

Integrated Control Strategy of Apple Scab According to Warning Equipment

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Abstract

In 1999–2001 in field trials two different apple scab control strategies were compared: (i) the current strategy – conventional disease management (CDM) and (ii) integrated disease management (IDM), according to scab infection periods. A new scab warning equipment METOS^R-D was used for detection of infection periods and forecast of disease intensity at three levels: light, moderate and severe. According to CDM apple-trees were sprayed 9 times a season. Scab warning equipment gave a possibility to optimize the use of fungicides against scab and to reduce the total spray applications per season in average till 6.3 in very susceptible cultivars and 5 in moderately susceptible ones. This is 30 and 44% less spray applications comparing with CDM. Annual spray program ranged from 5 till 8 spray applications of very susceptible cultivars. CDM and IDM gave high scab control in apple-trees and there was not found any essential difference in scab incidence between two control strategies.

Keywords: apple-trees; control strategies; scab; warning equipment

INTRODUCTION

About 70 to more than 90% of chemicals input in top fruit growing are fungicides of which the highest proportion is used for scab control (GOSZOZYNSKI 1997; HESJEDAL 1990). In practice scab control is mainly carried out with a calendar spray scheme using more or less fixed 7–14 day spraying intervals. Such schedules, though costly, have proved successful, reliable and simple for farm managers to operate. However with the increase in public awareness of chemicals and their possible side effects on health and the environment and increasing costs of chemicals, such routine fungicide programmes are not longer acceptable. On average 9 fungicide applications are made against scab in intensive orchards of apple-trees in Lithuania (PILECKIS 1994).

To avoid scab infection is used control strategy of Integrated Production in many countries (GRAUSLUND & LOSHENKOHL 1994; NOWACKA 1996). However this strategy is based mainly on specific fungicide sprays and it often leads to unnecessary treatments. Savings in scab sprays can be made by making use of warnings according to that conditions have been conducive to infection by *Venturia inaequalis*.

In recent years electronic scab warning instruments have found wide acceptance in integrated fruit production. Electronic instruments register warnings of apple scab infection periods on the basis of Mills' or MacHardy & Gadoury criteria. These criteria indicate for various temperatures the minimum length of time apple leaves must remain wet for ascospores to infect at three levels of risk: light, moderate and severe, including primary and secondary inoculum (BERRIE 1994; BÜHLER & GESLE 1994; BUTT & XU 1994; PESSL 1994).

In this paper results are presented of field trials where the current apple control strategy is compared with Integrated Disease Management, which involves scab warning equipment. The objective in the present study was to show conditions under which further reduction of the number of fungicide applications against scab is possible.

MATERIALS AND METHODS

In 1999–2001 field trials were carried out in the orchards of Lithuanian Institute of Horticulture to compare the current apple scab control strategy – conventional disease management (CDM) and integrated

disease management (IDM), according to scab infection periods. The scab warning equipment METOS-D (G. Pessl, Austria) recorded rainfall, air temperature, relative humidity, leaf wetness and calculated infection periods according to Mills and Laplante at three levels. At the beginning of the season METOS-D runs in primary (Asco) and in secondary (Conidia) infection mode when degree-day accumulation (base = 0°C) was 500°C. Susceptible to scab apple variety Lobo was treated when light infection occurred and moderately susceptible Spartan – at medium infection. CDM was based on prophylactic applications and apple-trees were sprayed at 10–14 days intervals. Fungicides were applied with a mist blower, using 250 litres of spray solution per ha. Fungicides and dose rates used were: Chorus 75WG 0.2 kg/ha; Zato 50WG 0.15 kg/ha; Systhane 12E 0.5 l/ha; Effector 70WG 1.0 kg/ha and Dithane 75DG 3.0 kg/ha. The orchard was established in 1995 on dwarf rootstock M 26, 1250 trees per hectare. Plot size – 5 trees (3 trees for assessments), 4 replications and random plot distribution. Assessments of scab on 100 leaves were made in July, and on 200 fruits at harvest.

RESULTS

In 1999, eight fungicide treatments were made with the CDM strategy, and only five for susceptible variety or four for a moderately susceptible variety (Figure 1). In 2000 nine treatments with CDM strategy were reduced to only five (susceptible variety) and four (moderately susceptible variety) with the IDM strategy (Figure 2). In 2001 ten treatments were made with the CDM strategy and eight and six for susceptible and moderately susceptible apple varieties (Figure 3). Nevertheless, significant difference in scab incidence was no found on leaves in July and on fruits at harvest (Figure 4). In 1999 there were 3.9 and 0.5% scabbed fruits, respectively of susceptible and moderately susceptible varieties in IDM strategy and 4.4 and 0.3% in CDM. In 2000 the damage of susceptible and moderately susceptible varieties was 0.2% in IDM and in CDM 0.5 and 0.2% for susceptible and moderately susceptible varieties. The highest incidence of scab was in 2001. From 50.7 till 60.0% of fruits were damaged in unsprayed plots. Meanwhile only 7.0% of fruits of susceptible

