



THHH-UN-DERRR: Resistance as a weapon to disease

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Potato diseases, especially late blight caused by the fungus *Phytophthora infestans*, remain a significant threat to potato production. Potato blight is an old foe but poses new challenges due to development of new pathogen variants, modern agricultural practices and climate change that increase disease risk. Although conventional management practices exist, concerns about fungicide resistance have spurred research into alternative strategies. Green chemistry approaches, which use natural or plant-derived products such as antioxidants, offer a promising way forward. These solutions can directly target the fungal pathogen or strengthen the potato plant's own defense mechanisms and provide a sustainable and environmentally friendly approach to disease management in modern agriculture.

THHH-UN-DERRR: a green fungicide

THHH-UN-DERRR is a new unique composition of plant-derived antioxidants such as Ascorbic Acid (Vitamin C) and Salicylic Acid as well as other proprietary ingredients.

This soluble concentrate is registered for use as a preventive control agent of potato diseases caused by the pathogen *Phytophthora Infestans*.

The unique formulation has a favourable ecological profile and no maximum residue level (MRL) or pre-harvest interval (PHI) is applicable and therefore offers a sustainable and environmentally friendly approach to disease management during potato production.

THHH-UN-DERRR is also registered for control of diseases caused by *Xanthomonas campestris* (bacterial spot), *Alternaria Solani* (early blight) and *Phytophthora Infestans* (late blight) on tomatoes. Figure 1 shows the effective average control of THHH-UN-DERRR against bacterial spot disease in tomatoes from various field trials and bioclimatic

zones in South Africa. The efficacy of THHH-UN-DERRR was measured as the percentage control (%) of bacterial spot, 7 days after four treatments and compared with the industry standard and an untreated control. The first foliar application was carried out at 50% fully ripe colour on plants showing no signs of stress and growing vigorously, followed by three subsequent applications at 7-day intervals. THHH-UN-DERRR provides an average % control of >75 % at 75 ml/100 L of water and >85 % at 150 ml/100 L of water against bacterial spot on tomatoes.

How does THHH-UN-DERRR work?

Disease resistance in plants is dependent on both existing physical or chemical barriers (such as thick cell walls or large amounts of lignin

Figure 1: Effective control of *Xanthomonas campestris* (Bacterial spot) on tomatoes expressed as % control over three bioclimatic areas.

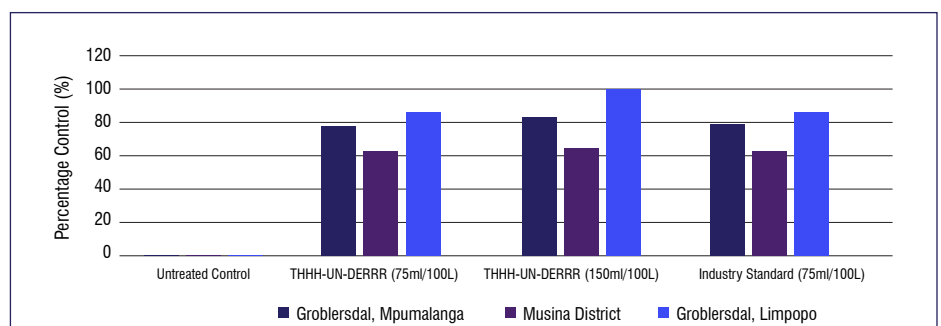


Table 1: THHH-UN-DERRR instructions for use:

Crop	Disease	Dose	Comments
Potatoes (Suppression)	Late Blight <i>Phytophthora spp.</i>	75 - 150 ml/100 L	Foliar Spray: First application at 4-6 leaf planting stage, followed by three subsequent applications at 7-day intervals. Spray volume: 500 – 800 L of sprayer per hectare
Tomatoes	Bacterial Spot (<i>Xanthomonas spp.</i>) Early blight (<i>Alternaria spp.</i>) Late blight (<i>Phytophthora spp.</i>)	75 ml/100 L	Apply to 4-6 leaf planting stage and repeat application every 7 days.

or tannins) as well as inducible defense mechanisms. Upon recognition of the pathogen, defense mechanisms are activated at the site of infection, as well as in other uninfected tissue. In the absence of any pathogen attack, these defense mechanisms can be triggered by physical or chemical origin. Antioxidants such as Ascorbic Acid and Salicylic Acid are activators of defense against various plant diseases when applied externally to plants.

