The wheat blast disease threat

The recent detection of wheat blast in Zambia raised alarms in the wheat industry in the SADC region. Once established, the disease is difficult to control, say researchers **Dr Tarekegn Terefe** of the Agricultural Research Council's Small Grain Institute and **Dr Willem Boshoff** of the Department of Plant Sciences at the University of the Free State.

FAST FACTS

Wheat blast poses a serious threat to wheat production in Southern Africa and could dramatically reduce yields.

The disease was first detected in Africa in the 2017/2018 production season, when it was found in Mpika in the Muchinga Province of Zambia.

Only a few cultivars are resistant to the disease and these offer only moderate resistance. Fungicides, too, provide only limited protection.

Wheat blast, caused by the fungus *Magnaporthe oryzae* pathotype *Triticum* (MoT) (syn *Pyricularia oryzae*), was reported for the first time on wheat in 1985 in Brazil and has subsequently spread across most wheat-producing areas of that country. The disease has the potential to cause yield losses of up to 100% on susceptible cultivars.

SYMPTOMS

Wheat blast infects the leaves and heads of the crop, but the canopy often remains green. Infection starts as brown to black spots, and eventually the entire spike above the infection points dries out and has a bleached or straw-like appearance.

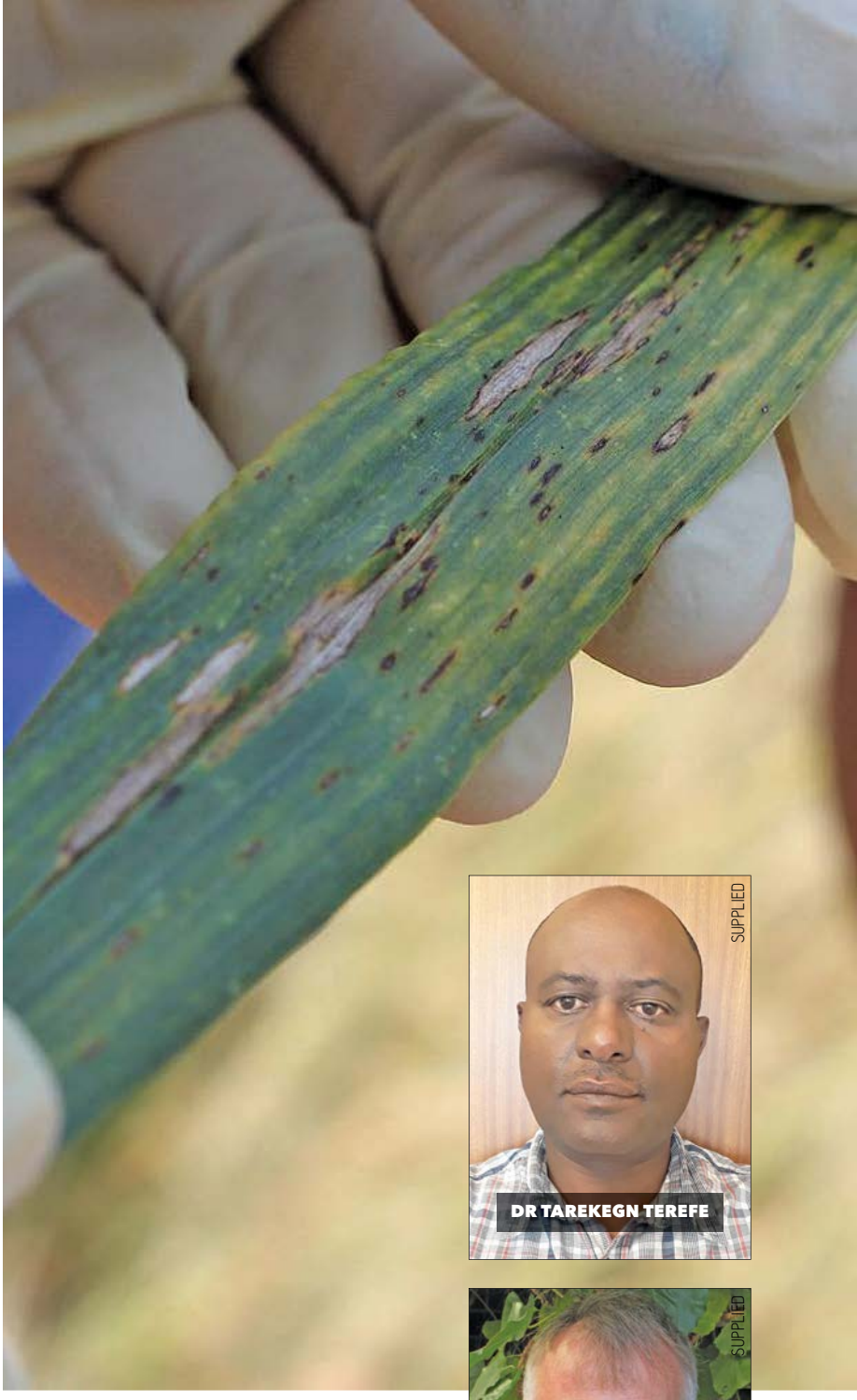
Infected wheat heads produce shrivelled, poor-quality grain or fail to produce any grain at all. Wheat blast symptoms on the head resemble those of *Fusarium* head blight, but wheat blast lacks the characteristic pinkish discolouration that often develops on wheat heads infected by *Fusarium*. Instead, greyish fungal growth may be visible on the rachis between spikelets on the head. Some grass species may also serve as an alternative host for the pathogen, creating an additional source of inoculum and helping ensure the survival of the fungus.

