

Vegetation Control as Part of Environment Strategy of Swiss Federal Railways

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Introduction

To increase its share of the transport market for passengers and goods, Swiss Federal Railways (SBB) has created an environment action strategy to promote itself as an environment-friendly transport mode. This strategy coordinates all SBB activities with the environment. Concrete programmes, such as a water protection programme, ensure that specific environmental targets are achieved.

The water protection programme, started in the early 1990s and is developing environment-friendly methods to control growth of vegetation along tracks. This has become an urgent necessity because previous methods using soil herbicides were polluting ground and drinking water supplies. As a result, national legislation in 1987 forced SBB to revise its vegetation control methods. Since 1992, SBB has used only leaf herbicides, and the number of areas where herbicide use is banned completely is also increasing. There is a serious need to develop alternative non-herbicide methods of controlling vegetation.

Investigations over the last 10 years have shown that a combination of various methods adapted to each location has the best result. A combination of construction measures and biological measures to prevent plant growth, supplemented by periodic maintenance, has been most effective. Any plants that still manage to grow are removed chemically (with Glyphosate leaf herbicide), mechanically, or thermally.

SBB Environment Strategy

To increase rail use, the competitive advantages of railways must be promoted and the disadvantages must be overcome. One strong competitive advantage of railways is environment friendliness. To

make best use of this advantage within the limitations of SBB's financial constraints, the company has developed an environment strategy coordinating its business activities with environmental protection¹. An environment analysis showed that SBB was already meeting many of the very strict environmental requirements laid down by Swiss law, but

this fact was not being properly publicized. However, the analysis showed that the following areas needed attention:

- Reduction of air-borne noise
- Reduction of vibration and structure-borne noise
- Protection of water, conservation of soil and treatment of contaminated sites
- Management and disposal of waste con-

Table 1 Environmental Targets of Swiss Federal Railways

- Achieve noise reduction based on 1996 decree of Federal Council for Promotion of Public Traffic (FöV)
- Determine bases for reducing impacts of vibration and structure-borne noise by 1998
- Introduce environment-friendly plant control methods for track by 2000
- Summarize SBB problems with contaminated sites by 1999 and formulate suggestions for handling contaminated sites
- Reduce specific energy consumption by 20% by 2005
- Gradually replace high-polluting materials and production resources with less-polluting ones and increase recycling over next 5 years
- Reduce potential risk of damage caused by transport of dangerous goods by improving transport safety

Table 2 Environment Protection Programmes of Swiss Federal Railroads

Programme	Measures
Environment management	Review and determine strategies and publicity
Noise abatement	Reduce noise by using low-noise rolling stock and noise barriers, etc.
Vibration	Evaluate impact of vibration and structure-borne noise and develop protection measures for tunnels and track
Energy savings	Introduce energy efficient buildings and rolling stock
Resources	Introduce waste management concepts
Safety	Develop concept for improving risk of incidents during transport of dangerous goods through measures for track, rolling stock and operations
Contaminated sites	Develop concept for handling contaminated sites when constructing and rebuilding installations, property and operating facilities
Water protection	Develop optimized methods for environment-friendly track vegetation control
Green area protection	Develop optimized methods for vegetation control in green areas (e.g. embankments)

struction materials

- Reduction of accidents involving transport of dangerous goods

SBB formulated new targets in these areas (Table 1) and various programmes were put in place to meet these targets (Table 2). Some are not new programmes, but are extensions of earlier work.

The Swiss people are most concerned with noise reduction and water protection programmes. The latter programme mainly covers development of environment-friendly, economic, and feasible vegetation control that does not cause water pollution. The rest of this article describes the programme in detail.

Environment-friendly Vegetation Control

For safety and operational requirements, ballast must be largely free of vegetation. In earlier years, soil herbicides like Atrazin and Diuron were used. However, their low biodegradability and good water permeability of the track foundation resulted in local pollution of ground and drinking water. As a result, in 1987, SBB and agricultural research institutes and the environment authorities started rethinking railway vegetation control. New herbicides were tested for several years and the results led to a ban in 1990 on Atrazin, and a complete ban on all soil herbicides (absorbed from soil through the roots) by railways in Switzerland in 1992. Since that time, only leaf herbicides (absorbed only via the green parts) may be used. Many other methods of vegetation control, especially constructional, biological, mechanical, and electro-thermal were also investigated as alternatives. The SBB strategy for vegetation control was formulated based on these investigations, taking diverse but equally important aspects into consideration (Fig. 1).

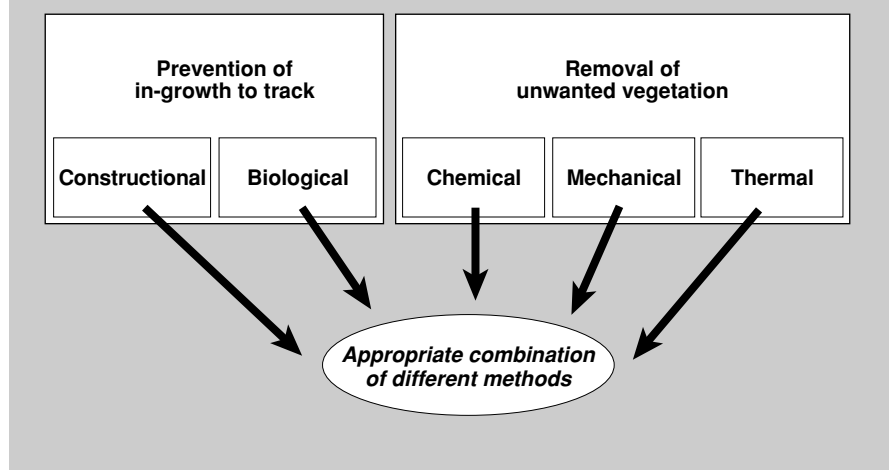
In addition to assuring the long-term track safety and functionality, the cost, environment protection, landscape, and water re-



Concrete barrier to in-growth of plants

(C. Müller)

Figure 1 Vegetation Control Strategy of Swiss Federal Railways



sources were all taken into consideration. The methods now in use can be divided into two main groups: methods for preventing growth of unwanted plants in the

track (stopping plant growth), and procedures for removing growing plants.

