AGRI MAGAZINE
(International E-Magazine for Agricultural Articles)
Volume: 02, Issue: 11 (November, 2025)
Available online at http://www.agrimagazine.in
©Agri Magazine, ISSN: 3048-8656

Management of Pulse Crops Diseases through Biological Control

*Dabhi Alpana A., Dr. Jaimin R. Pandya, Dr. D. M. Pathak, Dr. Sanjay G. Patel, Rakesh R. Patel and Aditya Singhal
Department of Plant Pathology, College of Agriculture, NAU, Bharuch, India
*Corresponding Author's email: dabhialpanaben113@gmail.com

Pulse crops are an essential source of plant-based proteins and contribute significantly to human nutrition and soil fertility. However, their productivity is hampered by various fungal, bacterial, and viral diseases. The use of biological control agents (BCAs) offers a sustainable and eco-friendly alternative to chemical fungicides. This review discusses the major pulse crop diseases, biological control agents, their mechanisms, and practical applications for disease management. The focus is on key BCAs such as *Trichoderma spp*., *Pseudomonas fluorescens*, and *Bacillus subtilis*, which effectively manage soil-borne pathogens and promote plant health.

Keywords: Pulses, Biological control, *Trichoderma*, *Pseudomonas*, *Bacillus*, Eco-friendly management

Introduction

Pulses are a vital component of global agriculture and nutrition, providing 21–25% protein, fiber, vitamins, and minerals. India ranks as the largest producer, consumer, and importer of pulses worldwide. Pulse crops, including chickpea, pigeonpea, mungbean, lentil, field pea, and dry bean, play a critical role in maintaining soil fertility by fixing atmospheric nitrogen. Despite their importance, pulse crops are often cultivated under rainfed conditions and are prone to attack by various pathogens, resulting in significant yield losses. Biological control is the suppression of disease by the application of a Biocontrol Agent (BCA) usually a fungus, bacterium, or virus. BCAs are playing an important role in controlling plant pathogens, especially soil borne fungal pathogens. The use of BCAs based products is not only safe for the farmers and consumers but it is also good for the environment.

Major Diseases of Pulse Crops

The major diseases affecting pulse crops include:

Disease	Pathogen	Major Symptoms
Chickpea wilt	*Fusarium oxysporum* f.sp. *ciceri*	Yellowing and sudden wilting; vascular discoloration
Ascochyta blight (Chickpea)	*Ascochyta rabiei*	Brown lesions with concentric rings; blighted appearance
Alternaria blight	*Alternaria spp.*	Necrotic leaf spots, coalescence leading to defoliation
Pigeon pea wilt	*Fusarium udum*	Yellowing, drooping of leaves, gradual wilting
Root rot (Field pea)	*Fusarium spp.*	Red to black root lesions; destruction of fine roots
Damping-off (Bean)	*Rhizoctonia solani*	Seedling death, hypocotyl lesions
Anthracnose (Black gram)	*Colletotrichum spp.*	Sunken lesions on leaves and pods

Biological Control: Definition and Concept

Biological control is the suppression of a plant pathogen by another living organism through natural or manipulated interactions. According to Baker and Cook (1974), it is "the reduction of inoculum density or disease-producing activities of a pathogen by one or more organisms through natural processes or environmental manipulation."

Biological Control Agents (BCAs)

BCAs are beneficial microorganisms capable of reducing disease incidence by inhibiting pathogen growth or activity. Commonly used BCAs include fungi such as *Trichoderma harzianum* and *T. viride*, and bacteria such as *Pseudomonas fluorescens* and *Bacillus subtilis*. These agents are environmentally safe, cost-effective, and long-lasting.

Advantages of BCAs include:

Reduce dependence on chemical fungicides
Prevent development of resistant pathogen strains
Environmentally friendly and safe for users
Cost-effective and stable during storage

Characteristics of bio-control agents

- BCA must be able to control the pathogen by inhibiting its development.
- BCA must have ability to compete with the pathogen for nutrient and space
- Production of antibiotic compounds.
- Production of lytic enzymes effective against pathogen.
- Ability to parasitize the pathogen.
- Ability to interfere with reproduction of pathogen.
- The induction of host defence.

Methods of Application

The primary methods for applying BCAs include:

a. **Seed treatment**: seeds are coated or soaked in a suspension containing BCAs such as *Trichoderma harzianum* or *Pseudomonas flurescens* before sowing. Provide early protection against seed borne and soil borne pathogens during germination.
b. **Soil application / soil drenching**: BCAs are mixed with compost or farmyard manure and applied to the soil before sowing or as a drench around the root zone at 15 – 30 days after sowing. Controls soil-borne pathogens like Fusarium spp. and Rhizoctonia solani.
c. **Soil amendment**: Organic matter enriched with BCAs (bio-compost) is incorporated into the soil during field preparation. Enhances microbial activity and soil health, creating unfavorable conditions for pathogens.
d. **Root inoculation**: Seedlings are dipped in a suspension of BCAs (10 g/L water) for 30 minutes before transplanting. Ensures immediate colonization of roots by BCAs, offering protection against root and collar rot pathogens.

Mechanisms of Biological Control

Competition: BCAs compete with pathogens for nutrients and space in the rhizosphere and phyllosphere, thereby restricting pathogen establishment

Antibiosis: Production of antimicrobial substances such as antibiotics and enzymes inhibits pathogen growth.

Mycoparasitism: Some fungi like *Trichoderma* parasitize pathogenic fungi by coiling around their hyphae and consuming their cytoplasm.

Induced Systemic Resistance (ISR): BCAs stimulate plant defense mechanisms, enhancing resistance to a broad range of pathogens.

Siderophore Production: BCAs secrete iron-chelating compounds that limit iron availability to pathogens.

Plant Growth Promotion: *Trichoderma* species promote root development and nutrient uptake.

Cross Protection: Mild strains of pathogens can protect plants from severe infections by related virulent strains.

Conclusion

Biological control represents a cornerstone of sustainable agriculture, offering a viable and eco-friendly alternative to chemical fungicides in pulse crop disease management. The integration of efficient biological control agents such as *Trichoderma spp*., *Pseudomonas fluorescens*, and *Bacillus subtilis* has demonstrated considerable success in suppressing key soil-borne and foliar pathogens of pulses. These BCAs not only inhibit pathogen growth through mechanisms like antibiosis, mycoparasitism, and competition but also enhance plant growth and induce systemic resistance. Adoption of bio-control-based management strategies can reduce the overdependence on synthetic fungicides, minimize environmental contamination, and preserve beneficial soil microbiota. Moreover, combining BCAs with organic amendments and integrated pest management (IPM) practices ensures long-term disease suppression and sustainability.