

Effect of date of sowing on powdery mildew severity and yield of sunflower

Sunflower (*Helianthus annuus* L.) is native of southern USA and Mexico. It is an important oilseed crop belonging to *Asteraceae* family and ranks third next to groundnut and soybean (Joksimovic *et al.*, 2006) in the world.

In India sunflower is cultivated over an area of 1.72 million hectares with a production of 0.50 million tonnes and productivity of 692 kg/ha (Anon., 2010). Karnataka stands first among the southern states accounting for an area of 0.38 million hectares with a production of 0.19 million tonnes and productivity of 503 kg/ha (Anon., 2012).

The lower levels of sunflower yields are mainly due to several biotic and abiotic factors. Among these, susceptibility to disease is considered to be one of the major constraints. Powdery mildew caused by *Erysiphe* (= *Golovinomyces*) *cichoracearum* DC. has been considered economically important disease causing considerable loss both in terms of quantity and quality. The disease is influenced by weather factors such as temperature, relative humidity and other microclimatic factors that result in subsequent epidemics. It is a well established fact that disease appearance and severity are influenced by season and sowing time (Anand Singh and Anil Sirohi, 2003; Shivanna, 2004; Band *et al.*, 2007; Akhileshwari *et al.*, 2012; Sanjivareddi, 2012). Hence, the present study was undertaken to know the effect of sowing dates on the severity of powdery mildew and seed yield of sunflower.

The experiment was conducted during *kharif* and *rabi*, 2013-14 in research fields of College of Agriculture, Vijayapur in a randomized complete block design with three replications and seven dates of sowings starting from first fortnight of July to first fortnight of October at fortnightly intervals. Individual plot size was 5 x 4 m². Sunflower seeds were sown at 60 cm spacing between rows and 30 cm between plants. The first date of sowing was imposed by sowing seeds of highly susceptible hybrid, KBSH-44 during first fortnight of July and subsequent sowings were taken up at an interval of 15 days till the last sowing date *i.e.*, first fortnight of October. The cultural practices like intercultivation and weeding were attended as per recommended package of practices along with insecticidal sprays for management of insects.

The severity of powdery mildew was recorded periodically at 20 days interval after the disease appearance on five randomly selected plants in each replication using 0-5 disease rating scale (Mayee and Datar, 1986) and per cent disease index (PDI) were worked out as under.

$$\% \text{ disease index} = \frac{\text{Sum of the individual disease ratings}}{\text{Number of leaves assessed} \times \text{Maximum grade}} \times 100$$

The results (Table 1) revealed that sowing of crop in the second fortnight (II FN) of July showed the reduced powdery mildew infection (8.80%) followed by crop sown in first fortnight (I FN) of August (8.82%) as against the crop sown in I FN of October (39.64%) and II FN of September (27.18%). It was also observed that the disease progressed linearly from initial disease

incidence recorded at 40 days after sowing (DAS) (4.08%) and reached the highest disease intensity at 100 DAS (37.92%). However, there was exception to this disease progress in the early sowing dates that indicated the decline in the disease development at 80 DAS as evident from July I FN (7.70%) and II FN (5.05%) as well as sowing in the August I FN (2.76%) recording reduced powdery mildew after fairly higher disease intensity at 60 DAS.

Generally at 40 DAS powdery mildew initiation took place and the highest disease intensity was in the I FN of October (16.40%) and was significantly highest as compared to all other sowing periods. Following this sowing in II FN of September (4.04%) was on par with II FN of August (2.60%) and I FN of September (2.55%). Similarly, the former two dates of sowings were on par with I FN of August sowing (1.53%). Significantly the least disease severity was observed in the crop sown during II FN of July (0.66%) and was on par with crop sown in I FN of July (0.79%) and I FN of August (1.53%).

At 60 DAS *i.e.*, during crop growth stage, sowing during II FN of August recorded significantly the least powdery mildew intensity (2.62%) and was significantly superior over all other sowing dates. Similar to 40 DAS, sowing during I FN of October recorded significantly highest disease (23.00%) and was on par with I FN of September (15.61%). It was observed that the sowing during I FN August recorded the powdery mildew intensity of 8.60 per cent and was found to be on par with I FN September, II FN September (7.75%), II FN July (9.95%) and I FN July (13.84%) as well as I FN September (15.61%).

At 80 DAS also similar trend was observed with sowing during I FN October recording significantly higher disease intensity (47.67%) followed by the sowing during II FN of September that recorded 36.59 per cent powdery mildew intensity. Significantly least powdery mildew intensity was recorded during I FN of August (2.76%) and was on par with II FN of July (5.05%) and I FN of July (7.70%).

The trend continued at 100 DAS also with maximum powdery mildew incidence during I FN October sowing (71.48%) followed by II FN of September (60.35%) while sowing during II FN of July was found to be the best for the reduced powdery mildew intensity (19.52%) that was found to be on par with I FN of August (22.37%) and I FN of July (27.11%). Overall reflection across different sowing dates also confirms the trend with maximum disease severity during first fortnight of October sown crop with initial PDI (16.40%) and maximum PDI (71.48%) at harvest. The least severity was observed during II fortnight of July sown crop with initial PDI (0.66%) and maximum PDI (19.52%) at harvest.

Further, it was noticed that the sowing of sunflower during II FN of July sowing recorded 10.26 q/ha seed yield which was significantly superior over all other sowing dates while significantly least seed yield (5.30 q/ha) was recorded in the sowing made during I FN of October that incidentally recorded significantly highest disease intensity.

