Technical Bulletin No. 10

BACTERIAL WILT IN BRINJAL AND ITS MANAGEMENT

ICAR RESEARCH COMPLEX FOR GOA

(Indian Council of Agricultural Research)

ELA, OLD GOA - 403 402, GOA, INDIA

Technical Bulletin No. 10

BACTERIAL WILT IN BRINJAL AND ITS MANAGEMENT

R. Ramesh

ICAR RESEARCH COMPLEX FOR GOA
ELA, OLD GOA – 403402, GOA, INDIA

2008

Published by:
Dr.V.S.Korikanthimath
Director
ICAR Research Complex for Goa
Ela, Old Goa – 403 402, Goa, India

Fax : 91-832 – 2285649
Phone : 91-832 – 2284678, 2284679
Email : director@icargoa.res.in
Web site : http://www.icargoa.res.in

Authored by: : **R. Ramesh**

Correct Citation : Ramesh, R. (2008). Bacterial wilt in brinjal and its management. Technical Bulletin No: 10, ICAR Research Complex for Goa (Indian Council of Agricultural Research), Ela, Old Goa- 403 402, Goa, India.

Technical assistance : Sidharth K. Marathe

Printed at : Sahyadri Offset System, Corlim, Ilhas, Goa-403 110

PREFACE

In the Coastal State of Goa, major share of the vegetables is coming from the neighboring states. However, during *rabi*, vegetables are cultivated in a sizable area in paddy fallows. Brinjal is one of the important vegetables cultivated in Goa during *rabi*. Though many released varieties are available, the local cultivars *viz*. Agassaim and Taleigao have a specific preference among the farmers as these cultivars fetch high prices. The consumers prefer these varieties to meet specific culinary needs due to their high flesh content.

The cultivation of brinjal in the state of Goa is affected mainly by the incidence of bacterial wilt disease. The local cultivars, Agassaim and Taleigao are highly susceptible to this disease. In certain cases, the entire crop is wiped out due to severe incidence. Wide host range of the pathogen coupled with its long periods of survival in the soil makes conventional chemical based management methods less effective.

The ICAR Research Complex for Goa conducted research on detection, spread, survival and methods of managing the disease with the emphasis on the use of biological control agents. The long term research efforts have showed that biological control is effective in reducing the disease incidence and in the long run it would lead to sustainable production besides improving the yield due to the growth promoting ability of these biological control agents. Thus biological control forms an important component of the Integrated Disease Management strategy being popularized by this Institute.

I am confident that, this technical bulletin will help the farmers, agricultural officers, extension officials to diagnose the disease and manage the problem by integrating different methods in a sustainable manner.

R. Ramesh

July, 2008

Contents

Introduction

Goa is a coastal state, situated along the Konkan track bounded by Arabian Sea and States of Karnataka and Maharashtra. Cultivation of vegetables is carried out mainly during the *rabi* season, after harvest of paddy. Among the vegetables, brinjal finds an important place in the cultivation. Though high variability exists in brinjal, the local cultivars "Agassaim" (an oblong type) and "Taleigao" (round type) are the preferred ones because of high flesh, less seeds and

Healthy brinjal cultivar Agassaim in the field (Inset: large size fruits)

bigger fruit size. The brinjal cultivation in Goa is mainly affected by Bacterial Wilt (BW) and is a major production constraint. The local preferred cultivars, Agassaim and Taleigao are highly susceptible to BW and the incidence ranges from 30-100 per cent during *rabi*.

Severe incidence of bacterial wilt in the field

This pathogen has a wide host range of more than 200 plant species which makes its management difficult. Other than chemical fumigants, there is no commercial pesticide available for the control of BW. Conventional management strategies like crop rotation, date of planting, other cultural methods and soil treatment are not very effective. Resistant cultivars are limited to locations, climate and to the strains of the pathogen. Only a few varieties show stable resistance but are not generally preferred by the growers. Recent studies have indicated that biological control of BW could be a sustainable and eco-friendly strategy. As there is no single effective control measure available for BW, integrating different methods is a must.

The objective of this technical brochure is to provide information to farmers/extension agencies on implementation of integrated management strategy for brinjal BW. Here the discussion focuses on the pathogen, host range, favorable condition, diagnosis and management of BW in order to minimize the loss caused by the disease.

About the disease

The pathogen

Bacterial wilt in brinjal is caused by *Ralstonia solanacearum*, a soil bacterium, formerly known as *Pseudomonas solanacearum*. The pathogen has five different races, each infecting different plant species. *R. solanacearum* strains are grouped into five biovars based on the biochemical tests. Brinjal BW is mostly caused by strains belonging to race 1 and biovars 3. Race 1 has wide host range including solanaceous vegetables like tomato and chilli. Race 1 strains from Goa exhibits genetic variability and difference in virulence on brinjal.

