



Evaluation of Biochar Application to Increase Soil Carbon Sequestration in Taiwan



Applying biochar before tillage

Biochar is a carbon-rich and alkaline material with considerably high carbon sequestration potential. It can retain carbon in soil at least 100 years to increase soil organic carbon (SOC) and thus mitigate climate change.

□ Potential of carbon sequestration

- Biochar is alkaline material. It can be used to improve 300,000 ha of strong acidic soil in Taiwan cultivated land (Fig.1).
- Most of biochars contains more than 50% organic carbon (C_{org}). The soil carbon content is expected to increase about 4.8 million Mg if 2% biochar applied in all of the strong acid soils.

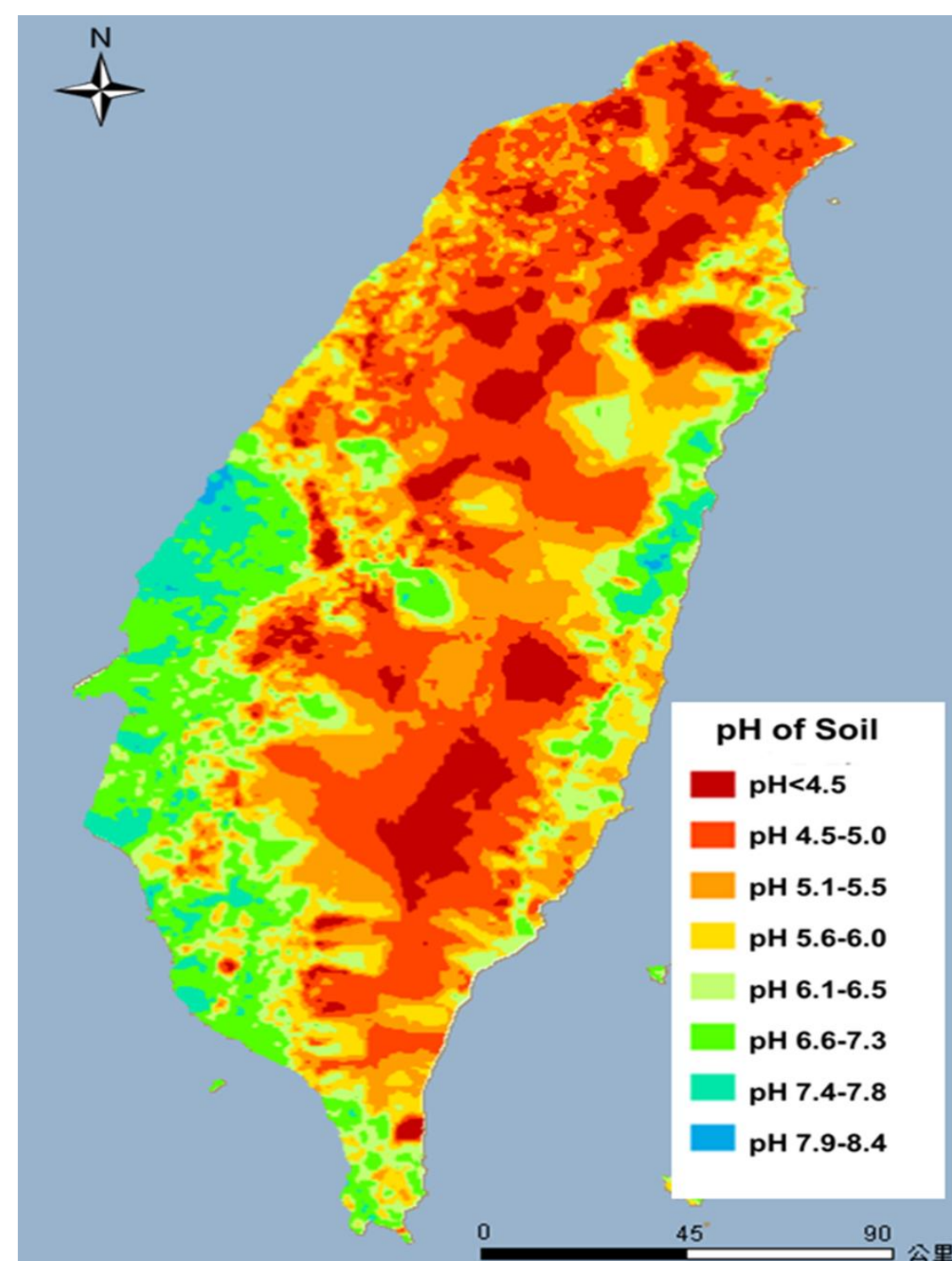


Fig.1 Distribution of strong acid soil in Taiwan.

