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Landscape Assessment of Southern Public Plant Breeding Programs

Capacity, Continuity, and Stewardship
Across State Agricultural Experiment Stations

Prepared by agInnovation South

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Landscape Assessment of Southern Public Plant Breeding Programs

Capacity, Continuity, and Stewardship Across State Agricultural Experiment Stations

EXECUTIVE SUMMARY

Public plant breeding programs are essential components of the agricultural innovation system, relying on sustained scientific expertise, institutional commitment, and stewardship of genetic resources. In 2026, agInnovation South surveyed State Agricultural Experiment Stations across the Southern region to assess breeding capacity, program continuity, commercialization practices, succession planning, and germplasm stewardship. The survey documents a diverse and productive regional breeding enterprise while identifying substantial variation in institutional capacity, support systems, and long-term continuity across breeding programs.

Breeding Capacity, Scope, and Program Impact

Southern State Agricultural Experiment Stations maintain a diverse portfolio of public plant breeding programs spanning major commodity, horticultural, forestry, forage, tropical, and regionally important specialty crops. Survey responses generally reflected three broad institutional profiles: large, diversified breeding programs with extensive infrastructure; mid-scale programs focused on selected commodity systems; and smaller, specialized programs serving individual commodities or regionally important production systems. Institutions reported impacts through cultivar development, germplasm enhancement, trait discovery, regional adaptation, pre-breeding, and long-term stewardship of crops receiving limited private-sector attention.

Survey responses documented widespread adoption of publicly developed cultivars across many Southern cropping systems together with substantial economic and agricultural impact. Institutions reported strong adoption in rice, wheat, peanut, soybean, sugarcane, and sweetpotato while also describing important contributions to fruit, vegetable, turfgrass, ornamental, tropical, and emerging crop industries. Program impact extended beyond cultivar release through germplasm development, regional adaptation, and support for commercial breeding pipelines and long-term agricultural innovation.

Commercialization, Partnerships, and Program Support

Public breeding programs rely on institutional commercialization systems and external partnerships to move cultivars from breeding programs into agricultural production while supporting long-term program continuity. Institutions consistently described public breeding programs as complementing private-sector breeding through regional adaptation, pre-breeding, specialty and emerging crops, and other long-term research priorities that receive limited commercial investment. Institutions reported diverse approaches to royalty distribution, intellectual property management, licensing, and cultivar commercialization through technology transfer offices, research foundations, crop improvement associations, and foundation seed organizations.

Financial support is derived from experiment station investments, Hatch funds, royalty reinvestment, grants, and commodity organizations. Collaborative support is provided through commodity groups, industry partners, USDA-ARS, foundation seed organizations, and crop improvement associations that strengthen breeding capacity, facilitate cultivar deployment, and expand scientific capability.

Succession Planning

Approaches to succession planning vary widely across the region. Most institutions reported replacement hiring rather than program expansion, while others described overlap hiring, interim management, documentation of breeding activities, and commodity-specific transition planning. Formal continuity plans remain uneven, although several universities are implementing more structured approaches. Survey responses indicate that continuity is influenced primarily by institutional planning, staffing capacity, and available resources. Several institutions also noted that current and future hires are integrating genomics, phenomics, artificial intelligence, data science, and related technologies into broader crop design programs.

Germplasm Stewardship

Institutions maintain diverse germplasm collections using a wide range of storage facilities, documentation practices, and data management systems. Capacity ranges from modern facilities with redundant storage to decentralized or aging systems with limited backup capability. Many institutions supplement local resources through USDA-ARS repositories and national or regional germplasm networks.

Stewardship increasingly extends beyond physical storage to include preservation of breeding populations, phenotypic and genotypic data, breeding records, and institutional knowledge supporting long-term cultivar development. Respondents identified continued needs for improved redundancy, digital data management, interoperability, and documentation to strengthen long-term breeding continuity.

Overall Observations

Together, the survey responses provide a regional snapshot of how Southern public plant breeding programs are organized, supported, and sustained. The findings document a productive and highly diverse regional breeding enterprise while revealing substantial variation in breeding capacity, commercialization systems, succession planning, and germplasm stewardship across institutions.

INTRODUCTION

Public plant breeding programs are inherently long-term, multi-generational efforts that depend on sustained expertise, institutional commitment, and stewardship of genetic resources to ensure long-term food security for our nation. A survey of State Agricultural Experiment Stations (SAES) was conducted by agInnovation South in the spring of 2026 to determine the status of breeding programs at universities in the Southern region.

Across the Southern region, there is growing concern about the durability of this system. While many programs remain highly effective and aligned with stakeholder needs, institutions are navigating increasing pressure from uneven succession planning, constrained resources, and shifting support structures. The broader ecosystem supporting plant breeding is under stress due to changing relationships with commodity groups and industry partners, limitations in federal support, and challenges in maintaining the next generation of breeders and technical staff. Collectively, these pressures may affect the capacity to train future breeders, with implications for regional competitiveness and agricultural resilience.

A consistent theme is the vulnerability of smaller and specialty crop programs. These programs, often serving niche or region-specific production systems, are more likely to lack stable funding, industry support, or clear succession pathways. At the same time, broader risks of all programs include the potential loss of genetic diversity, erosion of breeding pipelines and germplasm resources, and reduced capacity to develop cultivars adapted to local and emerging challenges.

The Southern region maintains a diverse and productive breeding portfolio reflecting the wide range of crops grown across the region; however, the conditions supporting that portfolio are uneven and, in some cases, fragile. The following sections provide a closer look at program capacity, infrastructure, and continuity, offering context for understanding both the strengths of the current system and the risks that may shape its future.

