



Investigation of Alternative Weed Management Methods in Organic Vineyards of The Aegean Region

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Abstract

This work was done during 2009-2011 in Manisa. The aim of work was determination of weeds in the organic production in vineyards and determine method of control weeds. The effect of some weed control methods was evaluated in organically grown vineyards. The tested methods in the organic weed control methods included application of textile mulch, straw, sawdust, peanut shells, hairy vetch, flame burning, olive water, tractor hoeing, hand hoeing, barley-vetch mixed cultivation and cabbage residues application. The effect of organic methods on weeds, yield, quality and the physical and chemical properties of soil was determined. The soil analysis of organic treatments indicated that highest phosphorus (P) was noted in olive processing waste application while highest organic matter was recorded in vetch + barley and olive processing waste applications. Highest values for potassium were noted in tractor hoeing and olive processing waste application. High levels of iron (Fe) and manganese (Mn) were recorded with application of cabbage residues application. Additionally, the cost of treatments application was determined. The economical analysis indicated that the most economical treatment was application of barley + vetch (35.5%). This treatment was followed by the other low cost applications including hairy vetch (26.8%), barley + vetch (25.5%), cabbage residues (18.30%), textile mulch (14.38%), tractor hoeing (13.1%) and groundnut shell (9.1%) applications, respectively. The other conventional treatments such as burning, straw, sawdust and hand hoeing were found to be more costly. The results of this work indicates that textile mulch application were the most effective weed control treatments for organic productions systems, respectively. These applications were found to have higher yield than the other applications. The application of textile mulch and mixed cultivation of barley + vetch was economical than the conventional applications and can be recommended for weed control in organic production systems.

Key Words: Vineyards, Grape, Weed, Mulching, Cover crop, Herbicide, Physical control, Mechanical control.

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Özet

Bu çalışma, 2009-2011 yıllarında Manisa ilinde geleneksel ve organik üzüm üretim yapılan bağlarda sorun olan yabancı otların saptanması ve bu yabancı otlara karşı mücadele yöntemlerinin belirlenmesi amacıyla yapılmıştır. Organik bağ alanında bazı mücadele yöntemlerin etkisini belirlemek amacıyla da çalışmalar yürütülmüştür. Organik mücadele yöntemlerinde ise malç tekstili, saman, talaş, yer fıstığı kabuğu, tüylü fiğ, alevle yakma, zeytin karasuyu, traktör çapası, el çapası, arpa-fiğ karışık ekimi ve lahana artığı uygulamaları yer almıştır. Çalışmada organik uygulamaların yabancı otlara, verim, kalite kriterleri ve toprağın fiziksel ve kimyasal özelliklerine etkileri de belirlenmiştir. Organik uygulamaların toprağa etkileri incelendiğinde; en yüksek fosfor (P) zeytin karasuyu uygulamasından, en yüksek organik madde miktarı arpa + fiğ ve zeytin karasuyu uygulamalarından elde edilmiştir. Potasyum (K) değerleri incelendiğinde ise en yüksek değerler traktör çapası ve zeytin karasuyu uygulamalarında belirlenmiştir. Lahana artığı uygulamasında demir (Fe) ve mangan (Mn) miktarının yüksek düzeylerde olduğu kaydedilmiştir. Maliyet analizi sonucunda kontrole oranla en ekonomik uygulama arpa + fiğ (% 35,5) olurken, bunu sırasıyla tüylü fiğ (% 26,8), arpa + fiğ (% 25,5), lahana artıkları (% 18,30), malç tekstili (% 14,38), traktör çapası (% 13,1) ve yer fıstığı kabuğu (% 9,1) uygulamaları izlemiştir. Diğer uygulamalar olan yakma, saman, talaş ve el çapası uygulamalarının geleneksel herbisit uygulamalarından daha yüksek maliyetli oldukları belirlenmiştir. Yürütülen bu çalışma sonucunda geleneksel yetiştirme koşullarında

sonbahar toprak işleme + glyphosate uygulaması ve organik yetiştirmede malç tekstili uygulamasının yabancı ot mücadelesi için en etkili uygulamalar olduğu belirlenmiştir. Bu uygulamaların diğer uygulamalardan daha yüksek verim oluşturduğu da belirlenmiştir. Malç tekstili, arpa + fiğ karışık ekimi ve tüylü fiğ uygulamalarının maliyet bakımından geleneksel uygulamalardan daha az maliyetli olduğu ve organik yetiştiricilikte yabancı ot kontrolünde tavsiye edilebileceği belirlenmiştir.

