

Corm Rot of Saffron: Symptoms and Biological Management

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Saffron (*Crocus sativus* L.) is an important medicinal and economic crop, a golden condiment which belongs to family *Iridaceae*. In India, state Jammu and Kashmir is having monopoly in this crop. Saffron is a perennial crop with underground corm and reproduces vegetatively. In the state of Jammu and Kashmir, 5361 hectares of area is under cultivation of this crop with a production of 173.82 quintals worth 43 crores annually. The total area under saffron cultivation in Kashmir in 2009 was 2667 ha with a production of 9.5 metric tons while almost a decade earlier, in 1997, 5707 ha were under saffron cultivation with a production of 16 metric tons, leading to decline in overall saffron production by 34 percent in just a short span of 12 years. The average productivity in Jammu and Kashmir State is reported to be declining year after year. As against productivity of 3.7 kg ha⁻¹ in 1977, the production has declined to 2.70 kg ha⁻¹ in 2002. Several factors have been identified to be the cause of decline in productivity. Less rainfall or drought like situations during active period of corm multiplication or at the time of flowering, inadequate soil nutrients and above all the incidence of many biotic factors like pests and corm rot disease are the major constraints in harvesting the maximum flower yields. However, among all factors corm rot disease forms the bottle neck. The corm rots do not allow the division of mother corm into daughter cormlets and thus leads to reduction in per unit area corm number and the yield. In newly infested fields, the disease occurred in small patches that gradually enlarged each year. Maximum corm rot infestation during both the years was observed in the corms collected at digging state. Symptoms appear as brown-to-dark brown sunken, irregular patches below corm scales. Lesions are usually 1 mm deep with raised margins. Severely infected corms have foliage dried from the tip downward. White fungal mycelia appears on the bulbs that rots at later stages of disease development. Saffron plants in Kashmir valley (India) show severe rotting of corms caused by *Fusarium*, *Penicillium* and *Rhizoctonia*. The primary symptoms are observed during the flowering stage (October-November), causing yellowing and wilting of shoots due to basal stem rot and the development of white rounded spots on the corm. Black powdery appearance developed beneath the outer tunic layer of the corm. The affected plants have less number and undersized daughter corms and flowers besides reduction in the flowering period. Three *Fusarium* spp. viz. *F. solani*, *F. moniliforme* and *F. oxysporum* have been found associated with the disease. However, *F. solani* was most prevalent and destructive and is regarded as the principal pathogen. This is the only species isolated from the infected corms collected at digging and harvesting stages. While other two species are isolated only from infected corms collected at storage stage but there too *F. solani* has been found to be the most predominant. Under this scenario, the adoption of green technologies especially the beneficial microbial applications seems promising to meet challenges of soil fertility and plant diseases management without disturbing the equilibrium of harmful and useful composition of environment and ecosystem. The corm rot can be managed non-chemically by the use of bioagents viz. *Trichoderma viride*, *Trichoderma harzianum*, *Gliocladium virens* and *Aspergillus niger*, which inhibit the growth of pathogen to varying degrees but *T. viride* has highest antagonistic affect and also has strong volatile and non-volatile inhibition activity as compared to other bio-agents. However, *T. viride* and *G. virens* are equally effective in reducing the corm rot to appreciable levels when tested as soil treatment. Recently, it was investigated that *Bacillus* strain viz., *Bacillus amyloliquefaciens* strain W2 was very effective to manage corm rot disease caused by *Fusarium* species. With recent advances in technology, it may soon become possible to prevent the corm rot disease of the world's costliest spice.

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