New Tillage Practices for South Asia: *Plowing Less to Save Water and Slow Global Warming*

For decades the continuous rotation of rice and wheat—two crops or more per year—has provided food and livelihoods for hundreds of millions of rural and urban poor in South Asia. Now a crisis looms. The population is growing at more than 2% (nearly 24 million additional mouths to feed) each year. Yet agricultural land area dwindles and yield increases are leveling off. In the next two decades, fresh water will become increasingly scarce in South Asia, and water tables in some areas are already dropping as much as one meter per year. Finally, heavy diesel use and crop residue burning pose local health hazards and add significantly to global warming.

Simple Changes, Astonishing Benefits

Alternative tillage practices that reduce costs and raise productivity are being tested and promoted by the Rice-Wheat Consortium for the Indo-Gangetic Plains (RWC).[1] It turns out that widespread adoption of one or several of these reduced tillage methods will also bring significant environmental benefits.

1 The RWC is an alliance of national organizations, CIMMYT, the International Rice Research Institute (IRRI), other international centers, and advanced research institutes that fosters sustainable productivity in rice-wheat farming systems of South Asia. The RWC is an ecoregional initiative of the CGIAR, with CIMMYT as the convening center.

For example, current land preparation practices for wheat after rice involve as many as 12 tractor passes. Changing to a zero-till system on one hectare of land would save 98 liters of diesel and approximately 1 million liters of irrigation water.[2] Using a conversion factor of 2.6 kg of carbon dioxide per liter of diesel burned, this represents about a quarter ton less emissions per hectare of carbon dioxide, a principal contributor to global warming.

These benefits increase dramatically if extended across even a portion of the rice-wheat region's 12 million hectares. Adoption of zero-till on, say, 5 million hectares would represent a savings of *5 billion cubic meters of water* each year. That would fill a lake 10 km long, 5 km wide, and 100 m deep. In addition, annual diesel fuel savings would come to *0.5 billion liters*—equivalent to a *reduction of nearly 1.3 million tons in CO_2 emissions* each year.

Scientists in the RWC are also working with farmers to cut down on the burning of crop residues, which amount to as much as 10 t/ha, producing some 13 t of carbon dioxide. Eliminating burning on just 2 million hectares would reduce the huge flux of yearly CO_2 emissions by *17 million tons.*[3] Leaving stubble on the field, rather than burning it or incorporating it, also leaves a better habitat for beneficial insects to proliferate—a benefit that has not yet been quantified.

How Likely Are These Scenarios?

Alternatives to burning residues are still in the exploratory stage, but reduced tillage practices are catching on quickly, simply because they are so attractive to farmers. For example, two methods promoted by the RWC—direct drilling and surface seeding—allow farmers to prepare soils and sow wheat in a single tractor operation after the rice harvest. How can one argue with a practice that saves 75% or more fuel, obtains better yields, uses about half the herbicide, and requires at least 10% less water? Farmers save at least US$ 65/ha in production costs, which makes a big difference to their profit margin.

This year, farmers used direct drilling with locally manufactured drills to plant 8,000 ha in Haryana, India, and 5,000 ha in the Pakistan Punjab. The area of adoption has increased ten-fold each year for several years. The main constraint on more rapid expansion has been a lack of good quality, fairly priced seed drills. Small private shops are beginning to produce more drills in response to rising demand.

Small-scale mechanization is also spreading in the form of the two-wheel tractor and a range of new implements. Used widely by smallholders in China and Bangladesh, two-wheel tractors are being tested as a one-pass, reduced-tillage system and adapted by farmers in Nepal and eastern India for more timely sowing and reduced labor and land preparation costs. Here the need is for more tractors, repair shops, mechanics, and credit support to purchase equipment.

Another recently promoted technique—planting wheat on raised beds—improves yields, increases fertilizer efficiency, reduces herbicide use, saves seed, saves an average 30% water, and can reduce production costs by 25-35% when permanent beds are used. Bed planting is gaining acceptance in Pakistan and is being tested by researchers in India and Nepal.

To help make seed drills, hand tractors, and tractor implements more widely available, RWC staff are linking and advising farmer groups, local machine shops, and agricultural engineering specialists. CIMMYT and the RWC are also developing appropriate planters and bed-shaping equipment so that farmers can maintain permanent beds and retain crop residues. This adds the advantages of conservation tillage to bed planting, reducing costs another 20-25%.

2 Because zero-till takes immediate advantage of residual moisture from the previous rice crop, as well as cutting down on subsequent irrigation requirements, water use is reduced by about 10 cm-hectares.

3 Normal decomposition of straw would still produce nearly 9 million tons of CO_2 per year.

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