KEY REGIONAL OBSERVATIONS

- Public breeding programs support a wide range of commodity, forage, horticultural, and specialty crops across the Southern region.
- Program scale and influence vary considerably, ranging from large-acreage commodity systems to smaller niche and regionally adapted crop programs.
- Adoption of publicly developed cultivars is typically robust but varies depending on crop and region.
- Public breeding programs frequently complement private-sector efforts by addressing regional adaptation, pre-competitive research, specialty crops, and long-term breeding needs.
- Breeding capacity varies widely across institutions, from large, diversified programs with extensive commodity and specialty crop portfolios to small programs dependent on limited personnel or external collaborations.
- Planned hiring in classical plant breeding remains limited, with most institutions reporting replacement hires rather than program expansion. Several institutions also described shifts toward broader crop improvement models incorporating genomics, phenomics, and advanced data science.

- Succession planning approaches remain uneven across institutions and are often strongest within large commodity programs.
- Internal institutional support and external stakeholder support vary substantially across breeding programs and commodities.
- Commodity group support is common for major crops but less prevalent within smaller or emerging crops.
- Partnerships with state, federal, and private entities are widely reported and, in several cases, are integral to breeding operations, germplasm management, seed distribution, or cultivar commercialization.
- Germplasm storage and data management systems vary considerably across institutions, ranging from modernized integrated systems to decentralized or highly constrained facilities with limited redundancy or standardization.
- Many institutions rely on external partnerships and national germplasm systems to supplement local breeding, storage, and preservation capacity.
- Institutions consistently identified concerns regarding continuity, staffing transitions, germplasm stewardship, and the potential loss of breeding programs over time.

CAPACITY, CONTINUITY, AND STEWARDSHIP

Breeding Capacity & Scope

Institutions maintain breeding programs spanning a broad spectrum of crops, including major commodity crops as well as horticultural and specialty crops. Program scale and institutional capacity vary considerably across the region, ranging from large, diversified portfolios with extensive infrastructure to smaller or commodity-specific programs operating with more limited personnel, infrastructure, and institutional capacity.

Survey responses generally reflect three broad categories of breeding capacity within the Southern region: large, diversified programs with extensive commodity coverage and infrastructure; mid-scale programs focused on selected commodity systems; and smaller or specialty-oriented programs with more limited institutional support. The share of acreage planted with publicly developed cultivars ranges from minimal to substantial depending on crop and region. Several institutions also emphasized germplasm development, trait discovery, and pre-breeding activities supporting broader regional and national breeding efforts.

Program impact was defined in multiple ways, including cultivar adoption, acreage influence, support for regionally adapted crops, germplasm development, and long-term stewardship of crops or production systems receiving limited private-sector attention.

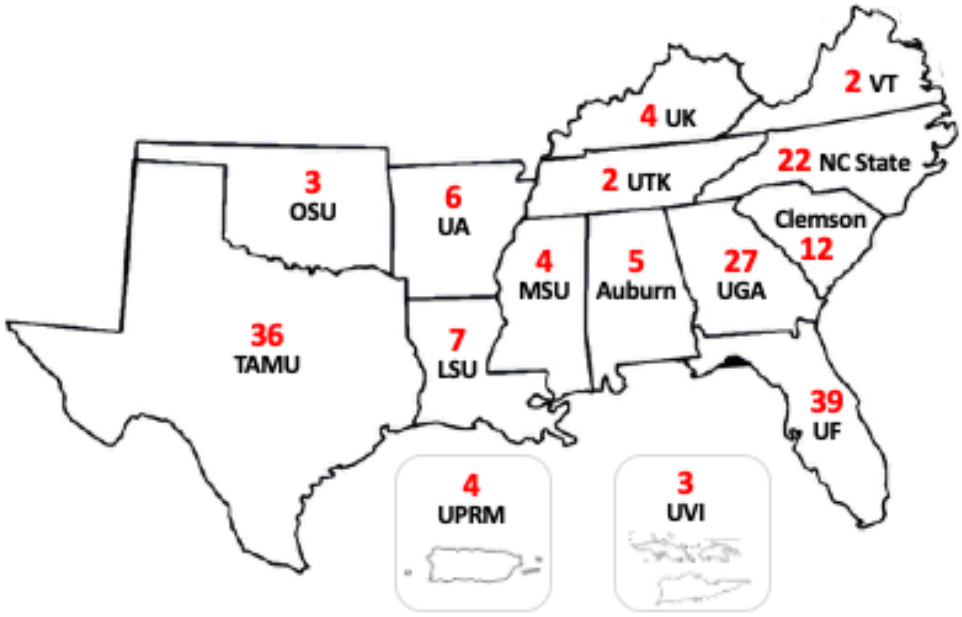

Figure 1. Geographic distribution of public plant breeding capacity across the Southern region. Numbers on the map represent the number of plant breeders associated with each institution.

Table 1. Distribution of Southern public plant breeding programs by crop category and selected Southern focus crops. Institution numbers indicate the number of universities with active breeding programs in each category, while breeder numbers represent the total number of breeders associated with those crops.

Crops	Institutions	Institution Numbers	Breeder Numbers	Representative Crops
Regional Crop Categories				
Grain Crops	Clemson, UK, LSU, NCSU, OSU, TAMU, UF, UGA, UPM, VT	10	28	Wheat, Oats, Rye, Corn, Grain Legumes, Sorghum, Barley, Rye, Triticale, Oats
Forages, Pasture, Bioenergy	Auburn, UF, UGA, MSU, NCSU, OSU, TAMU, UK	8	16	Clover, Vetch, Perennial grasses, Switchgrass
Vegetables	Clemson, UA, UF, NCSU, UGA, UK, TAMU, UPM, UVI	9	31	Tomato, Lettuce, Peppers, Cucurbits, Brassicas, Potato
Small Fruits	Auburn, UA, UF, UGA, NCSU, TAMU	6	14	Strawberry, Raspberry, Blackberry, Muscadine Grapes
Ornamentals	MSU, OSU, NCSU, TAMU, UF, UGA	6	13	Rose, Lily, Coleus, Nursery crops
Forestry	NCSU, UF, TAMU	3	6	Loblolly Pine, Slash Pine, Eucalyptus, Christmas trees
Tree Fruits	Clemson, UGA, UF	3	8	Peach, Pecan, Citrus, Pomegranate
Tropical Specialty Crops	UPRM, UVI, UF	3	7	Sorrel, Dragon fruit, Guar, Cowpea, Coffee, Calabaza, Pigeon Peas
Southern Focus Crops				
Peanut	Auburn, UF, UGA, NCSU, TAMU, VT	7	12	
Cotton	Auburn, Clemson, MSU, NCSU, TAMU, UGA, UA	7	13	

