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Control of broad-leaved dock on organic grassland farms

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Abstract

Investigations are reported on different aspects of broad-leaved dock control, which is still the main weed on Austrian grassland. In view of the large number of organic and integrated farms, which are not allowed to use herbicides, the main focus was given on mechanical dock control. The Mini-WUZI, an Austrian innovation, was tested for performance characteristics and for efficiency. It was shown, that there is only a minor risk of regeneration from treated dock roots and root parts. Compared with manual methods, this promising motorised system indicates a high efficiency with the ability to remove up to 400 dock plants h⁻¹.

Keywords: dock control, vegetative regeneration, forage quality, organic farming.

Introduction

Broad-leaved dock is still the main weed problem on European grassland. Measures for biological, mechanical and chemical weed control are used to regulate and fight against this very resistant herb, which has an inferior feed value with low digestibility and low energy concentration (Bohner, 2001). Organic and integrated farms, which take part in the Austrian programme for an environmentally friendly agriculture, are not allowed to use herbicides. These farms have therefore an increasing interest in preventive measures and in new and reliable treatments to reduce or to destroy broad-leaved dock (Poetsch, 2002; Poetsch, 2003). Some innovative technical solutions like the so called Mini-WUZI, a motorised milling cutter system, have been developed during recent years to increase the efficiency of mechanical dock control (Poetsch, 2004). In the meantime the Mini-WUZI is produced commercially on a small scale and available via a number of machinery rings in Austria.

Materials and methods

In order to detect and to evaluate the dock contamination on a farm level, a simple pictorial scheme was developed and tested in practice (Figure 1). Each pasture and meadow of an organic test farm with a size of about 30 ha was assigned to the categories no docks, low, medium and high proportion of docks. The field recordings were then digitised and transformed into real area values by using GIS. A farm map, illustrating the different levels of the dock problem was created both to raise the farmer's awareness by identifying and pointing out the "hot dock spots" and to provide a basic tool for further control measures.

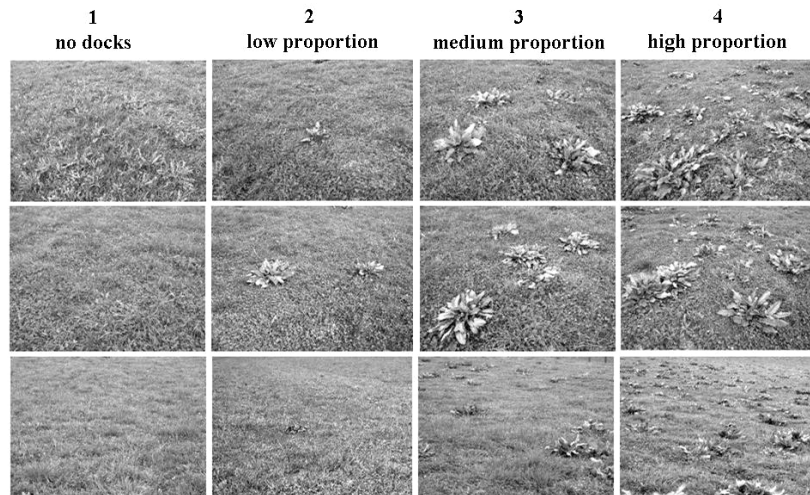


Figure 1: Simple pictorial scheme for different dock proportions

Special investigations have been carried out at HBLFA Raumberg-Gumpenstein to get detailed information about the performance characteristics and efficiency of the promising Mini-WUZI method (Figure 2). Attention was given to the possible risk from the vegetative regeneration of dock roots and root parts after the mechanical treatment. Residual parts of dock roots from the treated fields and roots, sliced to pieces with length from 0.5 to 5.0 cm, were collected and cultivated in boxes. After a period of four weeks the regeneration capacity of the dock roots and root parts was recorded and analysed.

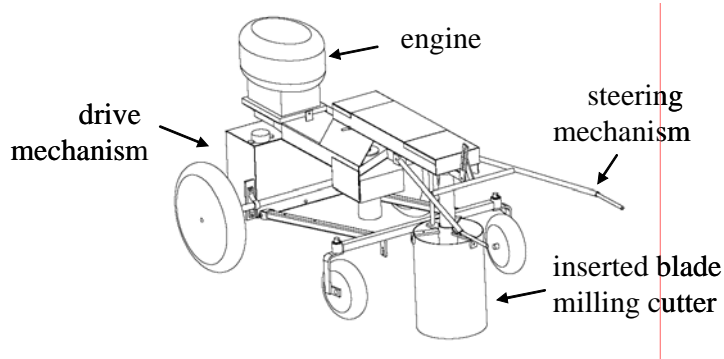


Figure 2: Schematic design of the Mini-WUZI, a motorised milling cutter system for mechanical dock control

Results and discussion

About 18% of the total test farm area, which amounted to about 30 ha, was identified as affected by broad-leaved dock plants at different proportions. The visualised distribution clearly showed that there was a stronger concentration of docks on pastures and meadows near the farm and barn area as well as on fields which are frequently used for grazing (Figure 3, left part). All grassland areas far from the farm centre and therefore rarely used as pastures and mostly fertilized at a lower intensity showed significantly lower proportions of docks (Figure 3, right part). In combination with the specific management history of the farm, the visualization and quantification of the dock problem provide the farmers with basic information about the reasons for the appearance and spread of docks (overgrazing, sward

damage, excessive nutrient supply, storage of solid manure etc.) and it allows them to prepare an adapted plan for dock control with different measures.

