

# Estimation of yield loss in sunflower due to new sunflower leaf curl virus disease at different stages of crop growth

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## ABSTRACT

An experiment was carried out to assess the crop loss due to sunflower leaf curl virus (SuLCV) disease. The crop loss assessment in terms of growth and yield components was recorded at first appearance of symptoms of SuLCV at 30 days to 90 days during the crop growth. The SuLCV disease infection in sunflower significantly affected the plant height (72.60 to 157cm), size of the head (8.60 to 18.78cm), 100 seed weight (2.20 to 6.32g), oil content (31.24% to 38.26%), and weight of seeds/10 heads (77.20 to 372.2g) as compared to the healthy control plants. In the plants, first appearance of symptoms at 30 DAS was recorded the seed yield loss of 79.25 per cent.

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## INTRODUCTION

Sunflower popularly known as Surajmukhi, is a familiar plant in India. The plant was traditionally grown for its ornamental value. However, presently sunflower is mainly grown for its oil. The oil is used for culinary purposes, in the preparation of *vanaspati* and in the manufacture of soaps and cosmetics. It is especially recommended for heart patients. Its cake is rich in protein and is used as a cattle and poultry feed. Sunflower is cultivated in an area of 0.90 million ha with a production of 0.62 million tones and productivity of 696 kg per ha in India. In Karnataka, the area under sunflower is 55.2 lakh ha with a production 42.83 lakh tones and productivity is 496 kg per ha. The major sunflower growing states are Karnataka, Andhra Pradesh, Maharashtra, Tamil Nadu and Haryana. In India, Andhra Pradesh with 29 per cent sunflower production occupies second position after Karnataka (40%).

There are many reports on occurrence of several pests

and diseases on sunflower. The crop is suffering from many diseases like leaf spot, blight, downy mildew, powdery mildew, charcoal rot, sclerotium rot or wilt, rhizopus head rot, sunflower necrosis virus, cucumber mosaic virus and root knot nematode (Saharan *et al.*, 2005). During 2009-10, leaf curl disease caused by begomovirus transmitted by whitefly (*B. tabaci*) on sunflower hybrid (Sunbred 275) with incidence up to 40 per cent was first confirmed from Main Agricultural Research Station, University of Agricultural Sciences, Raichur based on symptomatology, association of whitefly (*B. tabaci*) as vector and the coat protein of the begomovirus sequence analysis (Govindappa *et al.*, 2011).

Whitefly [*Bemisia tabaci* (Gennadius)] transmitted begomoviruses are considered to be one of the largest and most important group of plant viruses infecting a wide range of crops, particularly in tropical and subtropical regions. They can be monopartite or bipartite depending upon the presence

of one (DNA-A) or two (DNA-A and DNA-B) genomic components, each of approximately 2.5–2.8 kb size (Faquet *et al.*, 2008). Hence, an attempt was made to estimate the losses due to sunflower leaf curl virus disease at different stages of crop growth.

## MATERIAL AND METHODS

The estimation of losses due to sunflower leaf curl virus disease was carried out at MARS, Raichur using the variety KBSH-44 during *Kharif*, 2012. The crop was sown with a spacing of 60×30 cm in Randomized Block Design having plot size of 3×3 mt. All cultural practices were followed as per package of practices for cultivation of the crop. For estimating the loss due to sunflower leaf curl disease, 10 SuLCV diseased plants were tagged when initiation of first symptoms (Yellowing of emerging leaves) at 30, 45, 60, 75 and 90 DAS. Similarly, 10 healthy plants were also tagged as a control treatment. The tagged plants were harvested after maturity and the observations on plant height, test weight, diameter of the head, oil content and seed yield were recorded as per standard procedure and the data was subjected to statistical analysis. Later the loss in seed yield was estimated using the formula given below :

$$\text{Loss in seed yield (\%)} = \frac{\text{Yield in healthy control plot} - \text{Yield in the treatment plot}}{\text{Yield in the healthy control plot}} \times 100$$