Table 1. Effect of different dates of sowing of sunflower on powdery mildew severity and yield during 2013-14

Treatment	Powdery mildew incidence (PDI)					Yield (q/ha)
	40 DAS	60 DAS	80 DAS	100 DAS	Mean	
First Fortnight of July	0.79 (5.10)	13.84 (21.84)	7.70 (16.11)	27.11 (31.38)	12.36 (20.58)	8.50
Second Fortnight of July	0.66 (4.67)	9.95 (18.39)	5.05 (12.99)	19.52 (26.22)	8.80 (17.26)	10.26
First Fortnight of August	1.53 (7.10)	8.60 (17.05)	2.76 (9.56)	22.37 (28.23)	8.82 (17.28)	9.50
Second Fortnight of August	2.60 (9.28)	2.62 (9.32)	22.67 (28.44)	36.16 (36.97)	16.01 (23.59)	8.20
First Fortnight of September	2.55 (9.19)	15.61 (23.27)	17.95 (25.07)	28.50 (32.27)	16.15 (23.70)	7.40
Second Fortnight of September	4.04 (11.59)	7.75 (16.17)	36.59 (37.22)	60.35 (50.97)	27.18 (31.42)	5.93
First Fortnight of October	16.40 (23.89)	23.00 (28.66)	47.67 (43.67)	71.48 (57.72)	39.64 (39.02)	5.30
S.E.m.±	1.00	2.06	1.94	1.97	-	0.55
C.D. at 5%	3.10	6.36	6.00	6.09	-	1.72

DAS- Days after sowing, Figures in the parentheses are arc sine transformed values

Environmental factors decide the epidemics of powdery mildew of sunflower. Adjustment of planting dates is one of the important cultural practices in disease management. The environmental factors like temperature, relative humidity, dew point and rainfall are important for disease development and are being used for disease forecasting. Akhileshwari *et al.* (2012) observed that, the intensity of sunflower powdery mildew depends on the date of sowing. The observations on disease development at different stages of crop growth indicated that the crop raised during first fortnight of October recorded highest infection of powdery mildew disease at 80 DAS (78.67%) and 100 DAS (85.33%) followed by second fortnight of September recording 70.00 and 76.00 per cent as well as first fortnight of September with 63.33 and 68.89 per cent disease intensity at same growth stages. Similarly, the least severity was observed during first fortnight of July sown crop with PDI of 28.33 and 42.22 and the next best sowing date for reduced powdery mildew intensity was second fortnight of July sown crop with PDI of 35.00 at 80 DAS and maximum PDI of 51.67 at 100 DAS.

It is apparent that second fortnight of July sown crop showed the least PDI (8.80%) due to prevailing weather conditions like,

maximum temperature, maximum dew point and minimum relative humidity. The disease intensity was higher (39.64%) in the first fortnight of October sown crop which could be due to early infection, favourable condition for disease development and availability of enough inoculum from July, August and September sown crops that helps for build up of disease. The present findings are in agreement with the research findings on the effect of dates of sowing and age of the crop on the powdery mildew of bhendi (Shivanna, 2004).

Almost similar findings were documented by Sanjivareddi (2012) who reported that, the severity of the disease was low (39.65%) during first sown crop (I week of July); but it increased in the second sown crop i.e., II week of July (43.32%) again gradually increased in subsequent sown crops and reached maximum (50.21%) in the last sown crop (III week of October). Further, in all the three dates of sowings the onset of disease was noticed on 44th week and reached its peak at harvesting in all the sowing dates. The second sowing date (7-9-2009), recorded maximum per cent disease index (85.18% PDI) followed by first sowing date (74.07% PDI) and least in third sowing date (44.06% PDI).

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References

- Akhileshwari, S. V., Amaresh, Y. S., Naik, M. K., Kantharaju, V., Shankergoud, I. and Ravi, M. V., 2012, Effect of dates of sowing on powdery mildew severity and yield of sunflower. *Karnataka J. Agric. Sci.*, 25 (1): 129-130.
- Anand Singh and Anil Sirohi, 2003, Effect of some weather parameters on the development of powdery mildew (*Erysiphe polygoni*) in black gram. *Pl. Dis. Res.*, 18(1): 63-64.
- Anonymous, 2012, Directorate of Economics and Statistics, Department of Agriculture and Co-operation, New Delhi, India, pp. 107.
- Band, S. B., Khandge, S. V., Mahalle, A. M. and Band, A. M., 2007, Effect of temperature and relative humidity on incidence of powdery mildew on okra crop. *J. Soils and Crops.*, 17(2): 389-393.
- Joksimovic, J., Atlagic Jovanka, Marinkovic, R. and Jovanovi, D., 2006, Genetic control of oleic and linoleic acid contents in sunflower. *Helia.*, 29(44): 33-40.
- Mayee, C. D. and Datar, V. V., 1986, *Phytopathometry* - Technical Bulletin-1. Marathwada Agric. Univ., Parabhani, Maharashtra, India, pp.26-27
- Sanjivareddi, Y.B. 2012 Investigations on powdery mildew (*Erysiphe cichoracearum* DC. f. sp. *helianthi* Jacz.) of sunflower in northern dry zone of Karnataka *M.Sc. Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).
- Shivanna, E., 2004, Epidemiology and management of okra powdery mildew caused by *Erysiphe cichoracearum* DC. *M.Sc.(Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka (India).