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Influence of different sowing dates on sucking pests incidence in soybean (*Glycine max* (L.) Merrill) during rabi-summer

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Abstract

The field experiment carried out during Rabi-summer 2020-21, at Agricultural Research Station (ARS), Bailhongal, Karnataka, India. The population of different sucking pests recorded and the influence of different sowing dates was observed throughout the crop period. Crop sown at six different times from November first fortnight to till January second fortnight with 15 days interval. Among sucking pests, Aphids (*Aphis glycines*) were minor in November sown crop and absent in December and January sown crops. Highest population of whiteflies (*Bemisia tabaci*) recorded in November 1st FN sown crop (6.60 whiteflies/ top 3 leaves) at 51st MSW. Leafhoppers (*Empoasca fabae*) appeared after 2-3 weeks. November 1st fortnight sown crop found severely infected (10.50 hoppers / top 3 leaves). Thrips found after flowering stage and higher population was recorded in January sown crops. Overall, sucking pest load was more in November (early) and January (late) sown crops comparatively.

Keywords: Leafhoppers, rabi-summer, thrips, sowing dates, soybean

Introduction

Soybean (*Glycine max* (L.) Merrill) (Fabaceae, Fabales) is popularly referred as "Golden Bean" or "Miracle crop" and known to be originated in China and Far East. Growing as a major oil seed crop in whole world the production of soybean for various purposes are increased. The soybean seed contain (20%) Oil and protein (40%) along with fat (19.5%) and carbohydrates (20.9%) (Yadav, 2013) ^[17]. As it's having several nutrition values mentioned above, soya bean also contributes about 25% global edible oil and 2/3rd of world's protein concentrate for livestock feeding, poultry, fish feed and soybean meal as human diet supplements for protein (Alexander, 1974) ^[1]. Global production of 336.11 million tonnes in an area of 121.69 million hectares was remarked during 2019-20. Mean time India ranks fourth in production and fifth in area globally as per AMIS, FAO. In India, Karnataka stands fourth rank next to Madhya Pradesh, Maharashtra and Rajasthan (Anon, 2019) ^[2].

Many biotic factors influence the soybean growth and development. Among them insect pests and diseases play an important role because of the lush green growth and soft leaves. The crop was infested by more than 380 species of insect pests in the world while in India it varied around 10-12 during 1970's increased up to 270 pests along with some non-insect pests like mites, millipedes, vertebrates and snail (Singh, 1999) ^[15].

Among many insects, defoliators cause major damage in soybean which is followed by sucking pests and pod borers. Aphids, whitefly, leaf hoppers, thrips and pod sucking bugs were majorly recorded in soybean ecosystem. *Bemisia tabaci* (Genn) and *Thrips palmi* (Karny) recorded whole crop period and caused 24 per cent yield loss reported by Singh and Singh, 1990^[14]. Sutaria *et al.*, (2010)^[16] recorded Jassids infesting soybean while, Netam *et al.*, (2013)^[9] reported whiteflies and Jassids were major sucking pests on soybean variety JS 93-05. While various studies are conducted at different places in India. The present study is varied in terms of the season (Rabi-summer) which usually *Kharif* in earlier studies.

Materials and Methods

The present investigation is a field experiment on sucking pests incidence was carried out during Rabi-summer season of 2020-21 at University of Agricultural Sciences Dharwad, Agricultural Research Station (ARS), Bailhongal on medium black soil. Bailhongal is a taluk place in Belagavi district of North Karnataka at 15⁰48¹⁴7.88¹¹ N latitude and 74⁰51¹23.62¹¹ E longitudes with an altitude of 699.31 meter above MSL with the annual rainfall of 370-630 mm annually.

Soybean crop (JS-335) was grown at six different sowing dates started from November first fortnight to January second fortnight at fortnight (FN) interval. The crop of 10 rows at each of 5m length with 30×10 cm spacing. Numbers of insects (nymphs and adults) on top 3 leaves per plant in 10 randomly selected plants were observed and recorded the population. Later, mean was worked out. Observations were made from germination to till the harvest at weekly interval. The observations were correlated with weather parameters using correlation technique suggested by Panse and Sukhatme (1985) ^[10] to see the effect of different abiotic factors on the population of insect pests.

