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Towards a More Water Efficient Agriculture in Central Asia through Agroforestry

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Abstract

Most of the agriculture in Central Asia depends on irrigation, e.g. agriculture in such areas like the Ferghana Valley or along other rivers in Central Asia. The major source of irrigation water are rivers. Glacier melt, snow melt, and rain fall in the mountains generate the runoff of those rivers. In the course of climate change, glaciers melt down so that a decrease in runoff by 20 % – 50 % is expected by 2050.

Against this background it is of crucial importance to increase water productivity of irrigated agriculture and build resilience against water shortages. One method to achieve this goal might be introducing agroforestry, in particular shelterbelts. Literature suggests that crop evapotranspiration is reduced and crop yields are increased inside such shelterbelt systems compared to outside such systems. Though, water consumption of the trees that form shelterbelts is unknown.

In order to understand the water consumption and water productivity of a shelterbelt agroforestry system versus a corresponding non agroforestry system, tree water consumption and micro climate were assessed during the growing season 2016 on two representative sites in Chui Valley, Kyrgyzstan and Kazakhstan. Tree water consumption was assessed through sapflow measurements. Micro climate data were used in order to calculate crop evapotranspiration. The measurements of tree evapotranspiration together with measurements of crop evapotranspiration allowed compare the overall evapotranspiration of a shelterbelt system with a non-shelterbelts system. Data on crop yield losses and benefits from shelterbelt trees were collected through farm interviews.

Results indicate that wind speed is significantly reduced inside the two shelterbelt systems. As wind speed is a major driver of crop evapotranspiration, crop evapotranspiration inside shelterbelt is reduced compared to outside the shelterbelt systems. The overall water consumption of shelterbelt system was found to be lower by 10 % compared to non-shelterbelt systems. Income from shelterbelt trees overcompensated crop yield losses.

Keywords: Elm, Penman-Monteith, poplar, sapflow, shelterbelt, water productivity, wind break

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