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Effects of Alley Cropping on Microclimate and Some Winter Crop Productivity in Northern Sudan

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Abstract

Field experiments were conducted in the semi-arid regions of northern Sudan during 1999–2000 to examine the influence of micro-environmental elements on the growth and yield of wheat, faba bean and common bean in an alley cropping system. Above-ground interaction was examined by installing a series of weather stations in different zones of the alleys and control plots for monitoring the microclimatic changes. Shade behaviour (direction and length) was monitored in a systematic way and at regular intervals. Results showed that the solar irradiance in alleycropping plots was reduced by 37%. Average reduction in maximum and minimum temperature was 1.4°C and 0.7°C respectively, while increase in relative humidity was 8%. The wind speed was 66% of the control; Irrigation water used in the alleycropping plots was 27% less than that used in control plots.

The monitored climatic factors had substantial effects on crops behaviour and yields. The southern zone of the alley was permanently shaded, throughout the growing season. This zone gave the highest increase in relative humidity and highest reduction in air temperatures; however, it had the lowest value of solar irradiance. The yields were, therefore, reduced in this zone by 6.9, 7 and 20% for wheat, common bean and faba bean, respectively. However, the high increase in yield in the central alley had compensated for the reduction caused by low radiation in the southern alley. Hence, the average yields in the alley plots increased significantly ($p = 0.01$) over the control by 69, 15 and 10% for wheat; faba bean and common bean respectively. Ultimately, it becomes evident that the solar radiation was the most influential environmental factor responsible for yield reduction or increase in these alley cropping trials

Keywords: Irradiance, microclimate, alley-cropping, agroforestry