Results and Discussion

The population dynamics of different sucking pests associated with different sowing dates were observed in the prevailing weather conditions of Bailhongal, Karnataka during Rabisummer 2020-21. Four sucking pests were observed during the study period, which includes aphids (*Aphis glycines*), whiteflies (*Bemisia tabaci*), leafhoppers (*Empoasca fabae*) and Thrips. Aphids recorded in early sown crop (November 1st and 2nd fortnight) was ranged between 0.00-1.35 aphids per top three leaves in early stage of the crop and continued till 4-5 weeks after sowing but they were totally absent in late sown crop (December and January). Appropriate literature regarding aphid incidence in Rabi-summer is lacking so it was left undiscussed (Table 1-3).

The incidence of whiteflies was appeared throughout the growth period starting after 2-3 weeks. The incidence was high at 5-6 weeks after sowing and later declined gradually. The highest population was observed in November 1st FN sown crop (6.60 aphids/ top 3 leaves) and January first fortnight sown crop (6.30 aphids /top 3 leaves) coincides 51st and 7th MSW, respectively. The incidence was less during December sown crop when compared with early (November) and late (January) sown crops. Due to lack of research findings of Rabi-summer season on sucking pests, the available Kharif literature were taken and discussed to know nearby similarities throughout. The results were nearly similar with the finding of Patel (2012) ^[11] who reported first appearance of whitefly in 13 days after sowing and whitefly (Bemisia tabaci) first appeared on 49th MSW during Rabi season and peak during 8th SW also, during summer appeared on 1week after sowing (14th MSW) at Jabalpur from the reports of MaRabi et al. (2017)^[8]. The findings are also in partial agreement with the findings of Biswas (2013)^[4] who also reported that higher infestation of whitefly (Bemisia tabaci) was observed during the January to June crop on soybean in Bangladesh.

Leafhoppers population was found throughout cropping period starting from 2-3 weeks after sowing. The peak incidence was observed on 6-7 weeks after sowing and later declined gradually. The crop sown during November 1st fortnight and January first and second fortnight was found

severely infected with peak population of 10.50, 9.90 and 10.33 nymphs and adults per top three leaves, respectively. While the population in November second fortnight and December sown crops (Dec 1st FN and Dec 2nd FN) were significantly lower with peak of 4.20, 6.75 and 5.85 nymphs and adults per top three leaves respectively (Table 1-3). The present findings were in partial agreement with Brahman *et al.* (2018) ^[5] who reported the Jassids (*Empoasca Kerri*) infest the soybean in vegetative, reproductive/ flowering, pod formation and also at pod maturity stages. In soybean ecosystem Patil (2002) ^[12] also recorded the incidence of leafhopper during summer and in partial agreement with Chaudhary *et al.* (2018) ^[6] who reported with peak population of Jassids (5.95 Jassids/3 leaves).

Thrips were also found during late vegetative and flowering stage. They were observed throughout the cropping period. The population of Thrips attained peak at 7 weeks after sowing and later declined gradually. The peak population of Thrips was observed in November first fortnight, January first and second fortnight with 10.34 (51st MSW), 10.48 (10th MSW) and 10.80 (12th MSW) Thrips per top three leaves at flowering stage. While the crops sown in November second fortnight and December sown crops (Dec 1st FN and Dec 2nd FN) showed lower population where they attained a maximum population of 7.20, 8.55 and 8.55 Thrips per top three leaves, respectively (Table 1-3). The results were in partial agreement with Chaudhary et al. (2018) [6] who observed the Thrips (5.85 Thrips/3 leaves) during Kharif in Sardarkrushinagar (Gujarat) and El-Wahab (2016)^[7] also reported that Thrips tabaci was the abundant species on soybean sown in summer (late may) in Egypt.