Anahtar Kelimeler: Bağ, Üzüm, Yabancı ot, Malçlama, Örtücü bitki, Herbisit, Fiziksel mücadele, Mekanik mücadele

Introduction

In order to adequately meet the nutritional requirements of world population, the agricultural land is required to be used in alternative ways while integrated control methods are required to be investigated.

The use of organic crop products is increasing day by day, while the growing of crops organically is increasing in the world as well as Turkey with each passing day. In 2012, the area under organic crops increased by 14.4% compared with the data of 2005 (i.e. 203811 ha to 707909 ha) while the organic crop products were increased by 5.5% (i.e. 421934 tons to 1750120 tons) (Anonim, 2012).

The direct yield losses due to weeds in orchards are 1.1% (Cramer, 1967). The weeds uptake the water which necessary for crops; and hence, for producing 1 kg dry matter, weeds uptake 600 liter water (Oraman, 1959). Particularly, the weeds' competition water becomes dangerous when the water shortage is getting worse in the world. Many of the weeds in orchard, especially *Cirsium arvense* uptake higher N, P, and K than the vines (Farkhadi, 1968). While root exudates of *Sonchus arvensis* inhibit the root growth of vine (Racz and Siaba, 1971).

For Turkey, grape is an important agricultural export product while weeds have done both the direct and indirect yield losses to grape. This study was aimed to determine the effects of some alternative weed control practices in the organic vineyards in Manisa on the weed dry weight. The organic control methods evaluated were; textile mulch, straw mulch, sawdust, peanut shells, hairy vetch, torching, olive, tractor hoeing, hand hoeing, barley, and vetch and cabbage mixed cultivation (intercropping). The effect of organic weed control on soil physical and chemical properties, yield and quality of grapes and the economics was determined.

Materials and Methods

With the objective of finding out the most suitable weed control practices in organically grown orchards, experiments were conducted for two consecutive years (2010-2011) in Manisa (Sultaniye). The organic control methods evaluated were; textile mulch, straw mulch, sawdust, peanut

shells, hairy vetch, torching, olive, tractor hoeing, hand hoeing, barley, and vetch and cabbage mixed cultivation (intercropping). The soil properties of the experimental were recorded by taking soil samples before and after the experiments. The experiment was conducted with Randomized Complete Block Design with four replications and plot size of 6 x 9=54 m² (six vinestocks), and a distance was left among the parcels to avoid

Cover Crop Applications: In autumn vetch (*Vicia sativa*) and barley (*Hordeum vulgare*) were seeded in mixture with seed rate of 60 kg/hectare vetch and 5 kg/hectare of barley; hairy vetch (*Vicia villosa*) was planted alone with seed rate of 8 kg/hectare.

Application of textile mulch: Textile mulch (0.3 mm, 200 m x 1.50 m, 45 g/m²) was used in plots with 3 m width and 9 m length, covered with a perforated black polyethylene sheet (in two pieces), hence covering the area of 54m².

Application of Peanut Shell: Peanut shells were applied in the early spring at rate 5000 kg per hectare with a 10 cm thick layer on the soil so that sunlight does not pass through it.

Straw Application: The straw collected from the local wheat fields were spread in the field in 10 cm layer (so that the sunlight does not reach the soil surface). The straw was spread in spring season at 300 kg/hectare The experiment was checked throughout the season and any of the spaces were filled with additional mulch.

Sawdust application: The timber remains were collected from carpentry and were applied in a 10 cm layer (to avoid sunlight to reach soil) during the spring season at 4000 kg/hectare any of the spaces produced during the experimental period were re-filled with additional material.

Application of olive waste: The solid olive wastes were collected from olive oil manufacturing factory, dried, crushed and sieved. These materials were then spread on the soil surface during spring season at 3 kg/m² creating a layer of 0-20 cm. The dose of olive waste was decided based on work of Aydin et al. (2001) who investigated the suitable doses of herbicides and olive wastes. The analysis of olive waste indicated that it had: ; EC 16,400 mS/cm, pH 5,82, Organic matter % 42,12, N % 1,78, K % 1,15 and Ca % 1,43.