Crops	Institutions	Institution Numbers	Breeder Numbers	Representative Crops
Soybean	Auburn, NCSU, TAMU, UTK, UA, UGA, VT	7	8	
Turf	UF, UGA, MSU, NCSU, OSU, TAMU	6	8	
Rice	LSU, TAMU, UA	3	8	
Sugarcane	LSU, TAMU, UF	3	5	
Sweetpotato	LSU, NCSU, UVI	3	3	
Citrus	UF, TAMU	2	7	

Major Commodity Systems, Statewide Cultivar Influence, and Economic Significance

Public breeding programs influence agricultural industries encompassing millions of acres of production and billions of dollars in farm-gate value across the Southern region. Although this survey was not designed as a comprehensive economic impact assessment, responses demonstrate that public cultivars remain foundational to many of the South's major commodity systems while supporting long-term producer competitiveness, industry resilience, and regional agricultural economies.

Several institutions reported strong statewide influence through direct cultivar adoption, certified seed systems, and long-standing producer trust within major commodity crops. LSU-developed cultivars account for approximately 60–70% of Louisiana rice acreage, while essentially all Louisiana sugarcane acreage is planted in LSU varieties, supporting industries valued in the hundreds of millions to more than one billion dollars annually. Oklahoma estimated that roughly 70% of state wheat acreage is planted in OSU-developed cultivars, with previous analyses estimating an 8.8:1 return on public investment in the breeding program.

North Carolina indicated that approximately 90% of the state's sweetpotato acreage and 90% of Virginia-type peanut acreage are planted in NC State cultivars, along with approximately 80% of tobacco acreage. University of Arkansas reported that UADA-developed rice cultivars account for approximately 25–30% of Arkansas rice acreage, representing an estimated 310,000 acres in 2025. Georgia reported similarly strong influence in peanut production, where UGA-developed cultivars account for approximately 90% of runner-type peanut acreage supporting a crop with an annual farm-gate value of $877 million. Tennessee further estimated that approximately $2.3 million in direct producer revenue generated by UT soybean cultivars supported nearly $20.8 million in total economic activity through downstream processing and related industries.

Kentucky and Virginia highlighted continued public breeding influence within regional small grain systems through crop improvement partnerships and regionally adapted variety development. Collectively, these examples demonstrate that public breeding programs serve not only as major drivers of cultivar deployment across several of the South's most economically important commodity systems, but also as long-term investments supporting agricultural productivity and rural economies.

Germplasm, Adaptation, and Broader Industry Influence

Breeding impact extends beyond cultivar acreage through germplasm development, regional adaptation, disease resistance, and long-term support of commercial breeding systems. Texas A&M described a broad breeding portfolio spanning row crops, forages, turfgrass, horticultural crops, fruits, vegetables, ornamentals, and specialty commodities, emphasizing the continuing importance of public cultivars where regional adaptation, stress tolerance, and end-use quality remain critical.

Alabama, North Carolina, and Tennessee similarly emphasized broader germplasm and trait-development roles within commercial agriculture. Tennessee noted that several UT soybean lines have served as USDA check varieties in national testing systems, while Arkansas reported that its blackberry and table grape cultivars are grown worldwide despite limited commercial acreage within the state. Oklahoma highlighted the use of OSU-developed turfgrass varieties on collegiate and professional athletic fields, including surfaces associated with upcoming FIFA World Cup venues. Louisiana also reported international licensing of sweetpotato cultivars.

Collectively, Southern public breeding programs function not only as cultivar development programs, but also as regional adaptation and germplasm infrastructure supporting broader agricultural systems.

Specialty, Regional, and Limited-Market Crop Stewardship

The survey also highlighted the important role public breeding programs play in supporting specialty, perennial, tropical, and limited-market crops that often receive little sustained private-sector breeding investment. Institutions described breeding efforts involving muscadine grape, southern pea, sweetpotato, pigeonpea, cassava, blackberry, table grape, forage grasses, ornamentals, turfgrass, vegetable crops, and numerous tropical commodities.

Georgia and Florida demonstrated the extraordinary diversity of breeding targets supported within some Southern states, spanning forage systems, ornamentals, fruit crops, turfgrass, forestry species, vegetables, and specialty crops. Kentucky described work in specialty grains such as chia, cereal rye, and sorghum, while Oklahoma highlighted emerging ornamental breeding efforts supported through nursery partnerships and state investment.

Puerto Rico and the Virgin Islands provided particularly important perspectives on the role of public breeding within tropical and small-scale agricultural systems. Puerto Rico described AES programs supporting vegetable, legume, tropical staples, and specialty crop systems where formal certified seed systems remain limited, while the Virgin Islands emphasized breeding support for small-scale local farmers serving regional grocery and farmers market systems.

Many programs therefore serve as long-term stewards of crops receiving limited commercial breeding attention despite their regional agricultural and economic importance.

Transitioning Industries and System Vulnerabilities

Broader transitions are occurring within Southern agriculture and the breeding systems that support it. Kentucky noted that its historically important tobacco breeding program will not be replaced following

faculty retirement due to contraction of the tobacco sector. Arkansas similarly reported declining southern pea acreage following the loss of a major processing partner.

