Food and Agriculture Organization of the United Nations

SAVE AND GROW FARMING SYSTEMS
FACT SHEET 10

Agro-ecological zone
Temperate continental, rain- and snow-fed

Main cereal Wheat

Other crops
Oats, buckwheat, sorghum, oilseeds, legumes

Farmers stop ploughing on Kazakhstani steppe

In the spring of 2012, as farmers across the semi-arid steppes of northern Kazakhstan were sowing their annual wheat crop, the region entered one of its worst droughts on record. In many areas, no rain fell between April and September, and daily summer temperatures rose several degrees above normal. That year, many farmers lost their entire crop and Kazakhstan's wheat harvest, which had reached 23 million tonnes in 2011, plummeted to less than 10 million tonnes.

Some farmers, however, did not lose their crops. They were among the growing number of Kazakhstani wheat growers who have fully adopted conservation agriculture (CA), including zero-tillage, retention of crop residues and crop rotation. Those practices have increased levels of soil organic carbon and improved soil structure in their fields, allowing better infiltration of moisture captured from melting winter snow. As a result, some farmers in Kostanay province achieved yields in 2012 of 2 tonnes per hectare, almost double the national average of recent years.

Around 2 million of Kazakhstan's 19 million ha of crop land are under full conservation agriculture. On 9.3 million ha, farmers have adopted minimal tillage, which uses narrow chisel ploughs at shallow depths. The widespread adoption of conservation agriculture in northern Kazakhstan's wheat belt has been driven by necessity. While the country has vast land resources for wheat production, the crop relies entirely on precipitation and is, therefore, very vulnerable to the loss of soil moisture.

Wheat farmers began reducing tillage in the 1960s to cope with high losses of soil to wind erosion. By the end of the twentieth century, minimal tillage was a common practice. In 2000, the International Maize and Wheat Improvement Center (CIMMYT) and FAO, together with Kazakhstani scientists and farmers, launched a programme to introduce conservation agriculture in rainfed areas.

Trials showed zero-tilled land produced wheat yields 25 percent higher than ploughed land, while labour costs were reduced by 40 percent and fuel costs by 70 percent. The trials also demonstrated the advantages of growing oats in summer instead of leaving land fallow. With an oat crop, the total grain output from the same area of land

KEY POINTS

Zero-tilled land produces **wheat yields 25 percent higher** than ploughed land.

Rotating wheat with summer oats boosts total grain output by 40 percent.

Summer fallows are being replaced by rotations with **maize, sunflower and canola**.

Decomposing residues on wheat fields trap winter snows, which helps maintain soil moisture, and release acids that suppress weeds.

With government support, farmers have **invested US$200 million** in zero-till machinery.

The adoption of conservation agriculture has helped Kazakhstan increase **wheat production by 2 million tonnes** a year.

increased by 37 percent, while soil erosion was much reduced.

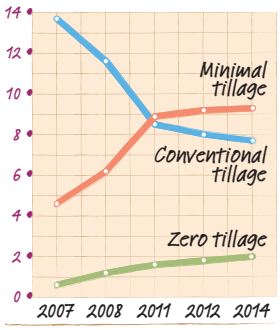
Today, Kazakhstan ranks among the world's leading adopters of zero-tillage. The area of land that is no longer ploughed at all rose from nil in 2000 to 1.4 million ha by 2008. That increase is attributed to very high adoption rates on large farming enterprises, where managers are striving to increase production while reducing costs. However, the approach has also been taken up on small to medium-sized farms, a category which, in sparsely populated Kazakhstan, ranges from 500 to 2 500 ha. The adoption rate has been particularly high on farms with rich black soils, where high returns provide the capital needed for investment in CA machinery.

Under zero-tillage, weeds are often controlled with herbicides. However, many farmers find that combining zero-tillage with permanent soil cover also helps to suppress weeds. The natural store of weed seeds in the soil diminishes over time, and decomposing residues release humic acids, which block the seeds' germination. After four or five years the incidence of weeds – and herbicide use – decreases considerably.

Another advantage of retaining crop residues is that it increases the availability of water to the wheat crop. Annual precipitation ranges from 250 to 350 mm, and winter snow accounts for around 40 percent of it; when the snow is blown away by wind, the soil surface is left bare and dry. Retaining the stubble of the previous wheat crop traps the snow which later melts into the soil. That has two benefits: more moisture is available along the soil profile and erosion is reduced or even eliminated. On-farm research has found that the use of residues to capture snow, along with zero-tillage, can increase yields by 58 percent.

Progress in the adoption of crop rotation has been slower – the vegetation period on the northern steppes in summer is short, with a high frequency of dry years. However, more farmers are now taking advantage of available – and sometimes abundant – rainfall to grow oats, sunflower and canola. Studies have shown the high potential of other rotational crops, including field peas, lentils, buckwheat and flax.

Changes in crop area under different tillage technologies in Kazakhstan (million ha)



A three-year study found that forage sorghum sown late in May and harvested in August provided not only fodder for sale or silage, but also left a durable post-harvest stubble that was very effective in trapping that precious winter snow.

The adoption of conservation agriculture in Kazakhstan has enabled an increase in annual wheat production of almost 2 million tonnes, sufficient to feed some 5 million people. Further increases will be possible with the development of high-yielding wheat varieties better suited to zero-tillage and the north's harsh winters and increasingly hot summers. That option is being explored through a programme with CIMMYT, which crosses in Mexico local Kazakhstani wheat varieties with Mexican, Canadian and US cultivars.

Conservation agriculture is considered highly suitable for all of Central Asia's major cropping systems, from north Kazakhstan's wheat belt down to the irrigated wheat, rice and cotton fields of Uzbekistan and Tajikistan. In recent years, information on conservation agriculture has reached farmers across the region and some CA practices are appearing in their fields. In Uzbekistan, for example, winter wheat is planted into standing cotton on some 600 000 ha. In Tajikistan, direct-seeding of winter wheat after the cotton harvest, with minimum soil disturbance, is practised on some 50 000 ha. Trials conducted recently by an FAO project in Azerbaijan convinced smallholder farmers to adopt conservation agriculture on 1 800 ha of irrigated land.

However, most Central Asian countries have no policies to foster CA. They could learn from the example of Kazakhstan, where state policy promotes conservation agriculture, and the top priority in agricultural research is the development and dissemination of water-saving technologies.

In 2011, Kazakhstan introduced subsidies on CA equipment that are three to four times higher than those on conventional technologies. Government support has encouraged farmers in northern Kazakhstan to invest an estimated Us$200 million to equip their farms with zero-tillage machinery.

Adapted from:
Save and Grow in practice: maize, rice, wheat. A guide to sustainable cereal production (FAO, 2016).
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http://www.fao.org/3/a-i4009e.pdf
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