Application of cabbage remains: The cabbage (*Brassica oleracea* L.) remains collected from another field were applied at 5000 kg/hectare. These straw remains were applied in the early spring season and incorporated into the soil with a tractor mounted rotary.

Experiment plots that was checked through of season and refilled instead of mulch added material was made.

Flame application: The flame was applied for burning the weeds at the start of spring season when the broadleaved weeds were at 4-6 leaves stage; while the flame was applied for narrow leaved weeds when weeds were at tillering stage. The combustion process was done using butane gas at 675 kg/hectare for 20 min in each parcel.

Hand hoeing: The hand hoeing was done during the spring season when the broadleaved weeds were at 4-6 leaves stage and the narrow leaved weeds were at tillering stage.

Hoeing with tractor. The hoeing with tractor was done with a 5-tined plow and rotary during the spring season.

The number of weeds was counted from each parcel at 5 places from an area of 50 x 50 cm² at 14th, 28th and 56th days after treatment application. The weeds were harvested from the same areas to calculate the % control effect using the Abbott's formula:

$$\% \text{ Effect} = \frac{\text{Weeds dry weight} - \text{Weeds dry weight in treated field}}{\text{Weeds number in control dry weights}} \times 100$$

The harvested weeds were immediately taken to laboratory to record fresh weight, and then put in the oven at 70 °C for 48 hours. Later, the dry weight of weeds was recorded and the % effect of applied treatments was calculated based on the fresh and dry weights recorded in the treatment plots and the untreated control.

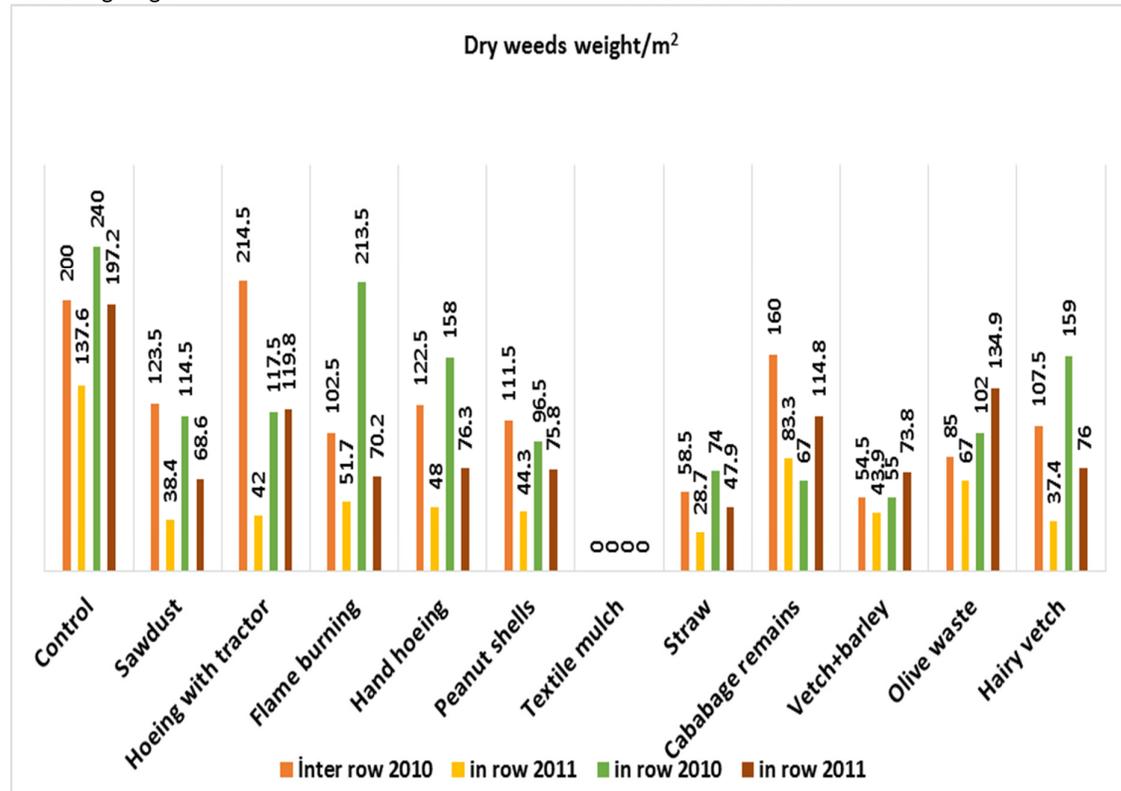


Figure 1. Weights of weeds in plots

Results

As show the figure 1. In 2010, mulch textile and control showed the lowest and the highest dry weight of weeds in inter row respectively.

