Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.7906

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2020) *8*(1), 49-55

Research Article

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Pest Population Dynamics of Soybean Varieties as Influenced by Varieties and Sowing Windows

Waghmare, S. V.*, Kharbade, S. B. and Sthool V. A.

Department of Agricultural Meteorology, Centre for Advanced Faculty Training (CAFT) in Agricultural Meteorology, College of Agriculture, Pune – 411 005 Maharashtra, India

*Corresponding Author E-mail: shrinivaswa@gmail.com

Received: 9.11.2019 | Revised: 18.12.2019 | Accepted: 26.12.2019

ABSTRACT

An experiment "Micrometeorological studies on growth, yield and pest infestation on soybean varieties under different sowing windows" was carried out at Faculty of Agriculture Department of Agricultural Meteorology Farm, Centre for Advanced Agricultural Meteorology, College of Agriculture, Pune during Kharif seasons of 2015 and 2016.

The infestation activity of Spodoptera noticed during the first sowing window 26th MW (D_1) with the varieties MACS- 450 (V_1), JS-335 (V_2) and DS- 228 (V_3) and KDS- 344 (V_4) the incidence of Spodoptera was ranged from 0.23 – 1.60, 0.10 – 1.67, 0.07 – 1.47 and 0.17 – 1.33 larvae/mrl with a peaks in 36th and 37th MW. Whereas, crop sown on 27th MW (D_2) recorded the maximum incidence (0.13 to 1.13 larvae/mrl).

Among the soybean varieties, higher incidence of Spodoptera and semilooper was recorded on MACS- 450 variety and minimum was recorded on Phule Kalyani. Timely sowing on 26th MW (D_1) and 27th MW (D_2) recorded lower incidence of Spodoptera and semilooper, whereas, crop sown delay during 29th MW (D_4) recorded the maximum incidence.

Keywords: *Spodopter, MW, Soybean, Sowing windows.*

INTRODUCTION

Population dynamics of insect pest, study to know the most susceptible stage (s) of the pest provides a very good alternative. In such study, the life table is the most important technique, which provides a summary description of mortality, survivorship and life expectancy for a specified population. It shows organism's mortality (or survival) and reproduction rate (maternal frequency) as a function of age. In nature, such mortality and reproduction rate depends on numerous factors such as temperature, population density, natural enemies, and diseases.

Life tables are the most important tools in the pest management revealed the most opportune periods and vulnerable stages of the insect species. Series of life tables of the pest increases the understanding about the pest dynamics and mortality factors such as predators, parasitoids and pathogen infection on the pest and we can use major key mortality factor in management of the pest.

Cite this article: Waghmare, S.V., Kharbade, S.B., & Sthool V.A. (2020). Pest Population Dynamics of Soybean Varieties as Influenced by Varieties and Sowing Windows, *Ind. J. Pure App. Biosci. 8*(1), 49-55. doi: http://dx.doi.org/10.18782/2582-2845.7906

The weather parameters which are directly responsible for the crop growth, yield and pest incidence under the climatic variability for the Pune region, Maharashtra, India due to the climate change. The increase in climatic variation associated with weather parameters like uneven rainfall distribution, sudden changes in day and night temperatures, relative humidity during the crop growing season and its impact on pest population dynamics. To avoid the losses caused by the insect pests, various control measures have been designed.

MATERIALS AND METHODS

The field experiment was conducted at Department of Agricultural Meteorology Farm, College of Agriculture, Pune during *kharif* seasons of 2015 and 2016. The experiment was conducted in a split plot design with three replications. The treatments were allotted randomly to each replication by keeping the gross plot size 5.4 x 3.6 m^2 and net plot size 4.5 x 2.7 m^2 with 45 x 5 cm spacing. There were sixteen treatment combinations.

The experiment was laid out in split plot design with three replications. The treatments comprised of four soybean varieties *viz.*, V_1: MACS- 450, V_2: JS- 335, V_3: DS – 228 (Phule Kalyani) and V_4: KDS- 344 (Phule Agrani) as main plot and four sowing windows *viz.*, D_1: 26th MW (25 June -1 July), D_2: 27th MW (2 July-8 July), D_3: 28th MW (9 July – 15 July) and D_4: 29th MW (16 July -22 July) as sub plot treatments.

RESULTS AND DISCUSSION

Seasonal incidence of major pests on soybean

The study was conducted during both the years of *kharif* season of 2015 and 2016. During the course of study the incidence of two major pests were recorded on soybean crop sown at different sowing windows with four varieties, two insect, *viz.,* Semilooper and *Spodoptera* were recorded as major pests associated with soybean crop.