## RESULTS AND DISCUSSION

The data on estimation of losses due to sunflower leaf curl virus at different stages of crop growth during *Kharif*, 2012 indicated that, the plant height was reduced at all the stages of SuLCV infection. However, significant difference was observed when the first appearance of symptoms at 30 days or earlier (72.60 cm) when compared to the first appearance of symptoms at 45, 60, 75 and 90 days after sowing (89.80 cm, 115.30 cm, 129.6 cm and 142.2 cm, respectively). However, healthy control recorded highest plant height of 157.0 cm and was significantly different from rest of the treatments (Table 1 and Fig. 1).

There was heavy reduction in size of the heads when the plants were shown first appearance of symptoms from 30 to 60 days after sowing. There was significant difference in diameter of the heads when plants shown first symptoms at early days (8.60 cm, 10.80 cm and 14.58 cm at 30, 45 and 60 days after first appearance of symptoms, respectively) and later days of infection, plants heads recorded diameter of 15.48 cm, 17.30 cm at 75 and 90 DAS, respectively. Healthy control recorded the highest head diameter of 18.78 cm (Table 1) and it is significantly different from rest of the treatments.

Numbers of unfilled seeds were more when plants shown

Treatments	Plant height (cm)	Size of the head (cm)	Test weight (g)	Oil content (%)	Seed yield/ 10 heads (g)	Seed yield loss (%)
30 DAS	72.60	8.60	2.20	31.24	77.20	79.25
45 DAS	89.80	10.80	2.70	34.4	122.00	67.22
60 DAS	115.30	14.58	3.32	36.04	152.00	59.16
75 DAS	129.60	15.48	4.82	36.64	239.00	35.78
90 DAS	142.20	17.30	5.60	37.46	345.60	7.14
Healthy control	157.00	18.78	6.32	38.26	372.2	-
S.E. ±	1.11	0.34	0.34	0.26	1.38	-
C.D. (P=0.05)	3.26	1.03	1.01	0.79	3.65	

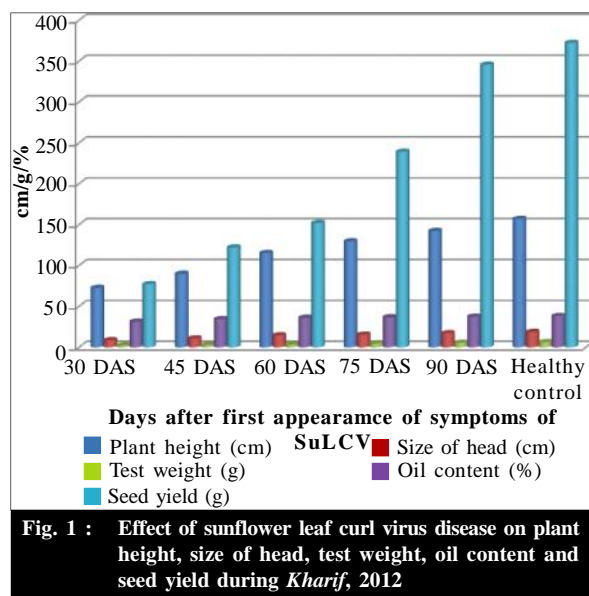


Fig. 1 : Effect of sunflower leaf curl virus disease on plant height, size of head, test weight, oil content and seed yield during Kharif, 2012

