

# Investigation on the effect of date of sowing on the incidence of defoliator pests of sunflower

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## ABSTRACT

A field experiment was conducted during the *Kharif/Rabi* season of 2014 in Regional Agriculture Research Station (RARS) to identify the appropriate sowing time to reduce pest incidence and to get higher seed yield. The sunflower hybrid, KBSH-53 recorded highest seed yield (12.95 q/ha and 12.05 q/ha) with reduced pest incidence and per cent foliage damage during the crop sown on first fortnight of September and second fortnight of August as compared to the crop sown on second fortnight of September, first fortnight of October and second fortnight of October.

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## INTRODUCTION

Sunflower (*Helianthus annuus* L.) is one of the important oilseed crops in the world and ranks third in area after soybean and groundnut. Cultivated sunflower belongs to the family Asteraceae (Compositae) a native of Southern USA and Mexico. It is a rich source of edible oil (40-52%) having anti-cholesterol properties due to the presence of polyunsaturated fatty acids (55-65% linoleic acid and 20-30% oleic acid) (Joksimovic *et al.*, 2006).

Presently in India sunflower is cultivated over an area of 0.75 mha with a production of 0.51 mt and productivity (692 kg/ha<sup>-1</sup>). The major sunflower growing states in the country are Karnataka, Maharashtra, Andhra Pradesh and Tamil Nadu. Among these, Karnataka is the leading state in the country, popularly known as "Sunflower state". Presently in Karnataka sunflower is

cultivated over an area is 0.39 mha with the production of 0.19 mt and productivity of 503 kg/ha<sup>-1</sup> (Anonymous, 2013). In the recent past, the crop is also becoming popular in non-traditional states *viz.*, Punjab, Haryana and Uttar Pradesh.

Despite the rapid spread of other crop, disheartening trend to that, the productivity is going down in recent years. The potential of the crop is, far from being exploited and the yield levels of the country are the lowest in the world due to several biotic and abiotic stresses. Among the several biotic stresses for successful sunflower production, susceptibility to insect pests and diseases is one of the major constraints. Insect pests are the major limiting factors for its successful cultivation. The most common method used for its control is indiscriminate use of insecticides, which led to disturbance

in biodiversity of natural ecosystem. The manipulation of sowing dates cause specific physiological changes that reduce the suitability of host plants while producing synchrony between insect pests with their natural enemies. The present investigation was carried out to identify appropriate sowing time to minimize pest intensity and to get higher seed yield of sunflower.

## MATERIAL AND METHODS

The field experiment was conducted in research fields of College of Agriculture, Vijayapur in a Randomized Block Design (RBD) with four replications and five dates of sowings (II Fortnight of August, I Fortnight of September, II Fortnight of September, I Fortnight of October and II Fortnight of October). Individual plot size was 4.2 x 4 m. Sunflower seeds were sown at 60 cm spacing between rows and 20 cm between plants. The first date of sowing was imposed by sowing seeds of hybrid 'KBSH-53' in II Fortnight of August and subsequent sowings were done at an interval of 15 days till the last sowing date *i.e.* II fortnight of October. Totally five different date of sowings were imposed in the experiment. The cultural practices like intercultivation and weeding were attended as required. General sprays of insecticides were given whenever necessary to avoid damage from diseases. The crop was raised as per University of Agricultural Sciences Dharwad (UASD) package of practices for sunflower cultivation (Anonymous, 2014).

### Observations recorded

– Number of defoliator insects during seedling, vegetative and reproductive stage and percentage of leaf

damage from 10 randomly selected plants.

– The incidence was estimated and the information was scored as follows:

- L = Low (<10% infestation)
- M = Medium (11-25% infestation)
- H = High (>25 % infestation)
- Number of natural enemies was recorded.
- Seed yield (q/ha).

## RESULTS AND DISCUSSION

The population density of *S. litura* was observed from different date of sowing during seedling stage. The population of *S. litura* was significantly higher during second fortnight of October (1.10 larvae/plant) and was on par with first fortnight of October (1.05 larvae/plant). Significantly lower population during second fortnight of August (0.25 larvae/plant) and was at par with first fortnight of September (0.25 larvae/plant) followed by second fortnight of September 0.55 larvae/plant (Table 1).

