

IMPACT: CROP YIELD

Reference 28

Bayala, J; Sileshi, GW; Coe, R; Kalinganire, A; Tchoundjeu, Z; Sinclair, F; Garrity, D 2012 Cereal yield response to conservation agriculture practices in drylands of West Africa: A quantitative synthesis JOURNAL OF ARID ENVIRONMENTS, 78, 13-25. 10.1016/j.jaridenv.2011.10.011

Background and objective

To address the decline in crop productivity in the drylands of West Africa, many initiatives have focused on combating soil degradation. The lack of quantitative synthesis in terms of the nature and magnitude of response and the contrasting results reported regarding the potential of conservation agriculture call for a comprehensive and quantitative analysis. The overall aim of assessing whether or not there is a consistent evidence for yield benefits using conservation agriculture with or without trees in the drylands of West Africa. The specific objectives of this analysis were to: 1) provide a comprehensive, quantitative synthesis of existing reports on the effect of conservation agriculture with and without trees on crop yield in general; 2) conduct parametric estimation of the magnitude of yield response. Here, only results regarding the effect of parkland and coppicing trees on yields are reported.

Search strategy and selection criteria

The studies included were located by searching through computer library databases (ICRAF, FAO, and Google Scholar). However, this alone does not provide a comprehensive search and therefore it was followed up with supplementary searches for 'grey' literature such as student theses and unpublished research reports. 1) The data are from one of the four countries: Burkina Faso, Mali, Niger and Senegal; 2) The publication contains reported crop yield of one or more of the 6 conservation agriculture practices and a corresponding control plot where the practice was not applied, with mean yields either reported numerically or graphically. The yield data from rotations were not time-averaged by including years when other crops were grown while data from tree-based systems were based on total area; 3) Data were from well designed and replicated experiments or observational studies either on a research station or on farmers' fields.

Data and analysis

Mean difference in yield data were analyzed by simple summary statistics and calculation of empirical cumulative distributions. Data on mean difference in grain yield (D) were further analyzed using mixed models fitted using Restricted Maximum Likelihood (REML). Besides null hypothesis testing, statistical inference was based on the predicted means and their 95% confidence intervals (CI).

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
63	Cereals in West Africa	Parkland trees, coppicing trees	No trees	Metric: Crop yield; Effect size: Difference of of the considered metrics between intervention and control	62.5

Results

- A large proportion of the cases recorded a reduction in grain yield ($D < 0$) in parklands (66%) and coppicing trees (44%) relative to the control.
- Similarly, straw yields were lower than or equal to the control in over 50% of the cases in parklands, 37% of the cases in coppicing trees.
- Coppicing trees increase crop yield of millet and maize.

Factors influencing effect sizes

- Rainfall : Differences in mean yield varied significantly with rainfall in parkland and coppicing legumes.

Conclusion

Parkland trees showed no effect on crop yields while coppicing trees increased crop yield of millet and maize while had no effect on sorghum.