Other institutions described challenges associated with tracking certified seed adoption, maintaining germplasm resources, or quantifying impacts within perennial and vegetatively propagated crops. Long-term continuity depends not only on scientific expertise, but also on sustained infrastructure, industry relationships, and institutional commitment.

DESCRIPTIVE FINDINGS

The following sections summarize institutional approaches to commercialization, industry alignment, succession planning, and germplasm stewardship across Southern public plant breeding programs. Together, these findings provide context for understanding the organizational structures, support systems, and continuity challenges shaping long-term regional breeding capacity.

Commercialization, Intellectual Property, and Partnerships

Survey responses highlighted the interconnected roles of royalty-sharing policies, intellectual property management, and external partnerships in supporting plant breeding and cultivar commercialization. Institutions described a range of structures involving technology transfer offices, research foundations, crop improvement associations, and foundation seed organizations. Together, these responses illustrate how experiment stations coordinate cultivar commercialization activities while helping sustain long-term breeding programs.

Royalty Sharing

A recurring theme was the importance of reinvesting royalty revenue into breeding programs, research infrastructure, and future cultivar development. Institutions use several approaches for distributing royalty income generated through cultivar commercialization. The most common model is a shared distribution framework in which inventors/breeders, departments or experiment stations, and institutional research or technology transfer offices each receive a percentage of royalty income. The degree of reinvestment into breeding programs varies considerably across institutions.

Several states, including Florida, Georgia, Mississippi, and Tennessee, reported tiered systems in which distributions change based on royalty revenue levels or cost recovery thresholds. These approaches often direct larger shares of higher revenues back into institutional or research infrastructure support.

Other institutions operate under simpler split models. Arkansas, Oklahoma, Louisiana, and Virginia generally described more direct percentage allocations among breeders, commercialization offices, and institutional units. South Carolina emphasized direct breeder/program support, while Texas reported a more inventor-focused approach with comparatively limited reinvestment into departments or colleges.

Table 2. Royalty-sharing approaches used by Southern public plant breeding programs. Institutions employ a range of royalty distribution models that balance inventor incentives, program reinvestment, and institutional support.

State/Territory	Model	Key Features
Alabama	Multi-party split	Revenue shared among foundation services, patent/IP offices, breeders, and university units.
Arkansas	Breeder-focused split	Majority to breeders with shares to commercialization and system offices.
Florida	Tiered reinvestment	Royalty income distributed through a phased reinvestment structure benefiting breeding programs and FAES.
Georgia	Detailed reinvestment model	Revenue supports inventors, research programs, departments, and UGA research infrastructure.
Kentucky	Dual pathway system	Public releases and hybrids handled through separate management pathways.
Louisiana	AgCenter split	Revenue distributed among inventors, OTT, departments, and college administration.
Mississippi	Tiered by income	Distribution percentages change as royalty income increases.
North Carolina	Structured reinvestment	Revenue shared across inventor, licensing, departments, and breeding support programs.
Oklahoma	Simple split	Direct allocation among inventors, technology office, and PI program.
Puerto Rico	No formal policy	No dedicated plant breeding royalty-sharing structure reported.
South Carolina	Breeder/program emphasis	Majority of royalties returned directly to breeder and program.
Tennessee	Tiered institutional model	Revenue shared among inventor, campus, departments, and UTFI using income thresholds.
Texas	Inventor-focused model	Larger share to inventors with limited reinvestment to departments or colleges.
Virginia	General split	Shared distribution between academic units and breeders.
Virgin Islands	Under development	Institutional policy currently being developed.

Intellectual Property Management

Plant breeding intellectual property differs from traditional university inventions because of cultivar release procedures, certification requirements, commodity-board involvement, and stewardship responsibilities. Most universities rely on centralized technology transfer offices or research foundations to oversee patents, Plant Variety Protection (PVP), licensing, and commercialization activities. In many cases, these offices work closely with experiment stations, foundation seed organizations, or commodity groups to coordinate cultivar release and royalty management.

Several institutions maintain agriculture-specific systems that differ from traditional university patent management models. Arkansas, Kentucky, Louisiana, and Oklahoma described hybrid approaches involving crop improvement associations, certification programs, or dedicated agricultural commercialization entities. Florida and Georgia reported highly structured systems centered on research foundations and formal licensing programs. Overall, institutions emphasized the need for intellectual property systems that balance commercialization opportunities with long-term public cultivar development goals.

Table 3. Institutional approaches to intellectual property management and cultivar commercialization. Management structures include technology transfer offices, research foundations, crop improvement associations, and other entities supporting variety protection and licensing.

State/Territory	Management Approach	Key Features
Alabama	Central technology transfer	Managed through the university technology transfer office.
Arkansas	Internal/agricultural crop-specific hybrid system	Row crop IP managed through the Arkansas Crop Variety Improvement Program; fruit IP managed through commercialization offices with emphasis on revenue generation.
Florida	Protection and licensing	Strong emphasis on PVP certificates and licensing coordinated through the UF research foundation.
Georgia	Research foundation model	IP assigned to UGA Research Foundation with dedicated commercialization staff support.
Kentucky	Committee plus commercialization	Seed/certification committees review releases while licensing and PVP processes are handled through commercialization offices.
Louisiana	Agriculture IP office	AgCenter maintains its own IP office for managing licensing and commercialization agreements.
Mississippi	Central OTM management	Managed through the Office of Technology Management.
North Carolina	Central licensing model	University Office of Technology and Licensing manages commercialization, patents, and licensing with breeder and college involvement.
Oklahoma	OTC plus marketing/enforcement partner	Office of Technology Commercialization manages IP while Oklahoma Genetics Inc. addresses non-compliance and enforcement.
Puerto Rico	Third-party/emerging model	Patent and commercialization activities handled through external technology transfer partnerships.
South Carolina	Research foundation	Managed through the Clemson University Research Foundation.
Tennessee	UTFI model	University of Tennessee Research Foundation created by UT employees and commercialization staff.
Texas	System-wide central model	Managed through TAMU System technology transfer/commercialization with collaboration from AgriLife and Foundation Seed units.
Virginia	Central commercialization program	Virginia Tech licensing and commercialization office manages plant IP associated with variety development.
Virgin Islands	Under review	No formalized model currently in place; policy development ongoing through research administration.

