Cowpea Living Mulch as a promising intervention in Northern Ghana

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Description of the technology

Cowpea living mulch is the intercropping of cowpea as live mulch in a maize-based cropping system. The cowpea is planted at 1-2 weeks after planting the maize in the field to give the maize competitive advantage for resource (water, light, nutrients) utilization. The use of grain legumes such as cowpea provide food for human consumption and feed for livestock in addition to improving soil quality which makes the technology more attractive to smallholder farmers compared with using non-grain legume crop. To avoid the cowpea from climbing the maize plants as a stake, the spreading type of cowpea is the recommended variety for this technology.

Cowpea living mulch technology at Upscaling farmer field at Nyangua community in Upper East Region (Photo Credit: Nurudeen (IITA), September 2018).

Key message

- Intercropping cowpea as living mulch in maize cropping system increased maize grain yield (34%) and protein production (75%) relative to that of the sole maize cropping system.
- It reduced weed biomass (78%) and weeding frequency from twice to once which gives farmers adequate time to do other agricultural related activities.
- It improved soil moisture storage (80%) at tasseling stage of maize, soil nitrogen (17%) and soil quality (≥50).

Condition that favor uptake

Agroecological conditions: Maize and cowpea require well drained and fertile soil with a pH of 5-7.2 to grow best. Maize requires a total crop water need of 500-800 mm per growing period while that of cowpea is 300-500 mm per growing period and therefore, the technology does well in areas with annual rainfall of 700 mm and above per cropping season. Both crops perform well in areas with a temperature range of 18-35°C.

Access to inputs and markets: The technology performs best in areas with access to effective agro-input dealer networks for easy access to improved seeds, fertilizer and market for maize and cowpea grains.

Livestock presence: The presence of cowpea may favor the technology as the cowpea will provide feed for the livestock, however, the extra labor may be required for harvesting and transporting of fodder to home for livestock feeding.

Alignment with household resource endowments

The technology can be implemented by all maize growing household at any level of resource endowment. Farmers who have poor access to the mineral fertilizer also benefit from biological nitrogen fixation from the cowpea as live mulch. Household with livestock may also be interested in the cowpea fodder as feed for their livestock. Farmers need to plan for extra labor that may be required for harvesting and transporting the fodder to the household for livestock feeding. Access to land resources allows for optimal implementation of the technology for women farmers.

Necessary ingredients for implementation

Appropriate varieties: The use of improved varieties that respond to farmers needs such as short duration maize varieties (80-90 days) that are high yielding and drought resistant. The cowpea variety for the mulching should be the spreading type as semi-erect and erect types will climb the maize plants if used.

Agronomic practice: The maize seeds should be sown at inter-row spacing of 75 cm and intra-row spacing of 40 cm. The cowpea seeds should also be sown at 75 cm inter-row spacing starting from the mid-point of the first two maize rows on the field and intra-row spacing of 20 cm. First weeding may be required at 14-21 days after planting depending on the weed growth in the field.

Apply NPK fertilizer at 40-40-40 kg ha^{-1} N P_2O_5 K_2O fertilizer to the maize plants at 10 days after planting and top dress with sulphate of ammonia fertilizer at 20 kg ha^{-1} N at 21 days after first application of fertilizer. Cowpea nodulate well with the native rhizobia and therefore does not require inoculant.

