Scientists are testing techniques for growing vines in a hot, parched future.

By AMY YEE

MITZPE RAMON, Israel — In the Negev Desert, the sun beats down on a parched landscape of brown, undulating hills. But on a parcel of land here in southern Israel, trees grow in green rows, and fat bunches of grapes dangle amid lush leaves.

This is not a desert apparition. It is a research vineyard, where scientists are studying how grapes can best grow in this harsh environment.

The Negev is a far cry from the temperate climates of many wine-growing regions. Yet about 20 wineries have sprouted here over the past 15 years, along with a budding wine tourism business.

The researchers are focusing on this harsh environment for a reason: to study how wine grapes can grow in the desert conditions that dominate Israel. That knowledge will become even more valuable in a world with more frequent droughts and heat waves.

“Climate is becoming more and more unpredictable,” said Aaron Fait, a biochemistry professor at Ben-Gurion University of the Negev. “The desert model is a way to study how climate change will affect wine worldwide.”

The techniques being tested here on 30 varieties of grapes include the use of nets that provide shade, trellises that coax vines to grow in formations that limit sun exposure, sensors that measure soil humidity and thermal cameras that track how much sunlight grapes and leaves absorb.

The work is gaining increased interest from European winemakers as summer
heat waves and other climate shifts affect their vines. In July, temperatures hit 106 degrees in the French wine-growing region of Bordeaux — the hottest day on record. Heat records were broken elsewhere on the Continent, including in Germany, Belgium and the Netherlands.

In recent years, scientists and vineyard owners from France, Italy, Slovenia and other parts of Europe have visited the researchers in the Negev. Experts hope Israel’s desert agriculture can provide valuable lessons about adapting crops to extreme and unpredictable weather.

To study innovations in winemaking, Dr. Fait works with several Negev wineries, as well as European researchers like Enrico Peterlunger, a professor of viticulture at the University of Udine in northern Italy. The effort started in 2014 with the Israeli irrigation company Netafim and support from the Italian and Israeli governments. “Growers are concerned about climate change” in Europe, Professor Peterlunger said. In his region, he said: “It rained a lot in May, which caused some problems during flowering and fruit set. June, July and August were really hot, and that is not optimal for grapevines.”

Naftali Lazarovitch, a soil scientist at the Blaustein Institutes of Desert Research in the Negev, also studies desert viticulture at the research vineyard. Europeans “are looking at Israel and the way we are dealing with harsh conditions and trying to learn from it,” he said. “We produce more with less, that’s our objective.”

More than 40 percent of the earth’s terrestrial surface is made up of drylands, including tropical dry forests, savannas and deserts, that are home to roughly 2.5 billion people. These regions are already threatened by resource overuse and desertification and more vulnerable to extreme weather, including droughts, heat waves and dust storms, according to a recent report from the Intergovernmental Panel on Climate Change.

Most of Israel is arid; the Negev spans more than half of the country. Out of necessity, Israel has honed desert agriculture to yield bountiful crops. In the 1940s, the Polish-Israeli inventor Simcha Blass pioneered modern drip-irrigation systems that now are used around the world.

Desert agriculture has existed in the region since ancient times. The Nabateans, nomadic Arab peoples dating to the fourth century B.C., used runoff and built small stone dams to divert water to irrigate crops and grow wine grapes.

Today in the Negev, farmers can control water with precise drip irrigation, unlike parts of the world that are at the mercy of rainfall. “Desert viticulture, where we can control a large number of variables like nowhere in a traditional vineyard, is of immense importance to test certain climate scenarios,” Dr. Fait said.

For his tests, he works with Negev wineries like Nana Estate, whose owner, Eran Raz, left a career in film production. Mr. Raz moved to the Negev to start a vineyard “because no great story ever began with salad,” he joked.

Water piped from a local aqueduct nourishes Nana Estate’s grapes, which produce chardonnay and chenin blanc wines. “I have total control over water,” Mr. Raz said. “I control how big the grapes will be.”

He closely monitors his vines to ensure that grapes grow — not the leaves — and checks sugar levels of the fruit. An optimal yield for one vine is four kilogrammes, or almost nine pounds. If there are too many grape clusters, it strains the plant, so Mr. Raz discards them.

In the Negev, days can reach 97 degrees and nights can drop to freezing in the winter. With its dry climate, Negev vintners might spray fungicide twice a season, whereas some European counterparts spray every week.

In addition to viticulture, Israeli researchers are studying a range of techniques to grow other crops. The Ramat Negev Agro-Research Center has about 15 hectares — or 37 acres — of research plots and greenhouses where scientists cultivate wine grapes, date palms, olives and jojoba.

In large greenhouses, researchers cultivate cucumbers, cherry tomatoes, eggplant and other vegetables, like an edible, crunchy grass called sarcocornia that thrives in saline conditions. Even strawberries are grown in long, suspended planters.

Mr. Lazarovitch and other scientists are testing innovations including cameras that monitor plant roots and sensors that monitor carbon dioxide, fertilizer and salinity levels. Mulching techniques can reduce water use by 20 percent. Covering plant roots with plastic also prevents evaporation.

These innovations “will be more and more relevant to many countries as a result of global warming,” said Ofer Guy, an agricultural researcher at the Ramat Negev center. “Issues of saline soil and water, extreme hot weather and lack of water are going to be big problems in the global future as agriculture is forced into marginal soils,” he added.

“For today agriculture, and food consumption, is based on a small variety of plants that are relatively sensitive to salinity,” Mr. Guy said. “This poses a great challenge to humanity.”

In a region that gets about 300 days of sun each year, scientists closely study how crops are affected by shade, assessing the color, density and material of various kinds of canopies and netting. For example, when grapes ripen, researchers cover them with nets to shield them from the sun. This reduces temperature, but increases humidity and the potential to draw insects.

The Ramat Negev center works with local farmers, many of whom are not from farming backgrounds. This helps bolster an industry whose numbers are dwindling. In the 1950s, more than 70 percent of Israel’s population worked in agriculture, compared with less than 2 percent today.

“It’s difficult to be a farmer,” Mr. Guy said. “You’re like a gambler. You don’t have any guarantees. It’s a very big risk. In 10 to 20 years, if no one promotes farms, less and less people will want to be farmers. There’s a lot of potential and cooperation. There’s a lot to learn from us, and a lot for us to learn still.”