Management Partnerships

Many institutions reported partnerships that play important roles in managing breeding portfolios and supporting cultivar commercialization. These partnerships commonly involve foundation seed organizations, crop improvement associations, commodity boards, research foundations, and affiliated nonprofit entities that assist with seed increase, licensing, stewardship, quality control, and industry coordination. In several states, these organizations serve as a bridge between public breeding programs and private-sector deployment.

Table 4. Partnerships supporting cultivar development, commercialization, and stewardship. Foundation seed organizations, crop improvement associations, research foundations, and commodity groups play important roles in extending the impact of public breeding programs.

State/Territory	Partnership Model	Key Features
Alabama	Limited/formal partnerships	Institutionally managed with some industry interaction.
Arkansas	Crop improvement partnerships	Strong collaboration with crop improvement associations and foundation seed programs.
Florida	Foundation seed organization	Florida Foundation Seed Producers supports licensing and commercialization.
Georgia	Foundation and commodity partnerships	Research foundation and commodity groups assist with licensing and cultivar deployment.
Kentucky	Commodity and certification partnerships	Commodity organizations and certification programs support release and seed systems.
Louisiana	AgCenter-centered coordination	Internal AgCenter system coordinates commercialization and partnerships.
Mississippi	Foundation/crop partnerships	Uses crop improvement and foundation seed collaborations.
North Carolina	University and commodity network	Commercialization supported through university licensing and commodity relationships.
Oklahoma	Foundation and compliance structure	Oklahoma Genetics Inc. supports commercialization and stewardship.
Puerto Rico	Emerging/external partnerships	Limited internal structure with reliance on external collaborators.
South Carolina	Research foundation support	Clemson foundation structure assists with IP and licensing coordination.
Tennessee	Research foundation model	UTFI supports licensing and commercialization activities.
Texas	System-wide commercialization network	AgriLife, Foundation Seed, and system commercialization offices coordinate activities.
Virginia	Centralized commercialization support	Managed through university commercialization and foundation structures.
Virgin Islands	Developing partnerships	Partnership and commercialization systems remain under development.

Partnership structures are often closely tied to institutional commercialization and IP management systems. Arkansas, Florida, Georgia, Oklahoma, Tennessee, and Texas described particularly structured models involving dedicated seed, foundation, or commercialization organizations. Other institutions rely more heavily on centralized university systems or commodity-based collaborations. Successful cultivar commercialization often depends on coordinated partnerships that extend beyond the breeding program itself and support long-term variety development, distribution, and stewardship. These collaborative structures further extend the impact and long-term sustainability of public breeding programs.

Public Breeding Support and Industry Alignment

Public plant breeding programs across the region operate within interconnected networks involving experiment stations, private industry, commodity organizations, and other institutional funding mechanisms. Although organizational structures and funding models vary considerably among states, most institutions described breeding programs as serving complementary roles alongside private-sector

breeding while relying on a combination of public investment, stakeholder support, and commercialization revenue to sustain long-term capacity.

Many experiment stations emphasized that public breeding programs focus on regional adaptation, specialty crops, disease resistance, pre-breeding activities, and other areas that may receive limited attention from commercial breeding programs. Several states described strong alignment with private industry through licensing agreements, cooperative testing, germplasm sharing, and stakeholder-driven variety development. Texas, Georgia, Louisiana, Arkansas, and Virginia reported particularly active engagement with commercial partners and licensing systems, while North Carolina, Tennessee, and Puerto Rico highlighted the continuing importance of public breeding programs in addressing niche, regional, or long-term agricultural needs not fully served by private-sector investment. This includes pre-breeding and germplasm development activities that support commercial breeding pipelines.

Institutions also described broad reliance on experiment station support through Hatch funds, institutional resources, royalty reinvestment, and infrastructure support mechanisms. Common forms of support included breeder salaries, technical staff, field operations, greenhouse infrastructure, laboratory equipment, and statewide testing networks. Several states emphasized the growing importance of royalty income as a mechanism for maintaining breeding operations and reinvesting in infrastructure and technical capacity. At the same time, respondents noted varying levels of institutional support and continuing constraints associated with equipment costs, personnel support, and long-term operational sustainability.

Commodity organizations emerged as another critical component of the regional breeding support system. Many institutions described strong commodity-board partnerships supporting crops such as rice, wheat, soybean, sugarcane, cotton, and specialty horticultural crops. In several states, commodity groups provide substantial direct funding, stakeholder coordination, field-testing support, and long-term engagement in breeding priorities. These relationships appear especially important in maintaining alignment between experiment station breeding activities and producer needs while helping sustain public breeding capacity in strategically important crops.

The survey highlights the importance of USDA-ARS partnerships across the Southern breeding landscape, including collaborations in cultivar development, genomics, germplasm evaluation, and long-term genetic resource stewardship. These collaborations often provide critical scientific capacity in areas such as genomics, marker-assisted selection, phenotyping, end-use quality evaluation, and cultivar development. Examples include rice breeding collaborations in Arkansas, cotton improvement in Texas, sugarcane breeding partnerships in Louisiana, peanut breeding collaborations in Oklahoma, and genotyping support for soybean breeding in Tennessee. Several states also reported reliance on USDA-ARS repositories, storage facilities, and national collections for germplasm preservation and evaluation. These partnerships effectively expand regional breeding capacity and help maintain capabilities that would be difficult for individual institutions to support independently.