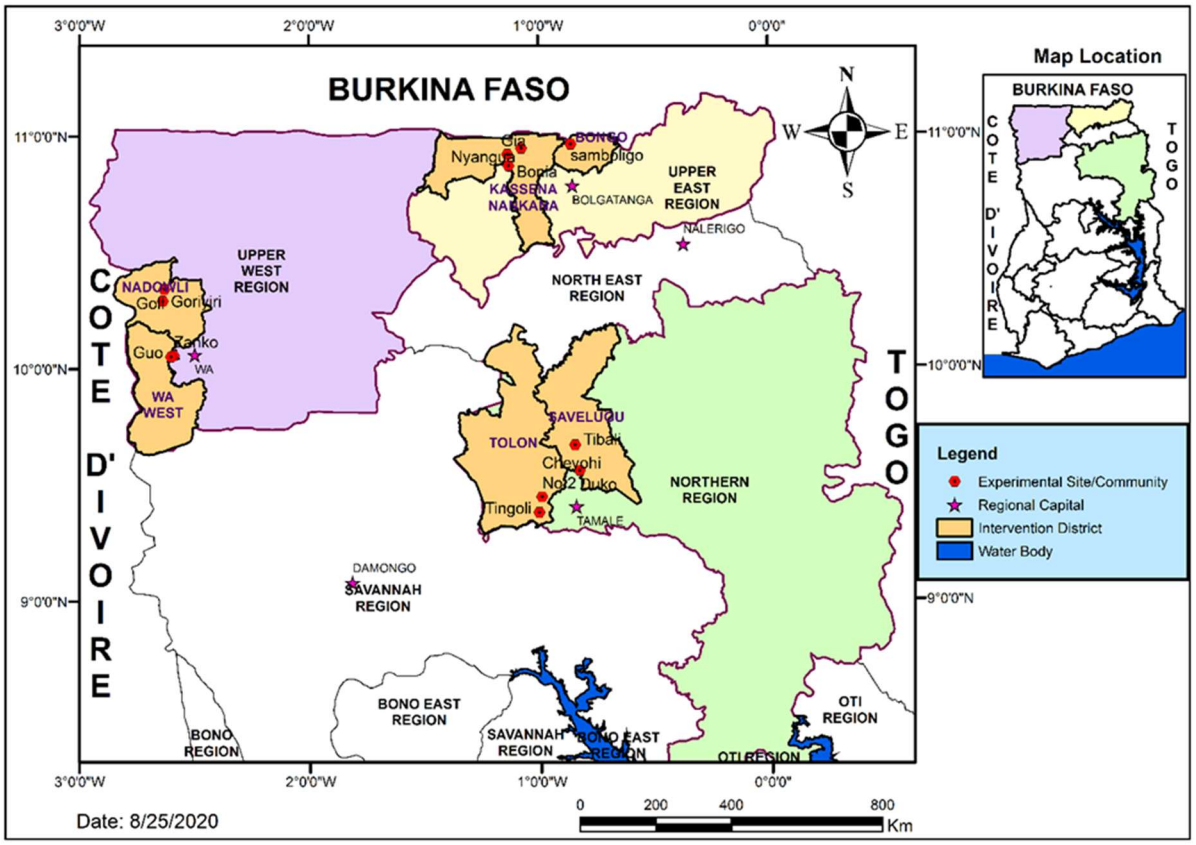
Adaptation possibilities

Other grain legumes such as groundnut (*Arachis hypogyeae*) preferably the spreading type and soybean (*Glycine max*) could be used as live much alternatives to cowpea in areas where farmers prefer groundnut or soybean and areas where groundnut and soybean grows better than cowpea. However, the maturity period of the groundnut and soybean varieties selected as alternative to cowpea should considered in order to meet the harvesting period of the season.

Where was the technology validated?

The information about the technology is from the results of on-farm validation trials which consist of technology parks (Researcher led) and Upscaling (Farmer led) trials conducted in 6 Districts and 12 communities across the 3 northern regions of Ghana. This technology was validated in 12 technology

parks and 129 upscaling fields during 2017, 2018 and 2019 cropping seasons. The size of a technology park was 357 m^2 of land whilst that of the upscaling field was 4000 m^2 of land.



Technology park experimental site and intervention communities in the Northern Region, Upper East Region and Upper West Regions

Potential benefit to users

Food security and dietary diversity: The technology increased maize grain yield which in turn increase the calorific food available to the household over a period. The harvest of cowpea grains provided source of protein to enrich household dietary diversity and nutrition.

Soil fertility: The presence of cowpea as live mulch helps to fixed biological nitrogen into soil and the litter from the cowpea also help to improve the soil nutrient and carbon. The cowpea mulch increased soil moisture storage in the topsoil (0-20 cm) by 80% at tasseling of maize plants, soil nitrogen by 17% and overall soil quality by 50%.

Weed control: The canopy of the cowpea mulch helps to reduce niche available to weeds in maize fields. This technology reduced weed biomass by 78% relative to maize fields without cowpea living mulch. The technology also reduced weeding frequency from twice to one depending on how fast the canopy of the cowpea covers the soil surface. This gives farmers ample to do other agricultural related activities during the peak demand of labor for agricultural activities within the cropping season.

Livestock productivity: The quality of cowpea fodder as feed for livestock and its positive impacts on livestock productivity is well studied, however, specific data from this study is lacking.

Things to worry about

Labor: The technology increased labor requirement for activities such as planting (65%), harvesting (221%) and processing which are mostly dominated by women and children. It also increased the time spent for first weeding (35%) as farmers must apply some level of care for the cowpea plant during this period. Harvesting of the cowpea is also impeded by the maize plants as farmers must go through the middle of maize plants to harvest the cowpea.

Access to inputs: Sometimes access to improved seed varieties and fertilizers may be hampered as a result of low income from most smallholder farmers.

Fluctuating market prices: Maize market prices are subjected to fluctuation depending on prevailing socio-economic conditions. This may have an impact on the livelihoods of smallholder farmers as lower prices of maize could result in loss of profit given the initial investment towards production.

For further details about the technology:

Abdul Rahman N., Larbi A., Berdjour A., Hoeschle-Zeledon I. and Kizito F. (2020). Cowpea Living-Mulch Affects Maize Grain Yield, Weed Biomass and Soil Quality in Northern Ghana. In ASA-CSSA-SSSA Annual Meeting Abstracts. ASA-CSSA-SSSA Annual Meeting, 9-13 Novermber2020, Phoenix, Arizona, USA.