ウズベキスタンにおける固定交互隔畝灌漑下での塩分と根群分布

Salinity and root distribution under fixed skip furrow irrigation for Maize in Uzbekistan

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Introduction

Skip furrow irrigation would be a cost-effective water saving method and mitigate soil salinity buildup. This method can save water by reducing the amount of water supplied and evaporation losses. Conventional skip furrow switches watered furrow at each irrigation. But if the watered furrow is fixed on one side, then we may further save water and plants may extend root preferentially and more effectively. We call it as Fixed Skip Furrow (FSF) Irrigation. A possible negative side effect of this method is that severe salt build up may occur on the shoulder of ridge of the opposite site due to capillary pressure gradient to the non-irrigated furrows side. Therefore, the purposes of this study were to evaluate the water productivity of FSF and to investigate salt distribution under the method.

Materials and Methods

An experiment was conducted from late June in an experimental field in Karakalpakstan, Uzbekistan. The field area was 40.5 m wide and 4.5 m long, with 54 of ridges with a spacing of 0.75 m. We then set up and three treatments: normal furrow irrigation(F), alternating skip furrow irrigation(SF), and FSF. Each treatment had three replicates consisting of furrows. Maize was sown on 25 June. Root and soil samples were collected in 24 October. According to observed soil moisture under SF, SF was carried out only for the first two irrigation events. We thus excluded the results of yield survey for SF.　Although the water supply may have halved in the treatment area of the FSF, the yield was also nearly halved, i.e., water productivity did not show any improvement for this crop, as shown in Figure1 .Additionally,Soil moisture sensors were buried in furrows and volumetric water content was also investigated and recorded in the investigated area of fixed skip furrow irrigation method. In the non-irrigated furrows, the surface layer was extremely dry, as shown in Figure2.

Results and Discussion

In the fixed skip furrow irrigation method, it was confirmed that salt accumulates in the shoulder of non-irrigated side of the bed as shown in Figure3. Additionally, in this case, large portion of the roots extended

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into the non-irrigated furrows side as similar density as watered furrow, as shown in Figure4. This may have wasted energy causing a significant loss in above ground biomass. In other words, it was found that they lacked the flexibility to extend their roots to places with abundant moisture. This might be the main reason why the WP of FSF did not improve.

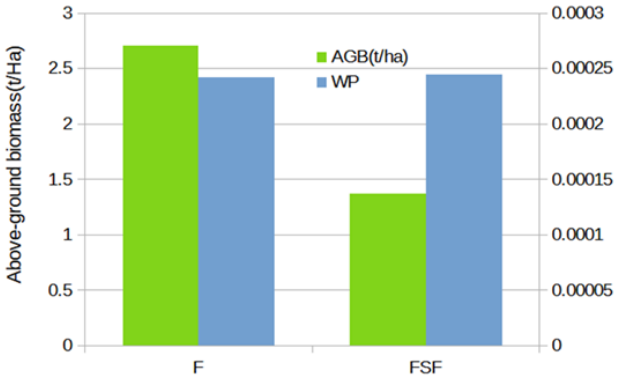

Figure1 Comparison of above-ground biomass and water productivity

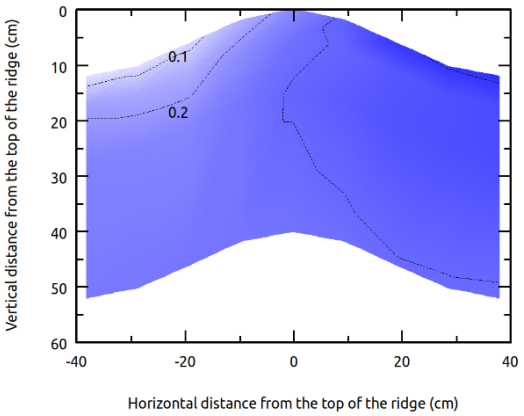

Figure2 Profile of volumetric water content under FSI

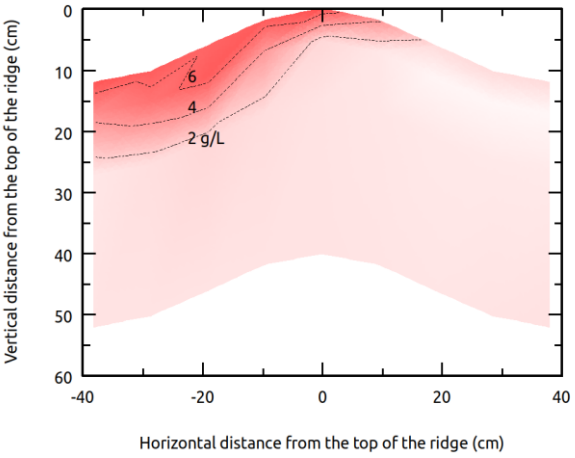

Figure3
Profile of the mass of salt volume under FSFI

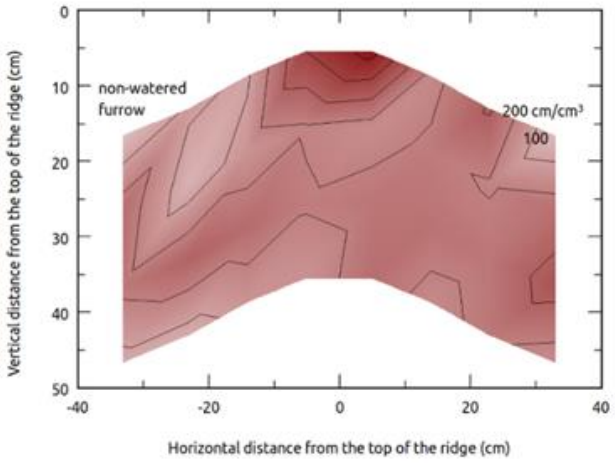

Figure4
Profile of root length density under FSFI