Mulches and pheromones - plant protection tools for organic black currant production

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Abstract

Different mulches have been studied in organic currant production since 1997 at MTT Ecological Production in Mikkeli. In 1998-2000, three mulch materials (black plastic, green mass and Tassu sapling shield) were studied in a field trial on black currant (*Ribes nigrum* L.). Mulches were compared with bare soil. Mulches, especially black plastic, suppressed weeds effectively. Mostly due to the suppressed weed population the currant bushes grew vigorously; in bare soil growth was negligible. Since green mass mulch decomposes fast on the soil surface, it can be recommended mainly as an additional fertilizer.

Lepidopterous pests *Synanthedon tipuliformis, Euhyponomeutoides albithoracellus* and *Lampronia capitella* are difficult to control even by chemicals. Therefore pheromone-based management was studied in 1999-2003. Disruption resulted in satisfactory control of low populations of *E. albithoracellus* when *Archips podana* pheromone was used, and poorer control of a high population of *S. tipuliformis*. The efficiency of different trap models for *L. capitella* was tested, but field experiments are still required to evaluate the efficiency of mass trapping.

Keywords: *Ribes*, mulch, pheromone, weed control, pest control

Introduction

In 2004, organic black currant covered 396 ha in Finland, which is 18.7 % of the total black currant cultivation area (KTTK, 2004). Interest in organic currant production has increased every year, but methods for organic currant plant protection, especially pest control, are still lacking.

Weeds and pests cause the most severe problems both in conventional and organic currant cultivation, but weed and pest control methods are not alike. Covering the soil with different mulches can strongly influence crop growth and soil properties (e.g. nitrogen content, soil moisture, soil temperature). According to many investigations, mulching suppresses weeds and affects soil temperature, soil moisture and nutrients in the soil (Shearman et al., 1979, Bristow, 1998, Larsson, 1994). Weeds can strongly compete with young currant bushes, which is why weed control is often the main reason for mulching.

The currant shoot borer *Lampronia capitella* (Cl.), currant bud moth *Euhyponomeutoides albithoracellus* (Tengström) and currant clearwing moth *Synanthedon tipuliformis* (Cl.) are serious pests of currant. As larvae live sheltered inside buds and twigs, their chemical control is difficult. Monitoring by pheromone traps facilitate the timing of sprays against adults, but in organic production reliable and acceptable control methods are lacking (Tuovinen et al., 2003). More effective measures are needed and therefore attempts to develop pheromone-based methods were initiated in 1999-2003.

The aim of our studies was to investigate the weed control aspects of mulching and the significance on the growth and development of young currant bushes to find alternatives for black plastic. Another aim was to develop new pest control methods for organic as well as conventional currant production.

Mulch experiment

One-year-old black currant bushes (three plants per plot, replicated four times) were planted in October 1998. The preceding crop was two-year green manure grass (alfalfa-timothy-meadow fescue). Black plastic (thickness 0.05 mm, width 1.2 m) was applied along the rows before planting. In mid-June the following year green mass mulch (grass and red clover mixture, layer thickness 10 cm) and Tassu sapling shields (made of waste paper and peat, thickness 4 mm, Ø 40 cm) were applied. Bare soil served as a control. Weeds were estimated once in 1999 and twice in 2000. The height, width and growth of the bushes were measured after each growing period.

<u>Weed control</u>
Mulching controlled weeds quite effectively during the experiment. Black plastic was the most effective treatment (Figure 1). Tassu shields lasted throughout the experiment, but wind and small animals (birds, rabbits) carried them away, which was a little problematic. Green mulch had to be applied every year because it decomposed very quickly.

<u>Growth of currant bushes</u>
Bushes grew more rapidly in black plastic mulch than in other mulches. Growth was lowest in bare soil. In 2000, two years after planting, the average annual growth of a single currant bush was 10.4 m for bare soil, 14.6 m for Tassu shield, 16.0 m for green mulch and 24.5 m for black plastic and the average height of bushes 80 cm, 91 cm, 95 cm and 108 cm, respectively. New shoot growth was highest in green mulch and lowest in bare soil.

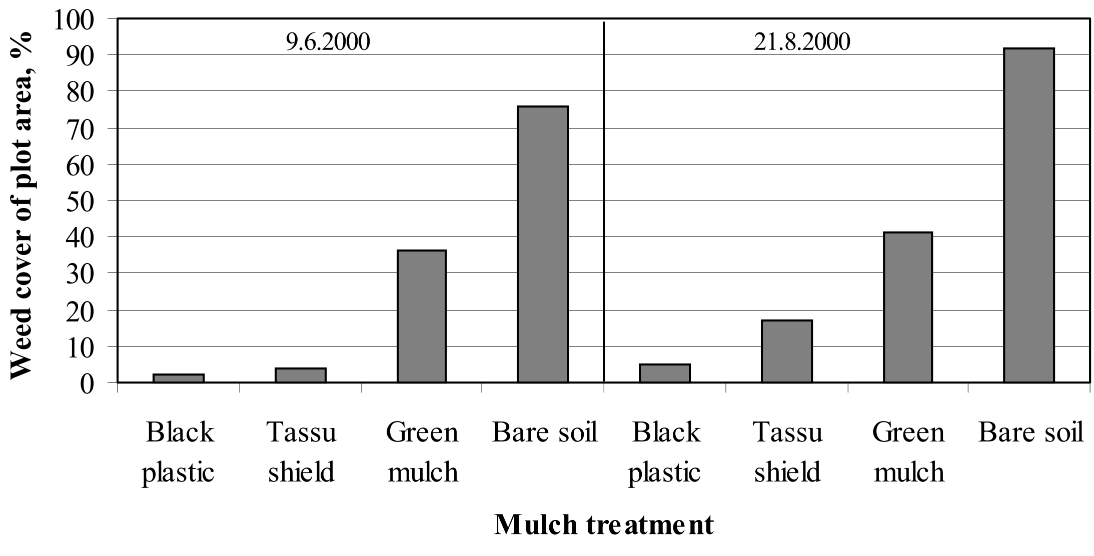

Figure 1. Average weed cover of plot area (%) in mulch treatments and in bare soil in June and August 2000.