Table 5. Selected USDA-ARS facilities supporting public plant breeding programs across the Southern region. USDA-ARS facilities provide breeding expertise, germplasm resources, and research infrastructure that support crop improvement efforts across the Southern region.

ARS Unit / Location	Crops	Regional Role	University Partnerships
Crop Genetics Research Unit - Stoneville, MS	Cotton, soybean	Coordinates Uniform Soybean Tests and National Cotton Variety Tests; develops disease and stress-resistant germplasm	Mississippi State University and regional soybean/cotton breeding programs
Dale Bumpers National Rice Research Unit – Stuttgart, AR	Rice	Conducts genetic improvement research, germplasm evaluation, disease and pest resistance	University of Arkansas
Crop Germplasm Research Unit – College Station, TX	Cotton, pecan, sorghum	Maintains national cotton and pecan germplasm collections; develops improved breeding materials	Texas A&M University and southern breeding programs
Crop Genetics & Breeding Research Unit - Tifton, GA	Peanut, sorghum, pearl millet, forage and turf grasses	Cultivar development and breeding methods research	University of Georgia
Plant Genetic Resources Conservation Unit - Griffin, GA	Multiple crops	National germplasm repository supporting breeding programs throughout the South	Regional S-9 germplasm network
Fruit & Tree Nut Research – Byron, GA	Peach, pecan	Rootstock and cultivar development; disease resistance	University of Georgia
Sugarcane Research Unit - Houma, LA	Sugarcane	Develops improved sugarcane germplasm with emphasis on disease resistance, yield, stress tolerance.	Louisiana State University
Southern Horticultural Laboratory - Poplarville, MS	Blueberry and specialty crops	Germplasm development and breeding technologies	Mississippi State University and regional fruit programs
Subtropical Horticultural Research Station - Miami, FL	Tropical and subtropical crops	Genetic improvement and protection of specialty crops	University of Florida and tropical crop researchers
Soybean and Nitrogen Fixation Research Unit – Raleigh, NC	Soybean	Develop improved soybean germplasm with emphasis on high yield, high protein quantity and quality, heart-healthy oil, and tolerance to drought, heat, and flood	North Carolina State University
Maize Breeding & Genetics Research Unit – Raleigh, NC	Corn	Genetic improvement of maize and developing understanding of maize genetic variation	North Carolina State University

Across the region, public breeding programs are sustained through layered systems of institutional investment, stakeholder support, commercialization activity, and industry collaboration. While specific structures differ across institutions, the survey consistently demonstrates the continuing importance of experiment stations as long-term stewards of regional crop improvement, germplasm development, and agricultural innovation.

Table 6. Public breeding support structures and industry alignment across Southern institutions. Responses summarize the role of institutional support, commodity organizations, and industry partnerships in sustaining public plant breeding programs.

State/Territory	Industry Alignment	Institutional Support	Commodity Support
Alabama	Strong testing and regional adaptation	Hatch support constrained by matching requirements	Moderate commodity-board support
Arkansas	Strong rice/fruit collaboration and germplasm sharing	Broad AAES infrastructure and equipment support	Strong soybean and rice board support
Florida	High private-sector alignment	Royalties reinvested into breeding programs	Partial commodity support
Georgia	Gap-filling role with licensing emphasis	Extensive infrastructure and technical support	Broad commodity engagement

State/Territory	Industry Alignment	Institutional Support	Commodity Support
Kentucky	Commodity-driven alignment	Mixed support from Hatch, grants, and royalties	Small grain and specialty crop partnerships
Louisiana	Cooperative licensing agreements	State and Hatch operational support	Major commodity investment
Mississippi	General industry alignment	Operational support with limited personnel support	Selective commodity-board support
North Carolina	Strategic pre-breeding role	Strategic royalty/institutional reinvestment	Broad commodity partnerships
Oklahoma	Targeted crop alignment	Hatch salary support	Wheat Commission and royalty partnerships
Puerto Rico	Niche and resilience focus	Hatch and limited program income support	Minimal commodity-board structure
South Carolina	Alignment with need for stronger strategy	Technical support emphasis	Targeted specialty crop support
Tennessee	Public gap-filling role	General institutional support	Commodity support present
Texas	Broad strategic partnerships	Large-scale coordinated investment	Extensive commodity involvement
Virginia	Industry-request driven releases	Royalty-supported operations	Commodity and federal support
Virgin Islands	Workforce and educational emphasis	Hatch-supported staffing/materials	No commodity-board support

SUCCESSION PLANNING AND PROGRAM CONTINUITY

Ensuring continuity within public plant breeding programs has become an increasingly important challenge across the Southern region as institutions face breeder retirements, constrained hiring capacity, and the long timelines required to sustain cultivar development programs. Formal, comprehensive succession plans are not consistently in place across plant breeding programs. While several institutions reported proactive or partially developed approaches, many described succession planning as informal, commodity-specific, reactive, or dependent upon available resources and hiring opportunities. Continuity planning is generally strongest for large, economically important crops, while smaller or specialty programs are more vulnerable to disruption following retirements, departures, or extended vacancies.

Table 7. Succession planning approaches within Southern public plant breeding programs[1]. Institutions reported varying levels of preparedness for breeder transitions, ranging from formal continuity frameworks to largely informal or reactive approaches.