Semilooper larvae

During the year 2015 the early instar larvae of semilooper, feed on leaves by scratching the green matter and grown up larvae consume entire leaves leaving behind only the midribs and veins. This pest was noticed defoliating from vegetative stage of the crop.

The incidence of semilooper was recorded all varieties during the year 2015 across all the windows of sowing. During the first sowing window 26th MW (D_1) with the varieties MACS- 450 (V_1), JS- 335 (V_2) and DS- 228 (V_3) and KDS- 344 (V_4), the incidence of semilooper was in the ranged from 0.10 - 1.47, 0.10 - 1.20, 0.07 - 1.33 and 0.10 - 1.33 larvae/mrl respectively, with a peak in 36th MW and 37th MW. Which was less than late sowings. Similar results reported by Meena and Sharma (2006).

Similarly it was evident from the data that there was clear cut differences in population of *Spodoptera* larvae in soybean crop at different windows of sowing. The infestation of *Spodoptera* increased during the first sowing window 26th MW (D_1) with the varieties MACS- 450 (V_1), JS- 335 (V_2) and DS- 228 (V_3) and KDS- 344 (V_4). The incidence of *Spodoptera* was ranged from 0.23 - 1.60, 0.10 - 1.67, 0.07 - 1.47 and 0.17 - 1.33 larvae/mrl respectively incidence in 36th and 37th MW.

During the second sowing window of 27th MW (D_2) with the varieties MACS- 450 (V_1), JS- 335 (V_2) and DS- 228 (V_3) and KDS- 344 (V_4), the incidence of semilooper was ranged from 0.13 - 1.60, 0.20 - 1.23, 0.23 - 1.60 and 0.23 - 1.63 larvae/mrl respectively peaks in 36th and 37th MW.

The infestation *Spodoptera* increased during the second sowing window 27th MW (D_2) with the varieties MACS- 450 (V_1), JS- 335 (V_2) and DS- 228 (V_3) and KDS- 344 (V_4), the incidence of *Spodoptera* was ranged from 0.10 - 1.83, 0.10 - 1.73, 0.13 - 1.47 and 0.10 - 1.47 larvae/mrl respectively, with the peaks incidence in 36th and 37th MW.

During the third sowing window of 28th MW (D_3) with the varieties MACS- 450 (V_1), JS-335 (V_2) and DS- 228 (V_3) and KDS- 344 (V_4), the incidence of semilooper was ranged from 0.15 - 1.90, 0.24 - 1.48, 0.27 - 1.90 and 0.27- 1.94 larvae/mrl respectively

with peaks in 37th MW. (Table 4.23). Similarly, the populations of *Spodoptera* during 28th MW(D_3) sowing window with the varieties MACS- 450 (V_1), JS- 335 (V_2), DS- 228 (V_3) and KDS- 344 was ranged from 0.12 - 2.14, 0.12 - 2.02, 0.15 - 1.72 and 0.12 -1.72 larvae /mrl respectively, with the peaks in 37th and 38th MW.

Sowing with last sowing window i.e. 29th MW (D_4) with the varieties MACS- 450 (V_1), JS-335 (V_2), DS- 228 (V_3) and KDS- 344 the incidence of semilooper was ranged from 0.14 -1.70, 0.23 -1.39, 0.23 - 1.63 and 0.32 - 1.73 larvae/mrl, respectively with peaks in 37th MW. Similarly the activity of *Spodoptera* increased during 29th MW (D_4) was in the ranged of 0.11-1.92, 0.11-1.82, 0.14 - 1.54 and 0.11 - 1.56 larvae /mrl respectively with peaks in 37th MW.

Early sowing on 26th MW (D_1) sowing window recorded lower incidence of semilooper (0.10 to 1.47 larvae/mrl) on different varieties of soybean. Whereas, crop sown on 28th MW (D_2) sowing window recorded the maximum incidence (0.15 to 1.94 larvae/mrl).

Present findings are in agreement with that of Harish (2008) who reported higher incidence of *T. orichalcea* on crop sown during 26th MW (D_1) (3.27 larvae/mrl) and late sown crop in 28th MW (D_3) recorded the maximum incidence of 4.80 larvae/mrl at Dharwad . Similar result were reported by Kamala (2000).

