Just a little squint, Ed Percival says now, just a little imagination, and he'd have thought he was back in western Texas: flat terrain, a few meager trees to break the horizon, and cotton seedlings scrabbling for survival in the arid soil.

But this wasn't Texas.

Percival was in the countryside edging Samarkand, fabled capital of the 14th-century empire of Tamerlane and now a metropolitan jewel of the modern Republic of Uzbekistan.

While Samarkand is legendary for its opulent silks and exotic teas, plant geneticist Percival was there for workaday cotton. He hoped to find germplasm whose Asiatic ancestors could share valuable genetic secrets with modern U.S. cotton destined for spinning into crisp summer dresses and designer sheets.

Like the travelers of ancient times, Percival and geneticist Russell J. Kohel had come to south-central Asia with special ARS funding to trade, not in wines or silks, but in cotton germplasm—the seeds that could be the genesis of tomorrow's supercrops. Percival is curator of the National Cotton Germplasm Collection at College Station, Texas, and Kohel leads the ARS Crop Germplasm Research Unit there.

Today Samarkand and its sister metropolis of Tashkent are writing new chapters in their histories as two of the world's oldest cities. Tashkent, dating back at least to the first century B.C. and now with a population of more than 2 million, has replaced Samarkand as the capital of Uzbekistan, which declared its independence from the former Soviet Union in 1991.

In south-central Asia, Uzbekistan is cotton country. Its unofficial national symbol is the cotton boll, depicted on all sorts of souvenir items including decorative plates and cups. So when Uzbekistan broke from the Soviet Union, within its California-sized territory it took the lion's share of the former Soviet Union's cotton-producing land, leaving the new Russia to scramble for a cotton crop.

Foreign Genes for Domestic Cottons

Russian, Uzbek, and Indian additions to the U.S cotton germplasm collection could prove to be a treasure chest of genes against cold weather, insects, and disease.

"Russia is now outside the cotton belt, so they have a problem," Percival notes. "They used to grow some cotton years ago, right off the Black Sea. They plan to try again near the city of Krasnodar on the Black Sea coast. But that's at a latitude about equal with Green Bay, Wisconsin—not what we'd considered prime cotton-growing conditions. Still, they can do it if they get some really short-season cotton."

Short-season cotton lines are a reality in the United States, thanks to ARS scientists such as plant geneticist Charles G. Cook, who is based at Weslaco, Texas. Cook and colleagues have produced several very-short-season lines, including Texas 121, with an eye to outrunning insect attacks and reducing the amount of pesticides cotton producers must spray to defend their crops. [See "Joint Venture Pays Ag Dividends," *Agricultural Research,* September 1995, pp. 4-10.]

So when Percival and Kohel headed east last June, their first stop was St. Petersburg, capital of Russia until Moscow regained that title in 1918. Known for many years as Leningrad, St. Petersburg is home to the famous Hermitage, one of the world's foremost art treasure houses. But of greater interest to Percival and Kohel was the N.I. Vavilov All-Russian Institute of Plant Industry, a germplasm treasure house generally called simply VIR.

In a meeting with VIR cotton curator Larisa Podolnaya, it quickly became evident that the Russians were extremely interested in a cotton germplasm swap, Percival recalls.

"The main obstacle for them is funding," he says.

"But interestingly enough, I had sent VIR some of our cotton lines 4 years ago, and on this visit I asked how those lines were now doing in their plantings. I found out they're still in quarantine in Moscow!"

Things are moving faster now, Percival reports. The first batch of VIR cotton germplasm was shipped to College Station by August, less than 2 months after he and Kohel returned home.

The ARS duo's next stop was Tashkent, with a brief stopover in Moscow. Tashkent is home to the former VIR headquarters and cotton germplasm working collection, now known as the Uzbek Research Institute of Plant Industry.

"The director of the Uzbek institute told us they had 6,000 cotton accessions in their collection," says Percival. "That's about the same number we have in the ARS cotton germplasm collection, so there's a lot of potential there."

Despite the Uzbeks' relatively balmy setting for cotton production—at least in comparison to their Russian cousins to the north—the Uzbeks are also interested in obtaining short-season cotton lines, Percival points out.

