypes under unprotected conditions. Proceedings of World Cotton Research Conference-3,"Cotton Production for the New Millennium" 9-13 March, Cape Town, South Africa pp.1282-1286.

Verma, S. K., Singh, D. R., Jeewesh, S., Saurabh, S. and Yadav, N. (2017). Population dynamics of pink bollworm, *P. gossypiella* (Saunders) in cotton crop. *Int. J. Pure Appl. Biosci., 5*(2): 801-806.

Yadav, V. S., Yadav, S. S., Singh, J. D. S. and Panwar, D. (1999). Morphophysiological basis of yield varieties in chickpea under late planting conditions. *Ann. Agric. Res., 20*(2): 227-230.

How to cite this article: K. Rajashekar, D. Mohan Das and Sreedhar Chauhan (2022). Effect of Harvesting Dates on Cotton Pink Bollworm Infestation and Sowing Dates on Chickpea Yield in Cotton-chickpea Cropping Sequence. *Biological Forum – An International Journal, 14*(4): 468-471.