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ASSESSING THE IMPACT OF CLUSTER FARMING INITIATIVES ON SMALL AND SOCIALLY DISADVANTAGED FARMERS, RANCHERS, AND FORESTLAND OWNERS: A CASE OF THE SOUTHEASTERN REGION OF THE UNITED STATES

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Abstract

Farming in clusters is an economically viable practice to sustain small, limited resource, and socially disadvantaged farmers and forestland owners with their agricultural operations. The objectives of the study were to strengthen the capacity of clientele on cluster farming and to lower production and marketing costs by sharing input costs. Clusters were created and interventions were provided by project partners through several activities, including workshops, meetings, field days, loans, and materials/equipment. The results showed that 29 clusters involving 224 farmers, and 14 cooperatives involving 410 farmers were formed and strengthened. The number of farmers participating in workshops, training programs, field days, and meetings were, respectively, 4,921, 3,095, 1,426, and 1,285. The results also revealed that 190 producers received access to farm loans, mobile and stationary cold storage facilities, and marketing materials. Additionally, 930 farmers strengthened their knowledge and skills, and changed their behavior due to the implementation of the cluster farming approach.

Keywords: Cluster Farming, Small and Socially Disadvantaged Farmers, Forestland Owners, Small Farmer Agricultural Cooperatives

Introduction

Most farms in the U.S. are small and account for close to half of the farmed acreage in the country. A vast majority of these small farms gross less than $50,000 per annum and their rate of return on equity is negative for all farms with less than $100,000 in gross sales. Small farms in the US account for less than 1% of total farm sales, and generally do not make a profit (USDA ERS, 2014). According to Butler and Wear (2013), forests cover more than 40% of the land in the Southern U.S. (232 million acres). Of these forests, over 86% are privately owned. Furthermore, Hanson et al. (2010) highlighted that forests are not only a matter of natural heritage and a source of clean air, water, and beauty, but they are also a source of renewable economic forest resources. The South is known as the world's "wood basket." The 13 Southern states contain some of the most productive forestlands in the world and provide for over 18% of the world's pulpwood for paper and paper-related products and 7% of its industrial round wood. In many areas served by 1890 land grant universities, small and underserved landowners control a significant portion of private forestland. Underserved and limited resource landowners often lack the knowledge to manage their forests and market the products and services derived from them. Their inability to market their forest products is also a result of their inability to participate in commercial markets with the amount of acreage that they produce timber on. According to

Tackie et al. (1998), the scale of operation of these farms, a majority of which are limited resource farms in Alabama, and by extension to forestland owners, is small; the mean farm size was 138 acres and the median size was 40 acres.

While poverty is a rural, suburban ,and urban challenge, the reality is that nearly 85% of America's counties that face persistent poverty are in rural areas. The USDA's Strike Force for Rural Growth and Opportunity Initiative is part of the commitment to growing economies, increasing investments, and creating opportunities in poverty-stricken rural communities (USDA ERS, 2014). Many of the small farms, ranches, and forestlands in the U.S. are located in or adjacent to persistently poverty-ridden counties and, many have been deemed USDA Strike Force counties. Despite the USDA's efforts to implement relevant policies and programs that benefit these communities, farmers and ranchers, rural communities, many continue to fall behind their counterparts with respect to opportunities that support sustainable enterprises and communities (MSLandCAN, 2019).

The spatial cluster has become an important concept in economic development research and policy practice, especially after its popularization in the Competitive Advantage of Nations (Porter, 1990). According to Smith (2003), clusters are geographic concentrations of firms in related industries that benefit not only from agglomeration economies derived from their spatial proximity but also from the increased competitive pressure as a result of the co-location. Cluster farming focuses on agriculture in all of its aspects. The major goal is to improve agriculture and reduce poverty with a socioeconomic approach to empower local farm families (Cluster Farming, n.d., a). Creating farmers' cooperatives to train, counsel, and assist the farm families financially with the setup of their farm is one of the major reasons why cluster farming exists. This results in a larger availability of affordable agricultural products for the local consumers in the market. Cluster farming creates real profit by merging several smallholder farms (called Satellites) attached to a mother farm (called a Hub farm) to a solid entrepreneurial group (called a cluster), which is capable of sharing both the revenues and the production costs. "Cluster Farming is the solution to empower people to grow food everywhere" (Cluster Farming, n.d., b).

