Holistic assessment of sustainable intensification and resilience of farming systems in Tanzania

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AfricaRISING farms' performance

- Based on 3 Selected (S) farms, 3 Comparison (C) farms and survey of 579 HH in Babati, Kilolo, Kongwa and Mbozi districts.
- Farm S1 performed better for all indicators compared with C1, except farm decision making and nitrogen efficiency. Farm 1 performed above average for most indicators, however productivity was slightly lower than the dataset mean.
- Farm S2 only performed better than C2 in terms of collective action and education. C2 performed better than S2 in terms of maize productivity and Household Dietary Diversity Score (HDDS), but had low performance on protein and dietary energy productivity, nitrogen efficiency, education, collective action, farm decision making index and asset ownership distribution. The nitrogen balance was worse than dataset mean. Erosion is a problem for this farm, however less than dataset mean.
- Farm S3 performs better than C3 for all indicators except the farm decision making index. Productivity of both farms is lower than dataset mean. Compared with dataset mean, farm S3 performed better for all indicators except productivity and nitrogen balance. Women were highly included in farm decision making and asset ownership distribution. C3 performed below or around dataset mean for most indicators.
- Comparing the three selected farms with the whole dataset shows that all three farms perform better at all domains, except productivity and nitrogen balance. Especially performance of farm gross margin, HDDS, Women Dietary Diversity Score (WDDS) and collective actions is far above dataset mean.

