



To The Point Resilient Crop Planning

Farmers' livelihoods rely on managing the risk of weather conditions throughout the growing season, from daytime and nighttime temperatures to precipitation and freezes. Across the U.S., farmers are increasingly experiencing extreme weather events like droughts and floods, as well as higher variability in temperatures and precipitation levels, that challenge their ability to manage these risks. The result can be extreme economic losses for farmers. Nationwide, disasters in 2023 were estimated by the American Farm Bureau Association to total nearly \$22B in crop and rangeland losses.¹ As more farmers face rising temperatures and droughts, crop switching and revenue diversification strategies can help adapt to higher temperatures and more frequent extreme events.

Crop Switching

Crops each have specific temperature ranges they need to grow and thrive across their lifecycle. Some crops, particularly fruits and nuts, may be especially vulnerable to the timing of freezes and frosts, which can stunt early growth or damage fruits already in bloom. Other crops, like cotton, are highly water-intensive and can fail to produce a yield when summer growing seasons bring extreme heat or drought.

As temperatures rise, the ideal geographies for common crops will shift. For example, farmers are growing soybeans farther and farther north into Canada as warmer weather becomes more common.² While this may produce new opportunities for farmers to grow previously untenable crops, they will also have to manage new risks to their existing crops that come with higher temperatures or more frequent heat waves.³ For example, a new NASA study published in the journal *Nature Food* shows that wheat yields in the U.S. plains regions are projected to increase over the coming decades while corn yields decrease.⁴

Farmers need to ensure that they can find markets for any new crops they grow. One strategy is to seek to replace crops with varieties or species that can fill existing market needs. For example, alfalfa is a water-intensive crop commonly grown as forage in the Colorado River basin. Switching from alfalfa to forage sorghum, which uses less water and is even more hardy to drought, can fulfill the same market need while providing resiliency benefits.⁵ Because crop choices are highly affected by regional and soil-specific needs, farmers should work with their trusted advisers to identify crops that can better withstand changing conditions in their region.

Diverse Crop Rotations

Another option is diversifying existing crop rotations by adding new crops to a multi-year plan. For example, small grains that were once common in the corn belt can be added back to a soy/corn rotation and benefit both productivity and profitability.⁶ More diverse rotations can increase the nutrient availability in the soil over time, reducing the need for expensive inputs. One University of Iowa study found that farmers who integrated oats into a corn-soy rotation used 80% less nitrogen than conventional systems while maintaining or increasing corn and soy yields.⁷ Small grain rotations also break up pest and weed cycles and can spread risk by opening up an additional crop market.

Diversified Revenue Opportunities

When extreme weather events negatively impact the yield of key crops, farmers can consider options to diversify their revenue streams during poor growing seasons. For example, in recent years, when cotton production in West Texas has faced high rates of losses, some farmers have moved to grow sunflowers, which are drought tolerant and have a wide planting window.⁸ Farmers can consider specialized crops like teff, a hardy ancient grain similar to sorghum that is used for equine feed.⁹ There may also be emerging opportunities for farmers to benefit from new markets for native crops. Farmers in Arizona and West Texas are trialing growing a native shrub, guayale, that produces rubber. The plant can withstand harsh conditions where water-intensive crops like cotton may fail to produce a yield and is being supported by new private sector initiatives to create domestic sources of rubber.¹⁰

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Outside of crop production, many farmers are leasing land to renewable energy developers for solar or wind sites, commonly earning \$1,000 or more per acre per year.¹¹ In some systems, solar panels can also offer heat resiliency to farmers by creating shade for crops or grazing livestock.

Farmers may also consider converting cropland that is no longer as productive for other uses. For example, U.S. Department of Agriculture's (USDA's) Conservation Reserve Program offers yearly payments to farmers who take marginal land out of production and convert the land to beneficial uses such as grasslands or vegetative buffers. These land uses often protect nearby waters from runoff or provide beneficial habitat for species which benefit farmers and their communities. Additionally, several projects within USDA's recent Partnerships for Climate-Smart Commodities program will support farmers in adopting new crops like oats and rye to create new food markets for climate-smart crops.^{12,13} Farmers should work with local advisers at USDA and conservation districts to identify opportunities to participate in supply chain market development programs.