According to the SFIC Project (2005), clusters are concentrations of firms or businesses that are located in relatively close proximity, and usually, compete with each other in similar markets and cooperate to enhance technical skills and market access support, through social networks, growth, and development of individual businesses. It argued that clusters with a greater density among, and less distance between, members are more effective. SFIC also stated that benefits from cluster farming are greater for small farmers because the input costs go lower when they operate in a cluster. Every cluster has one or more champions, who hold together the soft network infrastructure needed to make the cluster work. Clusters become more effective as they get older, become institutionalized and socially accepted locally, as they create a regional brand identity.
Hilchey (2008) mentioned that a functional cluster should have a clear vision and mission, strong leadership, an organizational framework, a broad representation of stakeholders, regular meetings, identified and prioritized issues, and should not integrate vertically or horizontally.

The purpose of this study, therefore, was to assess the impact of cluster farming activities on small and socially disadvantaged farmers, ranchers, and forestland owners. The specific

objectives were to (1) enhance sustainable production and marketing activities of a pre-established fruit and vegetable cluster, (2) support forest health and productivity for small forest landowners, and (3) sustain small cattle ranchers through equipment and nutritional innovations to enhance marketability.

Literature Review

Montiflor et al. (2015) conducted a comparative study of clustered farmers in Southern Philippines using a before and after approach, and found that the income of the farmers from vegetables increased by 42% after joining the cluster. The study further revealed that more than 82% of the farmers earned more income from cluster farming in comparison to individual farming. The authors further explained that respondents also indicated that cluster farming provided other benefits, including high or better market prices, better market opportunities, marketing assistance, financial support, and access to production inputs. Through cluster farming, farmers gained higher and more stable prices compared to what they received from traders.

Goetz et al. (2004) examined agricultural food industry clusters, and argued that industry clusters are essential in maintaining profitable U.S. agriculture. Clusters lead to higher productivity and profitability because they share common inputs, such as labor with specific skills. They benefit mutually from new, location-specific tacit knowledge generation and working together to respond to new demands, such as environmental, social, and economic goals. They further stated that clusters provide small farmers with countervailing market power in a "big-box" world and offer regions a source of competitive advantage. Also, clusters provide new avenues for technology transfer and new educational opportunities by helping farmers increase their entrepreneurial skills and business network. The authors further stated that clusters promote competitiveness and innovation, and agricultural operations always work better in clusters. Although clusters are beneficial, they may lack linkages. However, they can be used by producers, agribusinesses, and institutions to address the common challenges. They are especially valuable to small-scale farmers and agribusinesses alike.

Herr (2003) conducted a cluster analysis of Westmoreland and Fayette counties, and observed that cluster analysis provides an effective tool around which planning, policymaking, and service delivery activities can be focused. He indicated that relationships among individuals are crucial to cluster genesis and effective functioning as this enhances social network behaviors. The author further argued that "industry cluster identification and analysis can also allow planners to identify local industries that have a concentration of employment beyond the national average that may bean indicator of current stability and future growth or an ideal focus for the investment."

Varawa et al. (2014) assessed the use of cluster methodology to upscale tilapia fish production in Fiji Islands. They reported that cluster increased the economies of scale (i.e., lowered costs) of tilapia production, increased bargaining power in the procurement of farm inputs, like hatchery-seed and feed orders, provided better access to finance; led to a more coordinated marketing approach, and promoted knowledge-sharing among participating farmers. In this study, one group of farmers specialized in a particular aspect of the fish production chain, e.g., hatchery production, fingerling nursery, and feed manufacture, while other farmers specialized in growing

fish to harvest size. The cluster approach up-scaled the capacity of the farms that were operating at a 47% level to a production capacity of 80%, leading to a big boost in income.