Relationship between pest population and weather parameters were analysed. In the November first fortnight sown crop, aphid population was significant and positive correlation with relative humidity (0.627*) while in contrast it was negatively correlated with maximum temperature (-0.669*) at P = 0.05significance level. Along with that whitefly showed negative correlation with maximum temperature (-0.550*). Also, in case of January first fortnight sown crop, whiteflies population exhibited significantly negative correlation with minimum temperature (-0.748*). The results are nearer to the findings of Sable et al. (2018) ^[13] who reported whitefly population was significant negative correlated with maximum and minimum temperature on late sown soybean crop. Then, December first fortnight and December second fortnight sown crops, none of the pests populations were significantly correlated with weather parameters (Table 5). In late sown crop *i.e.*, January second fortnight sown crop, the population of leafhoppers was significant positively correlated with relative humidity (0.677*). This is in line with the report of Sable et al. (2018) ^[13] who reported Jassids population was positively correlated to relative humidity. While, Thrips exhibited the significant negative correlation with relative humidity (-0.603*) at 5% significance level (Table 4).

Table 1: Incidence of sucking pests of soybean during Rabi-summer (2020-21) at November sowing regiment

	MSW	Sucking pests (Average no. of nymphs and adults per three leaves)							
Month		November First fortnight			November Second fortnight				
		Aphids	Whiteflies	Leafhoppers	Thrips	Aphids	Whiteflies	Leafhoppers	Thrips
Nov	47	0.15	0.00	0.00	0.00	-	-	-	-
	48	1.35	1.50	0.00	0.00	-	-	-	-
	49	0.90	4.50	4.05	1.80	0.75	0.00	0.00	0.00
	50	0.75	3.00	8.10	5.85	0.15	2.10	0.00	0.00
Dec	51	0.60	6.60	10.50	10.35	0.10	3.60	2.25	0.90
	52	0.45	1.80	7.65	7.20	0.00	4.20	4.05	4.95
	53	0.00	0.30	3.15	0.90	0.00	0.00	2.70	1.35
	1	0.00	2.40	1.80	0.00	0.00	0.00	1.80	7.20
Ion	2	0.00	0.60	0.00	0.00	0.00	0.00	2.25	0.00
Jan	3	0.00	0.60	0.00	0.00	0.00	0.00	2.25	0.00
	4	0.00	0.30	0.00	2.25	0.00	0.30	3.60	5.40
Feb	5	0.00	0.00	0.00	0.00	0.00	1.20	2.70	0.00
	6	0.00	0.00	0.00	0.00	0.00	0.00	2.70	2.70
	7	-	-	-	-	0.00	1.50	0.00	0.00
	8	-	-	-	-	0.00	0.00	0.00	8.10
Mean ± SD 0.32±0.45 1.66±2.02 2.71±3.72 3.81±3.12 0.07±0.20 0.92±0.44 1.74		1.74 ± 1.45	2.19±2.96						

MSW-Meteorological standard week

 Table 2: Incidence of sucking pests of soybean during Rabi-summer (2020-21) at December sowing regiment

	MSW	Sucking pests (Average no. of nymphs and adults per three leaves)							
Month		December First fortnight			December Second fortnight				
		Aphids	Whiteflies	Leafhoppers	Thrips	Aphids	Whiteflies	Leafhoppers	Thrips
	51	0.00	0.00	0.00	0.00	-	-	-	-
Dec	52	0.00	0.60	0.00	0.00	-	-	-	-
	53	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00
	1	0.00	2.70	1.80	1.80	0.00	0.00	0.00	0.00
Jan	2	0.00	0.60	3.60	2.70	0.00	1.20	0.90	0.00
	3	0.00	0.60	4.05	4.05	0.00	1.20	3.15	2.70
	4	0.00	3.00	6.75	8.55	0.00	2.40	1.80	8.55
	5	0.00	1.80	4.95	1.35	0.00	2.10	1.80	5.40
Eab	6	0.00	0.30	2.70	2.70	0.00	1.50	0.90	7.20
гео	7	0.00	3.90	4.05	0.00	0.00	0.90	4.95	5.85
	8	0.00	0.00	7.65	4.05	0.00	0.90	5.85	3.15
	9	0.00	0.00	2.70	0.00	0.00	0.00	3.15	0.00
Mar	10	0.00	0.00	0.00	0.00	0.00	0.00	2.70	0.00
	11	-	-	-	-	0.00	0.00	0.00	0.00
	12	-	-	-	-	0.00	0.00	0.00	0.00
Mean ± SD		0.00 ± 0.00	1.15 ± 1.32	2.94 ± 2.58	1.94 ± 2.53	0.00 ± 0.00	0.78 ± 0.86	1.94 ± 1.94	2.53±3.20

