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# Different weed control systems in tomato

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## Introduction

In the last years physical methods have been developed for weed control. These methods can be interesting in organic farming and for integrated production. In this context, thermal weeding (selective heat employment for the elimination of weeds), mechanical weed control with horizontal brush weeder between the crop lines, and mulching with black plastic or crop residues are accepted weed control methods by the regulations of organic farming. Nevertheless, there is little empirical evidence about advantages of these weed control systems (Leroux *et al.*, 2000; Bàrberi, 2002). Suso *et al.* (2003) compared the above mentioned weeding systems for tomato crop with two trials located at Logroño and Zaragoza, Spain. Results of one year showed that the plastic mulching was a better weeding system, which in addition gave higher yield. However, to confirm these results, it is necessary to repeat the trial several years. In this work, different weed control systems were compared in three trials to analyze the efficiency in weed control and the effects on yield.

## Materials and methods

Three trials were performed in Montañana (Zaragoza, Spain) in 2002, 2003 and 2004. The experimental design was a randomized block with five treatments and four replications. Table 1 shows the description of the five treatments tested every year.

Table 1. Treatments description in trials for every year. HW: hand-weeded. DAT: days after transplanting.

| Treatment | 2002 | 2003 | 2004 |
|---|---|---|---|
| 1) Check with herbicide | Glyphosate (36%) (impregnation) | Metribuzin (70%) 0.5 l ha$^{-1}$ + glyphosate (36%) (impregnation) | Metribuzin (70%) 0.5 l ha$^{-1}$ + rimsulfuron (25%) 30 g ha$^{-1}$ |
| 2) Horizontal brush weeder | 2 times (22 and 34 DAT) | 1 time (13 DAT) + 1 HW (16 DAT) | 1 time (19 DAT) + 1 HW (21 DAT) |
| 3) Flame weeder | 5 times (13, 21, 27, 36, 44 DAT) | 2 times (10 and 24 DAT) + 1 HW (16 DAT) | 3 times (21, 28 and 41 DAT) + 1 HW (51 DAT) |
| 4) Black plastic mulch | Polyethylene 15µ + glyphosate (36%) (impregnation) | Polyethylene 15µ + glyphosate (36%) (impregnation) | Polyethylene 15µ + glyphosate (36%) (impregnation) |
| 5) *Artemisia absinthium* straw mulching | 2 HW +2 applications (1.6 + 1.6 kg m$^{-2}$, 10 an 26 DAT) | 2 HW + 2 applications (6.6 + 5.4 kg m$^{-2}$, 2 and 3 DAT) | 2 HW + 2 applications (3.4 + 1 kg m$^{-2}$, 8 and 2 DAT) |

The treatment 2 was performed with a horizontal rotary brush (trade mark Bärtschi-Fabro, mod. Brush Hoe type 500, of Hüswil, Switzerland) which operated between the crop lines. The thermal weed control was applied between the crop lines with a manual flame weeder (propane burner of 37x13 cm, trade mark: Agrironco de Tecnasa, Madrid, Spain). The glyphosate for doses impregnation in 1) and 4) were in average 9,9 ml.a.i/experimental plot (12 linear meters). The transplant was done in single rows 1.5 m apart. Tomato cv. 'Perfectpeel' was used and planted at 20 cm between plants. The dates of transplanting were 21/5, 10/6 and 26/5 in 2002, 2003 and 2004 respectively. Fertilization was done preplant and with foliar fertilizer. Every year several assessments of weed density were done in 3 m$^2$ of each

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elementary plot. In 2002, weed plants were counted three times during the crop season (17, 34 and 52 DAT), in 2003 only one time (17 DAT) and in 2004 two times (27 and 51 DAT). The crop was harvested ca. 120 DAT. For yield determination 40 linear m per treatment were harvested.

**Results**

a) Weed control: best weed control was generally achieved with black plastic mulch (Table 2). The representative weed species were: *Cyperus rotundus*, *Convolvulus arvensis*, *Chenopodium album*, *Portulaca oleracea*, *Amaranthus blitoides* and *Amaranthus retroflexus*.

b) Yield: the yield in 2002 differed between treatments being highest for black plastic mulch and *Artemisia* mulch. In 2003 yield was lowest for these two treatments due to high temperatures and excessive *Artemisia* straw application, respectively. Tomato yield was insignificant in treatment 4. In 2004, no significant yield differences were found (Table 2).

Table 2. Average density of *Cyperus rotundus* and annuals weeds (plants $m^{-2}$) and commercial tomato yield (t $ha^{-1}$) per treatment and year. Numbers refer to treatments described in Table 1.

| Treatment | 2002 | | | 2003 | | | 2004 | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Cyperus* | Annuals | Yield | *Cyperus* | Annuals | Yield | *Cyperus* | Annuals | Yield |
| 1 | 92 b | 22 a | 77,4 bc | 58 a | 3 a | 76,6 a | 26 a | 2 ab | 65,4 a |
| 2 | 114 ab | 22 a | 57,6 c | 51 a | 2 a | 64,6 a | 34 a | 7 ab | 74,5 a |
| 3 | 161 a | 11a | 61,8 bc | 27 a | 6 a | 72,6 a | 22 a | 9 a | 78,5 a |
| 4 | 49 b | 2 a | 98,1 a | 29 a | 0 a | - | 22 a | 1 b | 69,7 a |
| 5 | 55 b | 15a | 81,8 ab | 34 a | 6 a | 30,6 b | 49 a | 7 ab | 67,8 a |

In each year, treatments with different letters are significantly different (LSD test at $P<0.05$).

**Conclusions**

The best treatment for weed control was achieved with the black plastic mulch, which was very effective on annual weeds but not on *C. rotundus*, which perforated it. Effectiveness of the other treatments was erratic. The best yield was also obtained with black plastic mulch, but only during 2002 with an unusually cold summer. In contrast, results of the second year show that this system is not to be recommended with high temperatures (as found by Radics & Székelyné Bognár, 2002). It was also found that *Artemisia* straw application should be done carefully as too big quantities apparently delayed tomato growth, resulting in a significant lower yield. Under ordinary weather conditions (as in 2004), all the treatments gave similar yields, so that weather conditions strongly affect the choose of any tested control method. Disadvantages of the brush weeder and the flame weeder use are the need of a precise labour to avoid damaging the crops. With regard to *Artemisia*'s use it is necessary to properly calculate the quantity (biomass) and manpower requirements to implement it.

**References**


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