Effect of a Soil Conditioner FFC-Ace© on Growth of Sugarcane and Quality of Soil Penetration Water©

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INTRODUCTION

Since 1984, at Akatsuka Garden Company we have focused our attention on the behavior of certain ions, especially the iron ions in water and interactions of water molecules with them. We have 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 years of use, such as, productivity enhancement, cost reduction, decreased amount of agricultural chemicals required among others. In addition, it has been reported that "FFC-Ace" enhances the growth of plants under laboratory conditions while improving 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 short paper, we will report on a portion of the results on the effectiveness of FFC-Ace applied to agricultural products under field conditions.

We researched the effects of FFC-Ace on growth and yield of sugar cane in Miyakojima city, Okinawa Prefecture. In addition, Miyakojima City has a major eutrophication problem that groundwater is polluted mainly by chemical fertilizer and livestock manure. Therefore we also examined the influence of the FFC-Ace on leaching of nitrate nitrogen, which is in fertilizer, from soil.

MATERIALS AND METHODS

Field Experiments on Growth of Sugarcane

The examination was carried out over approximately 14 months in a sugarcane field (cultivar: Ni21) from 10 Oct. 2009 to 26 Jan. 2011. The size of a test plot was 56 m^2 (5.6×10.0 m). Details of the examination are shown in Table 1. The cultivation method, such as fertilizer and pesticide application, and weeding followed the precedent. Ten plants were randomly sampled from each test plot to measure the growth and the yield of the sugarcane.

Table 1. Test plot name and application amounts on research of growth and the yield of sugarcane.

Test plot	Application amounts
Control	Standard amount of chemical fertilizer only
FFC-Ace	Standard amount of chemical fertilizer and 150 kg per 10 a of FFC-Ace

Research of Soil Penetration Water
The size of a test plot was 56 m^2 (5.6×10.0 m). Details of the examination were shown in Table 2. Soil penetration water was collected into a polyethylene tank through a pipe connected to the Rohto type lysimeter (0.98 m^2 in area: 0.7×1.4 m, no wall) buried to 60 cm in depth from ground level (Figs. 1 and 2). We measured the amount of penetration water, cation and anion concentration, electric conductivity, pH, and also measured concentration of inorganic nitrogen in the water.

Table 2. Test plot name and application amounts on research of soil penetration water.

Test plot	Application amounts
Control	4 tons per 10 acres of compost and standard amount of chemical fertilizer
FFC-Ace	4 tons per 10 acres of compost, standard amount of chemical fertilizer and 150 kg per 10 a of FFC-Ace

Fig. 1. The Rohto-type lysimeter was buried 60 cm depth in the sugarcane field.

Fig. 2. Polyethylene tanks along the sugarcane field to collect soil penetration water.

RESULTS AND DISCUSSION

The crop index of FFC-Ace plots, which multiplied Brix sugar content by a unit area yield (t/10 acres), was compared with that of the controls to evaluate profitability of the FFC-Ace application. The crop index of the FFC-Ace plot section increased approximately 1.3 times from that of the control plot (Fig. 3). It compared the ratio of the amount of nitrate nitrogen in soil penetration water collected from the FFC-Ace plot with that of the control. The ratio of nitrate nitrogen in the FFC-Ace plot was 21.1%, and that of the control was 34.82%. There was clearly a lower ratio of nitrate nitrogen in the FFC-Ace plot than that of the control. The results show that the application of FFC-Ace to sugarcane cultivation is effective for increasing profit and restraint of elution of fertilizer components. In an area, such as Miyakojima, where eutrophication by nitrate nitrogen derived from agriculture is one of the environmental problems, it demonstrates that the application of FFC-Ace enables both an increase in crop productivity and reduction of environmental load.

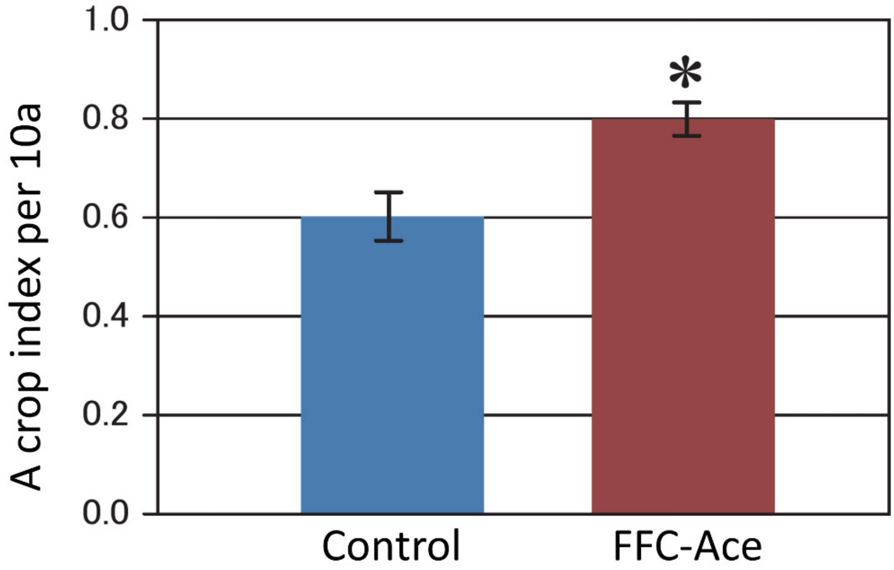

Fig. 3. Comparison of a crop index (multiplied sugar content in sugarcane by the yield). *p<0.05.

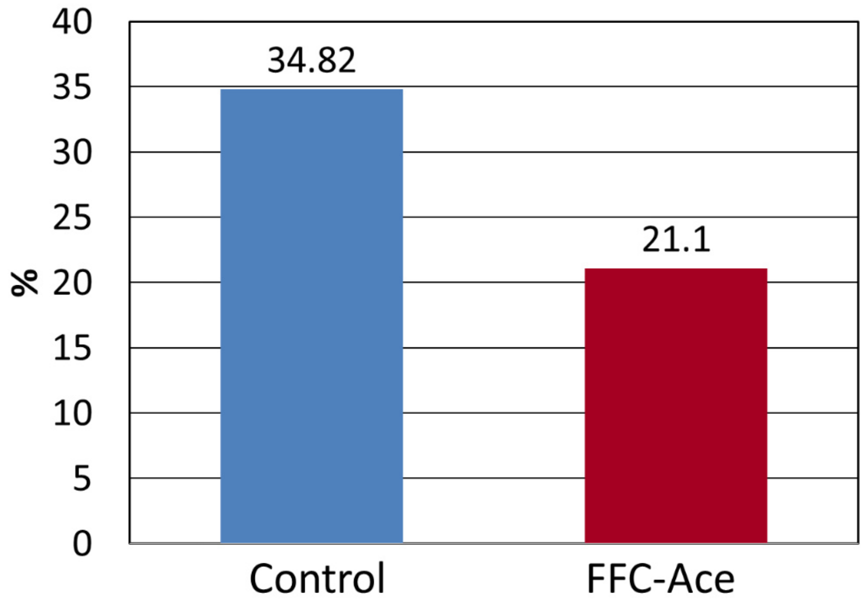

Fig. 4. A ratio of nitrate nitrogen volume in soil penetration water to total nitrogen volume of applied fertilizer.

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