

Adapting to Climate Change in Modern Cowpea Breeding

Low agricultural productivity contributes significantly to rural and urban poverty in West Africa, where on-farm cowpea yields average as low as 250–500 kg/ha—just 10 to 20 percent of their genetic potential. With all parts of the cowpea—young leaves, immature pods, immature seeds, and mature dried grain—used for human consumption in Africa, cowpea offers a clear solution to the food, nutritional, and economic insecurity experienced by smallholder farmers, many of whom are women, within this strategic region.

Among the many constraints to cowpea productivity, however, are drought, insect pests, and low soil fertility. Under the Feed the Future Innovation Lab for Collaborative Research on Grain Legumes, researchers at the University of California, Riverside (UCR), working in partnership with ISRA (the Senegalese Institute for Agricultural Research) and INERA (Institut de l'Environnement des Recherches Agricoles–Burkina Faso) are using modern molecular breeding tools to breed for resistances to drought and economically-damaging insect pests (thrips, aphids, and pod sucking insects). These traits have become increasingly important as climate change augments both the frequency and severity of drought and insect pest infestations within the Sudano–Sahelian region of West Africa where cowpea is cropped in combination with sorghum or millet by smallholder farmers.

Identification of resistance genes and molecular markers for these genes greatly improves the efficacy and efficiency of breeding of varieties with both the desired agronomic and culinary traits. As explained by Dr. Phil Roberts, UCR professor and Lead PI for the one of the Legume Innovation Lab's cowpea projects, "marker-assisted breeding technology for cowpea is based on finding genetic variability in cowpea that already exists in nature and that can then be brought into breeding programs. . . . The marker-assisted selection then allows for the crossing of varieties with complementary sets of favorable traits so that these traits can be stacked up and passed down to progeny. It's not about making transgenes and inserting them into plants. It's about bringing favorable traits from [plant] donors into highly bred cultivars via accelerated cross-breeding."

In Senegal, UCR researchers have used the ISRA-developed cowpea line *Pakau*, which is early maturing and possesses resistance to aphids and thrips, to breed additional cowpea varieties with medium to late maturity utilizing MAS. The crop maturation period is important in the Sahel region because it allows these new varieties to cope with the changing cropping season length in Senegal's northern zones as well as to provide needed fresh shell cowpea to the rural poor what is called *the hunger period*, that is, the period following the dry season before the first food is harvested. New breeding streams combining the most drought-tolerant lines with other valued characteristics are also being developed to produce additional drought-tolerant elite varieties.

Seed security for future plantings can also be a challenge for rural smallholder cowpea farmers, especially during years of food insecurity, which often force households to consume grain being stored for next season's planting. To address this problem, ISRA scientists in the Legume Innovation Lab have been producing greater amounts of foundation seed of improved varieties to distribute to certified cowpea seed growers for multiplication. To meet the increased demand for seed, ISRA is also working

with farmer organizations to identify new certified seed producers and to provide practical training to them on field selection, removal of diseased plants, and postharvest handling of seed—all of which help ensure sufficient seed for farmers to plant season to season.

Through the collaborative research of the Legume Innovation Lab, smallholder cowpea farmers in Western Africa are gaining increased access to quality seed of high yielding, insect-resistant cowpea varieties that will improve their resilience to climate change within the Sudano–Sahelian region of Burkina Faso and Senegal.