Pheromone experiments

Disruption

Two types of disruption dispensers were used: silicon dispensers (Miniket, Enno Mõttus, Estonia), ca. 400/ha, attached to branches, and ceramic dispensers (N.P.P., France), ca. 25/ha, attached to poles. Pheromones were obtained from E. Mõttus and N.P.P. *Archips podana* (Scop.) pheromone lure (*E11-14Ac* + *Z11-14Ac*, 1/1) was used for E. albithoracellus and a specific pheromone lure for *S. tipuliformis*, (*E,Z)-2,13-18Ac*. Most experiments were carried out in small organic fields. To evaluate the disruption effect, standard monitoring traps were used, and injured buds (*E. albithoracellus*) or injuries inside twigs (*S. tipuliformis*) were recorded. The results of *E. albithoracellus* are promising and support further development of disruption techniques (Table 1). The results of *S. tipuliformis* were disappointing. As the experimental fields comprised only part of a bigger currant area, it is concluded that the whole area should be treated for reliable evaluation of the method. In addition, the initial population was obviously too high in the study area.

Table 1. Examples of disruption trials of *E. albithoracellus* using two different methods. Monitoring trap catches from the middle of the area, injury percentages are counted as injured buds in the following winter.

		Disruption block		**Control block**	
Field / Year	**Method**	Catch/trap	Injury, %	Catch/trap	Injury, %
d / 1999	Miniket Silicon	0	0.0	7	0.0
e / 1999	Miniket Silicon	0	0.0	0	0.0
f / 1999	Miniket Silicon	0	1.0	15	0.0
f / 2003	N.P.P. Ceram	0	0.1	36	3.1
g / 2003	N.P.P. Ceram	4	0.3	43	1.8
i / 2003	N.P.P. Ceram	71	1.3	16	1.4

Mass trapping

For mass trapping of *L. capitella*, three sticky and four water trap models were compared with the standard delta monitoring trap in 2003. The sticky traps were made of open horizontal plastic cylinders (length 20 and 40 cm, Ø 10 cm) or delta-type Atrakon-AP traps lined with glue paper and pheromone dispensers placed inside the traps. The water traps were made of open water containers (Ø 8, 10, 16 or 20 cm), pheromone dispensers hanging near the water surface. Detergent (1%) was added and a plastic rain cover was placed above the traps. The traps were placed 50 cm above ground in the row spaces. All traps were equipped with a Miniket dispenser loaded with *L. capitella* pheromone (*Z,Z)-9,11-14OH + (Z,Z)-9,11-14Ac + (Z,Z)-9,11-14Ald* (4/3/1) (Löfstedt et al., 2004). Four trap models were tested in each of the four trials by placing traps at random in squares ca. 5 m apart in five or six replicates. Moths were counted four times during the flying period. Catches of different trap types are presented as relative catches by replicate so that all traps can be compared in one scheme (Figure 2).

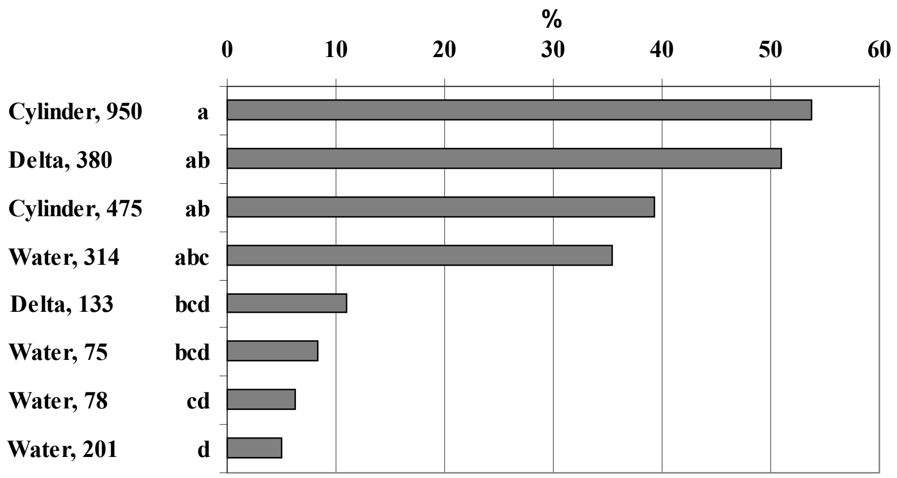

Figure 2. Results of *L. capitella* mass trapping experiments in 2003. Relative catches of trap models, trapping area in cm^2. Different letters indicate significant differences (Kruskal-Wallis, P=0.05).

Conclusion

The best weed control and growth were achieved by plastic mulch. Plastic is a resistant material, but difficult to remove from the field. Many organic currant growers favour organic materials (e.g. woodchips) instead of plastic. Tassu shields controlled weeds well, but the shape and the size of the shields were not suitable for currant bushes as such, and the price was high. Green mulch degrades too fast, allowing weeds to grow through the mulch layer.

The results of disruption of *E. albithoracellus* encourage further development and identification of the true pheromone blend. Disruption should be tested also for *L. capitella* as the mass trapping is obviously not effective enough in larger fields. Disruption trials of *S. tipuliformis* confirmed that this technique may not be effective in high-population conditions and in unisolated fields. In future, currant pest pheromones will have an important role if efforts to develop these techniques continue.

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