During the year 2016, two major pests were observed *viz.*, semilooper and *S. litura*. This pest was noticed defoliating at vegetative stage of the crop. The incidence of semilooper was recorded in crop sown during all the windows of sowing and soybean varieties. Sowing in 26th MW (D_1) with the varieties MACS- 450 (V_1), JS- 335 (V_2) , DS- 228 (V_3) and KDS- 344, the incidence of semilooper was ranged from 0.11- 1.54, 0.11- 1.26, 0.07- 1.40 and 0.11-1.40 larvae/mrl respectively peaks in 36th and 37th MW. Similar result reported by Madrap et al. *(*2007). Similarly, the population of *S. litura* observed at the crop during the 26th MW (D_1) with the varieties MACS- 450 (V_1), JS- 335 (V_2) and DS- 228 (V_3) and KDS- 344 ranged from 0.24- 1.66, 0.10 -1.74, 0.07- 1.53 and 0.18 - 1.38 (larvae/mrl) respectively, peaks in 36th and 37th MW.

During the sowing in 27th MW (D_2) with the varieties MACS- 450 (V_1), JS- 335 (V_2), DS- 228 (V_3) and KDS- 344 (V_4), the incidence of semilooper was ranged from 0.14- 1.68, 0.21-1.29, 0.24- 1.68 and 0.24-1.71 larvae/mrl respectively with the peaks in 37th MW. Similarly, population of *S. litura* on the crop sown during 27th MW (D_2) with the varieties MACS- 450 (V_1), JS- 335 (V_2), DS- 228 (V_3) and KDS- 344 with its ranged from 0.10- 1.90, 0.10- 1.80, 0.14 - 1.53 and 0.10-1.53 larvae/mrl respectively with the peaks in 36th and 37th MW.

Sowing during 28th MW (D_3) with the varieties MACS- 450 (V_1), JS- 335 (V_2), DS-228 (V_3) and KDS- 344 (V_4), the incidence of semilooper was in the ranged from 0.16 -2.00, 0.25-1.54, 0.29 - 2.00 and 0.29 - 2.04 larvae/mrl, respectively with the peaks in 36th and 37th MW. Similarly the population of *Spodoptera* on crop during 28th MW (D_3) with the varieties MACS- 450 (V_1), JS- 335 (V_2), DS- 228 (V_3) and KDS- 344 ranged from 0.12-2.23, 0.12 - 2.11 0.16 - 1.79 and 0.12 - 1.79 (larvae/mrl) respectively, with peaks in 36th and 37th MW.

Sowing in the 29th MW (D_4) with the varieties MACS- 450 (V_1), JS- 335 (V_2), DS-228 (V_3) and KDS- 344 (V_4), the incidence of semilooper ranged from 0.14 - 1.78, 0.24 - 1.46, 0.25 - 1.71 and 0.25 - 1.78 larvae/mrl respectively, peaks in 36th and 37th MW. Similarly the population of *Spodoptera* on crop during the 29th MW (D_4) with the varieties MACS- 450 (V_1), JS- 335 (V_2), DS-228 (V_3) and KDS- 344 ranged from 0.11-2.00, 0.11- 1.89, 0.14- 1.61 and 0.11- 1.59 (larvae/mrl) respectively, with peaks in 37th MW.

Present findings are in agreement with that of Harish (2008) who reported higher incidence of *T. orichalcea* on crop sown during 26th MW (D_1) (3.27 larvae/mrl) and late sown crop 29th MW (D_4) recorded the

maximum incidence of 4.80 larvae/mrl. Similar result reported by Negoyen (2001). Sontakke and Mishra (1994), reported the lowest incidence of semilooper and greatest yield with early sowing (20th June, 5th July and 1-15th November).

Table 1: Population dynamics of *Semilooper* and *Spodoptera litura* (larvae/mrl) of soybean during *kharif*, 2015

Sr. No.	Name of the insect pest	Mean of observations recorded for 26th MW sowing											
		28	29	30	31	32	33	34	35	36	37	38	Mean
	MACS- 450												
1	Semilooper	0.00	0.10	0.13	0.20	0.35	0.83	1.00	1.33	1.47	1.10	0.83	0.67
2	*S. litura*	0.00	0.00	0.23	0.33	0.47	0.69	1.07	1.20	1.60	1.33	0.93	0.71
	JS- 335												
1	Semilooper	0.00	0.10	0.20	0.23	0.40	0.59	0.60	0.87	1.00	1.20	0.67	0.53
2	*S. litura*	0.00	0.00	0.10	0.20	0.50	0.60	0.83	1.33	1.67	1.33	1.00	0.68
	DS- 228 (Phule Kalyani)												
1	Semilooper	0.00	0.07	0.10	0.20	0.33	0.50	0.63	1.00	1.33	0.83	0.47	0.49
2	*S. litura*	0.00	0.00	0.07	0.13	0.20	0.35	0.47	0.60	1.00	1.47	0.63	0.45
	KDS- 344 (Phule Agrani)												
1	Semilooper	0.00	0.00	0.10	0.23	0.33	0.70	0.80	1.07	1.20	1.33	1.00	0.61
2	*S. litura*	0.00	0.00	0.17	0.30	0.47	0.56	0.83	1.00	1.33	1.00	0.67	0.57