During vegetative stage, the population density of *S. litura* was significantly higher during first fortnight of October (0.83 larvae/plant) and was on par with second fortnight of October (0.78 larvae/plant). Significantly lower population during first fortnight of September (0.10 larvae/plant) and was on par with second fortnight of August (0.13 larvae/plant) followed by second fortnight of September 0.30 larvae/plant.

During reproductive stage, the population density of *S. litura* was significantly higher during second fortnight of October (0.73 larvae/plant) and was on par with first fortnight of October (0.65 larvae/plant). Significantly lower population during second fortnight of

**Table 1 : Effect of date of sowing on the incidence of defoliator insect pests and their natural enemies in sunflower during seedling stage**

Treatments	Date of sowing	Defoliator insect pests (larvae/plant)		% foliage damage due to defoliators	No. natural enemies/plant	
		<i>S. litura</i>	<i>T. orichalcea</i>		Coccinellids	Spiders
1.	2 <sup>nd</sup> Fortnight of August	0.25 *(1.11) <sup>b</sup>	0.08 *(1.04) <sup>b</sup>	6.00 *(13.95) <sup>b</sup>	0.15 *(1.07)	0.08*(1.04)
2.	1 <sup>st</sup> Fortnight of September	0.25 (1.11) <sup>b</sup>	0.10 (1.05) <sup>b</sup>	6.50 (14.61) <sup>b</sup>	0.10 (1.05)	0.10(1.05)
3.	2 <sup>nd</sup> Fortnight of September	0.55(1.24) <sup>b</sup>	0.60 (1.26) <sup>a</sup>	15.13 (22.85) <sup>a</sup>	0.13 (1.06)	0.10 (1.05)
4.	1 <sup>st</sup> Fortnight of October	1.05 (1.43) <sup>a</sup>	0.55 (1.24) <sup>a</sup>	19.38 (26.08) <sup>a</sup>	0.28 (1.13)	0.30 (1.14)
5.	2 <sup>nd</sup> Fortnight of October	1.1 (1.44) <sup>a</sup>	0.15 (1.07) <sup>b</sup>	18.25 (25.28) <sup>a</sup>	0.40(1.18)	0.28(1.13)
	S.E.±	0.05	0.03	1.03	0.03	0.03
	C.D. (P=0.05)	0.14	0.09	3.16	NS	NS
	CV (%)	7.40	5.15	9.99	5.68	5.99

\*Figures in the parentheses are  $\sqrt{(x+1)}$  transformed values and \*\*angular transformed values

NS= Non-significant

August (0.10 larvae/plant) and was on par with first fortnight of September (0.13 larvae/plant) and second fortnight of September 0.25 larvae/plant.

The mean number of *S. litura* larvae/plant during different dates of sowing ranged from 0.16 to 0.87 larvae/plant. The highest population of *S. litura* was observed during second fortnight of October (0.87 larvae/plant) followed by first fortnight of October 0.84 larvae/plant. The lowest population of 0.16 larvae/plant was recorded during second fortnight of August and first fortnight of September followed by second fortnight of September (0.37 larvae/plant).

The population density of *T. orichalcea* was significantly lower during second fortnight of August (0.08 larvae/plant) and was at par with first fortnight of September (0.10 larvae/plant) and second fortnight of October (0.15 larvae/plant). Significantly higher population during second fortnight of September (0.60 larvae/plant) and was at par with first fortnight of October 0.55 larvae/plant.

During vegetative stage the population density of *T. orichalcea* was significantly lower during second fortnight of August (0.35 larvae/plant) and was at par with first fortnight of September (0.38 larvae/plant) followed by second fortnight of October (1.05 larvae/plant). Significantly higher population during second fortnight of September (2.50 larvae/plant) which was on par with first fortnight of October 2.00 larvae/plant.