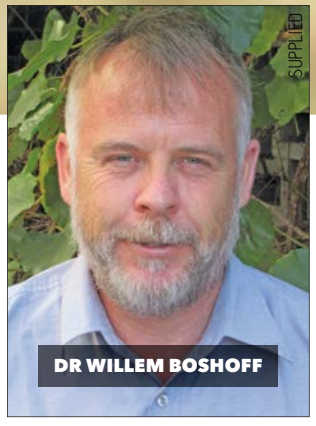
Wheat blast poses a serious threat to global wheat production and food security because the fungus produces airborne spores that can be dispersed by wind within and between wheat fields in a short period, resulting in severe yield loss. Moreover, the fungus is seed-borne and can be transmitted from infected seed to seedlings after planting. This may facilitate long-distance dispersal across the world's major wheat-producing countries through infected seeds.

Following the first detection in Brazil, wheat blast was confirmed in other South American countries, including Bolivia, Paraguay and Argentina, between 1996 and 2007, indicating its ability to spread. In addition, the disease was detected for the first time on the Asian

ABOVE RIGHT: Wheat blast can result in up to 100% yield loss of susceptible cultivars, and poses a great threat to wheat production in many countries. PIXABAY

FAR RIGHT: The disease can cause lesions and dark grey spots on mature leaves. WIKIMEDIA COMMONS





continent (in Bangladesh) in 2016, affecting over 15 000ha of wheat and resulting in yield losses of up to 100% on several fields.

SPREAD TO AFRICA

Wheat blast was not detected in Africa until the 2017/2018 season, when the disease was identified on wheat in several experimental plots and farmers' fields near Mpika in the Muchinga Province of Zambia. The disease incidence and severity, measured as head infection, ranged from 50% to 100%, which poses a threat to the Southern African wheat industry.

Previous studies have shown the occurrence of similar diseases in Zambia, Zimbabwe and South Africa, indicating the possibility of inoculum exchange between these countries. The wheat blast observed in Zambia could therefore spread to neighbouring countries, creating a severe danger for wheat production and food security in the region.

Wheat blast could potentially spread from Zambia to Zimbabwe and then to South Africa. It is therefore important for wheat-producing countries in the region to conduct intensive surveillance for the disease and share information on all developments in this regard. South Africa has an ongoing rust surveillance programme where the major wheat-producing regions are monitored regularly

TOP: Wheat spikes damaged by wheat blast. XINYAO HE, CIMMYT

ABOVE: Signs of wheat blast on the heads of wheat. COMPENDIUM OF WHEAT DISEASES AND PESTS 2010

by the Agricultural Research Council's Small Grain Institute for the occurrence of new rust strains. This surveillance programme is a valuable tool for the early detection of the disease.

SCOUTING IS ESSENTIAL

It is also important for South African wheat producers and researchers to be on the lookout for symptoms of wheat blast in commercial wheat fields as well as on experimental plots. Warm, wet and humid conditions, particularly long periods of leaf wetness, favour development of the disease.

Previous studies indicate the possibility of controlling wheat blast using resistant cultivars and fungicides. However, only a limited number of resistant cultivars have been identified over the past three decades, and such sources provide only moderate levels of resistance.

Fungicides, too, provide only partial protection. Furthermore, fungicide resistance has been detected within populations of the wheat blast pathogen in Brazil. Researchers have therefore proposed an integrated disease management approach involving crop rotation, planting of certified, disease-free seed, fungicide seed treatment, as well as foliar and head applications and breeding for genetic resistance.

The resistant cultivars identified in South America should be considered for use in local wheat blast resistance breeding. The evaluation of local wheat cultivars to determine their response to the wheat blast pathogen through an international collaborative project may be worthwhile, considering the threat of the disease.

Wheat blast, which can cause yield losses of up to 100%, has appeared in Zambia and could spread to South Africa

THREAT TO FOOD SECURITY

Since it was first detected, wheat blast has emerged as a major threat to global wheat production, according to the Food and Agriculture Organization of the United Nations.

Unlike rice blast disease, where many rice lines are known to provide nearly complete resistance to *M. oryzae*, the resistance response of wheat germplasm to the blast pathogen is limited to a few isolated lines with low to moderate levels of resistance.

Considering this aspect, along with the limited success achieved in managing wheat blast using chemical fungicide, managing this disease will be a highly challenging task. It is therefore imperative for wheat breeders and agricultural scientists to explore the knowledge and genomic and genetic resources gained by concomitant molecular biology research over decades while dealing with the rice-*Magnaporthe* pathosystem, and devising strategies to manage wheat blast disease effectively.

Email Dr Willem Boshoff at BoshoffWHP@ufs.ac.za, or Dr Tarekegn Terefe at TerefeT@arc.agric.za. **FW**