Effect of mechanical soil treatment in blueberry orchards

Bastian Benduhn[1], Peter Maxin[2], Barbara Pfeiffer[3]

Abstract

From June 2004 onwards a trial was conducted on a blueberry farm in the Lüneburg Heath, Northern Germany, in which methods of mechanical soil cultivation were compared with mulching. The aim was to determine how far the mechanical methods and equipment established for soil management in viniculture and pomiculture can be adapted to blueberry cultivation, and can be improved. The results showed a clear advantage of the methods based on mulch technology in the shape of increased yields. Whilst the mechanical treatments provided acceptable weed control, they cannot be recommended for routine use at present because of strong yield reductions associated with damage to the shallow root system of highbush blueberry shrubs.

Keywords

Small fruits, blueberry, mechanical cultivation

Introduction

Weed containment is a fundamental problem in organic blueberry cultivation which has not yet been solved satisfactorily. Because of the shallow root system of blueberry bushes, mechanical tillage can easily damage the upper roots. No critical research into the effects of mechanical cultivation on plant growth and berry harvests has been carried out as yet. Different tillage technologies and combined methods are being used in practice, and these show considerable differences in costs and effects. New and improved tools are continuously being developed.

Against this background we decided to examine the following questions: Which kind of weed control provides the best results in preventing weeds without damaging the highly sensitive root systems of the crop? What effects on plant health, growth and yield do the different methods and tools have which are available in organic blueberry production?

Material and methods

In June 2004 a trial was set up in a blueberry orchard (cultivar 'Bluecrop'; Grethem, Lüneburger Heide, Germany). The plants were spaced apart by 0,75 m within and 3 m between rows (Fig. 1). Seven treatments were set up, including the two mechanical tools with rotating blades Pellenc-Tournesol® (A) and Ladurner-Kreiselegge® (B), the two types of mulch technology Mypex® Ground Cover (C) and pine bark mulch (D), a manual hand hoe (E), a combined version of A, B, and E (F) and an untreated control (G), as shown in Table 1 which also indicates the dates of treatments. As the orchard showed a gradient in fruit and shrub quality, treatments were replicated four times, and different replicates placed at different positions along the gradient. In order to obtain uniform initial conditions, all plots were completely cleaned of weeds prior to the commencement of the trial.

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[1] ÖON und [2] KÖN, Obstbau Versuchs- und Beratungszentrum (OVB) Jork, Moorende 53, 21635 Jork, Germany

[3] Staatliche Lehr- und Versuchsanstalt für Wein- und Obstbau, Traubenplatz 5, 74189 Weinsberg, Germany

Figure 1: Arrangement of blueberry bushes on the experimental plot.

Table 1: Types of treatment and their dates

	2004	2005	2006
A: Pellenc®	Aug + Oct	11.05., 07.07., 01.08.	11.05., 30.5., 21.6.
B: Ladurner®	Aug + Oct	11.05., 07.07., 01.08.	11.05., 30.5., 21.6.
C: Mypex®	In.: June	In: 30.3.; out: 30.10.	In: 11.5.; out: 30.10.
D: Bark Mulch	Depl.: June	Weeding: 01.08., 31.10.	Weeding: 30.5., 13.10.
E: Hand hoe	Aug + Oct	11.05., 07.07., 01.08.	11.05., 30.5., 21.6.
F: Combination	Aug + Oct [1]	11.05. [1], 07.07. [2], 01.08.	11.05. [2], 30.5. [1], 21.6. [2]
G: Control	-	-	-

[1] Pellenc; [2] Ladurner, [3] Hand hoe

Results

As research work in 2004 could not commence until June, no effects on crop quality or quantity could be determined for that growing season. For this reason only the years 2005 and 2006 are evaluated here (Table 2). The harvest in 2006 was considerably poorer than in 2005, caused by the cold and humid weather during blossoming in spring 2006, followed by a hot and dry summer with serious water shortages which could not be fully compensated by the present irrigation. In 2006 the mulch versions, and especially treatment D (bark mulch) gave clearly superior results, doubtless caused by a better water retention. The mechanical versions A and B gave poor results in both years.

In addition to the effects on crop yields, the weeding efficiency was also recorded (Table 2). This evaluation was carried out 15 days after the first treatment of the planting row. All versions gave adequate weed control. As expected, the weed cover in the untreated control (G) was highest. In contrast, the Mypex ground cover (C) showed no weed cover at all (Fig. 2).

