The Andhra Agric. J 66 (3): 494-498, 2019

Effect of Sowing Dates and Plant Protection Aspects on The Incidence of Vector Leaf Hopper and Sesame Phyllody

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ABSTRACT

A field experiment was conducted during late *rabi* season of 2016 and 2017 to evaluate the effect of sowing dates and plant protection on the buildup of cicadellid and in turn sesame phyllody for realizing higher seed yield. The experiment was laid out in Factorial Randomized Block Design with three replications. Experimental factors were five sowing dates with 15 days interval (December 15, 31, January 17, February 5 and 21), spraying with imidachloprid 17.8 SL @ 0.3 ml l^{-1} applied twice at 30 and 50 days after sowing and control. The results showed that spraying had significant effect on the rate of phyllody incidence and the yield was significantly decreased at 5 per cent level in untreated plot (159.9 kg ha^{-1}) compared to treated main plot (245.3 kg ha^{-1}). Date of sowing had significant effect on the leaf hopper population, disease incidence rate and yield at 5 per cent level. The results inferred that highest seed yield (299.5 kg ha^{-1}), lowest disease incidence (0.05%) and leaf hopper population (0.17 per plant) were observed in early sowing date (15th December) and spraying with systemic insecticide. Most of these parameters were statistically identical to 31st December sowing but all of them were recorded significantly lowest in 21st February sowing as the incidence of phyllody was high (7.25 %) due to population build up of the vector with increased temperatures and subsequent migration from adjacent plots approaching maturity. Data indicated that early infestation by leafhopper in late sown crop was the most damaging and resulted in highest phyllody and yield reduction.

Key words: *Insecticide spray, Leafhopper, phyllody, Sesame variety Gowri, sowing date.*

Sesame or Til (*Sesamum indicum* L.) belongs to family Pedaliaceae is one of the principal oilseed crops grown in Andhra Pradesh both during *kharif* and late *rabi* /summer. The crop is affected by many pests and diseases and one of the important pests is leafhopper, *Orosius albicinctus* Distant which transmits phyllody disease in sesame (Akhtar *et al*., 2009), where the entire inflorescence is replaced by a growth consisting of short, twisted leaves closely arranged on a stem with very short internodes and affected plants remain partially or completely sterile. Phytoplasma as a causal agent have been reported by Akhtar *et al*. (2008) which takes a heavy toll resulting in significant yield losses. As much as 10-100% incidence of the phyllody disease has been recorded in sesame crop in India (Beech, 1981) and the yield loss due to phyllody in India is estimated to be about 80 per cent (Kumar and Mishra, 1992).

For controlling the vector usage of chemical insecticides has been successful (Misra, 2003; Dehghani *et al*., 2009 and Rojeet and Vastrad, 2015), however, the complete elimination of the disease is not possible because small areas are subjected to re-infection with leafhoppers migrating from adjacent natural or cultivated hosts. Number of crop hygiene practices which may reduce phyllody incidence in sesame *viz*., early rouging of diseased plants, restriction on growing sensitive crops and control of the leafhopper vectors. To control or avoid phyllody disease, some of the cultural methods could be practiced, particularly crop rotation, sowing dates. It has been noted that the severity of phyllody is influenced by the time of sowing (Sandhu *et al*., 2009; Dehghani *et al*., 2009; Rojeet, 2012 and Seyyed *et al.,* 2015). Early sowings of sesame tend to produce excessive vegetative growth which makes the plants very attractive to leaf hoppers, thereby increasing the incidence of phyllody. However, in later sowings which produce smaller plants, the incidence of phyllody will still be high due to migration of the vectors from adjacent host crops approaching maturity. In this context, the present experiment is conducted with a view to find out the effect of different sowing dates on the build up of phyllody under protected and un-protected conditions.

MATERIAL AND METHODS

An experiment was carried out at the Agricultural Research Station, Darsi, Prakasam District during the late *rabi* season of 2016 and 2017 to evaluate the effect of sowing dates and spraying with systemic insecticide on the buildup of cicadellid, *Orosius albicinctus* Dist. which transmits sesame phyllody. The experiment was laid with five sowing dates taken up at 15 days interval commencing from the second week of December to second week of

February *viz*., December 15, December 31, January 17, February 5 and February 21 under protected and unprotected plots in a Factorial Randomized Block design. The spraying with systemic insecticides are considered as the main treatment plot which formed the protected and unprotected plots and time of sowing in the sub-plots with three replications, using Gowri variety in a plot size of 1.5 x 5.0 m at a spacing of 30 cm x 15 cm. Standard package of practices except the plant protection schedule was followed for raising the crop. In protected plots, the leafhopper was kept under check by foliar application of imidacloprid 17.8 SL @ 0.3 ml l^{-1} applied twice at 30 and 50 days after sowing, while in the unprotected plots, it was allowed for natural infestation of leafhopper.

