

RESEARCH ARTICLE

Effect of necrosis disease on yield and yield attributes of sunflower

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ABSTRACT

Sunflower crop is affected by necrosis disease caused by *Tobacco streak virus*, which is of recent origin. As a result of infection by sunflower necrosis disease, yield components like plant height, head diameter, number of seeds / head, 100 seed weight and seed yield /plant of the cv. Morden were adversely affected. Significant reduction in yield and yield parameters were observed in the plants affected at different severity levels of the disease (<10 per cent, 11-50 per cent and > 50 per cent) compared to healthy ones. Maximum reduction over control in seed yield was recorded at > 50 per cent severity level (63.78 per cent reduction) than < 10 per cent severity level (31.86 per cent reduction). The necrosis disease also influenced the yield contributing factors such as reduction in the size of flower head, seed setting, and test weight. The results indicated that with the increase in severity of the disease, there was corresponding decrease in yield and yield parameters of sunflower cv. Morden.

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INTRODUCTION

Sunflower (*Helianthus annuus* L.) is an important edible oilseed crop in the country next to groundnut and soybean which accounts for nearly 5 per cent of the current oilseed production. In India, the crop is cultivated in an area of 1.48 million hectares with production of 0.9 million tonnes (DOR Annual Report, 2010). The major sunflower growing states are Karnataka, Andhra Pradesh, Maharashtra and Tamil Nadu.

In India, only the association of a *Poty* and *Tospo* virus has been recorded on sunflower plants, until the emergence of a new disease called sunflower necrosis disease (SND) in recent years, which has hampered sunflower cultivation. Sunflower necrosis disease was noticed in an epidemic form consecutively for the three years (1997-99), with the incidence ranging from 10 to 80 per cent and yield loss up to 90 per cent in most of the sunflower growing regions of southern India (DOR Annual Report, 2001).

The causal agent of SND was identified as Tobacco streak virus of *Ilar* virus group (Ravi *et al.*, 2001; Bhat *et al.*, 2002a). Natural occurrence of TSV infection has also been

recorded from other hosts, such as cotton, sunhemp, mungbean (Bhat *et al.*, 2002b) and groundnut (Reddy *et al.*, 2002).

The disease has significant impact on sunflower crop as early infection either kills the plant or causes severe stunting with malformed head or heads filled with chaffy seeds (Ravi *et al.*, 2001). Early infected plants remain stunted and develop malformed heads with poor or no seed setting, resulting in complete loss of the crop (Jain *et al.*, 2003). Keeping this in view, detailed study was made on the effect of SND on yield and yield attributes in sunflower cv. Morden.

MATERIALS AND METHODS

To study, the effect of SND infection on yield and yield parameters under natural conditions, the seeds of sunflower cv. Morden were sown during 2009-10 *Kharif* season in the plots measuring 4.2 m x 3.0 m in three replications with spacing of 60 cm x 30 cm. All the recommended package of practices were followed and the plots were irrigated whenever necessary. The infected plants at different severity levels were tagged.

For each severity level, ten plants were randomly selected and tagged. Observations on plant height (cm), head diameter (cm), number of seeds/head, 100 seed weight/test weight (g) and seed yield/head (g) were recorded at harvest in randomly tagged plants. Ten healthy plants (uninfected) randomly selected from the plot served as control.

The diseased plants were tagged in each category based on the following severity level corresponding to the symptom intensity (Chander Rao *et al.*, 2003).

Disease severity level	Symptom intensity
Healthy	: No symptoms
Less than 10 per cent	: Systemic chlorotic spots
11-50 per cent	: Systemic chlorotic and necrotic symptoms and stunting
More than 50 per cent	: Severe necrosis of leaves, petiole, stem, bracts, capitulum infection and stunting

$$\text{Per cent yield loss} = \frac{Y_n - Y_i}{Y_n} \times 100$$

where,

Y_n = Yield of healthy plant

Y_i = Yield of diseased plant

RESULTS AND DISCUSSION

There was significant reduction in plant height, head diameter, number of seeds / head, 100 seed weight (test weight) and seed yield per head in the sunflower plants affected at different severity levels over healthy ones (Table 1 and Fig.1).

Plant height :

There was significant difference between plant height of healthy and SND infected plants at different disease severity levels. The plant height was least (65.10 cm) at > 50 per cent severity level followed by 11-50 per cent (110.20 cm) and < 10 per cent (135 cm) disease severity levels compared to healthy (142.50cm).