State/Territory	Succession Planning Status	Continuity Approach	Key Observation
Arkansas	Case-by-case planning	Interim management and overlap hiring	High-impact programs may overlap retiring and incoming breeders.
Florida	Emerging formal framework	SOPs, transition planning, institutional coordination	Structured succession planning framework under development.
Georgia	Limited/program-specific	Commodity-focused planning	Planning primarily associated with peanut breeding.
Kentucky	Commodity-dependent	Selective transition planning	Wheat transition planned; tobacco breeder not replaced.
Louisiana	Proactive transition approach	Overlap hiring and retention efforts	Emphasis on bringing successors in prior to retirement.
North Carolina	Partial/priority-based	Commodity prioritization	Stronger continuity planning for major crops than specialty programs.

State/Territory	Succession Planning Status	Continuity Approach	Key Observation
Puerto Rico	Partial but constrained	Emeritus continuity	Hiring freezes limit long-term succession capacity.
Tennessee	Case-by-case planning	Commodity-focused planning	Successful soybean transition without formal written plan.
Texas	Structured multi-level planning	Overlap hiring, documentation, interim management	Comprehensive institutional framework.

[1]AL, MS, OK, SC, VA, VI indicated no formal plan

Several institutions described strategies intended to reduce disruption during leadership transitions. Common approaches included overlap hiring prior to retirement, interim management by postdoctoral associates or senior technical staff, continued involvement of retiring faculty, and temporary reliance on long-term collaborators or external partners. Arkansas described the use of postdoctoral or senior staff oversight during transitions and, in some cases, overlap appointments between retiring breeders and successors. Louisiana emphasized efforts to bring in replacements prior to retirement whenever possible, while Tennessee reported successful commodity-specific transitions managed on a case-by-case basis. Texas described a more structured multi-level approach involving departmental, college, and agency planning, identification of critical programs, interim management strategies, and efforts to document program continuity.

At the same time, many institutions reported limited or no formal succession planning capacity. Several states, including Alabama, Mississippi, Oklahoma, South Carolina, Virginia, and the Virgin Islands, indicated that no structured succession plans are currently in place. Puerto Rico reported continued emeritus involvement by retired breeders but noted that hiring constraints and frozen positions limit long-term planning capacity. North Carolina emphasized that continuity planning often depends on crop importance and available support, with stronger protections for major commodities than for smaller or specialty crop programs.

Responses also suggest that succession planning is closely tied to broader institutional hiring capacity and long-term investment in public breeding programs. Most institutions indicated that new hiring activity is largely limited to replacement positions rather than program expansion. In several cases, future positions may shift toward broader crop improvement responsibilities incorporating genomics, phenomics, data science, or related technologies rather than traditional commodity-specific breeding roles. These trends also raise questions regarding continuity of institutional expertise, long-term maintenance of regionally adapted breeding programs, and preservation of institutional knowledge associated with long-term cultivar development.

Although formalized succession planning remains uneven across the region, several responses reflected increasing recognition of the need for more structured continuity frameworks. One example currently under development is the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) succession planning initiative coordinated through the Florida Foundation Seed Producers system. The framework emphasizes development of program standard operating procedures, documentation of breeding workflows and decision processes, overlap planning for breeder transitions, and clearer

institutional responsibilities associated with program continuity. The initiative also includes efforts to streamline hiring and improve transition workflows.

Succession Planning Considerations

Survey responses indicate that more explicit institutional expectations regarding succession planning may help improve continuity across public breeding programs. Several institutions described effective use of overlap hiring, interim management strategies, and transition planning for high-priority programs, although these approaches remain unevenly applied across the region. Continuity planning appears strongest where long-term institutional commitment, commodity support, or clear program prioritization already exist.

Succession planning increasingly requires attention beyond replacement hiring alone. Documentation of breeding workflows, operational procedures, and institutional knowledge may help reduce disruption during leadership transitions, particularly within long-term breeding programs with extensive historical datasets, field trials, germplasm collections, and stakeholder relationships. More structured transition frameworks may also help institutions address vulnerabilities associated with smaller or specialty crop programs where replacement capacity is limited.

Several institutions further emphasized the importance of timely hiring processes and overlap opportunities when feasible. Emerging institutional models, including the developing framework at the University of Florida, illustrate how more coordinated transition planning approaches may support long-term continuity while helping preserve public breeding capacity across the region.

GERMPLASM CAPACITY, STEWARDSHIP, AND CONTINUITY

Long-term stewardship of breeding germplasm represents one of the foundational responsibilities of public plant breeding programs across the Southern region.

Institutions maintain highly diverse collections of breeding materials, seed stocks, field nurseries, and specialized crop resources; however, the infrastructure, documentation systems, redundancy safeguards, and continuity planning supporting these collections vary considerably across institutions and commodities. Germplasm stewardship extends well beyond storage considerations and increasingly involves broader issues of infrastructure investment, data management, continuity planning, and long-term preservation of regionally adapted genetic resources.

Current germplasm storage capacity and conditions vary widely across institutions, ranging from modern climate-controlled facilities with backup capacity to aging or constrained infrastructure with limited redundancy. Many institutions maintain decentralized storage systems at the program or research-station level rather than centralized institutional facilities. Arkansas described multiple secure storage locations supporting both Fayetteville and Stuttgart operations, while Louisiana reported crop-specific systems that include climate-controlled storage for rice alongside field nursery maintenance for sugarcane. Texas described both centralized and local storage systems with ongoing investments in redundancy and preservation capacity.

Other institutions reported more vulnerable or constrained systems. Tennessee described functional but aging cold rooms with limited backup capacity, no off-site duplication, and exposure to single-location risks following recent equipment failures. North Carolina identified concerns related to storage repair, renovation, backup power, and redundancy across decentralized collections. Alabama, Puerto Rico, Virginia, and the Virgin Islands reported limited or aging storage infrastructure with varying degrees of capacity constraints. Several institutions also emphasized that some germplasm collections remain dependent upon live field maintenance or greenhouse systems, particularly for perennial or vegetatively propagated crops, increasing vulnerability to environmental disruption, equipment failure, or resource limitations.