Host range and distribution

R. solanacearum is a widely distributed pathogen found in tropical, subtropical and some temperate regions of the world. It has an unusually wide host range of 200 plant species belonging to more than 50 families. Majority of the hosts are dicots with the major exception being bananas and plantains. Most economically important host plants are found in Solanaceae family. Specific host range and distribution of *R. solanacearum* depends on the race and to some degree the biovars of the pathogen.

Survival and spread

BW is a soil borne disease and *R. solanacearum* is able to survive in the soil for long periods which ranges from one to ten years without a host plant. Moreover it can colonize the non-host plants including many weeds which serve as the symptom-less carrier.

The pathogen infects the plant through root injuries/wounds or at the site of secondary root emergence. Intercellular spaces of the root cortex and vascular parenchyma are subsequently colonized and cell walls are disrupted facilitating spread through vascular system. In xylem vessels, the bacteria multiply rapidly and finally block the translocation of water, which leads to wilting of the plant. After wilting and plant death, the bacteria were found to be released into the soil. The neighboring plants can be infected *via* root contact or spread of the pathogen through irrigation water. The pathogen can also enter through priming wounds, contaminated water sources, symptom-less infected seedlings as well as humans or machinery carrying infected soil.

Favorable conditions

The disease occurs on all the types of soil, including sandy and clay soils. BW incidence was mostly prevalent in the acidic soils (soil pH < 7.0) and in the coastal humid areas. High temperature and moisture are favorable. Incidence of root knot nematode predisposes the plant and will accelerate disease development.

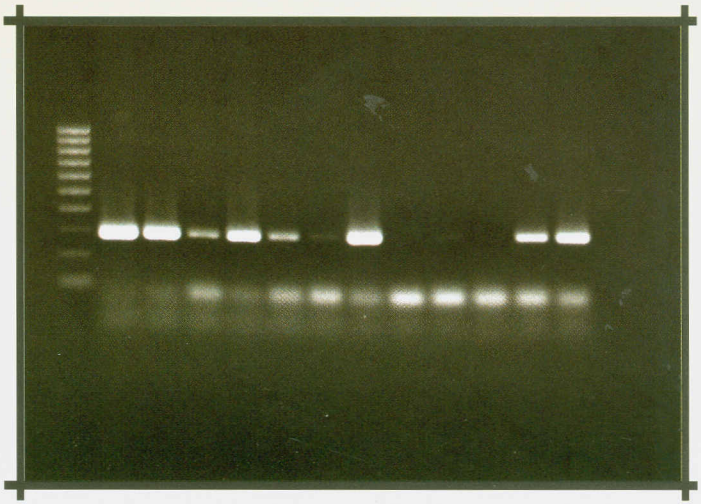
Symptoms and diagnosis

Disease develops very rapidly in warm weather. Symptoms are very clear during morning or immediately after irrigation. Symptoms manifest initially as leaf drooping followed by wilting of entire plant within a few days. Recently wilted plants look green, a distinct symptom when compared to other vascular wilt diseases which develops yellowing of the leaves. Vascular discoloration (brown) can also be seen in the wilted plant.

Typical symptom of bacterial wilt in brinjal

Bacterial ooze from the infected plant and colonies on TZC medium

A stream of milky white bacterial ooze can be noticed when the cut ends of the stem/root is kept undisturbed for few minutes in a clear container with water. This is a simple diagnostic method and could be used in the field to identify BW. In the laboratory, if the bacterial ooze is streaked in TZC medium, circular to oval shape, fluidal colonies with pink centre will appear after 48 hours of incubation which is unique to *R. solanacearum*. Molecular biology techniques like PCR can also be used in the detection of *R. solanacearum* from the soil and from the plant sap. The presence of bacteria can be seen by amplifying the specific region from its genome.



Detection of *R. solanacearum* by PCR

Management

1. Plant in a disease free field

Since the pathogen is a soil-borne, the disease will occur only if the pathogen is present in the field and environmental conditions are favorable for its development. Fields that have no previous history of BW and have not been planted with susceptible hosts during the previous season/year are less likely to have the pathogen. Regular rotation with other non-host plants will reduce disease incidence. However, rotation with paddy for only one season doesn't make the field disease free.