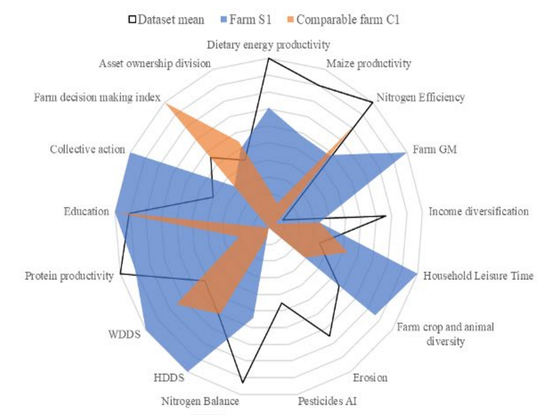


Fig. 1a. Farm comparison 1

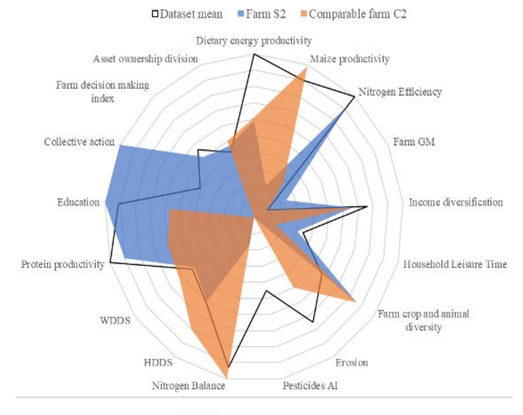


Fig. 1b Farm comparison 2

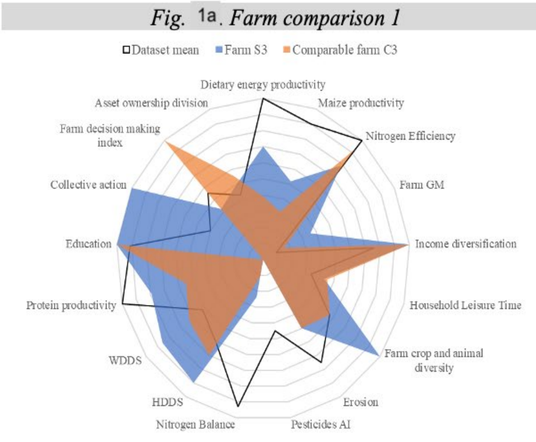


Fig. 1c. Farm comparison 3

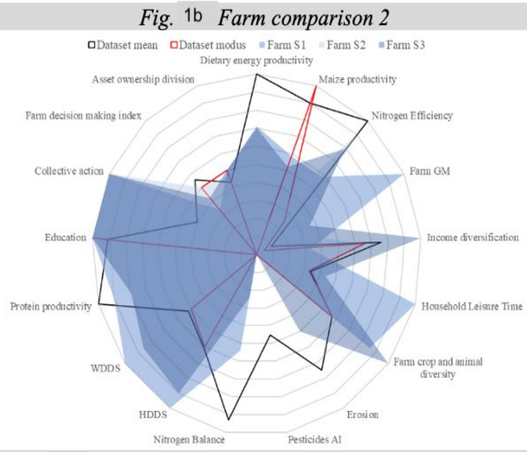
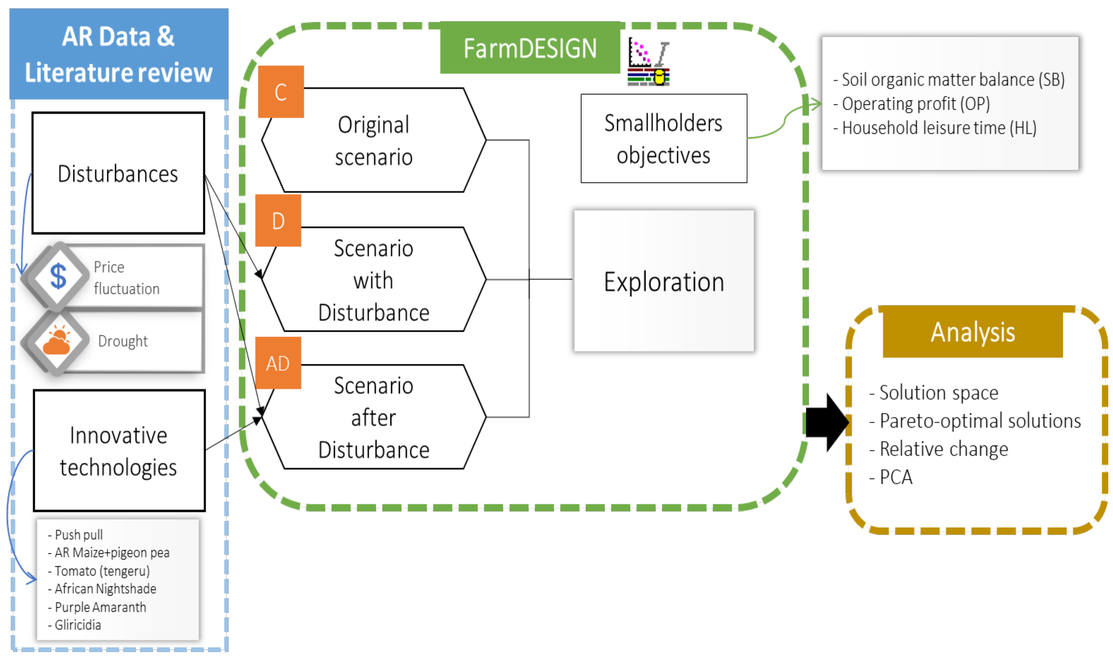


Fig. 1d Selected farms compared with dataset mean and modus

Fig. 1 provides the visualizations of farm performances of the three selected farms that have been part of the program for several years (Farm S1, S2 and S3), the comparable farms (Comparable farm C1, C2 and C3), and the dataset mean and modus.

Vulnerability and Resilience

- Sustainable intensification pathways were explored (baseline vs adoption of AR technologies) with FarmDESIGN. ARBES database.
- Farming systems were exposed to a drought and price shock. In the price disturbance scenario, only the staple crop prices decreased on a yearly basis, and in the drought disturbance scenario, only yield, labour amount, and price were adjusted.
- The simulation results show that in general farmers do decrease vulnerability and increase resilience when deploying AR technologies.
- The drought impact was more influential, and Africa RISING technologies were more effective for higher resilience to drought than to price fluctuation.
- A higher number (diversity) of crops can alleviate negative impacts of price and drought disturbances on OP, SB, and HL.
- Optimization of the objectives and trade-offs among the objectives were dependent on adopted crops and technologies. The ideal farming reconfiguration was different due to trade-offs among them.
- For operating profit, farmers could plant more high-income crops e.g. African nightshade and tomato.
- For soil organic matter, SOC enhancing technologies would be beneficial, e.g., intercropping with legumes, conservation agriculture,...
- For household leisure time, farming systems could include more less-labour demanding crops such as sorghum.



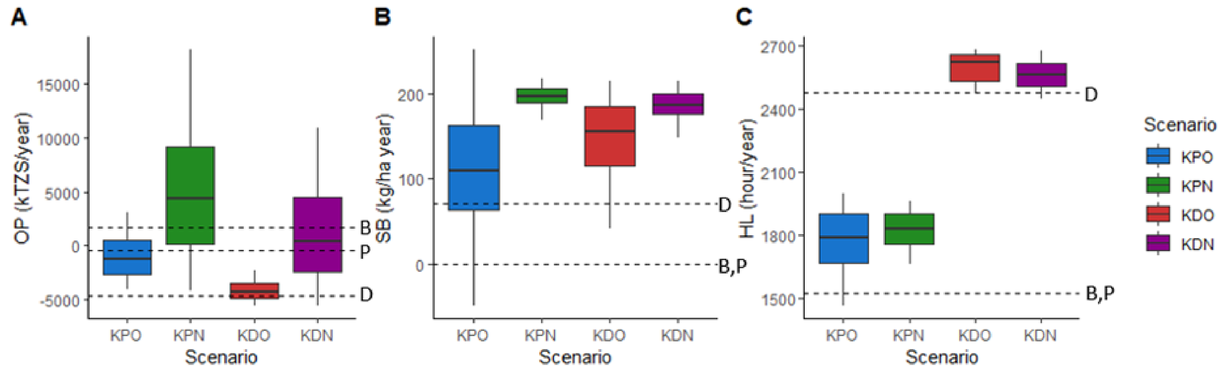


Figure 1. Example of farm performance under different scenarios and multiple-objective optimization. OP: operating profit. SB: soil organic matter balance. HL: household leisure time. KPO: farm K under price fluctuation scenario with original farm configuration. KPN: farm K under price fluctuation scenario with AR technologies adopted. KDO: farm K under drought scenario with original farm configuration. KDN: farm K under drought scenario with AR technologies adopted.

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