

Soil Conditioner FFC-Ace Effects on Growth and Quality of Berries of Wine Grapes[©]

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INTRODUCTION

We have focused our attention on the behavior of certain ions, especially iron ion in water or interactions of water molecules with them. Since 1984, Akatsuka Garden Company has continued research on various solutions to not only accelerate plant growth, but also activate physiological functions of plants. Based on this research, we have developed FFC materials such as FFC-Ceramics (a water improvement device), FFC-Ace (a soil conditioner), and others. In addition, many agricultural producers in Japan have been utilizing FFC materials to rejuvenate plants and increase profits. Those producers have also explored many other original methods for using FFC materials, and consequently found good ways to fit them into their actual production sites. As a result, they have obtained many advantages over the years of use, such as, productivity enhancement, cost reduction, decreased amount of agricultural chemicals required, and others. In addition, it is reported that FFC-Ace enhances the growth of plants under laboratory conditions, improves disease resistance, and drought and salt stress tolerance of plants (Ichikawa et al., 2013; Fujita et al., 2010; Hasegawa et al., 2006; Konkol et al., 2012; Shiraishi et al., 2010; Toyoda et al., 2010). In this paper, we will report a part of the results on the effectiveness of FFC-Ace on wine grape vines under field conditions.

Yamanashi Prefecture is Japan's top producer of grapes. However, the high quality grape berries for brewing are not cultivated easily in the cultivation environment of Japan (Asai, 1993; Nakayama, 1993). Therefore, we started a study on the promotion of the growth of Chardonnay grape vines and quality improvement of the berries by using the FFC materials. In addition, we also examined an additional wine grape, *Vitis vinifera* 'Koshu'. 'Koshu' grapes are widely cultivated in central Japan, particularly Yamanashi Prefecture. 'Koshu' is an indigenous grape cultivar that is used to produce Koshu wine, which is a special product of Yamanashi Prefecture.

MATERIALS AND METHODS

Field experiments of FFC-Ace using Chardonnay and 'Koshu' grapevines were undertaken.

Eighteen Chardonnay grapevines (guyot-style cultivation) were tested. Two holes of approximately 50 cm depth were dug approximately 0.5 m away from the main trunk of the grapevines. The required amount of FFC-Ace was put into the holes and also scattered on the ground surface approximately 1 m in diameter from the main trunk of the grapevines.

Six 'Koshu' grapevines [(shelf-style cultivation (overhead trellis))] were treated. Four holes of approximately 50 cm depth were dug at approximately 2 m away from the main trunk of the grapevines. The required amount of FFC-Ace was put into the holes and scattered on the ground surface approximately 4 m from the main trunk of the grapevines. The FFC-Ace was annually applied in the experimental fields every February from 2008 to 2011. Table 1 shows the amount of FFC-Ace which was applied each year. Twenty berries were randomly sampled from each grapevine to measure grape berry compositions, and divided into two groups. Each fresh berry's weight, the average total soluble solids (expressed as degrees Brix), the average of pH, the average of titratable acidity, and the average total phenolics concentration in juice extracted from the two groups were measured.

Table 1. The weight of FFC-Ace[®] provided to each grape each year.

'Chardonnay' grapes.				
	2009	2010	2011	
No FFC-Ace	–	–	–	
FFC-Ace 3.7 kg-1	3.7 kg	–	–	
FFC-Ace 3.7 kg-2	3.7 kg	3.7 kg	3.7 kg	
FFC-Ace 23 kg-1	23 kg	–	–	
FFC-Ace 23 kg-2	23 kg	23 kg	23 kg	
	(per 1 tree)			
'Koshu' grapes				
	2008	2009	2010	2011
No FFC-Ace	–	–	–	–
FFC-Ace treated	3.7 kg	3.7 kg	45 kg	7.5 kg
	(per 1 tree)			

Pot Experiments by Using Young Plants of Chardonnay and 'Koshu' Grapes

Young one-year-old plants of Chardonnay and 'Koshu' grapes were tested. We cultivated the young plant in Wagner pot (1/2000a) holding field soil mixed with FFC-Ace (3% w/w) or in untreated field soil. Growth of the young plants was estimated by measuring the length of shoots, the number of leaves, and chlorophyll content (SPAD-unit) in the shoot leaves.

RESULTS AND DISCUSSIONS

Degrees Brix in Chardonnay berries were increased by using FFC-Ace (Fig. 1). Because sugars in berries change to alcohol by fermentation an increase of degrees Brix in berries enhances the value of the wine grapes. Titratable acidity of Chardonnay berries during early growth in the field treated with the FFC-Ace declined earlier than without FFC-Ace. This result for Chardonnay grapes is similar to that of 'Koshu' grapes. Therefore, it was suggested that the application of FFC-Ace promoted maturation of both kinds of berries. Fresh berry weights, pH values, and total phenolics concentrations of both kinds of grapes were not influenced by the application of FFC-Ace. The young plants (1 year old) of Chardonnay and 'Koshu' grapes were transplanted in Wagner pot (1/2000a) holding FFC-Ace treated soil or untreated field soil. Growths of the young plants were observed (Fig. 2). The length of the young shoots of 'Koshu' plants in the soil treated with 3% of FFC-Ace was significantly longer than without FFC-Ace during early growth (105 days after the planting). In addition, the 'Koshu' young plants treated with FFC-Ace had a larger number of leaves than without FFC-Ace, and the SPAD unit of the grape leaves treated with FFC-Ace is higher than without FFC-Ace. The results for Chardonnay were also similar to those of 'Koshu', although no statistically significant difference was observed. These results indicate that the application of FFC-Ace to young grape plants might stimulate plant growth in the early stages, accelerate maturation of berries, and increase degrees Brix in the juice of berries.