The abundance of the vector was recorded both in protected and un-protected plots by selecting 10 plants randomly from each plot and the number of leafhoppers was counted from the top portion of the plants (15-20 cm) one day before and 1st, 3rd, 5th and 7th day after spraying and expressed as number per plant. The incidence of phyllody was recorded by counting the number of plants showing disease symptoms from the entire sub-plot of 7.5 sq.m. and total number of plants in the plot and expressed as per cent incidence at fortnightly interval, starting from 30 days after sowing. The yield of sesame was assessed based on the weight obtained from the un-protected and protected plots. Seed yield from the net plot of each treatment was taken, dried, weighed and expressed as kg ha^{-1}. Weight of 1000 seeds from each treatment was recorded when the moisture level was below 14 per cent after sun drying. Weight of three such seeds samples from three replications were taken and average was worked out for statistical interpretations. Data were summarized separately for 2016 and 2017 and the combined data of both the years were analyzed statistically after suitable transformations. Differences between data sets were determined using least significant difference at P=0.05.

RESULTS AND DISCUSSION

Population of Leafhopper

The pooled data for late r*abi* 2015-16 and 2016-17 indicated significant differences between protection levels, sowing dates and their interaction. The protected plot recorded significantly lower mean leafhopper population (0.47 hoppers/ plant) against 1.40 hoppers/ plant under unprotected conditions. Among the different sesame sowing dates, sowing taken up during December 15th and 31st were significantly superior over the remaining sowing dates by recording the lowest mean population of 0.55 and 0.72 hoppers/ plant followed by January 17th sown crop (0.83 hoppers/ plant) which was at par with February 21st and February 5th sown crop (1.36 and1.42 hoppers/ plant). Among the different treatment combinations of protection levels and different sowing weeks, sesame sown on December 15th and 31st under protected conditions recorded significantly lower population of 0.17 and 0.33 hoppers/ plant and both were at par. These were followed by January 17th (0.44 hoppers/ plant) which in turn non-significantly followed by February 5th and February 21st (0.67 and 0.72 hoppers/ plant) sown crop. There was a gradual increase in leafhopper population with the delay of sowing dates in both protected and unprotected conditions. However, all the treatment combinations under unprotected conditions in all the five sowings were recorded higher population of leafhoppers compared to all the treatment combinations under protected plot (Table 1).

Phyllody incidence

Pooled data revealed significantly higher phyllody incidence in unprotected plots as compared to protected ones with 3.08 and 1.03 per cent, respectively. The overall influence of different sowing dates irrespective of protection levels on phyllody incidence was found to be highest with February 21st sowing (4.55%) which was significantly followed by sowing at February 5th (2.75%). The next highest phyllody damage was recorded with January 17th (1.73%). The least phyllody percentage was recorded with December 15th (0.37%) sowing which was on par with December 31st (0.88%) sowing. The disease incidence in all the sowing dates was significantly increased with delay in sowing time. Among the different treatment combinations of protection levels and sowing weeks, significant differences were observed in per cent of phyllody incidence with highest during February 21st sowing under unprotected conditions (7.25 %) significantly followed by February 5th (3.76 %) and January 17th (2.23%) sowing. The later sowing week was on par with December 31st sowing (1.47%). The least per cent phyllody incidence was recorded at December 15th (0.05%) sown crop under protected situation which differed significantly from other treatment combinations (Table 1).

Test (1000 seeds) weight

Pooled result indicated significant difference between protected and unprotected treatments with a mean 1000-seed weight of 2.28 and 2.03 g, respectively as the wrinkled seeds increased in diseased plants. Sowing dates has no significant influence on 1000-seed weight. December 15th sown crop was numerically superior over all other dates of sowing irrespective of protection levels by recording mean highest 1000-seed weight of 2.26 g. However,

Table 1. Effect of different dates of sowing on sesame leaf hopper, *Orosius albicinctus* and phyllody incidence in chemically protected and un-protected sesame (*Sesamum indicum* L.)

Sowing date	Pooled Mean (late *rabi* 2015-16 & 2016-17)											
	#No. of leaf hoppers / plant			*Phyllody (%) incidence			1000 seed weight (gm)			Seed yield (Kg/ha)		
	Protected	Un-protected	Mean	Protected	Un-protected	Mean	Protected	Un-protected	Mean	Protected	Un-protected	Mean
Dec-15	0.17 (0.81)^{a}	0.94 (1.20)^{bc}	0.55 (1.01)^{a}	0.05 (1.84)^{a}	0.67 (4.44)^{ab}	0.37 (3.15)^{a}	2.39^{b}	2.13^{a}	2.26^{a}	299.5^{f}	233.9^{cde}	266.7^{c}
Dec-31	0.33 (0.91)^{a}	1.11 (1.26)^{c}	0.72 (1.08)^{a}	0.28 (2.99)^{ab}	1.49 (6.87)^{cd}	0.88 (4.92)^{a}	2.22^{a}	2.03^{a}	2.12^{a}	273.5^{ef}	183.9^{b}	228.7^{bc}
Jan-17	0.44 (0.95)^{ab}	1.22 (1.31)^{cd}	0.83 (1.13)^{ab}	1.23 (5.73)^{bcd}	2.23 (8.47)^{de}	1.73 (7.11)^{b}	2.34^{ab}	2.05^{a}	2.19^{a}	241.4^{de}	135.5^{a}	188.5^{ab}
Feb-05	0.67 (1.07)^{abc}	2.17 (1.63)^{e}	1.42 (1.34)^{b}	1.73 (7.51)^{d}	3.76 (11.16)^{e}	2.75 (9.34)^{c}	2.27^{a}	2.00^{a}	2.14^{a}	218.8^{bcd}	131.7^{a}	175.2^{a}
Feb-21	0.72 (1.09)^{abc}	2.00 (1.58)^{de}	1.36 (1.34)^{b}	1.84 (7.76)^{d}	7.25 (15.60)^{f}	4.55 (11.68)^{d}	2.20^{a}	1.92^{a}	2.06^{a}	193.2^{bc}	114.6^{a}	153.9^{a}
Mean	0.47 (0.97)^{a}	1.49 (1.40)^{b}	0.98	1.03 (5.17)^{a}	3.08 (9.31)^{b}	2.06	2.28^{b}	2.03^{a}	2.16	245.3^{b}	159.9^{a}	202.6
CV%	14.1			23			11.5			12.2		
Protection (CD p=0.05)	0.12			1.27			0.18			18.9		
Sowing date (CD p=0.05)	0.2			2.01			0.3			30		
Protection X Sowing (CD p=0.05)	0.29			2.86			0.43			42.5		

