

Application of potassium to grass used as cover crop guarantees higher-quality cotton

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Besides simplifying operational logistics and improving production, fertilization of the grass used as a cover crop can reduce fertilizer use in the long run. Credit: Vinícius Peres

The use of cover crops between cotton harvests protects the soil, conserves water, and reduces the risk of erosion. Researchers at the University of Western São Paulo (UNOESTE) and São Paulo State University (UNESP) in Brazil found that application of potassium (K) to a grass cover crop grown before cotton in sandy soil lowered production cost and resulted in cotton with a higher market value.

"The dynamics of early application of [potassium](#) to grass planted as a [cover crop](#) before [cotton](#) results in more resistant fibers and a smaller proportion of short fibers than when the conventional method of applying the nutrient to the cotton crop is used. In addition to the improvement in quality, the technique reduces production cost for the farmer because of its impact on operational dynamics. The farmer can apply potassium once instead of twice. The technique saves labor and diesel oil, as well as optimizing operational logistics. In the long run, it's also expected to reduce [fertilizer use](#)," said Fábio Echer, a professor at UNOESTE and lead author of an article on the study published in *Scientific Reports*.

The two-year study, which was conducted on UNOESTE's experimental farm, compared the conventional method of fertilizing cotton directly with two other methods, both involving early application of potassium. It also evaluated cotton growing without fertilizer and without a cover crop.

The research was funded by a master's scholarship awarded by FAPESP to Vinicius José Souza Peres. The São Paulo State Cotton Growers Association (APPA) and Fundação Agrisus also collaborated on the project.

Quantitative and qualitative analysis of fiber

In one of the treatments, the researchers applied potassium to the grass

cover crop in two doses (70 kg per hectare each). They compared this with application to the cover crop of a single dose of 140 kg per hectare and split application, with half going to the cover crop and the other half to the cotton. The results in terms of fiber yield were identical to those of the conventional method. Yield and quality were both lower with no fertilizer than when the conventional method or early application was used.

"The study included a calculation of fertilizer use efficiency," Echer told Agência FAPESP. "We found that early application enabled the forage grass used as a cover crop to recover nutrients from the soil, in addition to the function of protecting it. This plant has a deep rhizosphere and its roots are able to find soil nutrients lost via leaching from previous [crops](#), recycling them, and pushing them back to the surface. When the plant dries out, it releases potassium in the first rain to the crops that come next."



In an article published in *Scientific Reports*, Brazilian researchers show that besides simplifying operational logistics and improving production, fertilization

of the grass used as a cover crop can reduce fertilizer use in the long run. Credit: Vinícius Peres)

The main advantage of early application, however, is that it increases the commercial value of the cotton produced. The analysis of fiber quality and cotton value found that fertilizing the cover crop with potassium led to a smaller proportion of short fibers, which depreciate the finished product, and also enhanced fiber fineness (micronaire), maturity and strength. "These characteristics are important. They represent higher commercial value for the production of finer cotton fabric, which is better quality and fetches a higher price on the market," Echer said.

The improvement in quality relates to the availability of potassium in the soil and plant water status. "Cotton fiber is a cell, and like all cells it needs water to expand. By conserving more water in the soil and in the plant, we can also improve fiber size," he explained.

Potassium plays a key role in the control of plant water loss. It regulates stomata functioning, carbon dioxide fixation, enzyme activation, and nutrient transport, as well as aiding stress tolerance. Soil potassium reaches plant roots mainly by diffusion, which accounts for 72%-96% of each plant's requirement.

"Extreme weather events, high temperatures, and droughts have become more frequent because of global warming, and conservationist soil management techniques such as those suggested by the study can mitigate the adverse effects of all this on production," Echer said.

"Inconsistent rainfall may limit crop viability, and because only about 8% of Brazil's cotton plantations are irrigated, the use of a cover crop is especially important. Straw mulch helps reduce soil temperature, which in turn helps conserve water."

In western São Paulo, where the experimental farm used in the study is located, the temperature can reach 70°C on cotton plantations without a cover crop (and hence with exposed soil). The use of a cover crop keeps the soil at about 28°C-30°C, conserving soil moisture.

Early application of potassium is widely used in plantations with clayey soil, Echer added, but the technique had not yet been tested on sandy soil with little organic matter, making nutrient retention harder. "Farmers were reluctant to apply fertilizer early in the case of crops planted in sandy soil," he said. "The study proves that applying potassium to the cover crop maintains yield and improves fiber quality even in sandy [soil](#), which is more fragile, stores less water and makes potassium more susceptible to leaching."

According to the researchers, the method analyzed in western São Paulo can be replicated in cotton plantations with [sandy soil](#) in Mato Grosso (the leading cotton producer in Brazil) and Bahia, as well as in other countries. "The cover crop can be different from the one we used in this study, because the climate may be different, but a precedent has been set for testing new cover species in other parts of the world," Echer said.

More information: Fábio Rafael Echer et al, Potassium application to the cover crop prior to cotton planting as a fertilization strategy in sandy soils, *Scientific Reports* (2020). [DOI: 10.1038/s41598-020-77354-x](https://doi.org/10.1038/s41598-020-77354-x)

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