



## TOBACCO RESEARCH BOARD

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*Please address all  
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To: All Tobacco Growers  
Contractors  
Merchants  
Agrochemical Companies

Dear Grower

### **RE: FUSARIUM WILT/ROOT-KNOT DISEASE COMPLEX - A RE-EMERGING PROBLEM IN TOBACCO LANDS**

#### **INTRODUCTION**

This tobacco farming season, the Kutsaga Plant Clinic has recorded increased cases of Fusarium wilt/ Root-knot Disease Complex reported by tobacco and potato growers, especially during and after the recent mid-season drought.

#### **Symptoms**

##### ***Fusarium Wilt***

Fusarium wilt (caused by *Fusarium oxysporum*) begins looking like vein clearing on the younger leaves and drooping of the older lower leaves, followed by stunting, yellowing of the lower leaves, defoliation, marginal necrosis and plant death (Fig. 1). Especially when there is high temperature and humidity, *F. oxysporum* can cause significant damage.



**Fig. 1:** Symptoms of Fusarium wilt on tobacco plants.

### ***Root-knot***

Root-knot nematodes (*Meloidogyne spp.*), on the other hand do not have obvious above-ground symptoms. In most cases symptoms include stunting and yellowing or bronzing of the foliage (Fig 2a). Symptoms on infected plants may be similar to those of nutritional deficiency. The most distinctive symptom of the root-knot nematode infection is the formation of galls on the roots (Fig 2b).



(a)



(b)

**Fig. 2:** a) Above ground symptoms of root-knot nematode infection b) Formation of galls on the roots

### **Fusarium Wilt/Root-knot disease complex**

Nematode damage in most cases predisposes infected plants to other soil-borne pathogens which include bacteria and fungi, eventually resulting in disease complexes. Pathogenic *Fusarium* species are known to develop synergistic relationships with *Meloidogyne* species leading to a root-knot wilt disease complex. The Fusarium wilt-root-knot nematode complex is one of the most widely recognized and economically important disease complexes in the world as it affects the function of the root system (water and mineral uptake). The effect of the disease complex is hence usually greater than that of the single disease (root-knot or Fusarium wilt). In tobacco, it can be worsened by harsh weather conditions that can cause susceptibility in the plant.

### **RE-EMERGENCE OF THE FUSARIUM/ROOTKNOT DISEASE COMPLEX**

The biggest factor contributing to the re-emergence of this complex in Zimbabwe is lack of proper rotations caused by monoculture, where the tobacco crop is grown year after year. Monoculture can result in increased rates of buildup of pathogens and diseases in the soil and may lead to poor soil structure and nutrition, exacerbating the situation. This in turn leads to overreliance on pesticides which not only increases production costs but also poses a risk to both users and the environment. Management of the

complex is made difficult as both pathogens remain infective for years in the soil. Additionally the pathogens may remain dormant for more than five years.

## **MANAGEMENT OF THE FUSARIUM/ROOTKNOT DISEASE COMPLEX**

The unique features of soil-borne pathogens, in particular their existence in the soil, present both challenges and opportunities for their management. The basic approaches for disease management are resistance, cultural, chemical, physical and biological.

### **Resistance**

Root-knot resistance has already been incorporated into Kutsaga varieties. This resistance capability is crucial in limiting the possible development of the disease complex. However, because of continuous cultivation of tobacco, nematode populations have gradually built up to levels not manageable by resistance alone. As such, diagnosis of root knot damage even on RK cultivars has been noted in the Kutsaga Plant Clinic which led to the noting of the Fusarium-root-knot disease complex.

### **Chemical control**

There are currently no known curative solutions once tobacco plants are infected with both root-knot nematodes and *Fusarium oxysporum*. Management, therefore, is mainly through preventative nematicides and fungicides. *Fusarium oxysporum* may be a standalone infection on tobacco but usually combines with *Rhizoctonia solani*, another soil borne pathogen to form a complex commonly known as 'sore shin'.

Table 1 below shows some of the currently registered preventative treatments used to manage both sore shin and root knot nematodes.