Other application showed a 37.4-83.3 gr/m² dry weight. In 2011, in the same way the application of mulch textile was obtained the lowest dry weight of weeds in inter row. In intra row, application of mulch textile showed lowest dry

weight (0 gr/m²) in 2010. Other control methods were obtained for dry weights 55-213 gr/m² in plots. 2011, mulch textile and control showed the lowest and the highest dry weight of weeds in intra row respectively.

Effect of weed control methods on dry weight of weeds in plots were presented in Table 2. The evaluation of data on inter-row and intra-row weed dry weight were recorded from the organic vineyards. According to statistics analysis, field

applied weed control methods indicated that years 'effect was significant

Application of textile mulch was the most effective weed control treatment which had a 100% effect as indicated by the data recorded from 1 m² In 2010.

Other application showed a 37.4-83.3 gr/m² dry weight. In 2011, in the same way the Along with this treatment, the other applications showed a 38-73% effect. In inter row. The lowest effect was obtained from cabbage (20%). Hoeing with tractor application didn't effect in the plots. The highest effect (100%) was noted for textile mulch. The lowest effect was recorded for cabbage (39%). The other treatments showed an effect of 51-79% in 2011.

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Intra row, the highest effect was recorded for textile mulch (100%), the lowest effect was for flame burning (11%). The other treatments had a 52-77% effect. In 2010.

In same way. the textile mulch had the highest effect in 2011. However, the lowest effect was recorded for olive waste. Other applications showed a 39-76% effect.