During reproductive stage the population density of *T. orichalcea* was significantly lower during first fortnight of September (0.48 larvae/plant) and was on par with on with second fortnight of August (0.55 larvae/plant). Significantly higher population during second fortnight of September (1.50 larvae/plant) and was at

par with first fortnight of October (1.35 larvae/plant) followed by second fortnight of October 1.05 larvae/plant.

The mean number of *T. orichalcea* larvae/plant during different dates of sowing ranged from 0.32 to 1.53 larvae/plant. The highest population of *T. orichalcea* was observed during second fortnight of September (1.53 larvae/plant) followed by first fortnight of October 1.30 larvae/plant. The lowest population of 0.32 larvae/plant was recorded in first fortnight of September followed by second fortnight of August (0.33 larvae/plant) and second fortnight of October 0.75 larvae/plant.

The population density of *S. obliqua* was not appeared during seedling stage of crop. However, the population density of *S. obliqua* was gradually increased during vegetative stage and reached peak population during reproductive stage. This is because of the dense foliage of the crop during this stage.

During vegetative stage the population density of *S. obliqua* was significantly higher during second fortnight of October (3.25 larvae/plant) and was at par with first fortnight of October (2.75 larvae/plant) followed by second fortnight of September (1.15 larvae/plant). Significantly lower population during second fortnight of August (0.20 larvae/plant) which was on par with first fortnight of September 0.23 larvae/plant (Table 2).

During reproductive stage the population density of *S. obliqua* was significantly higher during second fortnight of October (3.80 larvae/plant) and was on par with first fortnight of October (3.28 larvae/plant). Significantly lower incidence during first fortnight of September (0.63 larvae/plant) and was at par with second fortnight of August (0.68 larvae/plant) and second fortnight of September 1.38 larvae/plant.

The mean number of *S. obliqua* larvae/plant during

**Table 2: Effect of date of sowing on the incidence of defoliator insect pests and their natural enemies in sunflower during vegetative stage**

Treatments	Date of sowing	Defoliator insect pests(larvae/plant)			% foliage damage due to defoliators	No. natural enemies/plant	
		<i>S. litura</i>	<i>T. orichalcea</i>	<i>S. obliqua</i>		Coccinellids	Spiders
1.	2 <sup>nd</sup> Fortnight of August	0.13 *(1.06) <sup>b</sup>	0.35*(1.16) <sup>b</sup>	0.20*(1.09) <sup>b</sup>	20.13**(26.42) <sup>b</sup>	0.30*(1.14) <sup>b</sup>	0.15*(1.07) <sup>b</sup>
2.	1 <sup>st</sup> Fortnight of September	0.10(1.05) <sup>b</sup>	0.38(1.17) <sup>b</sup>	0.23(1.10) <sup>b</sup>	18.75(25.02) <sup>b</sup>	0.45(1.20) <sup>b</sup>	0.18(1.08) <sup>b</sup>
3.	2 <sup>nd</sup> Fortnight of September	0.30(1.14) <sup>b</sup>	2.50(1.86) <sup>a</sup>	1.15(1.46) <sup>b</sup>	31.13(33.79) <sup>a</sup>	0.65(1.28) <sup>ab</sup>	0.35(1.16) <sup>b</sup>
4.	1 <sup>st</sup> Fortnight of October	0.83(1.34) <sup>a</sup>	2.00(1.72) <sup>a</sup>	2.75(1.92) <sup>a</sup>	38.75(38.48) <sup>a</sup>	0.83(1.35) <sup>ab</sup>	0.95(1.39) <sup>a</sup>
5.	2 <sup>nd</sup> Fortnight of October	0.78(1.33) <sup>a</sup>	1.05(1.43) <sup>b</sup>	3.25(2.03) <sup>a</sup>	42.50(40.67) <sup>a</sup>	1.38(1.53) <sup>a</sup>	1.00(1.49) <sup>a</sup>
	S.E.±	0.03	0.09	0.13	2.23	0.08	0.06
	C.D. (P=0.05)	0.11	0.27	0.39	6.88	0.26	0.18
	CV (%)	5.84	11.73	16.81	13.59	12.86	9.33

\*Figures in the parentheses are  $\sqrt{x+1}$  transformed values and \*\*angular transformed values

different dates of sowing ranged from 0.28 to 2.35 larvae/plant. The highest incidence of *S. obliqua* was observed during second fortnight of October (2.35 larvae/plant) followed by first fortnight of October 2.01 larvae/plant. The lowest population of 0.28 larvae/plant was recorded in second fortnight of August and first fortnight of September followed by second fortnight of September (0.84 larvae/plant).