□ Increasing the crop production

- Biochar applications is indirectly helpful crop growth by increasing pH, water and retention nutrient in the soil.
- Applying 2% biochar in pot cultivation of *Brassica chinensis* in different agricultural areas, the yields were mostly increased in acid soils (Fig.2).

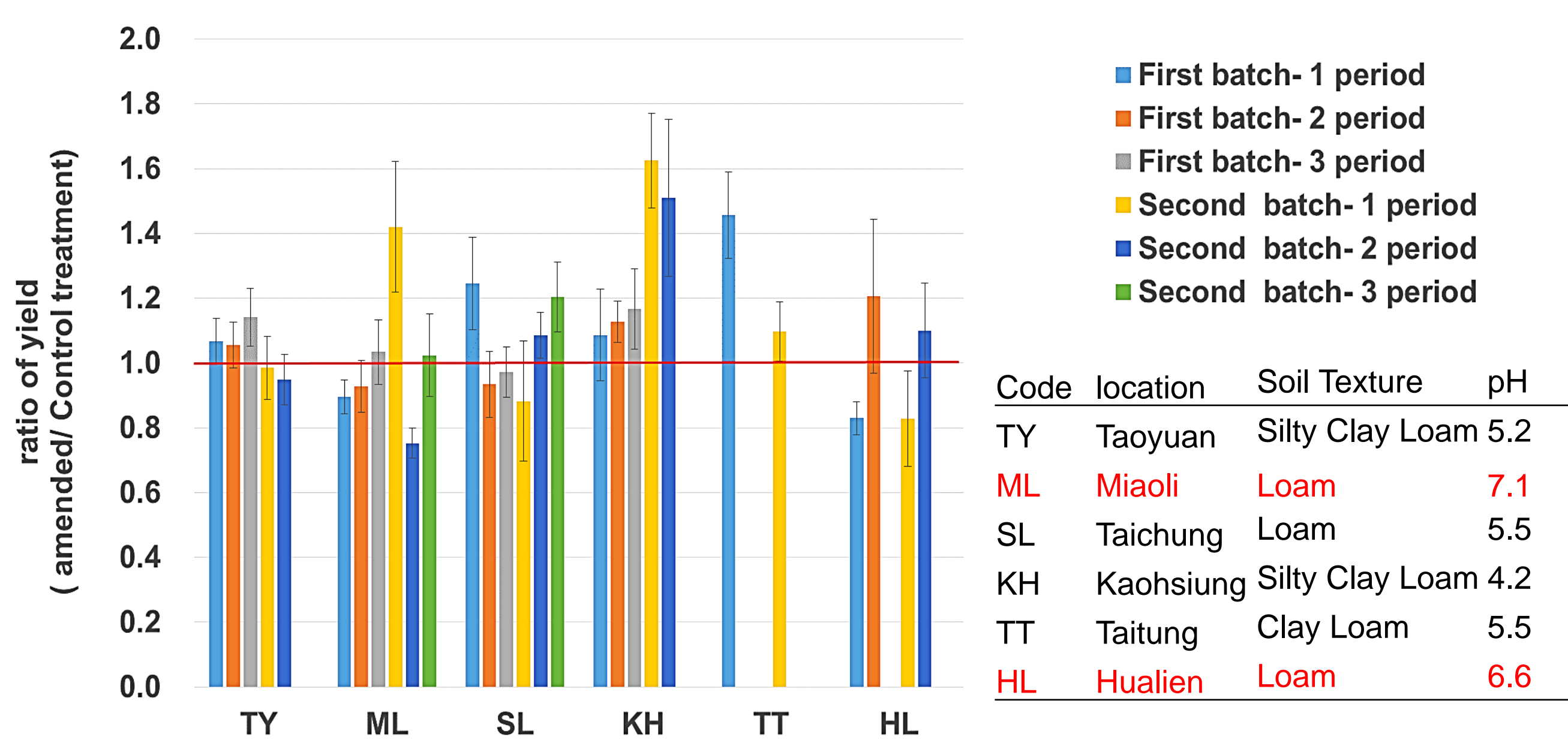


Fig.2 The yield of *Brassica chinensis* with applying 2% biochar in pot cultivation in different agricultural areas.

□ The greenhouse gases emission

- Three kinds of biochar of wood (*Dimocarpus longan*) biochar(F), mushroom waste biochar(M) and rice husk biochar (R) were applied in maize field. The CH_4 and N_2O have measured every 9 days by closed chamber method using FACE-EB3200 (Fig.3). The calculated emissions was estimated from planting to harvesting.