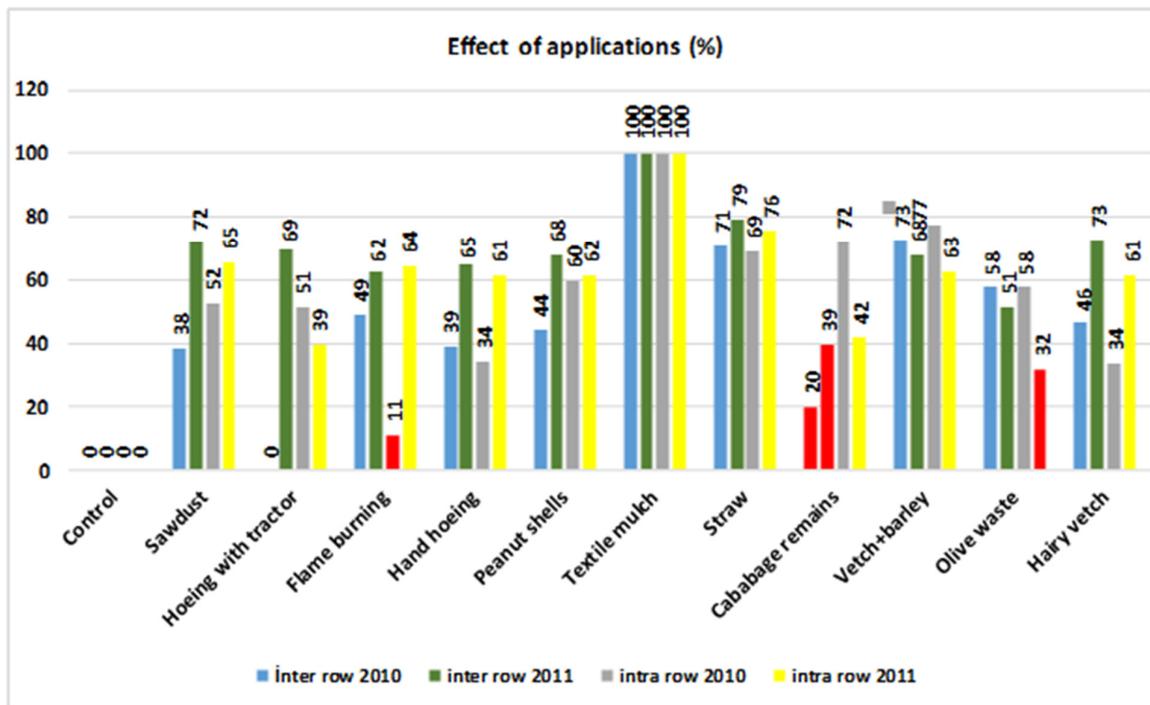


Figure 2. Effect of weed control methods in plots.

Effect of different weed control practices on the yield and quality of organic vineyard

The graph shows the effect of applied weed control practices in the organic vineyard area in Manisa during 2010 and 2011. The results in the graph show that the grapes' yield per hectare was increased by the applied weed control treatments.

However, the differences in yield for the treatments were not significant. In comparison with control, the highest yield was recorded for textile, straw and sawdust mulch applications. The lowest yield was recorded for flame weeding.

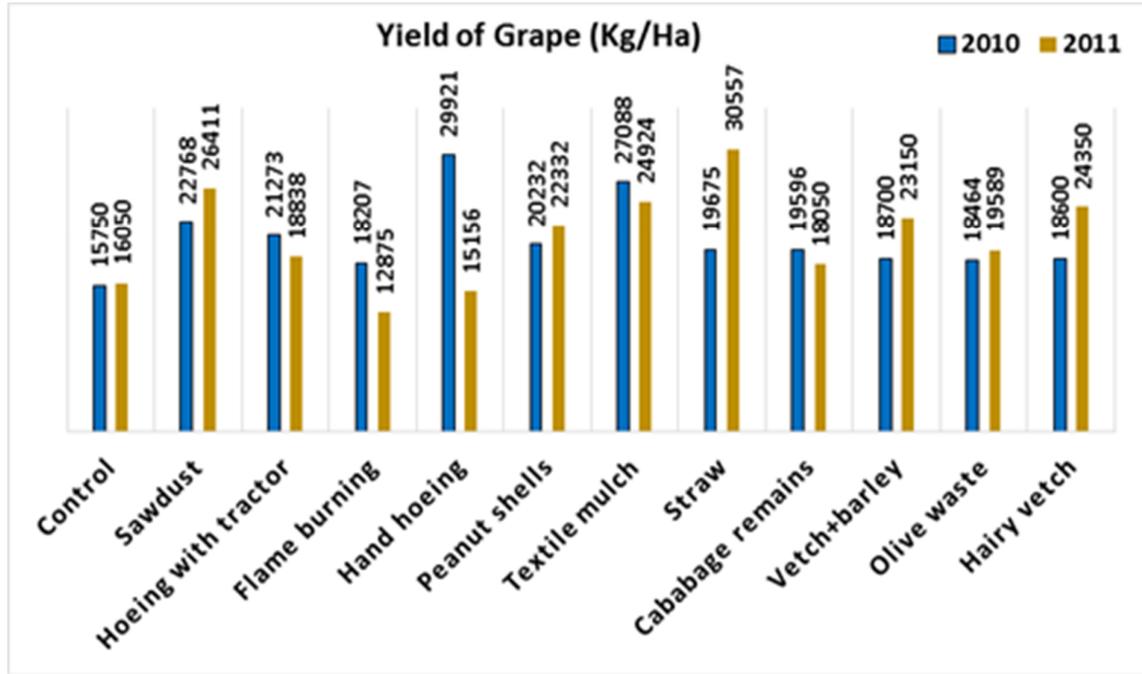


Figure 3. Effects of weed control methods on yield.

Results

- The results of organic weed control indicated that: the results were similar to the two years, the effect was much higher for organic weed control than the conventional one.
- According to data, the respective importance of methods was as: textile mulch, straw, sawdust, peanut shells, barley + vetch and hairy vetch.

- The results of this work indicate that, textile mulch application was the most effective weed control treatments for organic productions.
- These applications were found to have higher yield than the other applications. The application of textile mulch and mixed cultivation of barley + vetch was economical than the conventional applications and can be recommended for weed control in organic production systems.

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