From above results it can be concluded that, the population density of *S. litura*, *T. orichalcea* and *S. obliqua* was low during second fortnight of August and first fortnight of September compare to first fortnight of October and second fortnight of October. This is due to favourable climatic condition which might have resulted in insect pests development during above month.

The present investigation are close conformity with earlier workers Bilapate and Jadhav (1995) studied the incidence of defoliator insect pests of sunflower, maximum density of defoliators like *S. litura*, *Trichiplusia ni* and *S. obliqua* was observed during October to December month compare to July to August month. Kumar *et al.* (1998) also found that, the population densities *S. litura* was maximum during which coincided with grand growth phase of the crop was second fortnight of October. Kakakhel *et al.* (2000) opined that, the maximum population of hairy caterpillar (*D. obliqua* Walk.), was recorded in the second week of October.

**Per cent foliage damage :**

Per cent foliage damage due to defoliator insect pests was low during seedling of the crop. The per cent foliage damage due to defoliators was significantly lowest during second fortnight of August (6.00 %) and was on

par with first fortnight of September (6.50 %). Significantly higher during first fortnight of October (19.38 %) and was at par with second fortnight of October (18.25 %) followed by second fortnight of September 15.13 per cent.

During vegetative stage the per cent foliage damage due to defoliators was significantly lowest during first fortnight of September (18.75 %) and was at par with second fortnight of August (20.13 %). Significantly higher foliage damage during second fortnight of October (42.50 %) and was on par with first fortnight of October (38.75 %) followed by second fortnight of September 31.13 per cent.

During reproductive stage the per cent foliage damage due to defoliators was significantly lowest during first fortnight of September (23.88 %) and was at par with second fortnight of August (25.13 %). Significantly higher during second fortnight of October (57.50 %) and was at par with first fortnight of October (51.25 %) followed by second fortnight of September 36.38 per cent.

Mean per cent foliage damage due to defoliator insect pests ranged from 16.38 to 39.42 per cent. The maximum foliage damage was observed during second fortnight of October (39.42 %) followed by first fortnight of October (36.46 %) and second fortnight of September (27.54 %). The lowest foliage damage was recorded during first fortnight of September (16.83 %) followed by second fortnight of August 17.08 per cent.

From above results it can be concluded that, the per cent foliage damage is based on the population density of defoliator insect pests. However, the information on the level of incidence and foliage damage is lacking.

The present investigation are closely related with

**Table 3 : Effect of date of sowing on the incidence of defoliator insect pests and their natural enemies in sunflower during reproductive stage**

