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Integrated Management of Linseed Wilt (*Fusarium oxysporum f.sp.lini*)

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Abstract
Linseed, scientifically known as *Linum usitatissimum* L., is indeed an important oilseed crop in India. It is also known by various other names such as Alsi or Tisee. Linseed is cultivated primarily for its seeds, which are rich in oil content. The oil extracted from linseed is commonly known as linseed oil or flaxseed oil and is widely used for various purposes, including culinary, industrial, and medicinal applications. In India, linseed cultivation has a long history and is mainly concentrated in states like Madhya Pradesh, Rajasthan, Uttar Pradesh, Bihar, and Gujarat. Linseed crop is affected by the various insect-pests and diseases. Among the various pathogens, *Fusarium oxysporum f.sp.lini* cause significant economic loss to crop. Planting resistant cultivars is one of the most effective strategies for managing linseed wilt. Implement a crop rotation strategy to break the disease cycle. Practice good sanitation measures to prevent the spread and buildup of the pathogen. Remove and destroy infected plant debris, as *Fusarium oxysporum f.sp. lini* can survive in crop residues. Clean and disinfect farm equipment and tools to minimize pathogen transmission.

Keywords: *Fusarium oxysporum f.sp.lini*, Pathogen transmission, Resistant cultivars, Insect-pests.

Introduction
Linseed is one of the oldest cultivated crops, commonly known as "Ulsee" or "Tisee". (*Linum usitatissimum* L.) (2n = 30) belongs to the family Linaceae is second commercially most important Rabi oil seed crops after rape seed mustard in area as well as in production. It is a multipurpose crop grown either for fiber or oil. Every part of the plant is utilized commercially either directly or after processing. Linseed grain contains about 40 per cent oil and 24 per cent crude protein. The crop is well-suited to diverse agro-climatic conditions and can be grown in both *Kharif* and *Rabi* seasons. Linseed is known for its hardy nature and can tolerate relatively poor soil conditions. It requires moderate rainfall or irrigation during its growth stages. The oil extracted from linseed is highly valued for its nutritional composition, which includes essential fatty acids like omega-3 and omega-6 fatty acids. It is also a source of various micronutrients and antioxidants. The integrated management of linseed wilt (*Fusarium oxysporum f. sp. lini*) disease involves the implementation of various strategies and practices to effectively control and minimize the damage caused by this disease. This approach combines cultural, biological, and chemical methods to achieve sustainable control and reduce the economic impact of linseed wilt on crop production. In this article, we will discuss the epidemiology of the disease, the nature of damage it causes, and the integrated management strategies employed to combat linseed wilt.

Casual Organism of Wilt Disease

Linseed wilt caused by the fungus *Fusarium oxysporum f. sp. lini*, is a devastating disease that affects linseed (flax) plants. The pathogen infects the plant through the roots and colonizes the vascular system, leading to wilting, stunting, and ultimately, plant death. The disease spreads through soil-borne inoculum, including infected plant debris and soil particles. Favorable environmental conditions, such as high soil moisture and warm temperatures, promote disease development and progression.

The mycelium is septate, branched, and intracellular. The pathogen produces branched, hyaline, and short conidiophores that give rise to hyaline and septate conidia (Figure 1). The conidia are both micro- and macro-conidia. The micro-conidia are mostly 1-2 celled and measure 4.8 -14.4 x 2.2-4.8 µm, whereas the macro-conidia are usually 3-septate (4-celled) and measure 21.0-53.0 x 2.4-5.6 µm.

Figure 1: a. Wilt infected plant of linseed

b. Culture of *Fusarium oxysporum f. sp. lini*

Integrated Management of Linseed Wilt disease

Cultural Practices: Implementing cultural practices is an important component of integrated disease management. These practices include crop rotation, where linseed is rotated with non-host crops to break the disease cycle. This helps reduce the inoculum levels in the soil. Additionally, maintaining proper plant spacing, adequate irrigation, and appropriate nutrient management can enhance the plant's overall health and resistance to diseases.

Biological Control: Biological control involves the use of beneficial microorganisms or natural enemies to suppress the pathogen population. Several bio-control agents, such as *Trichoderma spp*. and *Pseudomonas fluorescens*, have shown potential in suppressing *Fusarium* wilt in various crops. These beneficial organisms can colonize the rhizosphere, compete for nutrients and space, and produce antifungal compounds, thereby reducing disease incidence.

Resistant Varieties: Developing and cultivating linseed varieties with resistance to *Fusarium* wilt is a crucial strategy for disease management. Breeding programs focus on identifying and incorporating resistance genes into linseed cultivars to enhance their ability to withstand the pathogen. Resistant varieties can significantly reduce disease severity and limit the spread of the pathogen. According to Ekka *et al.*, 2018, a group of 90 test entries from initial and advanced varieties, as well as 26 from advanced breeding lines, were tested under natural epiphytic conditions for wilt, alternaria blight, powdery mildew, and rust. Of which, germplasm that was both highly sensitive (HS) and disease-free (F) was not discovered. Only 11 test entries—RL-29210, RLC-153, BAU-15-06, RC-1007, RLC151, RLC-153, RLC-157, SLS-101, SLS-106, NDL-2014-11, and BAU-06–3—recorded multiple resistant reactions,

while 20 test entries showed moderately resistant reaction, 16 showed moderate susceptibility, and 29 displayed sensitivity to Alternaria blight, powdery mildew, wilt.

Chemical Control: Chemical control measures, such as fungicides, can be used in combination with other management practices to reduce disease incidence. Fungicides are applied as seed treatments or through foliar sprays to protect the plants from infection. However, their use should be judicious, considering environmental and health concerns, and following recommended application rates and timings. Raxil was the most effective fungicide against linseed wilts, followed by Thiram, Captan, Vitavax, and Agrosan-GN. Among the bio-agents, *Trichoderma sp*. showed better disease control compared to *Pseudomonas sp.* (Verma *et al.*, 2023).

The specific management practices may vary depending on the particular wilt pathogen and local conditions. It is advisable to consult local agricultural extension services or plant pathology experts for tailored recommendations based on your region and the specific wilt pathogen affecting linseed crops.

Conclusion

The integrated management of linseed wilt disease is essential to mitigate its impact on linseed crops. By combining cultural practices, biological control, planting resistant varieties, and, if necessary, judicious use of chemical control measures, farmers can effectively manage this destructive disease. Implementing these integrated management strategies can minimize yield losses, promote sustainable agriculture, and ensure the long-term viability of linseed production.

References

1. Verma, P.K., Patel, S., Srivastava, V., Yadav, S.K. and Singh, G. (2023). Studies on survey and management of linseed wilt (*Fusarium oxysporum f. sp. lini*.). *The Pharma Innovation Journal*, 12(6): 3540-3543.
2. Ekka, S., Lal, H. C., Ram, S., Surin, S. S. and Xaxa, E. (2018). Evaluation of multiple sources of resistance and integrated management of linseed wilt. *Journal of Pharmacognosy and Phytochemistry*, *7*(1S), 3286-3288.