Table 1: Prophylactic options for sore shin and root-knot nematodes

Stage	Problem	Remedy (Active Ingredient)	Remedy (Trade names)	Method	Rates
48 h before planting	Soreshin ( <i>Fusarium</i> and/or <i>Rhizoctonia</i> )	Triadimenol	Triadimenol 15 FS,	Drench	330 ml/100 L water @ 2 L/m <sup>2</sup>
			Poladime 250 EC, Triadimenol, Triadimenol 25 EC, Shavit 25 EC, Triadimenol 250 EC		200 ml/100 L water @2 L/m <sup>2</sup>
		Cyproconazole	Alto 100 SL	Drench	125 ml/100 L water @ 2 L/m <sup>2</sup>
Two weeks before planting	Nematodes	1,3-Dichloropropene	Telone	Fumigate using hand injector guns or mechanical applicator	4 ml/ planting station, 600 ml/100m of ridge
		Sodium N-methyl dithiocarbamate	Metham sodium/Herbifume	Fumigate using hand injector guns or mechanical applicator	4 ml/ planting station, 600 ml/100 m of ridge
Seven days before planting		Fluensulfone	Nimitz	See product label	2l/450 L water - 1 x 30 ml cup/planting hole
At planting		Fluopyram	Velum	Planting hole application	900 ml/450 L - 1 x 30 ml cup/planting hole
		Ethoprophos	Ethoprophos	Planting hole application	1 g/ planting hole 120 g/100 m row

					(15 kg/ha)
		Abamectin + Thiamethoxam	Solvigo	Planting hole application	630 ml/100 L – 1 x 30 ml cup/planting hole/ (3L/ha)
		Fenamiphos (GR)	Nemacur/ Fenamiphos	Planting hole application	1 g/ planting hole 120 g/100 m row (15 kg/ha)
		Fenamiphos (EC)	Nemacur/ Fenamiphos	Planting hole application	800 ml/100 L - 1 x 30 ml cup/planting hole (3.6 L/ha)
		Oxamyl (GR)	Vydate Blockade Vyten	Planting hole application	1 g/ planting hole 120 g/100 m row (15 kg/ha)
		Oxamyl (EC)	Vydate Blockade Vyten	Planting hole application	630 ml/100 L – 1 x 30 ml cup/planting hole (3 L/ha)
Supplementary 3 – 5 weeks after planting	Nematode	Oxamyl	Vydate	Spray 3 L/ ha	1260 ml/100 L water
		Fenamiphos	Fenamiphos (EC) Nemacur	Spray 3 L/ ha	800 ml/100 L water

## **Crop rotation**

Management of *Fusarium oxysporum* by cultural practices such as crop rotation is of lesser efficacy because of the production of survival spores such as chlamydospores. However, use of crop rotations in the integrated management of Fusarium diseases should not be disregarded to avoid recurrent increase of the inoculum in soil. Crop rotation remains one of the most important nematode management tools. Katambora Rhodes Grass has been found to effectively reduce root knot nematodes as either a relay crop or in alternation with tobacco. Similarly, Sunn-hemp also has good nematode suppression properties when used as a relay crop with tobacco. Both Katambora Rhodes Grass and Sunn-hemp can be hosts to *Fusarium oxysporum*, with no damage in the former crop and lethal effects in the latter crop. As such, it is important to ensure that seed used for rotation crops does not harbour seed-borne pathogens because this may lead to field contamination.

## **Sanitation**

Control measures for the Fusarium Wilt/ Root-knot Nematode Disease Complex include practices that remove and destroy sources of inoculum from affected plants or infested debris. The systemic infection of the host plant that characterizes Fusarium wilt gives rise to formation of abundant chlamydospores in above-ground organs that can become incorporated into soil after harvest of affected crops and contribute to build up of soil-borne inoculum. Burning or flaming residues of affected crops to achieve thermal killing of pathogen resting structures would reduce that effect, thereby reducing disease risk in subsequent host crops. As such, tobacco plants exhibiting sore shin or Fusarium damage should be destroyed immediately by burning.

In conclusion, the management of the Fusarium wilt/ root-knot disease complex is premised on an integrated approach to prevent occurrence of the single diseases as there is no remedy available when the complex occurs.

For more information, contact Kutsaga Research Station's Plant Health Services Division  
on telephone # (024) 2575 289/94 or toll-free, 08004511 or Email:  
tobres@kutsaga.co.zw or visit Kutsaga Research Station.

Yours sincerely,

For and on behalf of Tobacco Research Board

A handwritten signature in blue ink, appearing to be 'Dr. C. Chinheya', written in a cursive style.

Dr. Cleopas Chinheya  
**Acting Head – Plant Health Services Division**