Table 2 : Population dynamics of *Semilooper* and *Spodoptera litura* (larvae/mrl) of soybean during *kharif*, 2015

Sr. No.	Name of the insect pest	Mean of observations recorded for 27th MW sowing											
		28	29	30	31	32	33	34	35	36	37	38	Mean
	MACS- 450												
1	Semilooper	0.00	0.13	0.20	0.23	0.40	0.67	1.20	1.20	1.33	1.60	0.83	0.69
2	*S. litura*	0.00	0.10	0.33	0.43	0.50	0.73	0.96	1.20	1.47	1.83	1.00	0.77
	JS- 335												
1	Semilooper	0.00	0.20	0.23	0.30	0.47	0.60	0.76	0.93	1.07	1.23	1.00	0.61
2	*S. litura*	0.00	0.10	0.20	0.30	0.50	0.67	1.20	1.47	1.73	1.47	1.00	0.77
	DS- 228 (Phule Kalyani)												
1	Semilooper	0.00	0.00	0.23	0.30	0.46	0.57	0.83	1.10	1.47	1.60	0.93	0.68
2	*S. litura*	0.00	0.00	0.13	0.20	0.44	0.47	0.63	0.93	1.33	1.47	0.93	0.58
	KDS- 344 (Phule Agrani)												
1	Semilooper	0.00	0.00	0.23	0.30	0.43	0.53	0.83	1.20	1.63	1.47	1.13	0.70
2	*S. litura*	0.00	0.10	0.23	0.47	0.65	0.83	1.00	1.33	1.47	1.20	0.93	0.74

Table 3 : Population dynamics of *Semilooper* and *Spodoptera litura* (larvae/mrl) of soybean during *kharif*, 2015

Sr. No.	Name of the insect pest	Mean of observations recorded for 28th MW sowing											
		28	29	30	31	32	33	34	35	36	37	38	Mean
	MACS- 450												
1	Semilooper	0.00	0.15	0.24	0.27	0.48	0.83	1.43	1.43	1.58	1.90	0.99	0.85
2	*S. litura*	0.00	0.12	0.39	0.50	0.59	0.78	1.12	1.40	1.72	2.14	1.17	0.90
	JS- 335												
1	Semilooper	0.00	0.24	0.27	0.36	0.56	0.73	0.90	1.11	1.27	1.46	1.19	0.74
2	*S. litura*	0.00	0.12	0.23	0.35	0.59	0.79	1.40	1.72	2.02	1.72	1.17	0.92
	DS- 228 (Phule Kalyani)												
1	Semilooper	0.00	0.00	0.27	0.36	0.55	0.70	0.99	1.31	1.75	1.90	1.11	0.81
2	*S. litura*	0.00	0.00	0.15	0.23	0.51	0.57	0.74	1.09	1.56	1.72	1.09	0.70
	KDS- 344 (Phule Agrani)												
1	Semilooper	0.00	0.00	0.27	0.36	0.51	0.65	0.99	1.43	1.75	1.94	1.34	0.84
2	*S. litura*	0.00	0.12	0.27	0.55	0.76	0.63	1.17	1.56	1.72	1.40	1.09	0.84

Table 4 : Population dynamics of *Semilooper* and *Spodoptera litura* (larvae/mrl) of soybean during *kharif*, 2015