Table 1 The characteristics of biochar.

Characteristic	R	M	F
C_{org} (%)	65	85.5	90.5
N(%)	0.6	2.2	0.6
H(%)	2.3	2.2	2.7
H/ C_{org}	0.42	0.3	0.36
O/ C_{org}	0.22	0.03	0.09
pH	9.5	9.5	8
EC (mS/cm)	1	0.6	0.4
CEC (cmol/kg)	9.5	2.8	23.4
Surface area(m ² /g)	3.7	2.3	188.2
Ash(%)	31.9	18.7	7.2
water holding capacity(%)	83.1	43.6	48.7



Fig.3 The GHG measured by closed chambers method.

- The results of monitoring reveal that applying F and R has the trend of reducing N_2O emission, applying F and M has the trend of increasing CH_4 emission, but due to the high standard deviations of the data of the emission with biochar application do not reach significant difference with control in the two maize field. The CO_2 eq of CH_4 and N_2O emission is less than 0.5% of carbon sequestration of 2% biochar application.

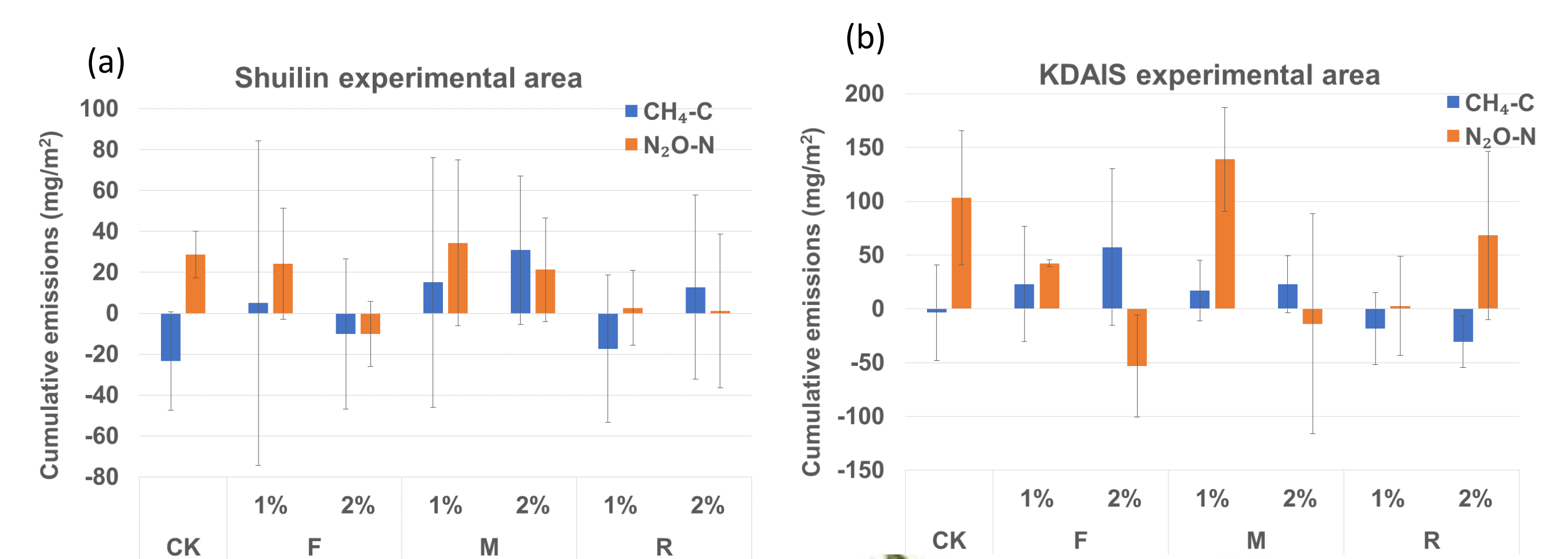


Fig.4 The CH_4 -C and N_2O -N emission after biochar application in maize field.(a) Shuilin experimental area;(b) KDAIS experimental area

Contact

Coordination Author:
Dr. Chiling Chen

Taiwan Agricultural Research
Institution (TARI), Taiwan R.O.C.

chiling@tari.gov.tw

+886-4-2331-7407

□ The contribution of biochar application to reach the goal of “4‰ Initiative” in Taiwan.

- The content of SOC in Taiwan is about 237 million Mg in 0-100cm depth.
- The soil carbon sequestration can increase 0.34 % per year if 2% biochar applied on 5000 ha acid soils per year.