first appearance symptoms at early stages compared to plants which shown first appearance symptoms at later stages. The test weight (100 seed weight) was highest in healthy control plants (6.32 g) and significantly different (2.2 to 5.6 g) from other days of first appearance symptoms (30, 45, 60, 75 and 90 DAS) (Table 1). Further, seed yield of 10 heads was varying significantly with different days of first appearance symptoms. The lesser seed yields of 77.20 g, 122.0 g, 152.0 g, 239 g and 345.6 g were recorded at 30, 45, 60, 75 and 90 days of first appearance symptoms when compared to highest seed yield of 372.2 g in healthy plants. Based on the seed yield data, the loss in yield was calculated and results indicated that the loss varied from 79.25 to 7.14 per cent during the early days of first appearance symptoms. The highest loss was 79.25 per cent recorded when the crop was shown first appearance symptoms at 30 DAS and there after the loss reduced gradually from 67.22 to 7.14 per cent from 45 to 90 days after sowing (Table 1 and Fig. 2). There was significant per cent reduction in oil content (31.24% to 38.26% at 30 to 90 DAS) when plants were shown first appearance symptoms at 45, 60 and 75 DAS was 34.4, 36.04 and 36.64 per cent was recorded (Table 1). The results are in conformity with (Sastry and Singh, 1973) who reported that ToLCV infected plants produced very few fruits when infected within 20 days after planting and resulting up to 92.3 per cent yield loss in tomato. Plants infected at 35-50 days after transplanting resulted in 23-74 per cent yield loss.

The sunflower leaf curl virus disease infection in sunflower significantly affected diameter of the head, 100 seed weight, oil content and all yield components depending on the growth stages at which first symptoms appears. In the plants, first appearance of symptoms at 30 DAS, the diameter of the head, 100 seed weight, oil content and weight of seeds/10 heads were reduced to maximum extent compared to the

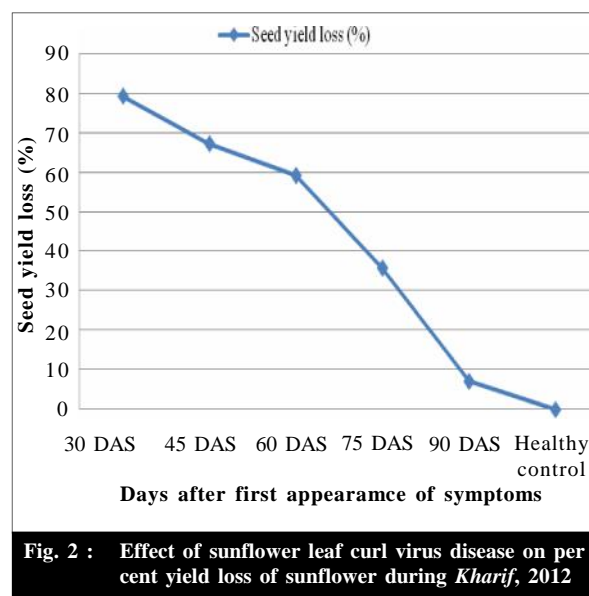


Fig. 2 : Effect of sunflower leaf curl virus disease on per cent yield loss of sunflower during Kharif, 2012

parameters recorded in healthy plants. The findings are supported by (Sinha and Chakrabarthi, 1978) who studied the effect of bhendi yellow vein mosaic virus (BYVMV) when okra plants were infected at various growth stages. They reported that the virus has an adverse effect on plant height, number of branches, number and size of fruits and seed yield. The highest loss of seed occurred in plants showing symptoms on the 33<sup>rd</sup> day after sowing and the least in those with symptoms on the 75<sup>th</sup> day however, there was no effect on germination.

The results of the present work also clearly demonstrated that early appearance of first symptoms of sunflower leaf curl virus disease led to severe loss in seed yield, whereas plants shown first appearance symptoms at later stages yielded less loss in comparison to healthy plants. It is noticed in the present study that, the first appearance symptoms of SuLCV at 30-45 days was found to affect the growth and yield components to the maximum extent. The maximum loss in seed yield of 79.25 per cent was recorded at 30 DAS and the yield loss was gradually reduced at later stages of crop. The results of present investigation are in conformity with (Gopal and Upadhyaya, 1991) who also recorded early infection caused heavy reduction in dry pod yield, 100 seed weight, and shelling percentage compared to late infection in PBNB of groundnut (Hanson, 1961; Huffaker and Gutierrez, 1991; Nadarajan and Gunasekaran, 2005; Panse and Sukhatme, 1989; Sharma, 1998 and Srivastava, 1996).

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