

# Carbon Sequestration in Two California Soils under Native and Irrigated Cropping Conditions

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## Introduction

- ❖ The conversion of native land to irrigated cropland affects carbon (C) sequestration by changing the vegetative cover, inputs of organic materials, and soil moisture and nutrient content.
- ❖ Little is known about the degree of change in total C and soil organic C due to human activity in irrigated soils. Previous research in irrigated soils have shown both increases and decreases in the total C and organic C content compared to the native soil (pre-cultivated conditions).
- ❖ It is not clear how the conversion of native land to irrigated cropland has affected organic carbon storage in arid/semi-arid-zone soils within California.

## Study sites

- ❖ Two areas were chosen for sampling: near Wasco in the San Joaquin Valley and near Holtville in the Imperial Valley (Figure 1).



❖ San Joaquin Valley soil samples were taken from 5 sites: a native site and 4 sites that were cultivated for either 10, 15, 20, or 30 yrs.

❖ Imperial Valley soil samples were taken from 3 sites: a native site and 2 sites that were cultivated for either 50 or 90 yrs.

❖ Within each site, samples were taken from 5 locations (replicates) at four depths (0-10, 10-25, 25-60, 60-100 cm).

Table 1. Climate data for the study areas.

Site Location	Mean annual		
	Precipitation	ET	Temp (max,min)
Wasco, San Joaquin Valley	172 mm	147 mm	26, 9.7 °C
Holtville, Imperial Valley	65 mm	182 mm	31, 15 °C

Figure 2. Native site near Holtville, Imperial Valley, CA.



Figure 3. Cropland site that has been cultivated/irrigated for approximately 50 years near Holtville, Imperial Valley, CA.

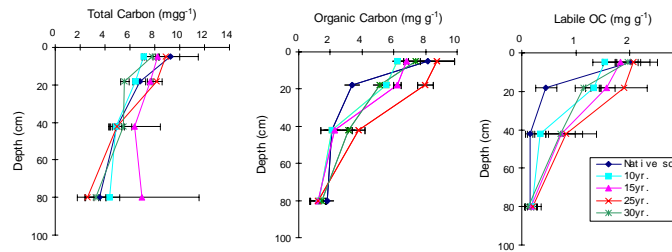


## Objective

To gain insight into changes in carbon storage in native soils and cropland soils under various management systems

## Results

### Wasco Soil



### Holtville, Imperial Valley

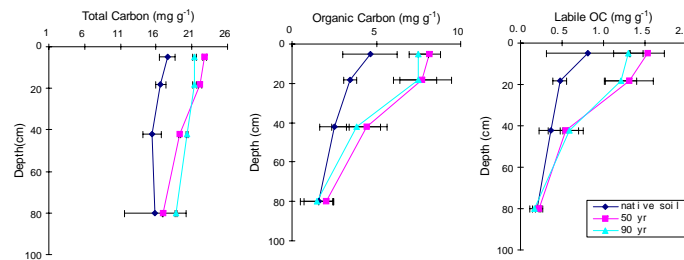


Table 2. Effect of Cultivation/irrigation on Carbon Sequestration

Treatments	Total C (mg/g)	CaCO <sub>3</sub> (mg/g)	Organic C (mg/g)	Total C Density (kg/m <sup>2</sup> )	SOC Density (kg/m <sup>2</sup> )	Labile C
Wasco Soil						
Native Soil	6.16(2.43)	2.30(1.17)	3.86(2.75)	5.96(0.41)	3.25(0.59)	0.69(0.82)a
10 yr.	5.72(1.22)	1.93(1.16)	3.78(2.20)	6.33(0.27)	3.31(0.38)	0.85(0.62)ab
15 yr.	7.30(2.41)	3.18(2.96)	4.11(2.53)	7.91(2.03)	3.31(0.60)	1.07(0.76)bc
20 yr.	6.17(2.69)	0.75(0.65)	5.43(3.22)	6.40(0.70)	4.91(0.32)	1.24(0.84)c
30 yr.	5.52(1.75)	1.24(1.08)	4.28(2.31)	6.68(0.70)	4.45(0.23)	0.98(0.71)b
Imperial Soil						
Native	16.4(2.9)	13.4(2.0)	3.0(2.6)	19.92(2.19)	3.01(0.68)	0.5(0.3)
50 yr.	20.3(2.8)	14.7(1.2)	5.6(2.8)	26.84(2.01)	6.02(1.03)	0.9(0.6)
90 yr.	20.5(1.1)	15.4(1.9)	5.1(2.8)	25.49(0.08)	4.70(1.03)	0.8(0.5)

## Results

### Wasco Soil:

- Conversion from native to irrigated agriculture (10 to 30 yrs) does not appear to affect the total carbon (Total C) content and density in the 100-cm profiles.
- An increase in organic C (OC) and labile organic C (LOC) content was observed in the soils with >20 yr cropping compared to the native soil samples, especially in the top layers (0-10, 10-25 cm).
- Inorganic C was highest in the native soil. The content of inorganic C differs among the treatments, but was not correlated to the length of cropping.

- The 20-yr site has the greatest OC content at the 0-25 cm depth, which is attributed to the high biomass at the time of sampling.

### Imperial soil:

- No significant differences between the OC and LOC contents of soil samples from 50- and 90-yr sites throughout 0 to 100 cm depths, but the native soil has the lowest OC and LOC.
- Total C of the native soil was significantly lower than those of cultivated/irrigated for 50 and 90 years.

### Both sites:

- Greatest change in OC and LOC content from native to irrigated cropland sites is at the 10-25 cm depth.
- Soil samples from Imperial Valley have a higher content of carbonates than the soils from the San Joaquin Valley.

## Conclusions

- Our results show that irrigated agriculture significantly increases the soil OC and Labile OC content in the upper soil profiles (0 to 60 cm). Deeper in the soil profiles, however, the total C content is essentially the same in native and in irrigated soils for both sites.
- No consistent result was found correlating the length of cultivation/irrigation and the total C content and C density between the two sites. In an arid/semi-arid region, total C content and density also depend on the irrigation water quality and management practices.
- Future research is needed to compare OC dynamics in native and irrigated soils.