PROTOCOL COMPARISON FOR QUANTIFYING IN SITU MINERALIZATION B.J. Wienhold, G.E. Varvel, and W.W. Wilhelm



Mineralization contributes significantly to N budgets in agronomic soils. Many factors affect mineralization and it remains difficult to accurately predict mineralization rates. Models for accurately predicting mineralization under field conditions are needed. In situ mineralization methods provide field based data needed for model development. Few studies have been conducted to determine how environmental conditions within in situ containers compare to those in the surrounding bulk soil. Our objective was to compare water content and temperature in soil within cylinders to that in adjacent bulk soil for cylinders installed with resin bags or soil + resin bags, and compare net mineralization for cylinders installed the entire season to that for cylinders installed at 28 to 30 day intervals in corn grown on a silty clay loam soil under rainfed or irrigated conditions.

Figure 1. Resin bag in base of mineralization tube.

Methods

Two continuous corn sites were used, one under irrigation and one rainfed.

Soil at both sites was a well-drained Aksarben silty clay loam.

An intact soil core, resin bag in situ mineralization method was used. A 4.75 cm diameter metal cylinder was inserted 17 cm into the soil, removed, and the bottom 2 cm of soil was replaced with a nylon bag containing resin (Fig. 1).

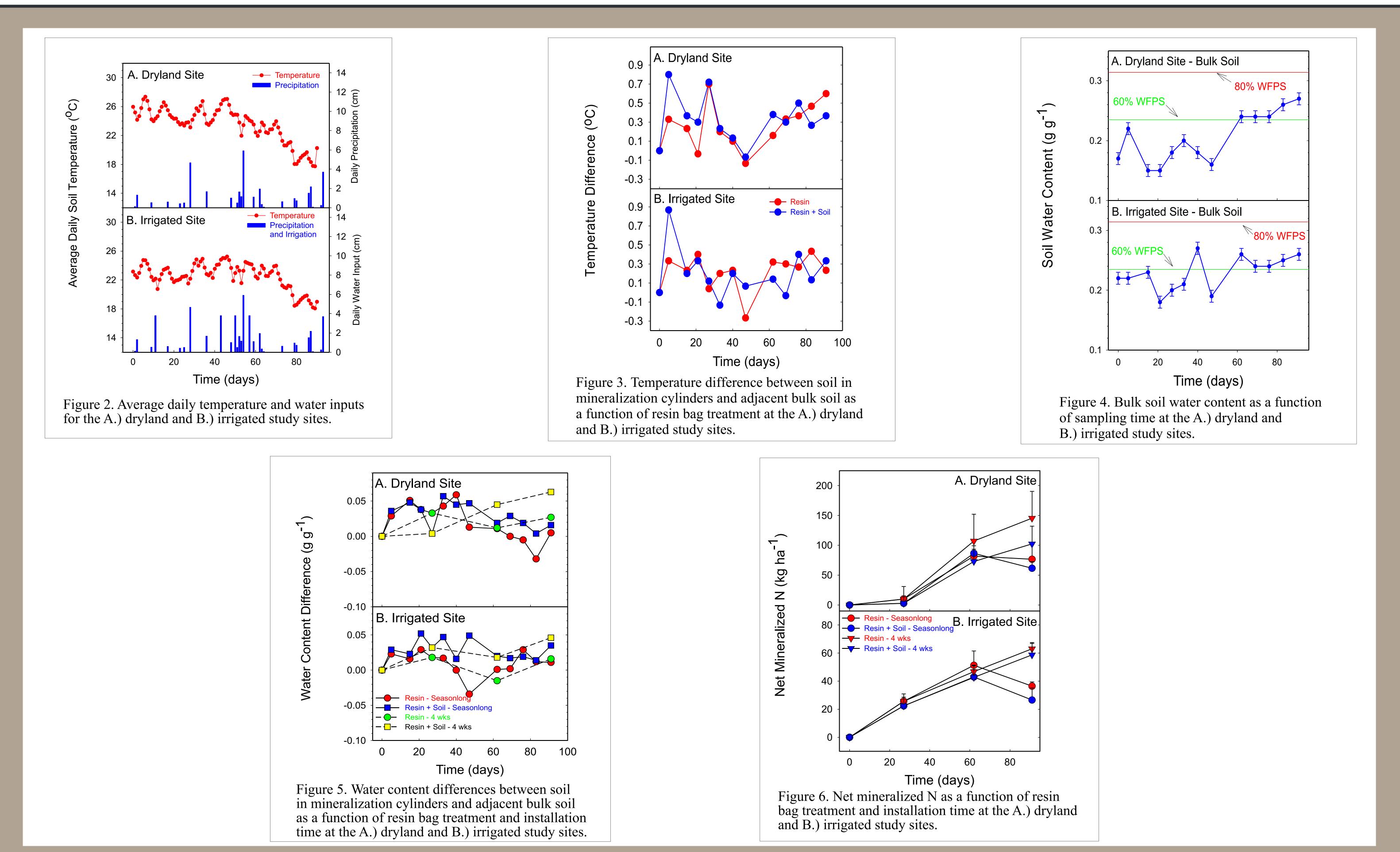
Two resin treatments: resin alone and resin plus soil.