Treatments	Date of sowing	Defoliator insect pests (larvae/plant)			% foliage damage due to defoliators	No. natural enemies/plant	
		<i>S. litura</i>	<i>T. orichalcea</i>	<i>S. obliqua</i>		Coccinellids	Spiders
1.	2 <sup>nd</sup> Fortnight of August	0.10 *(1.05) <sup>b</sup>	0.55*(1.24) <sup>b</sup>	0.65*(1.28) <sup>b</sup>	25.13***(29.97) <sup>bc</sup>	1.13*(1.46) <sup>bc</sup>	0.75*(1.31) <sup>b</sup>
2.	1 <sup>st</sup> Fortnight of September	0.13(1.06) <sup>b</sup>	0.48(1.21) <sup>b</sup>	0.63(1.27) <sup>b</sup>	23.88(29.02) <sup>c</sup>	1.00(1.39) <sup>c</sup>	0.40(1.18) <sup>b</sup>
3.	2 <sup>nd</sup> Fortnight of September	0.25(1.12) <sup>b</sup>	1.50(1.57) <sup>a</sup>	1.38(1.51) <sup>b</sup>	36.38(36.99) <sup>b</sup>	1.98(1.72) <sup>ab</sup>	0.88(1.37) <sup>b</sup>
4.	1 <sup>st</sup> Fortnight of October	0.65(1.28) <sup>a</sup>	1.35(1.53) <sup>a</sup>	3.28(2.06) <sup>a</sup>	51.25(45.72) <sup>a</sup>	1.95(1.71) <sup>ab</sup>	1.73(1.65) <sup>a</sup>
5.	2 <sup>nd</sup> Fortnight of October	0.73(1.31) <sup>a</sup>	1.05(1.43) <sup>a</sup>	3.80(2.18) <sup>a</sup>	57.50(49.39) <sup>a</sup>	2.20(1.78) <sup>a</sup>	1.75(1.64) <sup>a</sup>
	S.E.±	0.04	0.06	0.12	2.31	0.09	0.08
	C.D.(P=0.05)	0.13	0.19	0.38	7.11	0.29	0.25
	CV (%)	7.24	8.82	14.88	12.09	11.52	11.43

\*Figures in the parentheses are  $\sqrt{(x+1)}$  transformed values and \*\*angular transformed values

earlier workers Suhas *et al.* (1996) reported that sunflower cv. MORDEN was defoliated by 0, 25, 50, 75 or 100 per cent on 25, 50 and 75 days after sowing (DAS) to simulate attack by *S. obliqua* and *T. orichalcea*. The loss in seed yield per hectare due to defoliators in a rain-fed kharif crop was upto 58.06 per cent. Bakhietia *et al.* (1997) also found that, *Amrasca biguttula biguttula*, *Bemisia tabaci*, *Helicoverpa armigera*, *S. litura*, *Trichoplusia ni* and *S. obliqua* were the important insect pests in Punjab and causes upto 35.7 to 51.3 per cent reduction in yield of sunflower.

#### Incidence of natural enemies :

The incidence of coccinellids and spiders was observed lower level during seedling stage of crop. However, the population density of coccinellids and spiders was gradually increased during vegetative stage and reached peak population during reproductive stage. This is because of the dense foliage of the crop and observed more pests during this stage.

The population density of coccinellids and spiders non-significant among the different dates of sowing during seedling stage. This is because of the lower level of pests incidence.

During vegetative stage the population of coccinellids was significantly higher during second fortnight of October (1.38 adults/plant) followed by first fortnight of October (0.83 adults/plant). Significantly lower population during second fortnight of August (0.30 adults/plant) followed by first fortnight of September (0.45 adults/plant) and was at par with second fortnight of September 0.65 adults/plant.

The population of spiders was significantly higher during second fortnight of October (1.00 adults/plant) and was at par with first fortnight of October (0.95 adults/plant). Significantly lower population during second

fortnight of August (0.15 adults/plant) and was at par with first fortnight of September (0.18 adults/plant) and second fortnight of September (0.35 adults/plant) during vegetative stage of the crop.

The population density of coccinellids was significantly higher during second fortnight of October (2.20 adults/plant) and was at par with second fortnight of September (1.98 adults/plant) and first fortnight of October (1.95 adults/plant). Significantly lower population during first fortnight of September (1.00 adults/plant) and was on par with second fortnight of August (1.13 adults/plant) during reproductive stage of the crop (Table 3).

