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Enhancing grassland productivity through disease management of grass and forage species

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The total area of grassland in China is about 400 million hectares, accounting for 41.7% of the country's land area, which plays important role in ecological construction and food security assurance of the national. However, diseases of grass and forage limited the development of the pastoral agriculture. There are more than 1500 new diseases were reported in the past 16 years with more and more new diseases were discovered. The damage to grassland is becoming more severe with the known diseases prevalent areas expanding.

A total of 4373 fungal diseases were reported on 1343 grass and forage species belonging to 316 genera and 15 families in China till 2010. Of which, 1832 diseases occurred in Gramineae (41.9% of total), 994 in Leguminosae (22.7% of total), and 684 in Asteraceae (15.6% of total).

In total, 3510 diseases (80.3% of total), and 993 host plant species (73.9% of total) were represented within these three plant families. One thousand six hundred and sixty five fungal pathogens have been identified and reported from the host plants mentioned above. Of these, 585 (35.14% of total) were fungi Imperfecta, 493 (29.6% of total) were species of Uredinales, 222 (13.3% of total) of other fungi (non obligate fungi excepting Fungi Imperfecta) and 211 (12.7% of total) of Ustilaginales.

The economically important diseases of legume forage-lucerne (*Medicago sativa*) were rust (*Uromyces striatus*), downy mildew (*Peronospora aestivalis*), common leaf spot (*Pseudopeziza medicaginis*), Fusarium root rot

complex (*Fusarium* spp.), Powdery mildew (*Erysiphe pisi*) and Sclerotium blight (*Sclerotium bataticola*). For milkvetch (*Astragalus adsurgens*), they were yellow stunt and root rot (*Embellisia astragali*) and powdery mildew (*E. pisi*). For sainfoin (*Onobrychis viciifolia*), the disease limited pasture production were Botrytis stem and leaf blight (*Botrytis cinerea*), Ascochyta stem canker (*Ascochyta onobrychidis*), rust and root rot (*Fusarium* spp.). For red clover (*Trifolium pratense*) and white clover (*T. repens*), the most commonly occurred diseases were leaf spot (*Stemphylium saciniiforme*), and rusts (*Uromyces* spp.). The most commonly occurred diseases on grasses were rusts (*Puccinia* spp.), smuts (*Urocystis* spp. and *Ustilago* spp.) and ergot (*Claviseps purpurea*).

The diseases occurred at different growing stage and seasons of forage and grasses. Lucerne common leaf spot happened at the whole growth season and reached the highest disease incidence in June and July, downy mildew mostly occurred in early spring and late autumn. The Fusarium root rot complex of lucerne occurred more severe in the old field than the new established field. Rusts mainly occurred from June to September.

The chemical, biological, genetic and cultural approaches have been employed to manage grasses and forages disease in grassland and pastures, however the economic and environmental conditions restricted the choice of the disease management options. The usage of host resistance is the most practical and effective ways of managing grass and forage diseases. The applications of both

yellow stunt and root rot resistance plants of milkvetch and rust resistance plants in lucerne increased yield by over 30%, and improved persistence of the pastures. Lucerne cultivars have been evaluated under field conditions for resistance to rust, common leaf spot, downy mildew, powdery mildew and root rot, similar work have been carried out on other grasses and forage species. For plant disease in grassland, grazing could decrease plant diseases incidence up to 80% and affect the diversity of grassland by food intake of animal.

Significant progress has been made to

acquire and apply new knowledge and technology in grass and forage species disease management. Molecular biology, genetics and bioinformatics technologies offered more opportunities to develop methods for grass and forage species disease management. At the same time, the traditional methods such as disease investigation, quarantine regulations and standards for seed health testing, breeding and usage of disease resistant varieties, development of ecological control and techniques for large-scale fungicide seed treatment should also be considered.

Key words: China; Grassland; Fungal disease; Grass; Forage; Disease management;