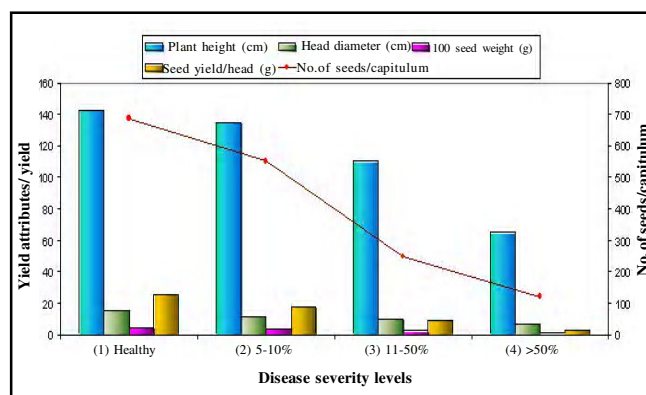


Fig. 1 : Effect of SND on yield and yield attributes of sunflower cv. Morden at different disease severity levels

Diameter of the capitulum :

Significant differences were observed in diameter of the capitulum produced by healthy and diseased plants. Head diameter was 6.60 cm at > 50 per cent disease severity level, followed by 9.85 cm and 11.40 cm in plants showing 11-50 and < 10 per cent disease severity levels, respectively compared to healthy check (15.35 cm).

Number of seeds / capitulum :

Average number of seeds / capitulum was 119.9, 247.0 and 550.4 at > 50 per cent, 11-50 per cent and > 10 per cent severity levels, respectively which were significantly lower than the healthy plants (686.10).

Test weight :

Significant differences were observed in test weight of the seeds produced by healthy and infected plants at different severity levels. At > 50 per cent severity level, the test weight was 1.11 g as against 2.21 g and 3.41 g at 11-50 per cent and > 10 per cent severity levels, respectively as against 4.45 g in healthy plants. The seeds from infected plants at different severity levels were small, discolored and chaffy compared to those seeds from healthy plants.

Seed yield / head :

Seed yield per head recorded at > 50 per cent disease

SND Severity level	Plant height * (cm)	Head diameter* (cm)	No. of seeds / head*	Test (100 seeds) weight* (g)	Seed yield / head* (g)	Yield reduction (%) over healthy
<10 %	135.00	11.40	550.40	3.41	17.38	31.86
11-50 %	110.20	9.85	247.00	2.21	9.24	63.78
> 50 %	65.10	6.60	119.90	1.11	2.75	89.22
Healthy	142.50	15.35	686.10	4.45	25.51	
S.E. ±	1.18	0.21	4.34	0.093	0.33	
C.D. (0.05)	3.43	0.62	12.59	0.27	0.96	

* Mean of 10 plants

severity level was significantly lower (2.75 g/head) as compared to 11-50 per cent and < 10 per cent severity levels (9.24 g and 17.38 g, respectively); whereas, healthy ones recorded 25.51 g/head. Highly significant differences were observed between seed yield of healthy and diseased plants at different severity levels. Maximum (89.22 per cent) reduction in seed yield over healthy plants was observed in infected plants at > 50 per cent disease severity level followed by 63.78 per cent and 31.86 per cent reduction at 11-50 per cent and < 10 per cent disease severity levels, respectively.

The results indicated that with the increase in severity of the disease (SND), there was corresponding decrease in yield and yield attributes of sunflower cv. Morden. Further, the necrosis disease also influenced the yield contributing factors by mainly reducing the size of flower heads, seed setting and seed weight. The reduction in plant height as a result of SND infection is one of the factors leading to reduced synthesis of food materials and also depends on the stage of infection and cultivar. The effect was more when plants were infected early as compared to those infected later. The results also suggest that it is very important to initiate plant protection measures, right from the initial crop growth stages to manage thrips vector as well as the causal virus.

The results are in accordance with DOR Report (2000) and Chander Rao *et al.* (2003) who reported that all the growth and yield parameters were significantly affected due to SND resulting in yield loss of 89 per cent at > 50 per cent disease severity level, 63 per cent and 20 per cent at 11-50 per cent and < 10 per cent disease severity levels, respectively. Chandra Mohan (2004) also reported that SND infection in sunflower caused significant reductions in plant height (58.99 per cent), head diameter (64.48 per cent), number of seeds per head (91.07 per cent), seed filling per cent (62.20 per cent), seed yield per plant (96.72 per cent), test weight (59.57 per cent) and oil content (50.97 per cent) compared to healthy plants.

It can be concluded that disease severity had definite effect on yield and yield attributes of sunflower cv. Morden. With the increase in disease severity, there was corresponding decrease in yield and yield attributes.

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