Conservation agriculture and mechanization for smallholder agriculture: A win-win for agriculture and the environment

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Conservation agriculture (CA) is now practiced on over 157 million hectares worldwide but adoption is still limited in smallholder farms of Asia and Africa. The practice of CA involves crop production with minimum soil disturbance, soil cover with crop residue or mulch and rotation of diverse crops. Research in Bangladesh demonstrates the benefits of CA for smallholders: yields are maintained or increased; crop production costs are reduced; savings of fuel; savings of labour, and; more timely sowing of crops. In addition, the benefits for the environment include: decreased greenhouse gas emissions, and increased soil organic carbon. Development of CA in rice-based cropping systems is under way in Bangladesh and the Eastern Gangetic plain. A prerequisite for a system-based CA is to use minimum soil disturbance for rice. Transplanting of rice into non-puddled soil with minimum soil disturbance is feasible by strip tillage followed by inundation to soften the soil in the strip. The Non-puddled transplanting was reliably able to produce as much grain yield as the conventional tilled and puddled soils. Moreover, with continuation of minimum soil disturbance by strip planting methods, the yield of both aman and boro rice crops equal or exceed those of the conventional puddling and transplanting of rice. With mechanised transplanting, the grain yield was similar between non-puddled soil with minimal disturbance and conventional soil puddling for rice establishment. We conclude that changing to transplanting in non-puddled soil with minimal disturbance represents minimal risk of yield loss for rice producers while providing labour, fuel and water savings. Ongoing studies are examining the water balance in rice fields after the adoption of CA practices in rice as well as the other crops in the rotation. The accumulation of increased soil organic carbon takes 2-3 years after adoption CA to be measurable in soil in 3-crop per year rotations. Shortages of labour and intensive crop production (cropping intensity in Bangladesh is 190 %) are driving interest among farmers in small-scale mechanization of planting based around the Chinese-made two-wheel tractor (2WT; 12-15 horsepower). A number of planters, attached to the 2WT, are available in Bangladesh for sowing seeds with minimum soil disturbance. In the present project, the Versatile Multi-crop Planter (VMP) has been designed and extensively tested on a range of soils and crop species, with many design and performance improvements over time. At this stage strip planting (rotating blades till a strip 5-8 cm wide for planting seeds and placing fertiliser but < 25 % of the soil is disturbed) is favoured over tyne or disk openers. Agronomic practices for mechanised seeding are under development including systems for effective weed control. Integrated weed control involves the use of herbicides, retained crop residue and row planting to suppress and optimise control of weeds. Further challenges are to develop a supply chain for planters and planting services. Commercialisation plans for scaling out the use of planters for CA involve demand creation among farmers and then support to local service providers (LSP) and manufacturers to develop profitable business models. High level dialogue is required to create an enabling policy environment in which the private sector can promote CA and small-scale mechanization so that benefit to farmers and the environment can be realised.