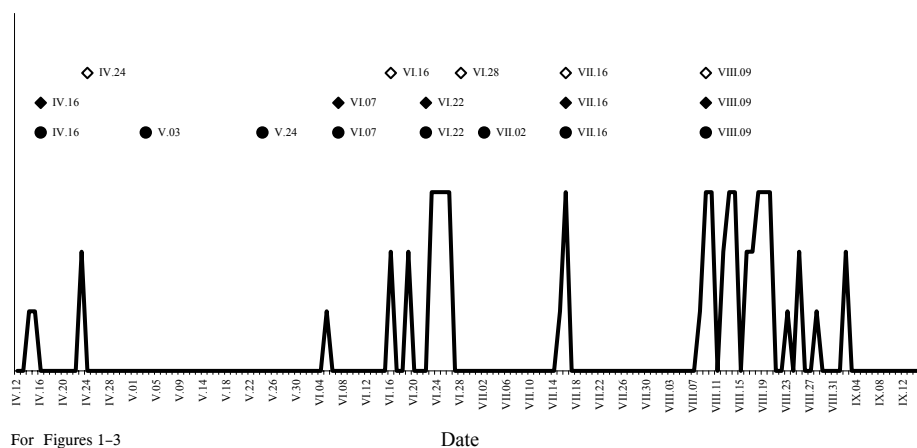


Figure 1. Scab intensity according to METOS-D and dates of fungicide applications in 1999

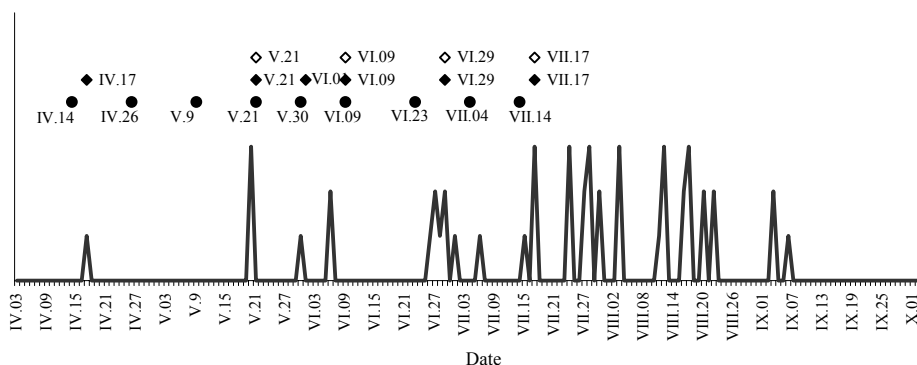


Figure 2. Scab intensity according to METOS-D and dates of fungicide applications in 2000

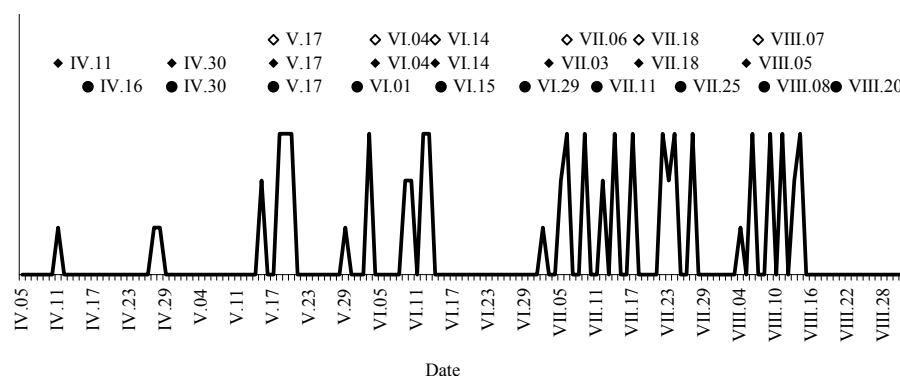


Figure 3. Scab intensity according to METOS-D and dates of fungicide applications in 2001