Axalan et al. (2011) examined the socioeconomic impact of cluster marketing, and observed that farmers in a cluster increased their technical and marketing knowledge, improved their farming and marketing practices, improved their access to capital, and increased their income. The author further explained that trust, confidence, commitment, and unity among cluster members were established during the cluster marketing approach.

Naik and Nagadevara (2010) assessed spatial clusters in organic farming, and reported that cluster development has so far been very successful in transforming the economy of many countries as well as in the spread of multi-national companies (MNCs). However, the concept has not gained adequate attention in the development of micro, small, and medium enterprises where there is enormous potential for enhancing inclusive growth. The introduction of clusters in these enterprises can offer various advantages compared to a situation where such small businesses are located in geographically scattered areas. Such advantages include improved efficiency in production and marketing as well as a conducive environment for innovation.

Brasier et al. (2007) evaluated small farm clusters and pathways to rural community sustainability. They stated that cluster farming is a pathway to community development. The reason is that the benefits of clustering accrue primarily to the cluster as a whole and secondarily to the individual firms making up the cluster, and their customers. First, clusters can create a public value that in turn potentially justifies public interventions, including subsidies. Second, they are increasingly seen as key to the creation and exploitation of regional innovation and competitiveness. Because clusters are tied to specific places (regions), the benefits they create spill over into the wider community in which they are located.

Hassanein and Kloppenburg (1995) assessed knowledge exchange in the sustainable agriculture movement, and indicated that clusters encourage the growth of the local networks that can induce change in management behaviors. They stressed that research within the sustainable agriculture movement has emphasized the role that private networks play in disseminating local knowledge among producers to help them learn about techniques, technologies, practices, and environmental idiosyncrasies that will make them more successful.

Bernat (1999) examined industry clusters and rural labor markets. The author stated that cluster farming accrues many benefits over non-cluster farming. He mentioned specific economic benefits that include lower transportation costs for firms in the community because of input and output market agglomeration, higher worker productivity and skills, as well as spillovers of knowledge and accelerated spreading of innovation.

Methodology

The Existing Situation/Beginnings

These existing scenarios led to instituting the cluster farming approach to stimulate production and productivity of the small farmers, ranchers, and forestland owners. A cluster is a group of farms/farmers and/or allied food and agricultural enterprises, individuals, institutions, and agencies working together on shared interests and toward a common goal. Clusters in this study

were concentrations of small, limited resource, and socially and historically disadvantaged farmers and forest landowners of similar enterprises coming together for a common goal of increasing farm household income through agricultural and forestland operations. Clusters arise because they increase farm production and productivity, and thereby, farm income. The development and upgrading of clusters were initiated through a virtual "Center of Excellence for Innovative and Sustainable Small Farms, Ranches, and Forest Lands" (CISFRL). CISFRL is a partnership between seven 1890 universities (Tuskegee University [TU], the University of Arkansas at Pine Bluff [UAPB], South Carolina State University [SCSU], West Virginia State University [WVSU], Alcorn State University [ACSU], Southern University and A&M College [SUAMC], North Carolina A&T State University [NCAT]) and four USDA agencies (Natural Resources Conservation Service [NRCS], Forest Service [FS], Rural Development [RD], and Farm Service Agency [FSA]). The Center is focused on increasing profitability for small and socially disadvantaged farmers, ranchers, and forestland owners, through a clusters and cooperatives development model, an alternative methodology to empower these target groups.

A pilot program was implemented in seven states by the seven 1890 institutions in 2015. The Center intends to develop partnerships between clusters of small farmers, ranchers, and forestland owners with (1) commercial food systems, including food-based corporations, school systems, the timber industry, and other markets that have a commitment to enhancing the profitability, (2) selected larger farmers to buffer volume requirements to sustain commercial and diverse market contracts, and (3) facilitate peer-to-peer cooperation between cluster members for the transfer of information, opportunities, and technology. The target group of farmers are small family operations, including farms of the socially disadvantaged, veterans, women, underserved farmers, and other traditionally marginalized groups. An integral component of the program is managing risk through deliberate diversification at the market as well as the farm level.

