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THE INVOLVEMENT OF PLANT PATHOGENIC FUNGI IN THE NATURAL DIEBACK OF BLACKTHORN IN NAMIBIA: PART 6

INTRODUCTION

The general conception is that dieback/decline diseases are possibly initiated by the effects of abiotic or biotic environmental stress. In many of these diseases, two phases occur: dieback and decline. The dieback phase – manifested by a progressive dying back of buds, twigs, branches, and rootlets – often results from the effects of such stress alone. This phase can be viewed as a survival mechanism, however, since trees often recover when the stress is reduced. The decline phase, in which the vitality of the entire tree is reduced, usually results from attack by secondary-action organisms and often culminates in death. Recovery from this phase is less likely to occur after removal of the stress factor.

To obtain a better understanding of Blackthorn dieback, it was necessary to estimate the influence of rainfall on the disease and to determine the rate of symptom development in individual trees and within given areas. The objective of this study was to determine, firstly, the rate of dieback in individual bushes over a period of two years, and secondly, the ability to recover after pruning.

This paper reviews the results of disease development over a period of two years at the Neudamm Experimental Farm. In order to estimate the rate of symptom development and disease severity over time, two sites (the Neudamm and Thorn Trees Farms) were monitored from 1986 until termination of the project in 2005. Criteria to estimate disease severity are chlorosis of leaves, leaf cover, twig and branch dieback, and regrowth (Part 3 in this series, *Spotlight on Agriculture* No. 83). These data will be used to establish which criterion is the most reliable in assessing the state of health of individual Blackthorn bushes.

METHODOLOGY

Disease ratings and indices

Experiments for the study were conducted at the Neudamm Experimental Farm. The site chosen had no history of dieback prior to 1985, when disease symptoms were noted for the first time. The bushes chosen varied in respect of size and stage of decline. Individual plants were selected so that variation in soil type, elevation and stand density could be minimised.

Dieback of *Acacia mellifera*

In one experiment, 30 bushes were selected on 20 February 1986 and rated for disease severity. During April 1987 and April 1988, these bushes were again rated for disease severity and for regrowth. In another experiment, 34 bushes were selected during February 1986, rated for disease severity, and pruned. The first 12 bushes were heavily pruned: all shoots and branches which had died back as well as healthy shoots and branches were removed, leaving only the main frame. The next 12 bushes were cut back less severely, although all shoots and branches that had died back were removed.

Rainfall data and dieback

The following farms with a known history of dieback were selected: Good Hope, Jagboom, Neudamm, Otjikuoko, Sonnleiten, Teufelsbach, Thorn Trees and the Uitkomst Research Station. Precipitation at each site during a 30-year period preceding the 1987–1988 season was compared with rainfall norms for each region in which the respective farms were found. The norms are based on decile values determined for a 30-year period (1956–1985) for each rainfall station. To estimate the possible influence of prolonged dry periods on disease development, stress periods for each site were calculated on a scale of 1 to 3, where 1 represented a period of precipitation below average; 2 a period of precipitation considerably below average; and 3 a period of precipitation very much below average. Cumulative values for two or more consecutive periods with precipitation below normal were then determined for each site.

RESULTS

Disease development

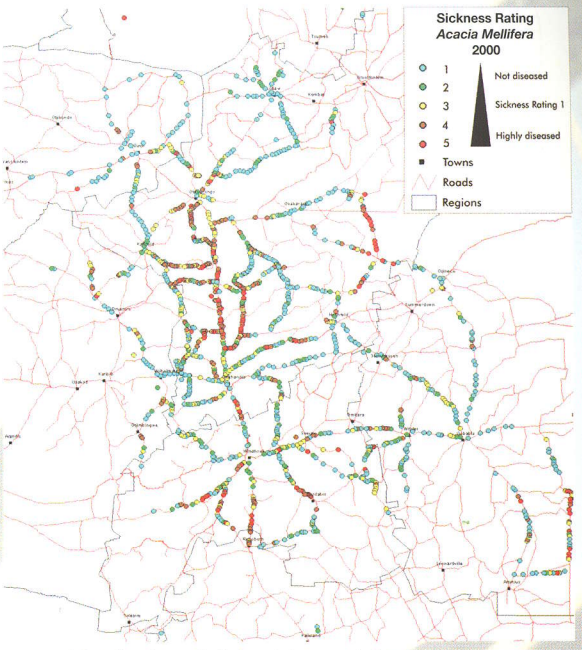
During 1986, 30% of the bushes that were rated for disease severity had a disease index above 5. During 1987 and 1988, the disease indexes gradually increased to the extent that 40% and 67% of the bushes had an index value higher than 5 in each respective year. Furthermore, statistical analysis of the data confirmed that the disease index for 1988 was significantly higher than that for 1986. No recovery of bushes was evident during any of the rating exercises.