MSW-Meteorological standard week

Table 3: Incidence of sucking pests of soybean during summer (2020-21) at January sowing regiment

	MSW	Sucking pests (Average no. of nymphs and adults per three leaves)							
Month		January First fortnight			January Second fortnight				
		Aphids	Whiteflies	Leafhoppers	Thrips	Aphids	Whiteflies	Leafhoppers	Thrips
	2	0.00	0.00	0.00	0.00	-	-	-	-
JAN	3	0.00	1.50	0.45	0.00	-	-	-	-
	4	0.00	3.60	2.25	2.70	0.00	0.00	0.00	0.00
	5	0.00	1.80	4.05	3.60	0.00	0.00	0.00	0.00
EED	6	0.00	3.90	3.60	4.05	0.00	1.20	1.80	0.00
FEB	7	0.00	6.30	4.50	4.50	0.00	2.40	2.70	1.80
	8	0.00	3.30	5.85	2.70	0.00	3.00	5.85	3.60
	9	0.00	3.90	9.90	9.90	0.00	2.40	4.95	5.85
	10	0.00	3.60	7.65	10.40	0.00	3.00	10.35	10.35
MAR	11	0.00	2.10	7.20	8.95	0.00	1.80	8.55	7.65
	12	0.00	0.00	3.60	2.25	0.00	1.20	8.10	10.80
	13	0.00	0.00	2.25	0.00	0.00	0.60	5.04	3.60
APR	14	0.00	0.00	0.00	0.00	0.00	0.00	3.60	0.00
	15	-	-	-	-	0.00	0.00	1.80	0.00
	16	-	-	-	-	0.00	0.00	0.00	0.00
Mean	± SD	0.00 ± 0.00	2.31±1.99	3.95±3.07	3.78±3.78	0.00 ± 0.00	1.20 ± 1.20	4.06±3.45	3.36 ± 4.07

MSW-Meteorological standard week

Fable 4: Correlation values of sovbear	sucking pests with weather	parameters during Rabi-summer (2020-21)
Table 4. Conclution values of soybean	sucking pests with weather	parameters during Rubi Summer (2020 21)

Correlation coefficient (r)									
Weether recorded	Insect pests								
weather parameters	Aphids	Whiteflies	Leafhoppers	Thrips					
	Nov	ember first fortn	ight						
Max. Temp. (⁰ C)	-0.669*	-0.550*	-0.537	-0.363					
Min. Temp. (⁰ C)	0.328	0.058	-0.389	-0.331					
Relative Humidity (%)	0.627*	0.469	0.327	0.198					
November second fortnight									
Max. Temp. (⁰ C)	-0.503	-0.369	0.081	0.072					
Min. Temp. (⁰ C)	0.315	0.389	-0.311	-0.020					
Relative Humidity (%)	0.534	0.181	-0.138	-0.138					
December first fortnight									
Max. Temp. (⁰ C)	-	-0.010	0.252	0.050					
Min. Temp. (⁰ C)	-	-0.405	0.263	0.187					
Relative Humidity (%)	-	-0.035	-0.208	0.055					
	Decer	mber second fort	night						
Max. Temp. (⁰ C)	-	-0.294	0.172	-0.103					
Min. Temp. (⁰ C)	-	-0.333	-0.080	-0.504					
Relative Humidity (%)	-	0.183	-0.135	-0.113					
January first fortnight									
Max. Temp. (⁰ C)	-	-0.231	0.241	0.260					
Min. Temp. (⁰ C)	-	-0.748*	-0.126	-0.223					
Relative Humidity (%)	-	-0.172	-0.522	-0.530					
January second fortnight									
Max. Temp. (⁰ C)	-	-0.249	0.349	0.306					
Min. Temp. (⁰ C)	-	-0.375	0.126	0.122					
Relative Humidity (%)	-	-0.235	0.677*	-0.603*					

*Correlation is Significant at the 0.05 level

Conclusion

The study concludes that whitefly, aphid, leafhopper and Thrips were the different sucking pests recorded and population was low in all the sowing dates during the study period. The incidence was significant in early and late sown crops but December sown crops suffered with severe winter and incidence of sucking pests was less. From all the previous results we can conclude the sucking pest incidence during Rabi-summer was significant and the damage caused by them definitely affect the yield levels and net profit.

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