



Science for Environment Policy

Straw covering on soil can increase crop yields and improve the efficiency of water use

Straw from previous harvests can be used to help increase crop yields and improve the efficiency of water use in arid regions, finds a new study from China. By testing different techniques to improve water efficiency, the researchers found that the most effective method involved using straw to cover the soil when growing maize and wheat together in the same growing season.

In north-western China, small-scale self-sufficient [farms](#) are important producers of maize and wheat crops. The two crops are typically farmed in an intensive relay system, where wheat is planted in strips early in the spring and maize planted between the wheat later in summer. This style of planting optimises [land use](#) and has been shown to increase crop yields.

However, the system requires a high level of [water](#) to operate effectively. Freshwater availability is low in this part of China — 760m³ per capita per year — a figure that is 25% below the internationally recognised level for water scarcity¹.

In this study researchers looked at whether integrating straw mulching —when straw is chopped and spread on the [soil](#) surface — with the relay system could maintain the efficiency of production while decreasing the water requirement. In previous studies the use of straw mulching has increased crop establishment and grain yield; however this technique had never been tested within a relay planting system before.

The researchers tested both monoculture and relay planted growing systems (polyculture) over three years. In the monoculture systems maize was grown in 2010, followed by wheat in 2011 and maize again in 2012 — to replicate rotational growing techniques sometimes used in the region. In the relay planting system wheat was planted in March each year and maize in April. The plots were irrigated in accordance with local guidance for water treatment.

Four water conservation treatments were tested on both the monoculture and relay systems: no-till straw standing, where no ploughing occurs and straw from the previous harvest is left standing (25 cm high) in the field; no-till straw covering, where no ploughing occurs and chopped straw is evenly spread on top of the soil; tillage with straw, where straw is mixed with the soil during ploughing; and conventional tillage, where the soil is ploughed and straw removed from the soil.

The results confirmed that the relay planting system produced superior yields to the monoculture planting. The use of straw mulching resulted in a reduction in water evaporation from the soil and a reduction in the amount of water used by the plants. In particular, no-till straw standing and no-till straw covering slows the movement of air at the soil's surface and reduces the amount of water evaporating. In addition, no-till straw covering also reduces the amount of competition for water between wheat and maize strips.

The authors conclude that out of the three types of straw management tested, the no-till straw covering is the most effective way to increase crop yields while improving water use in arid regions.

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1. *Addressing China's growing water shortages and associated social and environmental consequences*
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