

Effects of HerbaGreen application on vegetative developments of some grapevine rootstocks during nursery propagation in glasshouse

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Abstract: Substantial developments in wine and grape markets worldwide have resulted in a gradual increase in vineyards planting. This case synchronously increased the demand for grape planting materials. Environmentally healthy applications in the production of vigorous planting material are basic subjects of adaptation in sustainable agriculture. In this study, effects of HerbaGreen (a 100% natural product containing 40% CaO, 4% SiO₂, 1% MgO and 1% Fe₂O₃ in 1 µm granules) spraying on shoot development characteristics of one year old grape rootstocks 140 Ru, 99 R and 41 B were investigated during nursery production in glasshouse. HerbaGreen pulverization resulted in the formation of longer shoots across the rootstocks, varying from 51.4 cm (99 R) to 53.4 cm (140 Ru) while shoot lengths of the control plants were 35.6, 38.5 and 39.1 cm for 41 B, 140 Ru and 99 R, respectively. Besides, certain vegetative features such as shoot development level and lateral shoot number were also improved by application, depending on the responses of genotypes. General observations suggest that HerbaGreen would be beneficial in production of robust saplings by accelerating vegetative development without environmental hazard and therefore would be recommended to use in sustainable viticulture practices.

Introduction

In intensified agriculture techniques, chemical fertilizers, fungicides, pesticides, and herbicides have become most common practices. However, these applications have had some undesirable results such as the loss or depletion of topsoil, land becomes less fertile, and the excessive use of such chemicals has resulted in pests resistant to the current chemicals resulting in the development of even stronger chemicals (Denholm *et al.*, 2002). Consequently, environment is being damaged by toxic materials, chemicals leaching into rivers and water reservoirs are contaminating our drinking water, and the effect of global warming is becoming a major part of the political agenda.

For a sustainable and environmentally healthy agriculture, the cultivated soil has to be protected by working with natural sources. Such practices include the use of organic fertilizers to replenish the cultivated soil (Doran *et al.*, 1996). The principal aims of organic agriculture is to produce food of high nutritional quality in sufficient quantity, to interact in a constructive and life-enhancing way with natural systems and cycles, to encourage and enhance biological cycles within the farming system, to maintain and increase long-term fertility of soils, to promote the healthy use and proper care of water, to help in the conservation of soil and water, to use renewable resources in locally organized agricultural systems, to minimize all forms of pollution that may result from agricultural practice, to maintain the genetic diversity of the agricultural system and its surroundings, including the protection of plant and wildlife habitats, to consider the wider social and ecological impact of the farming system (Ingels, 1992; Kara, 2007; Sabir & Sabir, 2009).

Recently, researchers and developers have discovered many agents that promote plant growth and/or restrict the attack of pest and diseases (Kara, 2009). Many are environmentally safe products that contain different biocontrol agents. Plant growth stimulating products, such as HerbaGreen (100% natural product containing CaO, MgO, Fe₂O₃, SiO₂) are also beneficial substances for a vigorous and healthy developments in both vegetative and generative respect to resist pests and diseases.

In this study, the effects of HerbaGreen applications on vegetative developments of young grapevine plants were aimed to investigate under nursery conditions.

The Study

The grape rootstocks 140 Ru (*V. berlandieri* x *V. rupestris*), 99 R (*V. berlandieri* x *V. rupestris*) and 41 B 41 B (Chasselas x *V. berlandieri*) were used as plant materials. The hardwood cuttings used in this research were taken from dormant vines. Cuttings were prepared as about 35 cm long and 0.8 to 1.4 cm thick, including four or five buds each. Perlite was used as the rooting media under glasshouse conditions with intermitted mist units (about 10 s per 10 min interval). Cuttings were placed into *Richter* chests filled with moistened perlite. The perlite was kept moist throughout the experiment. The chests were kept in temperature-controlled room maintained at 20±5 °C. Four weeks after the cuttings were potted; all living plants were transplanted to polyethylene bags and moved to a glasshouse. The plastic tubes contained soil, perlite, peat and manure with percentages of 25% for each substance. A total of 30 plants were used for application of each genotype, dividing into three replicates.