Many institutions rely heavily on external germplasm systems, including USDA-ARS collections, national repositories, and crop-specific preservation networks, to complement local storage and preservation efforts. Kentucky utilizes external crop improvement infrastructure for portions of its foundation seed system, while Louisiana and South Carolina reported reliance on USDA or national collections for certain crops and breeding materials. Participation in regional and national germplasm systems provides important redundancy and long-term security for breeding resources, particularly where institutional storage capacity is limited.

Data management and documentation systems associated with germplasm stewardship also vary substantially across institutions and commodities. Few institutions maintain centralized, institution-wide systems for inventory management, phenotypic and genotypic integration, or standardized data coordination across breeding programs. Most institutions instead rely on program-specific approaches ranging from spreadsheets and localized databases to more integrated platforms such as BreedBase, AgroBase, Field Book, or custom SQL systems. Texas reported relatively advanced integration of digital inventory, standardized field data, and genotypic and phenotypic analytics, while several other institutions described mixed or evolving systems with limited interoperability. Alabama reported no formalized system, and several institutions, including Puerto Rico and Kentucky, emphasized reliance on breeder-managed spreadsheets or commodity-specific approaches.

The survey also highlights broader risks associated with decentralized germplasm stewardship and uneven infrastructure capacity. Institutions identified concerns related to loss of genetic diversity, erosion of breeding populations and pre-breeding pipelines, limited redundancy in storage systems, and reduced availability of locally adapted germplasm over time. Challenges associated with breeder retirements or staffing transitions are also closely tied to germplasm stewardship responsibilities, particularly where collections, historical data, and breeding pipelines remain concentrated within individual programs. Several institutions noted that continuity planning increasingly involves preserving not only seed and breeding populations, but also institutional knowledge, historical datasets, operational workflows, and long-term breeding records.

Table 8. Germplasm stewardship capacity and continuity considerations across Southern breeding programs. Responses highlight variation in storage infrastructure, continuity safeguards, and data management systems supporting long-term preservation of breeding resources.

State/Territory	Storage Capacity	Continuity Risk	Data Systems
Alabama	Limited but improving	Facility transition	Minimal
Arkansas	Strong, multi-site	Moderate redundancy	BreedBase/Genovix
Clemson	Uneven/program-specific	Reliance on external systems	Decentralized
Florida	Variable by program	Program-dependent	Mixed/basic
Georgia	Adequate to strong	Variable by crop/location	No centralized system
Kentucky	Improving	External dependency	Individual breeder systems
Louisiana	Strong crop-specific systems	Mixed field/storage dependency	Customized BreedBase
Mississippi	Adequate but uneven	Decentralized vulnerability	Partial digital inventory
North Carolina	Large decentralized collections	Redundancy concerns	Mixed program systems
Oklahoma	Improved but constrained	Transition vulnerability	Evolving systems
Puerto Rico	Limited	Minimal redundancy	No integrated system
Tennessee	Functional but aging	High single-location risk	Practical decentralized
Texas	Extensive/modernizing	Active redundancy investment	Advanced integrated systems
Virgin Islands	Minimal	Limited continuity capacity	Developing
Virginia	Limited but improving	Capacity constraints	Limited integration

Germplasm Stewardship Considerations

Survey responses suggest that more explicit institutional expectations regarding germplasm stewardship, redundancy planning, and long-term continuity safeguards may help reduce vulnerability across public breeding programs. While some institutions maintain modern facilities and coordinated preservation systems, many reported decentralized or program-specific approaches with uneven backup capacity and limited long-term redundancy.

Continued engagement with external germplasm systems, including USDA-ARS and national repository networks, remains important for long-term preservation and risk reduction. Complementary institutional and regional approaches may further strengthen continuity capacity, particularly for specialty crops, perennial systems, and smaller breeding programs with limited infrastructure support.

The survey further suggests that germplasm stewardship increasingly depends upon effective data management, documentation, and interoperability across breeding programs. More coordinated approaches to inventory management, digital recordkeeping, and integration of phenotypic and genotypic data may improve continuity during personnel transitions while supporting long-term preservation of breeding populations and associated institutional knowledge.

Taken together, the responses demonstrate that germplasm stewardship within public breeding programs extends well beyond storage facilities alone and increasingly represents a broader institutional responsibility involving continuity planning, infrastructure investment, data management, and long-term preservation of regionally adapted genetic resources.

CONCLUSIONS

Southern public plant breeding programs continue to provide substantial impact across major commodity, horticultural, forage, and specialty crop systems. The survey responses reflect a highly diverse regional portfolio ranging from large-acreage commodity programs to smaller, regionally adapted, and specialty crop efforts that often receive limited private-sector attention. Many programs maintain strong alignment with producer and industry needs through cultivar development, germplasm improvement, regional adaptation, and long-standing stakeholder partnerships.

At the same time, the report highlights increasing unevenness in the institutional capacity supporting these programs across the region. Approaches to staffing, succession planning, infrastructure investment, germplasm preservation, data management, and commercialization vary considerably among institutions and commodities. Larger commodity programs often benefit from stronger continuity planning, commodity support, and established infrastructure, while smaller or specialty crop programs may operate with more limited personnel, redundancy, and long-term support.

The findings also demonstrate that public breeding capacity extends beyond individual breeders or cultivar releases alone. Long-term continuity increasingly depends upon broader institutional systems supporting germplasm stewardship, technical staffing, operational infrastructure, transition planning, data management, and preservation of institutional knowledge associated with long-term breeding programs.

Collectively, the responses reflect a regional breeding system that remains highly productive and influential, but increasingly uneven in its ability to sustain long-term continuity across all crops and institutions. The diversity and impact of Southern public plant breeding remain clear; however, maintaining that capacity over time will depend upon continued stewardship of expertise, infrastructure, germplasm resources, and institutional commitment.