"They want to get some high-quality-fiber cottons, too," he adds. "Uzbek produces about 3.7 million acres of cotton annually. But their cotton is very short-fiber and coarse, which works for making blue jeans but not dress shirts. They want to get into the world market, and they need different cottons for that."

As with the Russians, the ARS scientists are likely to have something to fit the farmers' bill—in exchange for cotton germplasm useful to U.S. farmers.

"In Uzbekistan, they're at a latitude about even with St. Louis, Missouri, so we'll have some short- or shorter-season cotton germplasm for them that also has some disease resistance," Percival predicts. "In return, they'll have some Asiatic cotton lines that we'd like to explore.

"In the United States, we grow primarily *Gossypium hirsutum* cotton, some 12.5 million acres of it," Percival continues. "The exception is about 100,000 acres of *G. barbadense* in Arizona and New Mexico. Some of the disease resistance characteristics that we really like in *G. hirsutum* are said to have come originally from Asiatic cottons, so you can imagine how interested we are in taking a look at Uzbek's Asiatic lines."

SCOTT BAUER

Cotton. (K5348-17)

A look at the map makes it clear why Uzbek cottons might have a strong Asian flavor. Just beyond Uzbekistan's neighbor to the northeast, Kazakhstan, lies Mongolia. And the small republic of Kyrgyzstan—76,642 square miles, almost exactly the size of Nebraska—is all that separates Uzbekistan from China to the southeast.

Ground has already been broken with an exchange of germplasm collection catalogs between ARS and the Uzbek institute, Percival says. But negotiations are continuing for trades of the plant material itself.

As they headed home to Texas, Kohel and Percival scored another hit with a stopover at New Delhi in India. There, a long-standing agreement with India's Central Institute of Cotton Research at Nagpur finally bore fruit. So they shipped a hefty bag of Indian cotton germplasm back to Texas, in exchange for more than 2,000 samples provided to India 3 years earlier.

"In all, we got 1,147 germplasm samples from India and 28 from Russia out of this trip, so far," he reports. "We are growing out samples of about 900 of those at a winter nursery at Tecoman in Colima, Mexico. By this summer we'll have a better idea of what we've really got."

The National Cotton Germplasm Collection is already home to accessions from some 74 countries or political jurisdictions, Percival says. "We have cottons from Martinique and Mexico, Cuba, South Africa and Zaire, Bulgaria, Turkey, Iran, Afghanistan, and China, to name a few examples. We have cotton germplasm from almost any country from a latitude of 40° north to 40° south—even the Galapagos Islands."

Germplasm collection opens the door to evaluation, which involves finding the specific gene or group of genes that controls a particularly desirable trait, such as fiber quality or strength, or plant disease resistance.

The next step would be genetically engineering that gene or group of genes into already favored cotton breeding lines, Percival explains.

"We do the basic characteristic evaluation at College Station, though we don't have the funding to go further.

"But," he adds, "we'll send out samples of 25 seeds from anything in our germplasm collection to anyone with a legitimate use for it. Breeding companies, universities, even foreign scientists can get our seed."

Simply producing the seed to keep germplasm stores stocked is a costly and labor-intensive operation.

"We self-pollinate everything we increase," says Percival. "That means we go in and tie the flower shut by hand so there's no accidental cross-pollination from another plant. Then we harvest seed only from those flowers that were tied shut.

"We split our seed production with the ARS National Seed Storage Laboratory at Fort Collins, Colorado. We keep about 3,000 seeds of every accession here at College Station, and we send 3,000 to them."

While the Russian, Uzbek, and Indian additions could prove to be a treasure chest of genes against cold weather, insects, and disease, there are still plenty of opportunities to pursue in the accessions already tucked away at the College Station collection, according to Percival.

"There's a growing interest right now among craftspeople in colored lint, such as naturally brown or green cotton," he points out.

"Also, some people are allergic to dyes, and others just want a cotton cloth that's more environmentally pure and natural.

"We do have germplasm for brown and green cotton lints in all sorts of shades—from an Army green and a very light tan to a deep chocolate. One brown is almost a lavender. These are potentially valuable, too," says Percival. "I heard of one cotton mill in western Texas that's been making 'brown blue jeans' that were selling at a premium price."—By **Sandy Miller Hays**, ARS.