Table 2: Crop yield and average fruit weight in 2005 and 2006.

Version	Yield [kg] per plant		**combined yield**	average fruit weight [g]	
	2005	2006	**2005 + 2006**	2005	2006
A: Pellenc®	1,98	0,45	**2,43**	1,13	1,06
B: Ladurner®	2,31	0,66	**2,97**	1,13	1,06
C: Mypex®	3,11	1,75	**4,86**	1,37	1,08
D: Bark Mulch	2,81	2,19	**5,00**	1,50	0,96
E: Hand hoe	3,19	1,33	**4,52**	1,33	1,16
F: Combination	3,53	1,25	**4,78**	1,39	1,12
G: Control	2,78	1,34	**4,12**	1,36	1,00

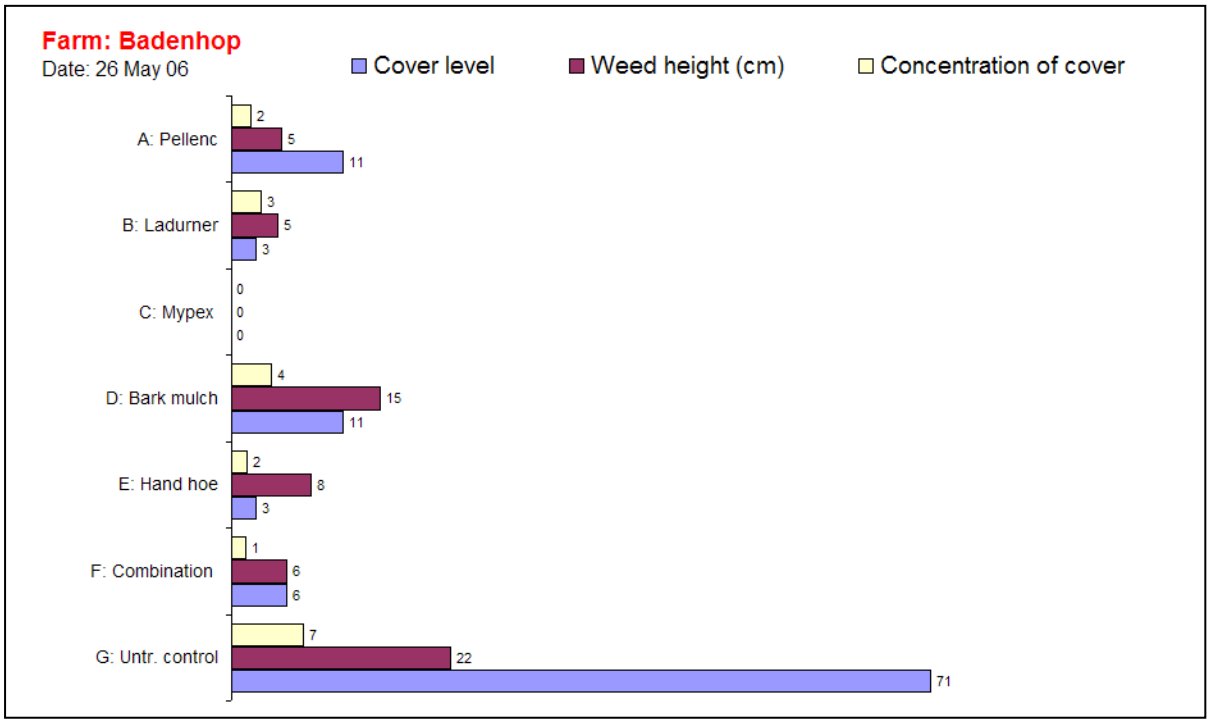

Figure 2: Natural cover in the planting row, assessed as density of weed cover (light bars), weed height (purple bars) and percentage of ground cover (blue bars).

Conclusions

Weed treatments A and B, both based on mechanical cultivation, resulted in poor crops in both years of the trial. In this context, the high crops of version F, a combination of these two treatments, seem inexplicable. However, it is likely that an interference with the roots of blueberry shrubs caused damage to the root systems, finally restricting nutrient and water intake. Comparatively high yields were obtained from the mulch versions, especially in 2006 when water was short.

All versions showed an acceptable degree of weed control, merely the bark mulch version D was slightly more affected by weed infestation. Nevertheless, it would seem highly premature at present to recommend any of the tested mechanical weeding strategies for organic blueberry cultivation.