Sr. No.	Name of the insect pest	Mean of observations recorded for 29th MW sowing											
		28	29	30	31	32	33	34	35	36	37	38	Mean
	MACS- 450												
1	Semilooper	0.00	0.00	0.14	0.24	0.42	0.73	1.27	1.27	1.41	1.70	0.88	0.75
2	*S. litura*	0.00	0.00	0.11	0.45	0.53	0.80	1.01	1.26	1.54	1.92	1.05	0.82
	JS- 335												
1	Semilooper	0.00	0.00	0.23	0.34	0.53	0.70	0.86	1.05	1.21	1.39	1.13	0.70
2	*S. litura*	0.00	0.00	0.11	0.32	0.53	0.72	1.26	1.54	1.82	1.54	1.05	0.83
	DS- 228 (Phule Kalyani)												
1	Semilooper	0.00	0.00	0.00	0.31	0.47	0.60	0.85	1.12	1.50	1.63	0.95	0.70
2	*S. litura*	0.00	0.00	0.00	0.21	0.46	0.52	0.66	0.98	1.40	1.54	0.98	0.63
	KDS- 344 (Phule Agrani)												
1	Semilooper	0.00	0.00	0.00	0.32	0.46	0.58	0.88	1.27	1.56	1.73	1.20	0.75
2	*S. litura*	0.00	0.00	0.11	0.49	0.68	0.89	1.05	1.40	1.26	1.56	0.98	0.79

Table 5: Population dynamics of *Semilooper* and *Spodoptera litura* (larvae/mrl) of soybean during *kharif*, 2016

Sr. No.	Name of the insect pest	Mean of observations recorded for 26th MW sowing											
		28	29	30	31	32	33	34	35	36	37	38	Mean
	MACS- 450												
1	Semilooper	0.00	0.11	0.14	0.21	0.35	0.87	1.05	1.40	1.54	1.16	0.87	0.70
2	*S. litura*	0.00	0.00	0.24	0.34	0.49	0.70	1.11	1.25	1.66	1.38	0.97	0.74
	JS- 335												
1	Semilooper	0.00	0.11	0.21	0.24	0.42	0.60	0.63	0.91	1.05	1.26	0.70	0.56
2	*S. litura*	0.00	0.00	0.10	0.21	0.49	0.62	0.86	1.38	1.74	1.38	1.04	0.71
	DS- 228 (Phule Kalyani)												
1	Semilooper	0.00	0.07	0.11	0.21	0.35	0.49	0.66	1.05	1.40	0.87	0.49	0.52
2	*S. litura*	0.00	0.00	0.07	0.14	0.21	0.34	0.49	0.62	1.04	1.53	0.66	0.46
	KDS- 344 (Phule Agrani)												
1	Semilooper	0.00	0.00	0.11	0.24	0.35	0.70	0.84	1.12	1.26	1.40	1.05	0.64
2	*S. litura*	0.00	0.00	0.18	0.31	0.49	0.55	0.86	1.04	1.38	1.04	0.70	0.60

Table 6 : Population dynamics of *Semilooper* and *Spodoptera litura* (larvae/mrl) of soybean during *kharif*, 2016

Sr. No.	Name of the insect pest	Mean of observations recorded for 27th MW sowing											
		28	29	30	31	32	33	34	35	36	37	38	Mean
	MACS- 450												
1	Semilooper	0.00	0.14	0.21	0.24	0.42	0.70	1.05	1.26	1.40	1.68	0.87	0.72
2	*S. litura*	0.00	0.10	0.34	0.45	0.52	0.76	0.97	1.25	1.53	1.90	1.04	0.81
	JS- 335												
1	Semilooper	0.00	0.21	0.24	0.32	0.49	0.63	0.77	0.98	1.12	1.29	1.05	0.65
2	*S. litura*	0.00	0.10	0.21	0.31	0.52	0.70	1.04	1.53	1.80	1.53	1.04	0.80
	DS- 228 (Phule Kalyani)												
1	Semilooper	0.00	0.00	0.24	0.32	0.42	0.60	0.87	1.16	1.54	1.68	0.98	0.71
2	*S. litura*	0.00	0.00	0.14	0.21	0.31	0.49	0.66	0.97	1.38	1.53	0.97	0.60
	KDS- 344 (Phule Agrani)												
1	Semilooper	0.00	0.00	0.24	0.32	0.42	0.56	0.87	1.26	1.51	1.71	1.19	0.74
2	*S. litura*	0.00	0.10	0.24	0.49	0.62	0.86	1.04	1.38	1.53	1.25	0.97	0.77

Table 7 : Population dynamics of *Semilooper* and *Spodoptera litura* (larvae/mrl) of soybean during *kharif*, 2016