2. Use resistant varieties and pathogen free seedlings

A simple and most promising way to control BW is to plant resistant varieties. However, commercial/preferred varieties with high and stable resistance to BW are not common. Kerala Agricultural University has recommended a few BW resistant varieties viz. Surya, Swetha and Haritha which could be tried. When resistant varieties are not available grafting with resistant root stocks could provide better yields. Since the pathogens could spread through infected, symptom-less seedlings, the nurseries should not be located in the fields with the history of BW. It is recommended to fumigate/ solarize nursery soil for 15 days prior to sowing.

3. Prevent the spread of the pathogen

Infected plants should be removed and destroyed and also the infected portion of the field should be isolated if possible by preventing the water flow into and from the field. Frequency of irrigation and quantity of water should be reduced. Flood irrigation in the infected field increases the disease incidence by two fold. Movement of people/machinery should also be limited.

4. Reduce the pathogen load in infected field

Once introduced in to the field, pathogens like *R. solanacearum* are very difficult to eradicate but the pathogen population/load can be reduced by following methods in order to reduce the disease incidence:

(a) Fumigation with chemicals like methyl bromide. However, it is highly toxic and not practical for small scale farmers.

(b) Crop rotation with paddy and other non-host crops for 3-4 seasons.

(c) Flooding the field for 1-3 weeks before planting will reduce BW.

(d) Growing marigold (*Tagetes* spp.) in rotation or as intercrop will suppress the pathogen in addition to its anti-nematode effect. Growing *Brassica* spp. and incorporating the plants into soil at flowering stage will reduce BW incidence.

(e) Application of organic manures like FYM/ poultry manure in every year will increase the beneficial soil microflora and reduce the BW incidence.

(f) Biological control

Nursery application: Treat the seeds with talc based formulation of antagonistic *Pseudomonas fluorescens* (10g/100g of seeds) and soil application of antagonistic *P. fluorescens* (50g mixed with one kg of soil and incorporated in the nursery bed).

Main field treatment: Dip the seedlings in the antagonistic *P. fluorescens*/ *B. subtilis* (@ 25g talc formulation per litre of water) solution for 20-30 minutes just before transplanting. The left-over solution should be drenched around the root zones (50ml/plant).

Soil application of biocontrol agent

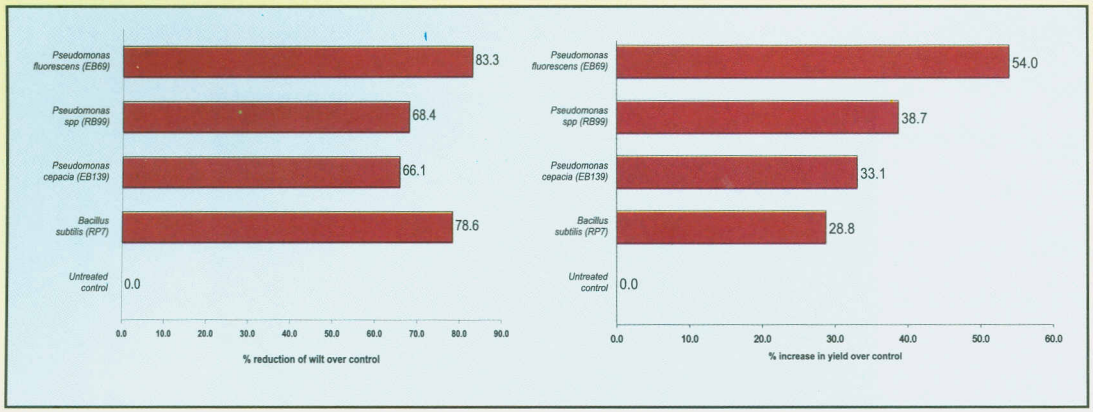
Application of biocontrol agent by drenching

View of biocontrol treated field after 15 days

A B

Biocontrol treated (A) and untreated (B) field

Treatment with biological control agents reduced the incidence of BW by more than 65 per cent compared to control. Further, an increase of yield (28 to 54%) was observed in the biological control agent treated plants.



Reduction of bacterial wilt (%) and increase of yield (%) in brinjal treated with biological control agents (Mean of two years, 2005-06 and 2006-07).

Conclusion

Bacterial wilt in brinjal is a major production constraint and to-date no single effective management method exists. Recent studies have indicated that the integration of biological control agents in the management strategies reduced the bacterial wilt incidence and increased the yield. Further, biological control could be adopted along with soil solarization and organic amendments. Incorporation of biological control agents against bacterial wilt in brinjal offers a sustainable and eco-friendly tool in an overall management strategy of this serious disease.