HerbaGreen, made of carbonate calcium, silica, magnesium and certain trace elements (Table 1), were pulverized onto the plant in the concentration of 0.5% with weekly intervals, while no application was performed to those belonging to control group. 5 g HerbaGreen was mixed with pure water (according to the specifications of the company) and afterwards shake vigorously before pulverization for four time intervals in 30 min. Applications were performed with a hand-pump pressure spray systems equipped with an integrated swirl mechanism. Pulverizations were commenced when the first leaf on the cuttings was half-open in rooting stage within the perlite medium. All the plants were irrigated with 2 or 3 days intervals depending on weather conditions without using any supplementary nutritional matter.

Data were collected on shoot length (cm), shoot development level (0-4 scale), shoot diameter (mm), lateral shoot number and leaf dry weight (g). Data were subjected to analyses of variance (TARIST) and were separated using LSD multiple range test (level 0.01).

Main components warranted	Percentage (%)
CaCO ₃ (Carbonate calcium)	40
SiO ₂ (Silicium dioxide)	4
MgO (Magnesium oxide)	1
Fe ₂ O ₃ (Iron)	1
pH	8-10

Table 1. Main components of HerbaGreen

Findings

Pulverization of HerbaGreen on young grapevine plants with a concentration of 0.5% promoted the shoot elongation in varying degrees depending on genotypic aptitude (*Fig. 1*). Actually, effects of HerbaGreen application on shoot elongation, leaf development and leaf color of entire plants were noticeable when the shoots were approximately five cm (data not shown).

Differences between means of HerbaGreen treated and non treated groups with respect to shoot length, shoot development level, shoot diameter, lateral shoot number and leaf dry weight parameters were statistically significant at p<0.01 level.

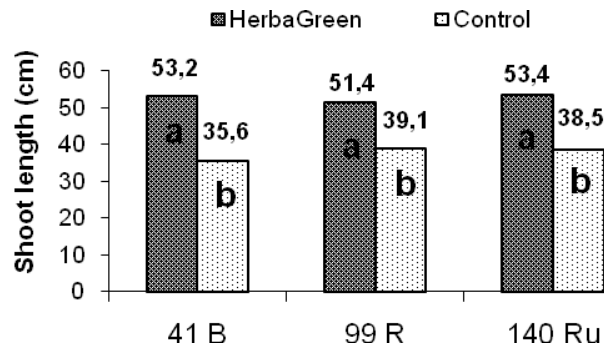


Figure 1. The effects of HerbaGreen application on shoot length (cm)

HerbaGreen applications resulted in the formation of longer shoots across the rootstocks, varying from 51.4 cm (99 R) to 53.4 cm (140 Ru). On the other hand, shoot lengths of the control plants (35.6, 38.5 and 39.1 cm for 41 B, 140 Ru and 99 R, respectively) were significantly lower than those of applications.

Responses of grapevine rootstocks to application were different by means of shoot development level (Fig. 2). HerbaGreen spraying significantly improved the shoot development levels of 41 B and 140 Ru rootstocks although control group of 99 R exhibited better shoot development. Such improvement in vegetative development would be anticipated to promote vine resistance to stress conditions (Santalucia *et al.*, 2007) such as drought and cancerous conditions both of which are principal agriculture-restrictive factors predominating in Konya province (Anonymous, 2007).

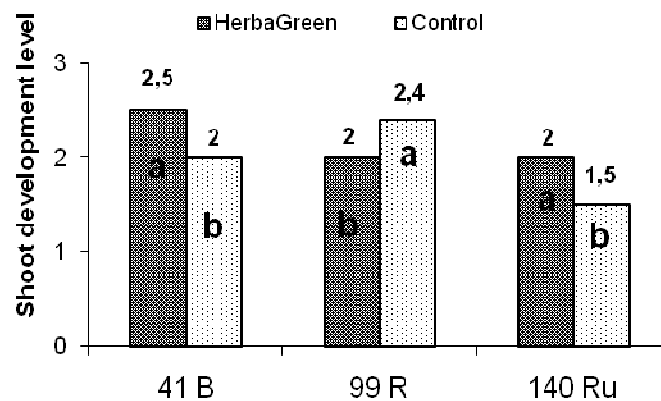


Figure 2. The effects of HerbaGreen application on shoot development level

The highest value with respect to shoot diameter was observed in HerbaGreen treated plants of 140 Ru although application was unable to enhance the thicknesses' of other rootstocks (Fig. 3). Actually, grapevine rootstocks exhibit significant variation in terms of physiological activities (Reynolds and Wardle, 2001), most likely because of the fact that they have been bred via complex hybridizations of a wide range of North American *Vitis* species (Weaver, 1976; Pongracz, 1983). Different responses of rootstocks used in this study are in agreement with that fact.