Sr. No.	Name of the insect pest	Mean of observations recorded for 28th MW sowing											
		28	29	30	31	32	33	34	35	36	37	38	Mean
	MACS- 450												
1	Semilooper	0.00	0.16	0.25	0.29	0.50	0.84	1.25	1.50	1.66	2.00	1.04	0.86
2	*S. litura*	0.00	0.12	0.40	0.52	0.61	0.89	1.13	1.46	1.79	2.23	1.22	0.94
	JS- 335												
1	Semilooper	0.00	0.25	0.29	0.37	0.59	0.75	0.91	1.16	1.34	1.54	1.25	0.77
2	*S. litura*	0.00	0.12	0.24	0.37	0.61	0.82	1.22	1.79	2.11	1.79	1.22	0.93
	DS- 228 (Phule Kalyani)												
1	Semilooper	0.00	0.00	0.29	0.37	0.50	0.71	1.04	1.37	1.84	2.00	1.16	0.84
2	*S. litura*	0.00	0.00	0.16	0.24	0.37	0.57	0.77	1.13	1.62	1.79	1.13	0.71
	KDS- 344 (Phule Agrani)												
1	Semilooper	0.00	0.00	0.29	0.37	0.50	0.66	1.04	1.50	2.04	1.84	1.41	0.88
2	*S. litura*	0.00	0.12	0.28	0.57	0.73	1.01	1.22	1.62	1.79	1.46	1.13	0.90

Table 8 : Population dynamics of *Semilooper* and *Spodoptera litura* (larvae/mrl) of soybean during *kharif*, 2016

Sr. No.	Name of the insect pest	Mean of observations recorded for 29th MW sowing											
		28	29	30	31	32	33	34	35	36	37	38	Mean
	MACS- 450												
1	Semilooper	0.00	0.14	0.22	0.26	0.45	0.75	1.11	1.34	1.48	1.78	0.92	0.77
2	*S. litura*	0.00	0.11	0.36	0.47	0.55	0.80	1.02	1.31	1.61	2.00	1.09	0.85
	JS- 335												
1	Semilooper	0.00	0.24	0.27	0.36	0.56	0.71	0.87	1.10	1.27	1.46	1.19	0.73
2	*S. litura*	0.00	0.11	0.22	0.33	0.55	0.73	1.09	1.61	1.69	1.89	1.09	0.84
	DS- 228 (Phule Kalyani)												
1	Semilooper	0.00	0.00	0.25	0.32	0.43	0.61	0.89	1.18	1.57	1.71	1.00	0.72
2	*S. litura*	0.00	0.00	0.14	0.22	0.33	0.51	0.69	1.02	1.45	1.61	1.02	0.63
	KDS- 344 (Phule Agrani)												
1	Semilooper	0.00	0.00	0.25	0.33	0.44	0.58	0.91	1.31	1.78	1.60	1.23	0.77
2	*S. litura*	0.00	0.11	0.25	0.51	0.65	0.90	1.08	1.44	1.59	1.30	1.01	0.80

CONCLUSION

Population dynamics between pest with weather parameters increasing semilooper and *Spodoptera* peaks in 36th and 37th MW, due to maximum relative humidity during both the years. Among the soybean varieties, higher incidence of *Spodoptera* and Semilooper was recorded on MACS- 450 variety and minimum was recorded on Phule Kalyani. Timely sowing on 26th MW (D_1) and 27th (D_2) recorded lower incidence of semilooper and *Spodoptera* whereas, crop sown delay on 29th MW (D_4) recorded the maximum incidence.

REFERENCES

Harish, G. (2008). Studies on incidence and management of defoliator pests of soybean. M.Sc. (Agri.) Thesis Univ. of Agricultural Sciences, Dharwad (India).

Kamala, N. V. (2000). Development of integrated pest management modules for soybean [*Glycine max* (L.) Merril]. M.Sc (Agri). Thesis (unpub.), Univ. of Agricultural Science, Bangalore. pp. 33-50.

Madrap, I. A., Pole, S. P., & Patange, N. R. (2007). Development of pest tolerant soybean genotypes. *Proc. ISOR Nat. Seminar*, pp.165-167.

Meena, N. L., & Sharma, U. S. (2006). Effect of sowing date and row spacing on incidence of major insect pests of soybean, [*Glycine max* (L.) Merrill.] *Soybean Res. 4*, 73-76.

Negoyen, (2001). Studies on the effect of selected insecticides on the abundance and diversity of insect pests of soybean. M.Sc. (Agri.) Thesis, Univ. of Agricultural Sciences, Bangalore, (India).

Sontakke, B. K., & Mishra, P. R. (1994). Impact of different sowing dates/seasons on the incidence of insect pests and yield losses in soybean. *J. Insect Sci. 7*(1), 84-87