During reproductive stage the population density of spiders was significantly higher during second fortnight of October (1.75 adults/plant) and was at par with first fortnight of October (1.73 adults/plant) followed by second fortnight of September (0.88 adults/plant) and significantly lower population during first fortnight of September (0.40 adults/plant) which was at par with second fortnight of August 0.75 adults/plant

The mean number of natural enemies coccinellids and spiders were observed adults/plant ranged from 0.52 to 1.33 adults/plant and 0.23 to 1.01 adults/plant. The maximum number of coccinellids population was observed during second fortnight of October (1.33 adults/plant) followed by first fortnight of October (1.02 adults/plant) and second fortnight of September (0.92 adults/plant). The minimum number of coccinellids population was observed during first fortnight of September (0.52 adults/plant) followed by second fortnight August 0.53 adults/plant. The maximum number of spiders population was observed during second fortnight of October (1.01 adults/plant) followed by first fortnight of October (0.99 adults/plant) and second fortnight of September (0.44 adults/plant). The minimum number of spiders population was observed during first fortnight of September (0.23

**Table 4 : Population of defoliator insect pests and their natural enemies of sunflower (mean of three stages)**

Treatments	Date of sowing	Defoliator insect pests (larvae/plant)			% foliage damage due to defoliators	No. natural enemies/plant		Yield q/ha
		<i>S. litura</i>	<i>T. orichalcea</i>	<i>S. obliqua</i>		Coccinellids	Spiders	
1.	2 <sup>nd</sup> Fortnight of August	0.16	0.33	0.28	17.08	0.53	0.33	12.05 <sup>a</sup>
2.	1 <sup>st</sup> Fortnight of September	0.16	0.32	0.28	16.38	0.52	0.23	12.95 <sup>a</sup>
3.	2 <sup>nd</sup> Fortnight of September	0.37	1.53	0.84	27.54	0.92	0.44	9.23 <sup>b</sup>
4.	1 <sup>st</sup> Fortnight of October	0.84	1.30	2.01	36.46	1.02	0.99	6.55 <sup>c</sup>
5.	2 <sup>nd</sup> Fortnight of October	0.87	0.75	2.35	39.42	1.33	1.01	5.06 <sup>d</sup>
	S.E.±	-	-	-	-	-	-	0.37
	C.D. (P=0.05)	-	-	-	-	-	-	1.13
	CV (%)	-	-	-	-	-	-	8.02

adults/plant) followed by second fortnight of August (0.33 adults/plant).

From above results it can be concluded that, the higher populations of natural enemies were recorded during reproductive stage second fortnight of October and first fortnight of October. This is because of more incidences of pests was observed during this month and as compared to seedling and vegetative stage of the crop.

The present observations are in line with the findings of Ambrose *et al.* (2000) who reported in pigeonpea maximum predation was noticed at the highest prey densities and searching time decreased as prey density increased. Borah and Dutta (2003) who reported that, predatory spiders of *Helicoverpa armigera* in pigeonpea ecosystem was *Oxyopes ratnae*, *Oxyopes shewta*, *Neoscona* spp. and *Plexippus paykullii* appeared from flowering until maturity and at senescence. Manu (2012) studied seasonal population density of natural enemies in soybean during *Kharif* season and found the activity of coccinellids (2.54/mrl), chrysopids (0.94/mrl) and *N. rileyi* infected cadavers (9.50/mrl) during cropping period.

#### Seed yield :

The yield obtained from different dates of sowing was ranged from 5.06 to 12.95 quintal/hectare. The significantly highest yield was recorded during first fortnight of September (12.95 q/ha) and was at par with second fortnight of August (12.05 q/ha) followed by second fortnight of September (9.23 q/ha). The significantly lowest yield was recorded during second fortnight of October (5.06 q/h) followed by first fortnight of October 6.55 q/ha (Table 4).

From above results it can be concluded that, the highest yield was obtained from first fortnight of September. This because of the minimum incidence of pests was observed and availability of sufficient moisture during this month. The lowest yield was obtained second fortnight of October. This because of the maximum incidence of pests was observed and moisture stress also noticed during this month.

The results are in agreement with the findings of Reddy *et al.* (2005) revealed that sunflower hybrid, KBSH-41 recorded highest seed yield (13.40 q/ha and 13.00 q/ha during 2003 and 2004, respectively) with reduced pest incidence.

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★ ★ ★ ★ ★ of Excellence ★ ★ ★ ★ ★  
 10<sup>th</sup> Year