Regression analysis showed a significant negative correlation between the disease indices of 1987 and the regrowth indices that same year. Therefore, as disease severity increased, the ability to regrow decreased.

For pruned bushes, the foliar and regrowth indices for 1987 showed significant correlation with the disease indices for 1986. Therefore, the ability for regrowth decreased as the disease index increased.

Rainfall and disease development

Seasonal stress values for the Good Hope, Neudamm, Otjikuoko. Teufelsbach and Thorn Trees Farms were essentially the same, whereas at Uitkomst and Jagboom, the two sites with the lowest and highest seasonal stress values, respectively, disease intensity was low, with virtually no dead bushes prevalent.



Distribution of dieback in rated *Acacia mellifera*

Hollows in the trunk base cut off water and nutrient supplies

DISCUSSION

This study has shown that, although normal precipitation was recorded during the period 1984/1985 to 1987/1988, disease severity in Blackthorn bushes at the test site increased significantly during 1986 and 1987. None of the bushes showed any recovery. The study also showed that dieback and decline under normal conditions increased rapidly after the onset of symptoms. Prior to 1985, Blackthorn dieback had not occurred in the area. After 1986, however, there was a rapid increase in symptoms; by April 1988, when the four referees measured disease intensity in Blackthorn at the site, it was classified as moderate to high (5–10).

Like most Acacias, Blackthorn produces coppice shoots from the stems whenever the top growth is damaged. In this study, the capacity for pruned bushes to regrow was negatively correlated with the disease index. This implies no coppice shoots formed on bushes that had a disease index higher than 5 and which had been cut back heavily. This confirmed that dieback was caused by an infectious disease, and was not due to drought stress alone. It affirmed previous work (*Spotlight on Agriculture* No. 83), which suggested that infection at the base of the trunk or upper taproot caused a gradual cut-off of water and nutrient supply to the crown.

In decline diseases, triggering stress factors frequently occur many months or even years before plants die. It is anticipated that prolonged dry periods or droughts are frequent in Namibia and, therefore, could act as a stress factor triggering dieback and decline in Blackthorn bushes. It is expected that similar triggering stress factors such as prolonged dry periods (drought) would influence disease development – i.e. rate and intensity of dieback – in the different localities in the same way.

The results of this trial did not coincide with expectations. In this study, no distinct period of drought stress that might have acted as such a trigger could be identified for the different sites. The (drought) stress values calculated for the 30-year period preceding the 1987/1988 seasons for Neudamm and Thorn Trees were essentially the same, but the onset of disease symptoms and the incidence of dieback on the two farms differed markedly. In addition to Neudamm and Thorn Trees, the farms Good Hope, Otjikuoko and Teufelsbach, which were classified into three different disease intensity categories, showed nearly similar stress values. The farms Uitkomst and Jagboom, with the lowest and highest stress values, respectively, had almost similar dieback intensities. The possible influence, if any, of a prolonged dry period on Blackthorn dieback remains obscure, therefore.

The reason for the sudden onset of Blackthorn dieback over parts of Namibia is unknown. One suggested explanation is that the disease was present in the northern parts of the country before the outbreak, but at a low level of infection. Abiotic factors favouring a significant increase in infection could also have led to a rapid build-up of inoculum, thereby perpetuating new cycles of infection.

References

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