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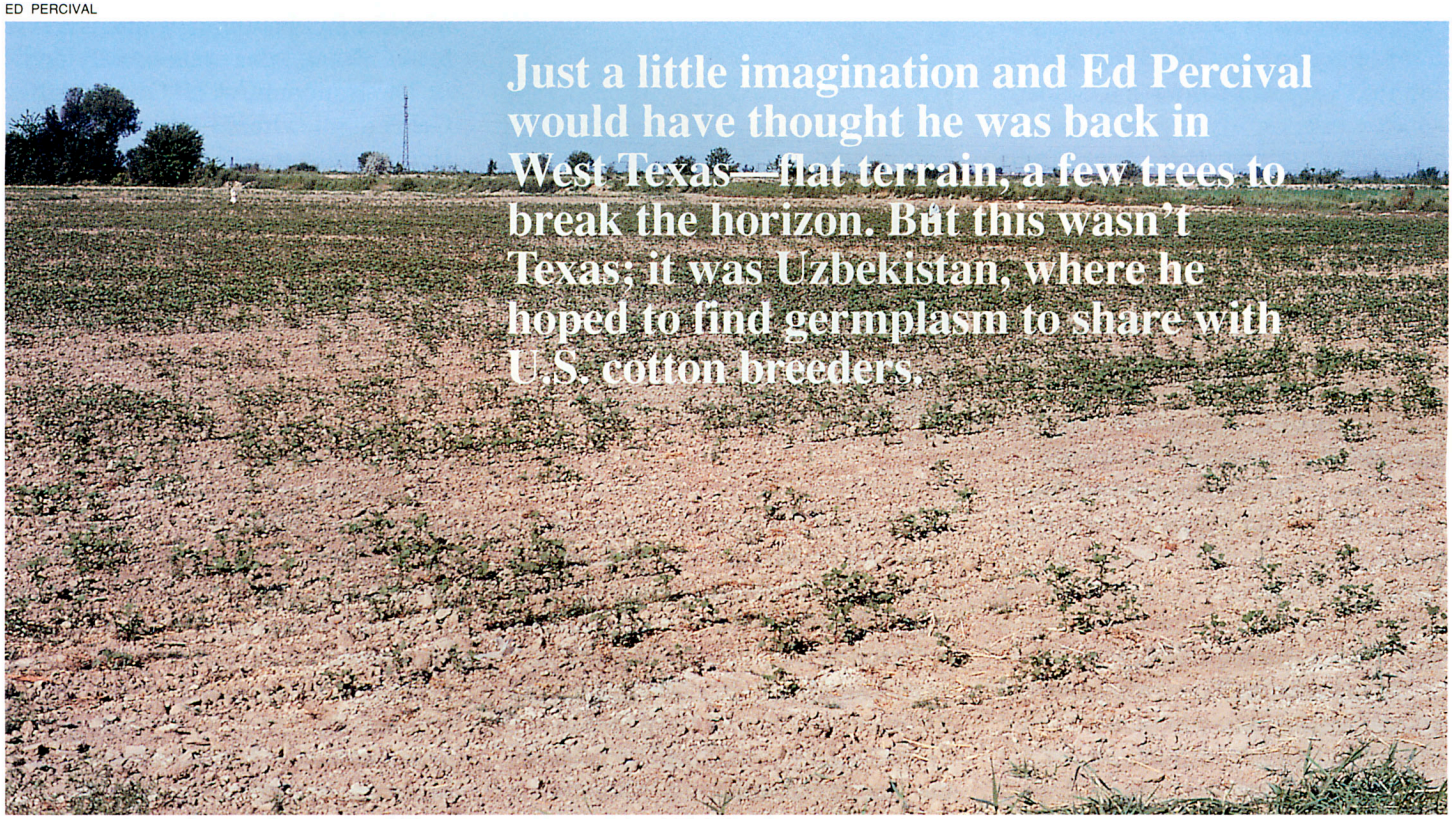
ED PERCIVAL



Young field of cotton between Tashkent and Samarkand, Uzbekistan.