In geographies with specific resource concerns, farmers may have other programs available to help them switch crops or convert land. For example, farmers who draw from the water-stressed Colorado River basin may be eligible for payments to switch to water-efficient crops or remove land from production.¹⁴

Seed and Genetic Innovation

Advances in crop breeding and genetics have produced varieties of crops that are more tolerant to common weather stresses. Corn is particularly sensitive to drought, and drought-tolerant (DT) varieties are available that help the corn plant better access soil moisture. The effectiveness of DT varieties depends on the severity of the drought, but they have been proven to reduce yield losses in mild to moderate drought cases. Since being commercialized in the early 2010s, DT corn has grown to make up 22% of all corn planted in the U.S. and is expected to grow.¹⁵

Private seed companies continue to invest in crops resilient to drought, heat, disease, and other risks. Emerging technologies such as CRISPR¹⁶ gene editing tools may also accelerate the development of resilient crop varieties.¹⁷

Decision Support Tools

Many extension research centers offer decision support tools to farmers to help them make crop decisions with climate modeling data. "Growing Degree Day" calculators, offered regionally by many extension programs, model expected temperatures across the growing season to predict the best dates for planting and harvest or the likelihood of early freezes. Emerging AI software and technology solutions also offer farmers precise data tools to help them plan for future weather changes.

Importance of Resilient Crop Planning

Farmers decide which crops to plant based on agronomic, cost, and market factors, requiring strong support from trusted partners and supply chain customers to assess risks and adapt their operations. Benefits farmers should evaluate when making crop planning decisions include:

- Preserving lands and livelihoods for future generations.
- Increasing resilience to drought and extreme heat.
- Diversifying revenue streams and market opportunities are important risk management strategies.
- Enhancing productivity and profitability with more diverse rotations.

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For more information about protecting your company, contact your local Chubb Risk Engineer, email us at RiskEngineeringServices@chubb.com, or visit www.chubb.com/engineering.

Resources

Technical Guidance for Farmers

- Small Grain Crop Rotations, extension.umn.edu/small-grains-crop-and-variety-selection/small-grain-crop-rotations
- Small Grains, practicalfarmers.org/programs/field-crops/small-grains/

Regional Climate and Crop Planning Tools

- CalAgroClimate, calagroclimate.org/
- Climate Smart Farming (CSF), <http://climatesmartfarming.org/tools/csf-growing-degree-day-calculator/>
- Ag-Climate Tools, mrcc.purdue.edu/Ag-Climate-Tools

Funding Opportunities

- Conservation Reserve Program (CRP), www.fsa.usda.gov/resources/programs/conservation-reserve-program
- State and local funding opportunities may be available through trusted organizations:
 - Find NRCS Resources in Your State, www.nrcs.usda.gov/conservation-basics/conservation-by-state/new-york
 - Find Your Extension Office, www.uaex.uada.edu/about-extension/united-states-extension-offices.aspx
 - Find Your Soil and Water Conservation District, www.nacdnet.org/general-resources/conservation-district-directory/

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3. Climate Impacts on Agriculture and Food Supply, climatechange.chicago.gov/climate-impacts/climate-impacts-agriculture-and-food-supply
4. Climate impacts on global agriculture emerge earlier in new generation of climate and crop models, www.nature.com/articles/s43016-021-00400-y.epdf
5. Agricultural Water Conservation in the Colorado River Basin, www.crbagwater.colostate.edu/files/CWI_Completion_Report232_Part4.pdf
6. Fossil Energy Use, Climate Change Impacts, and Air Quality-Related Human Health Damages of Conventional and Diversified Cropping Systems, pubs.acs.org/doi/10.1021/acs.est.9b06929#
7. Diversifying Corn-Soybean Rotations, dr.lib.iastate.edu/server/api/core/bitstreams/0f479181-ba7b-457f-b30a-e8af3ef59496/content
8. Alternative Crops Add Options for Farmers, texasfarmbureau.org/alternative-crops-add-options-farmers/
9. Grain or Grass, Teff Fits on Right Farm, www.agweb.com/news/crops/grain-or-grass-teff-fits-right-farm
10. Guayule! A West Texas Rubber Tree? agrillifeorganic.org/2024/05/07/guayule-a-west-texas-rubber-tree/
11. Farmers Are Now Being Offered \$1000 Per Acre or More to Lease Their Land for Solar, www.agweb.com/news/business/taxes-and-finance/farmers-are-now-being-offered-1000-acre-or-more-lease-their-land
12. Climate Smart Agriculture, www.regenagalliance.org/climate-smart-agriculture/
13. USDA Climate Smart Commodities Opportunity, www.starofthewest.com/climate/
14. Are Low-Water Crops a Realistic Way to Cut Back on Colorado Water Use? coloradosun.com/2024/04/24/colorado-farmers-challenging-market-low-water-crops/
15. Drought-Tolerant Corn in the United States, www.ers.usda.gov/amber-waves/2019/march/drought-tolerant-corn-in-the-united-states-research-commercialization-and-related-crop-production-practices/
16. "Clustered Regularly-Interspaced Short Palindromic Repeats", www.genome.gov/genetics-glossary/CRISPR
17. Why Bayer and the Gates Foundation are Using CRISPR to Reduce Food's Climate Impact, www.greenbiz.com/article/why-bayer-and-gates-foundation-are-using-crispr-reduce-foods-climate-impact

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