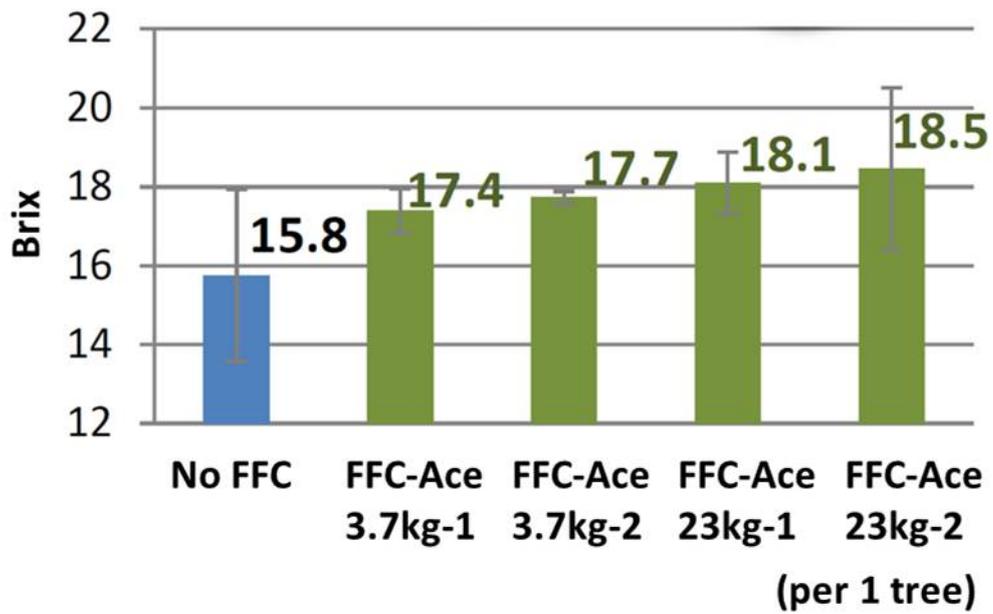


Fig. 1. Degrees Brix in Chardonnay berries were increased by using FFC-Ace.



Fig. 2. The length of the young shoot of 'Koshu' plant in the soil treated with 3% of FFC-Ace.

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Literature Cited

- Asai, S. 1993. Thinking about wine grapes used in Japanese winery. *J. Brewing Soc. Japan* 88(5):338-343.
- Fujita, K., Suzuki, T., Hasegawa, S., Meguro, A., Sugiura, S.H., Toyoda, K., Shiraishi, T., Sakaguchi, E., Nishimura, T. and Kunoh, H. 2010. Enhancement of growth and yield of barley by the soil conditioner FFC-ace. *Scientific Reports of the Faculty of Agriculture Okayama University* 99:13-20.
- Hasegawa, S., Meguro, A., Shimizu, M., Nishimura, T. and Kunoh, H. 2006. The ceramic bead that is suitable for a carrier of plant-rooting accelerator, *Streptomyces* sp. MBR-52. *Actinomycetologica* 20:23-29.
- Ichikawa, K. and Fujimori, T. 2013. Effects on growth of plants by the soil conditioner FFC-Ace[®]. *Comb. Proc. Int. Plant Prop. Soc.* 62:459-462.
- Konkol, N.R., McNamara, C.J., Bearce-Lee, K.A., Kunoh, H. and Mitchell, R. 2012. Novel method of micronutrient application increases radish (*Raphanus stivus*) and shirona (*Brassica papa* var. *pekinensis*) biomass. *J. Plant Nutr.* 35(3):471-479.
- Nakayama, M. 1993. Wine grape growing in Japan. *J. Brewing Soc. Japan* 88(9):654-659.
- Shiraishi, T., Toyoda, K., Suzuki, T., Meguro, A., Hasegawa, S., Nishimura, T. and Kunoh, H. 2010. Effect of FFC ceramic water on the infection process of a fungal pathogen. *Scientific Reports of the Faculty of Agriculture Okayama University* 99:27-34.
- Toyoda, K., Matsuoka, S., Meguro, A., Hasegawa, S., Nishimura, T., Kunoh, H. and Shiraishi, T. 2010. FFC ceramic water[™] enhances plant apyrase activity. *Scientific Reports of the Faculty of Agriculture Okayama University* 99:21-26.