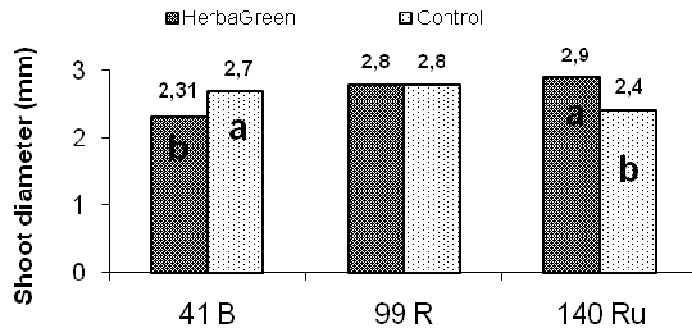


Figure 3. Effect of HerbaGreen application on shoot diameter (mm)

Lateral shoot numbers were always higher in HerbaGreen treated plants than those of control groups (*Fig. 4*). Especially, the response of 99 R to application regarding lateral shoot number was noticeable. It is well known that lateral shoot emergence in grapevines could be influenced easily by applications or climatic conditions, although response magnitude of such activity is genotype-dependent (Tezuka *et al.*, 1980). 140 Ru, in this sense, did not respond in the similar manner observed in 41 B and 99 R.

Leaf dry weight values of 41 B and 99 R were increased by HerbaGreen pulverization although 140 Ru did not respond in the same manner (*Fig. 5*). As stated by Howell (2001) previously, it is proposed that response in achieving leaf weight of vines would vary with regard to cultivars or rootstocks. Regardless, vine balance is most readily understood when based on the principles of leaf development balance as mediated through well-understood factors such as gram dry weight at a certain stage of development.

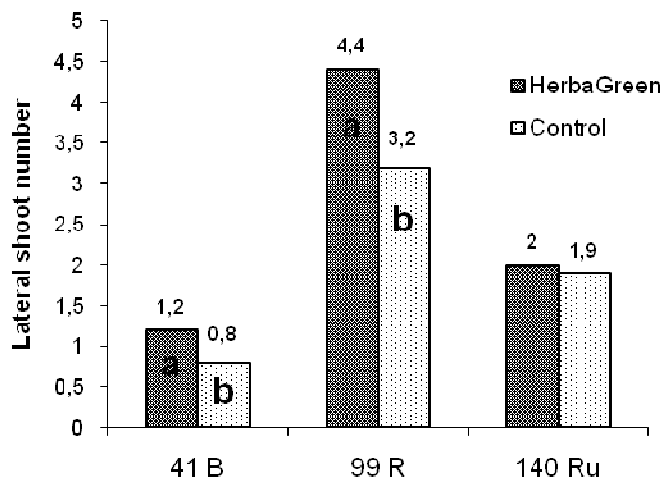


Figure 4. Effect of HerbaGreen application on lateral shoot number

Besides the findings presented above, obvious vitalization of the green mass of vines was noticeable. The leaves were of dark green color (data not shown). Such case would imply that HerbaGreen might accelerate the photosynthetic activity in leaves.

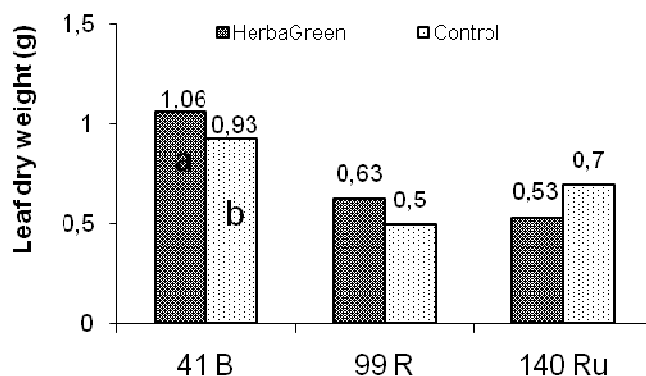


Figure 5. Effect of HerbaGreen application on leaf dry weight (g)

Conclusions

HerbaGreen application had obvious impact on the vegetative development by promoting shoot elongation, leaf enlargement, thickening, and final take of plants. Furthermore, it helped the vines to produce greenish leaves which ensure optimum photosynthesis process. Considering the overall findings obtained in this study, HerbaGreen would be recommended a plant growth promoting agent for a vigorous and healthy vine development in sustainable viticulture.

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