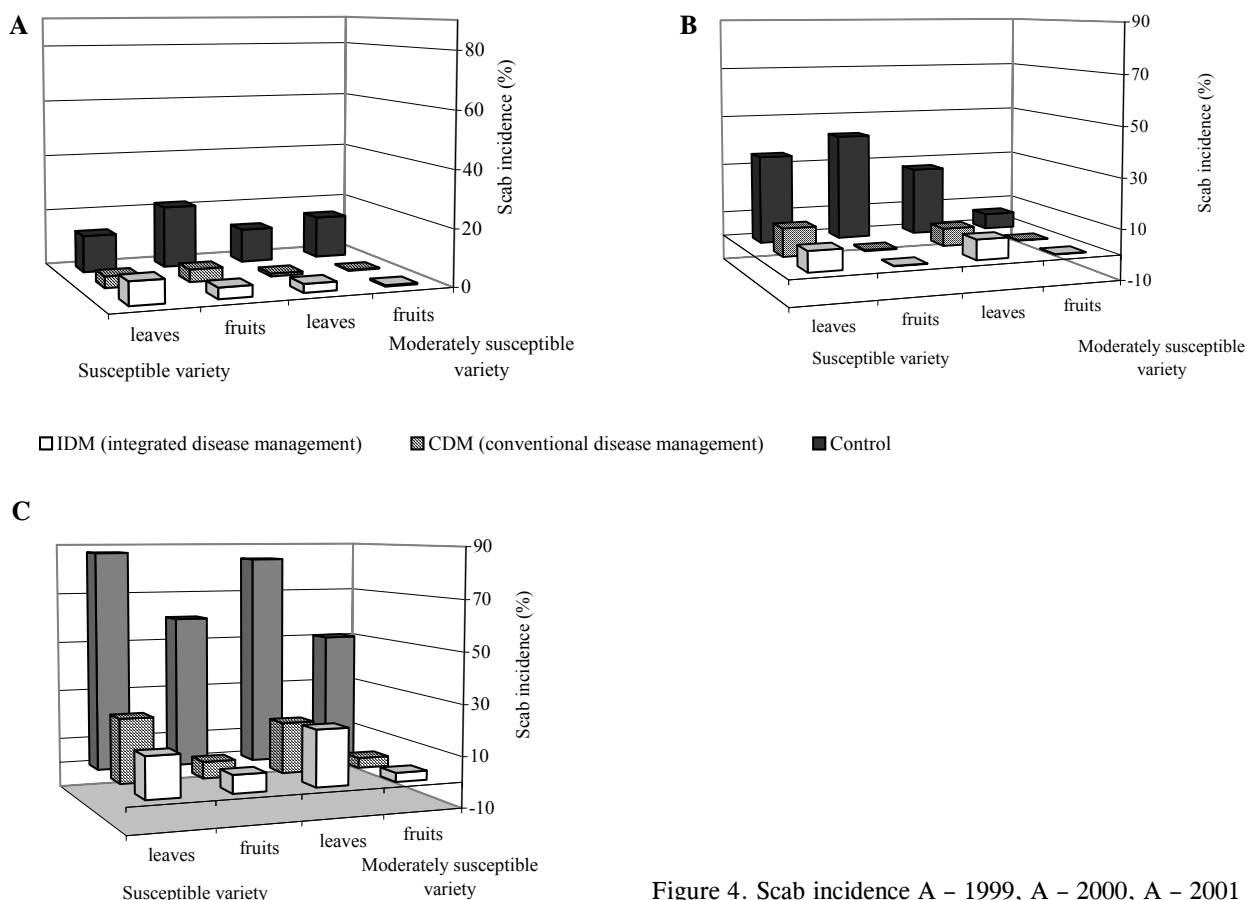


Figure 4. Scab incidence A – 1999, A – 2000, A – 2001

variety Lobo were scabbed in IDM strategy and 3.5% of moderately susceptible variety in CDM.

DISCUSSION

At the orchards of the Lithuanian Institute of Horticulture IDM strategy was successful for three years, though climatic conditions for disease development were favourable. Scab incidence on fruits was increasing in unsprayed plots: 21.8 and 14.9% for susceptible and moderately susceptible varieties in 1999, 42.2 and 6.2 in 2000 and 60.0 and 60.7 in 2001.

With the improved apple scab warning system of the IDM, which is based on warning equipment METOS-D, it was possible to avoid two fungicide applications in May and one in June for the susceptible variety Lobo in 1999, because scab infection was not observed during that time. Similar results were obtained in 2000, except there was observed only light infection till the end of May. The first fungicide application was made on 21st of May for moderate susceptible varieties, when medium infection occurred. In 2001 high number and level of scab infections were observed. It resulted in more intensive use of fungicides. In spite

of that two treatments were omitted in IDM control strategy: one in July and one at the end of the season. Totally IDM strategy gave a possibility to optimize the use of fungicides against scab and to reduce the total spray applications per season on average till 6.3 in very susceptible cultivars and 5 in moderately susceptible ones. This is 30 and 44% less spray applications comparing with CDM.

CONCLUSIONS

Two different apple scab control strategies were compared: (i) the current strategy – conventional disease management (CDM) and (ii) integrated disease management (IDM), according to scab infection periods. A new scab warning equipment METOS^R-D was used for detection of infection periods and forecast of disease intensity at three levels: light, moderate and severe. According to CDM apple-trees were sprayed 9 times a season. Scab warning equipment gave a possibility to optimize the use of fungicides against scab and to reduce the total spray applications per season on average till 6.3 in very susceptible cultivars and 5 in moderate susceptible ones. This is 30 and 44% less spray applications comparing with CDM. Annual spray program ranged from 5 till 8 spray applications of very susceptible cultivars. CDM and IDM gave high scab control in apple-trees and any essential

difference in scab incidence was not found between two control strategies.

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