The THHH-UN-DERRR fungus control mechanism of ascorbic acid and salicylic acid involves individual and synergistic effects on improving the plant's defense responses against pathogens. Studies have shown that the simultaneous administration of ascorbic and salicylic acid can lead to a decrease in the severity of diseases compared with when this active is used individually. This synergistic effect is possibly due to the complementary actions of these compounds to activate the plant's defenses that improve resistance to pathogens.

In addition, Ascorbic Acid and Salicylic Acid are naturally-occurring compounds and therefore pose minimal environmental impact and human health risks at recommended application rates.

Ascorbic acid acts as a powerful antioxidant, capturing reactive oxygen species produced during plant-fungal interactions. By reducing oxidative

stress, Ascorbic Acid helps protect plant cells from damage caused by fungal infections.

Ascorbic acid exhibits antimicrobial properties by altering bacterial cell wall synthesis and membrane permeability. Ascorbic acid has been found to regulate the expression of defense-related genes in plants, such as those encoding pathogenesis-related proteins. These proteins play a crucial role in controlling fungal pathogens by inhibiting their growth and spread within the plant tissues.

Salicylic acid can directly inhibit the growth and development of fungal pathogens by disrupting their cellular processes. It inhibits fungal enzymes and pathways essential for infection, thereby limiting the establishment of fungal diseases in potato plants. Salicylic acid functions as a plant defense signal molecule.

In pathogen attack, salicylic acid triggers a cascade of defense reactions within the plant, including the production of antimicrobial compounds and the activation of the plant's immune system. Salicylic acid is an important signaling molecule in plant defense reactions and is known to induce systemic acquired resistance (SAR), a systemic immunity that prepares the entire plant to resist pathogen attacks. SAR involves the activation of defense

genes and the accumulation of antimicrobial compounds in plant tissues.

Practical application and management practices for optimal results

THHH-UN-DERRR is a broad spectrum, preventive product for the control or suppression of many important plant diseases. It can only be applied as a foliar spray, in alternating spray programs or in tank mixes with other registered plant protection products.

For maximum efficiency, apply THHH-UN-DERRR before or in the early stages of disease development. When conditions are conducive to heavy disease pressure, use THHH-UN-DERRR in a rotation program with other registered fungicides. THHH-UN-DERRR is an ideal resistance management tool given its unique, multiple modes of action.

As plants with strong immune systems are less susceptible to disease, it is essential to ensure optimal plant nutrient status and foliar feeds as well as amino acid applications are recommended as adjunctive treatments.

Furthermore, soil health makes a major contribution to suppression of plant diseases and biology such as *Trichoderma Harzianum* which is well known for their ability to improve soil health.

ALWAYS READ LABEL BEFORE USE. Reg. No. L11557, Act 36 of 1947 (RSA) / Active Ingredients: Ascorbic acid 20 g/L, Salicylic acid 30 g/L.
HAZARD STATEMENTS: Causes skin irritation. Causes eye irritation.
REGISTRATION HOLDER: In Line Trading 112 (Pty) Ltd. (Co. Reg. No. 2003/008663/07) Cedar Lake Industrial Estate, C/O M57 & Porcelain Roads, Olifantsfontein, 1666, Gauteng, RSA Tel: +27 (11) 392 4072



WARNING

For more information on how your farm could benefit from the use of Thhh-Un-Derrr, visit www.nutrico.co.za or contact us on 011 392 4072 or 021 807 5922.