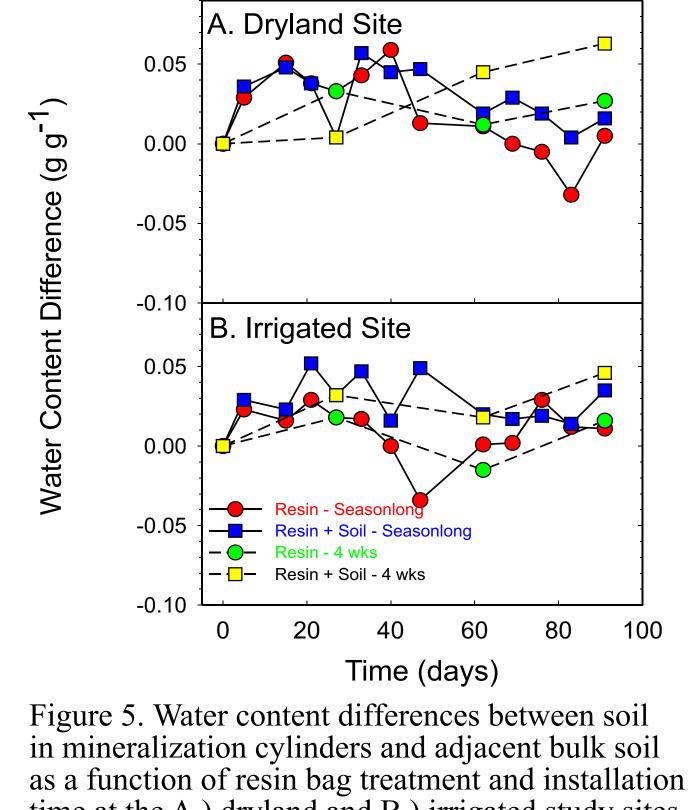
Two installation time treatments: Seasonlong, all cylinders installed on day 0 and collected on day 27, 62, and 91; four week installation, tubes installed from day 0 to day 27, installed on day 27 to day 62, and installed on day 62 to day 91. Weekly comparison of soil temperature and water content between cylinder and adjacent bulk soil.

Inorganic N determined for resin and soil in cylinders collected on day 27, 62, and 91.

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Introduction





RESULTS

Average daily soil temperature at the dryland site ranged from 17.7 to 27.4°C and averaged 23.5°C (Fig. 2A). This site received 33.8 cm of precipitation. Average daily soil temperature at the irrigated site ranged from 18.1 to 25.2°C and averaged 22.5°C (Fig. 2B). This site received 33.8 cm of precipitation and an additional 15.2 cm of irrigation. Soil temperature in cylinders was greater than that in adjacent bulk soil at both sites but never exceeded 1°C at the dryland site (Fig. 3A) and was < 0.5°C for all but one date at the irrigated site (Fig. 3B).

Bulk soil water content at the dryland site (Fig. 4A) was lower than at the irrigated site (Fig. 4B) for the first 50 days of the study and soil water content was near optimum for aerobic microbial activity after day 50 at both sites. Soil water content in cylinders was slightly greater than that in bulk soil at both the dryland (Fig. 5A) and irrigated (Fig. 5B) sites.

Net mineralization was similar among resin treatments and installation times at the dryland (Fig. 6A) and irrigated sites (Fig. 6B) for days 0 to 60. After day 60 net mineralization in cylinders installed every 4 weeks increased while that in cylinder installed seasonlong decreased suggesting loss of inorganic N from the resins.

CONCLUSIONS

Soil within cylinders is warmer and moister than adjacent bulk soil but the differences are relatively small.

Care is needed when installing cylinders in wet soil to avoid soil compaction.

Resin bags should not be installed in the field for over 60 days.

This in situ method can be used to compare management effects on mineralization or provide field-based data for model development and validation.