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“Development on the margin”

## Microclimatic Changes in Different Alley-cropping Width and their Impact on Growth and Yield of Wheat in the Dry Zone of Central Sudan

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### Abstract

Wheat is the second most important cereal crop in the Sudan. To meet its ever-increasing demand, its cultivation spreads southwards into the central plain of Sudan, where there is plenty of land and water available. However, the highly stressed environment of the central Sudan is impeding wheat production. Thus, producing wheat in an alley cropping system poses a challenge to agroforestry research. Field experiments were conducted during 2008–2010, at the Agroforestry Research Farm of the Gezira Research Station in the dry zone of central Sudan (latitude 13.5 - 15° N and 32.5 - 33.6° E). The objective of the study was to examine the effect of alley-cropping microclimate on wheat production. Experimental design was a split-split plot. Main plots were tree species (*Acacia ampliceps* and *Acacia stenophylla*), the sub-plots were alley width: 6, 8, 10, 12, 16 and 20 m and the sub-sub plot were assigned for wheat (*Triticum aestivum*, variety Imam). Aboveground interactions were examined by installing a series of weather stations in different zones of the different alley width and control plots. Solar energy at ground was measured using tube solarimeters.

Results showed that, in alley cropping plots, there were significant ( $p < 0.01$ ) reductions in wind speed, solar radiation, air temperatures and high increases in relative humidity. With regard to these parameters *A. ampliceps* had better results than *A. stenophylla*. On spacing basis, the narrow spacing (6–10 m) had a higher increase in relative humidity (7 - 10 %) and higher reduction in maximum temperature (1.3 - 2.6°C). The grain yield and yield components (no. spikes, seed weight per head, and 1000-seed weight) had higher values in the narrow alley width (6 - 10 m width). Increase in grain yield in the different alley widths ranged between 33 and 67 % and between 33 and 59 % in *A. ampliceps* and *A. stenophylla*, respectively. In the two consecutive seasons, the 8 m alley – with optimum radiation – had the highest increase in grain yield of 67 % (1616 kg ha<sup>-1</sup>) and 59 % (1545 kg ha<sup>-1</sup>) for *A. ampliceps* and *A. stenophylla*, respectively. The lowest yield was obtained in the 20 m alley, which had a similar increase in grain yield (33 %) for both tree species.

**Keywords:** Alley widths, dry zone, microclimate, solar energy