*Figures in the parentheses are arc sine transformed values

#Figures in the parentheses are square root transformed values

Means followed by similar letters in columns or rows are not significantly different ($P < 0.05$) as per DMRT sesame sown on other sowing dates maintained its similarity with December 15th sowing in recording 1000-seed weight and was significantly unaffected by the sowing dates. The interactions between protection level and dates of sowing also followed the similar trend in recording 1000-seed weight without significant differences among the combinations (Table 1).

Seed yield

Pooled analysis of late *rabi* 2015-16 and 2016-17 data revealed significant difference between protected and unprotected plots with a mean seed yield of 245.3 and 159.9 kg ha^{-1}, respectively. Significantly the highest mean seed yield of 266.7 kg ha^{-1} was obtained when the crop was sown during December 15th and it was on par with December 31st sown crop (228.7 kg ha^{-1}). January 17th sown crop recorded 188.5 kg ha^{-1} and was on par with February 5th (175.2 kg ha^{-1}) and 21st sown crop (153.9 kg ha^{-1}). The higher seed yield produced in early sowing was mainly due to production of higher number of branches, capsules/ plant and maximum number of seeds/ capsule. Significant differences were observed in interaction between protection level and sowing time and significantly higher grain yield of 299.5 kg ha^{-1} was recorded in December 15th sown crop under protected conditions than the seed yield obtained in other dates and it was statistically on par with December 31st (273.5 kg ha^{-1}) which in turn on par with January 17th (241.4 kg ha^{-1}) sown crop. With delay in sowings, February 5th and 21st sown crops differed significantly by recording sesame seed yield of 218.8 and 193.2 kg ha^{-1}, respectively (Table 1). The same trend followed in all the five-treatment combinations under unprotected conditions but seed yield was inferior to all the treatment combinations under protected ones.

Date of sowing and protection levels play a vital role in determining final seed yield of sesame. With delay in sowings, there was progressive decline in grain yield due to increased phyllody incidence under natural conditions. Sustenance of plant to biotic stress is dependent on the growth, vigor and age of the plant. The crop that was sown late produced lower biomass (foliage area) and stunting of growth at the time when the phyllody incidence was high. Consequently, there was increased virescence, yellowing, flower sterility, wrinkled seeds and stem proliferation in later dates of sowing was manifested in lowering the grain yield. The reduction in the seed yield under late sown conditions might be attributed to shorter reproductive phase of crop (Roy *et al*., 2005). On the other hand, the lower population of leafhopper in early sown crop resulted in less incidence of phyllody and increased seed yield. By sowing sesame at fortnightly intervals, Rojeet (2012) also observed that both the phyllody and leafhopper population were higher when the crop was sown in the month of June compared to July. The effect of five sowing dates (June 8, 22, July 6, 16 and 28) and spraying with Metasistox -R on sesamum phyllody and crop yield was evaluated by Dehghani *et al*. (2009) and reported that highest yield and lowest disease incidence were obtained with the latest sowing date (July 28) along with spraying with Metasistox -R. Seyyed *et al*. (2015) propounded that sowing of sesame straight after wheat harvesting in May needed spraying to reduce disease incidence, but delay in the sowing date to July 5 can reduce disease incidence without any significant differences in seed yield. However, delay in sowing date is dependent on weather and needs to be determined for each area.

CONCLUSION

From the present study it can be concluded that there was a progressive increase in the incidence of phyllody and the leafhopper population with the delay of sowing dates in sesamum crop from December 15 to February 21. Phyllody incidence in the treated plots was significantly lower than the untreated plots. However, keeping in view the yield and other growth parameters in addition to the disease and vector incidence, the sesamum sowing may preferably be initiated in the second fortnight of December during late *rabi* situation for higher productivity and profitability on sustainable basis and to minimize the insecticide applications.

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Received on 28.02.2019 and revised on 04.04.2019