Methods Adapted to Vegetation

When hard-to-remove plants (for example, horsetails, reeds, brambles) grow into track above or below ground, the expenditure to eliminate them is very high and conventional methods may not be successful. To determine the type and extent of control, it is essential to know which plants grow where.

Constructions preventing in-growth of vegetation

Constructional measures are most effective overall for preventing in-growth of vegetation because they often aim to reduce water available in the track area. However, because of the high cost, they are used for new constructions or completely rebuilt sections, or in areas with total bans on herbicides. These measures are mainly:

- Asphalt under the track bed
- Concrete barriers along the track bench
- Barrier between the ballast and embankment
- Foil on the track bench

A sufficiently thick asphalt layer under the ballast both prevents water accumulating in the track, and inhibits in-growth of vegetation for a long time. Ten years after its installation on new SBB tracks, the tracks can still be kept free of in-growth without using herbicides.

Concrete barriers installed since 1991 during bed reconstruction also serve as footpaths, and so far have largely prevented plants from growing into the track. To optimize prevention of in-growth, the embankments bordering the concrete must be mowed periodically.

In addition to well-placed cable ducts, sleepers or concrete slabs also can be used between the embankment and ballast as side obstacles to in-growth of plants. Their effectiveness is increased by periodic mowing of the bordering embankments. Foil is used on the track bench to impair



Maintaining greenery by mowing embankment

(SBB)

growth in zones with groundwater protection where herbicides are banned and in places with strong growth of horsetails, which propagate by underground rhizomes (against which Glyphosate leaf herbicide is ineffective). Foil has remained effective for more than 2 years, but requires weighting with ballast so that it will not be blown away; it must also be strong and impermeable to light so that plants cannot grow through it.

Many construction measures (especially asphalt layers and concrete barriers) are not installed only to control vegetation; they also have other important track technology functions, but slight adaptation enables them to control vegetation as well.

Biological control of vegetation

Biological control means planting and maintaining greenery adjacent to the track, so that only desirable plants are found there.

Natural plant succession often results in a mixture of species with a high percentage of problem plants like horsetails, so areas near embankments (5 to 7 m from the track centre) should be seeded with a mixture of species that compete with the

problem plants and that are adapted to the location.

Greenery requires periodic maintenance and two mowings near the embankment during the growing season promotes grass cover which inhibits problem plants.

Eliminating and suppressing unwanted plants

Chemical methods are most cost-efficient and are still used most frequently by SBB to eliminate and suppress problem plants. Mechanical and thermal measures are also used sometimes.

Since 1992, only leaf herbicides may be used on Swiss railways, and areas subject to total herbicide bans are increasing. It is quite possible that herbicide use on railways will be totally banned in the future. The change from soil herbicides to Glyphosate leaf herbicide has resulted in a change in the application method. Long-term investigations have shown that leaf herbicides have optimum effect when sprayed with a back spray or a small motorized sprayer, rather than from a spraying train. This change has reduced herbicide use by 75% and so far there have been no problems with using

Glyphosate throughout the network. Although the personnel doing the spraying require special training, the back spray is gradually displacing the car-mounted sprayer and today, most of the SBB network is treated using the back spray. A further advantage is that back spraying does not impede train traffic.

So far, mechanical control of vegetation has not been used widely. However, due to the lack of better alternatives, in water protection areas, problem plants are pulled out by hand. Mechanized weeding machines have been developed in recent years by third parties, but they still are not ready for application. Ballast cleaning and removal of surface dirt also help impair plant growth, but are too costly to use simply for vegetation control.

Thermal methods damage only the above-ground parts of plants and are very energy-intensive so they have not yet found widespread use. They are used mainly as alternative solutions to manual weeding where herbicides are prohibited and constructional or biological measures cannot be used. In addition to flaming, mobile infra-red equipment is used in isolated cases. Steaming might be effective and is still under trial.

Combination of Methods

The findings over the last 10 years have shown that a combination of various methods adapted to each location is most effective in controlling plants. The longest-lasting method combines constructional (e.g. asphalt layer, concrete barrier) and biological (e.g. competing greenery) measures, supplemented by periodic maintenance (e.g. embankment mowing). Plants that still manage to grow are removed chemically, mechanically, or thermally, depending on the location.



Back spraying leaf herbicide

(SBB)

Outlook

Application of environment-friendly vegetation control shows quite good results. Despite the ban on soil herbicides, plant growth in tracks has rarely increased. However, since vegetation grows slowly, 10 years of experience may be too short for certainty and some questions still need answers:

- Determining long-term effectiveness and costs
- Developing effective and economic methods for unwanted plants
- Putting the new methods and knowledge into widespread practice
- Examining development of plant resistance to Glyphosate

These questions need answers so that SBB can achieve its target of completely environment-friendly plant control. In addition to determining the long-term effectiveness and costs of each method, emphasis is being placed on staff education and training. International cooperation by various railway companies is being coordinated to develop more effective, and environment-friendly methods of controlling vegetation by the turn of the millennium. ■

Notes:

1. P. Hübner and H. Kuppelwieser, Preparation of the CFF's environmental action strategy, *Rail International*, April 1997, pp. 15–20



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