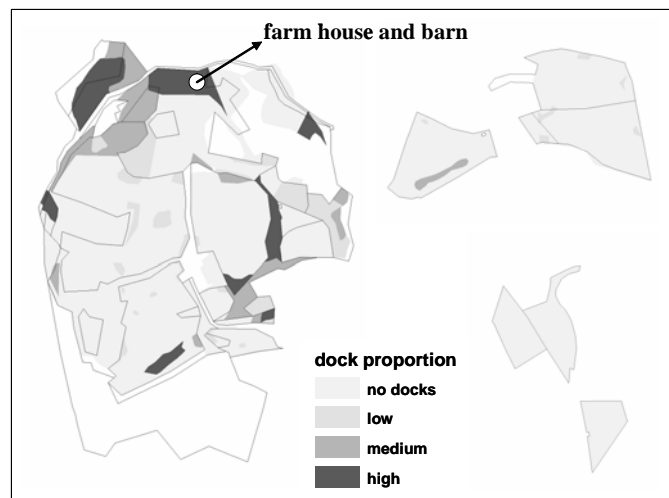


Figure 3: Proportion of broad-leaved dock on pastures and meadows of an organic test farm in Austria (30.4 ha)

For organic farms such a plan should include both preventive measures to avoid the spreading of docks within the farm and different biological and mechanical treatments. The activity of dock leaf beetles (*Gastrophysa viridula*) depends on many factors and can not be seen as a reliable and sustainable method to regulate docks (Hahn and Kromp, 2001). Therefore organic farmers concentrate on mechanical methods to dig out or to finely chop dock plants, after ploughing up grassland. These approaches are limited by the site conditions (steepness and shallow soil) and specific regulations in the Austrian environmental programme for agriculture.

Up to now special forks were mainly used to dig out dock plants by hand. This is both hard work and a time-consuming activity. In 1996 a very innovative Austrian organic farmer constructed a motorised dock extractor named Ampfer-WUZI. Some studies indicated the high capacity and efficiency of this prototype, which unfortunately has never reached the stage of a commercial production. In the meantime the so called Mini-WUZI has been developed and seems to be a promising and reliable method for the mechanical dock control. Some important technical characteristics of both machines are presented in Table 1. The high dock performance with up to 400 plants h⁻¹ makes it possible to treat even larger fields with higher proportion of dock. The prize for the Mini-WUZI is at €7,000,- but it is also available via a number of machinery rings at costs of €15,- per hour of operation.

Table 1: Basic technical characteristics of the Ampfer-WUZI and Mini-WUZI system

	Ampfer-WUZI	Mini-WUZI
engine output	29.4 kW	9.6 kW
total weight	3,700 kg	70 kg
milling head rotation	app. 1,000 min ⁻¹	app. 1,800 min ⁻¹
diameter of the milling hole	20 cm	20 cm
depth of the milling hole	15 cm	15 cm
dock performance	up to 600 dock plants h ⁻¹	up to 400 dock plants h ⁻¹

It is well known that besides their enormous seed productivity, docks are also able to regrow via regeneration buds on their strong root system (Kutschera und Sobotik, 1992; Poetsch and Krautzer, 2002). Farmers worry about this risk of regrowth, which can be noticed after ploughing and cultivation and may also occur after mechanical measures of dock control. Our study showed, that about 4% of the 300 cultivated roots/root parts regenerated again to produce viable dock plants. This regeneration activity was observed for all the tested root lengths, with the exception of the 0.5 cm root slices. The milling size of the dock roots should therefore be as small as possible to avoid a stronger dock spreading after a mechanical control treatment.

The results also indicated that the regeneration of dock roots only appeared at the upper part of the root system from 0 to about 12 cm. This confirms the practical recommendation which advises to remove or to destroy at least the first 12 to 15 cm of the dock root system. This basic requirement can be fulfilled by the Mini-WUZI-technique if the soil is deep enough and not too stony.

Conclusions

The visualisation of the appearance and distribution of broad-leaved dock on a farm level can be an important tool to raise the farmer's awareness and to set up a plan for future control measures and treatments. The proposed pictorial scheme is a simple and realisable instrument to rapidly record the status quo of the dock problem.

Special investigations have been carried out to get detailed information about performance characteristics and efficiency of the so called Mini-WUZI, which seems to be a practical and efficient method for the mechanical control of docks. This Austrian innovation shows an impressive performance and is now available via a number of local machinery rings. The tests indicated that the degree of milling of the treated dock plants and dock roots is sufficient to avoid strong regeneration, a factor of major concern for farmers. The treated patches should be reseeded to close the sward gaps and to compete against other weeds.

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