# Weed control treated with salt and seawater in organic agricultural upland

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## Abstract

*Weed control is the most important issue in organic farming systems that limit crop growth and their yield. Field experiments were conducted in organic soybean (Glycine max Merrill) to evaluate the weed suppression effects of salt and seawater treatment. Weed population and fresh weight were monitored after 6 weeks of salt and seawater treatments. The most important weeds were Digitaria sanguinalis, Portulaca oleracea, Tradescantia reflexa and Chenopodium album var. centrorubrum, but also 6 other species were observed in soybean arable field. Soybean crops under seawater or their solids application were well grown. The results treated with salts and seawater indicate decreases by 13.4~30.8% in weed density and by 18.0~43.2% in their fresh weight and soil hardness increases of up to 2.1-fold. Salt and seawater provided good additional weed control, but they were caused a serious problem in deterioration of soil physical properties.*

## Introduction

In organic farming systems, weeds can cause a serious reduction of substantial crop production, because they compete with the main crop in using light, water, and nutrients. Many agriculture scientists (Auld and Tisdell. 1985; Kouwenhoven, 1997; Turner et al., 2007; Ulloa et al., 2010; Weih et al., 2008) did research on weed management used to various methods of non-chemicals, mechanicals and other cultivation practices such as rotary hoeing, cover crops and intercropping. Recently, organic as well as conventional farmers in Korea are often the use of salt and seawater for improving crop quality, disease and weed control. The objectives of this experiment were to investigate the possibility of weed control on salt and seawater in organic soybean cultivation.

## Materials and methods

Field experiments were conducted in 2010 at the organic soybean farmer's field located in Seosan, province Chungnam. All experimental plots were applied with 8,000kg $ha^{-1}$ compost before sowing of soybean and not fertilized during the crop growing season. We made five treatments of salt 300kg, 500kg $ha^{-1}$, seawater 10,000 ℓ, 15,000 ℓ $ha^{-1}$ and without any application treatment (control). Treatments of salt and seawater were done 3 days after sowing of soybeans. Salt was applied by hand und seawater was evenly sprayed on soil surface using an electric charge power sprayer.

At 6 weeks after applications of salt and seawater, weeds in rows were removed 1 $m^{-2}$ from each plot and estimated their density and fresh weight except roots. Soil hardness was measured direct using penetrometer (model 350, Fujiwara) after soybean harvest.

**Results and discussion**

A total of 10 weed species were identified on the experimental plots. The major weed species in organic soybean cultivation plots were *Digitaria sanguinalis*, *Portulaca oleracea*, *Tradescantia reflexa* and *Chenopodium album var. centrorubrum*, and 6 other species irregularly spread in the experimental field. The dominant weed species were increased their growth and biomass production due to supply nutrients in salt and seawater. The results of soybean growth and weed density measurement are showed in Table 1. Soybean crops in all treatment plots were well grown without crop damages. Salts under natural condition dissolve quickly by rain. The weed suppression effects were about 13.4 ~ 22.1% of the seawater treatment plots and 21.2~30.8% of the salt application plots contrast with control. Salt application was more effective better than seawater spray for weed suppression. However, average soil hardness in salt application plots was increased by 2.1-folds compared to seawater treatment (Fig.1). It is considered to be due to the difference in amounts of salt contents between salt and seawater. Seawater and their solids contain various inorganic anion and cations over 75 kinds for plant growth or disease control, and also can be used easy from anywhere in the world as one of the abundant earth natural resources. However, the agricultural use of seawater or solids can utilize unsuitable for salt-sensitive crops because their crop can be damaged due to the accumulation of salts in the soil from increasing high salt levels. Therefore, we are considered that seawater or salt use for weed control would be desirable to use combined with any other agricultural byproducts such as rice straw, wheat straw, rice bran or their chaffs and so on rather than treated only seawater or their solids.

Table 1. Weed control effects treated with salt and seawater in organic soybean cultivation

| Treatments | Plant heights (cm) | Weeds | | | |
|---|---|---|---|---|---|
| | | Density (No. $m^{-2}$) | control effect (%) | fresh weight (g $m^{-2}$) | control effect (%) |
| Seawater 1,000ℓ | 67.5 ± 4.0b | 127 ± 8.3b | 13.4 | 1,997 ± 167b | 18.0 |
| 1,500ℓ | 66.1 ± 0.9b | 114 ± 15.1b | 22.1 | 1,384 ± 138c | 43.2 |
| **Means** | **66.8 ± 2.5** | **120 ± 11.7** | **17.8** | **1,691 ± 152** | **30.6** |
| Salts 30kg | 64.5 ± 1.0b | 115 ± 3.1b | 21.2 | 1,515 ± 174bc | 37.8 |
| 50kg | 65.3 ± 1.8b | 101 ± 7.0c | 30.8 | 1,395 ± 197c | 42.8 |
| **Means** | **64.9 ± 1.4** | **108 ± 0.5** | **26.0** | **1,455 ± 186** | **40.3** |
| Control | 59.1 ± 2.9a | 146 ± 11.5a | | 2,437 ± 75a | |

Values within each columns denoted by same letter are not significantly different at $p$ = 0.05%

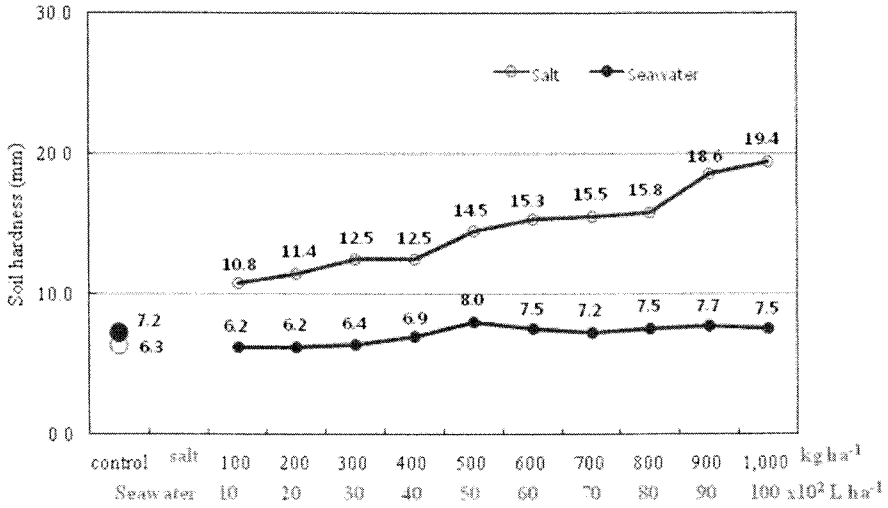


Figure 1. Soil hardness change according to salt and seawater treatment

**Conclusion**

Based on these results, Soybean crops in seawater or their solids application plots were well grown better than their in control plot. The weed population was simplified by salt and seawater treatments, and the growth of weeds could be suppressed by salt and seawater. Weed suppression effects was by salt application plots better than by seawater spraying plots. Our results showed also that high salt application can considered a serious problem in deterioration of soil physical properties. Weed control in our trails for organic farming may be needed to combine any other additional practices.

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