Multiple Case Study Approach

A multiple case study approach was utilized to assess the impact of the first year of operation for CISFRL. In order to initiate the program, 1890 administrators developed an announcement for proposals to address small farm, ranch, and forest issues using methods of traditional extension or integrated research and extension projects. Out of the proposals reviewed, seven institutions Figure 4 were selected and funded for the inaugural year, 2015. Each of the seven institutions was a case study in this project and served as a data collection point in the program. In order to measure the impact of activities done and services provided by the institutions, a survey was conducted at the institution level capturing the events and activities organized and implemented by these seven institutions. The findings presented in this paper are based on the survey at the institution level that focuses on the outputs and the immediate impacts as a result of these interventions.

Theoretical Approach of Cluster Farming

A cluster farm merges 3-7 smaller farms in terms of management and resource allocation. This approach consolidates the limited and scattered resources from the smaller farms, increases the scale of production and thus, lowers the per-unit production cost to benefit everyone involved in the cluster. Simultaneously, it diversifies the costs into different products and markets the products in bulk, which simultaneously decreases the marketing cost. The reduction of production and marketing costs makes the product affordable for low-income families.

Moreover, the increased scale of production enables cluster farms to increase the quantity supplied and this, in turn, increases the amount of revenue that small farmers get. Clusters may include cooperatives, associations, networks, and other community-based organizations focused on increasing farm profitability for the participating small farmers. Figure 1 shows a conceptual framework of cluster farming. It reinforces the preceding explanations of cluster farming.

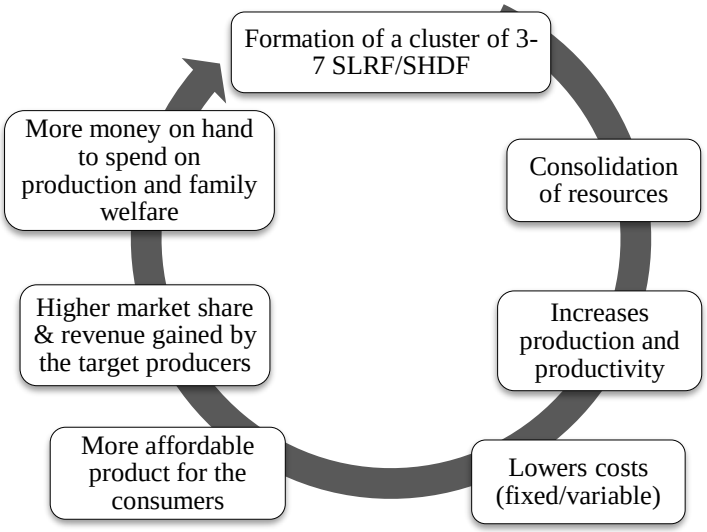

Figure 1. A Conceptual Framework of Cluster Farming
SLRF = Small and Limited Resource farmers; SHDF = Socially and Historically Disadvantaged Farmers

Economies of Scale and Production Costs at Clustered Farms vs. Small Farms

Regarding the economies of scale of production, Hilchey (2008) argued that combining resources for economies of scale is one of the major benefits of cluster farming compared to farming as individuals, where economies of scale are difficult to achieve, especially for small farmers. Figure 2 compares the production costs between a small farm and a clustered farm. The point a (pcsif) indicates an average cost per unit of production for a small individual farm that produces QPSIF quantity. Similarly, point b (pccf) shows an average cost per unit of production in a clustered farm that produces QPCF quantity. If per unit produce price is below pcsif, these small individual farms will suffer a loss. Thus, small farms generally do not make a profit because of the high cost per unit of production (pcsif). Therefore, QPCF could be an immediate policy approach to empower small and limited resource farmers (SLRF) and socially and historically disadvantaged farmers (SHDF) to sustain their agricultural operations. Figure 2 shows how bringing farmers together in a cluster helps reduce the production cost as shown by point b (pccf), the much lower cost in cluster farms in comparison to a much higher production cost of an individual small farm or small farms as denoted by point a (pscif).

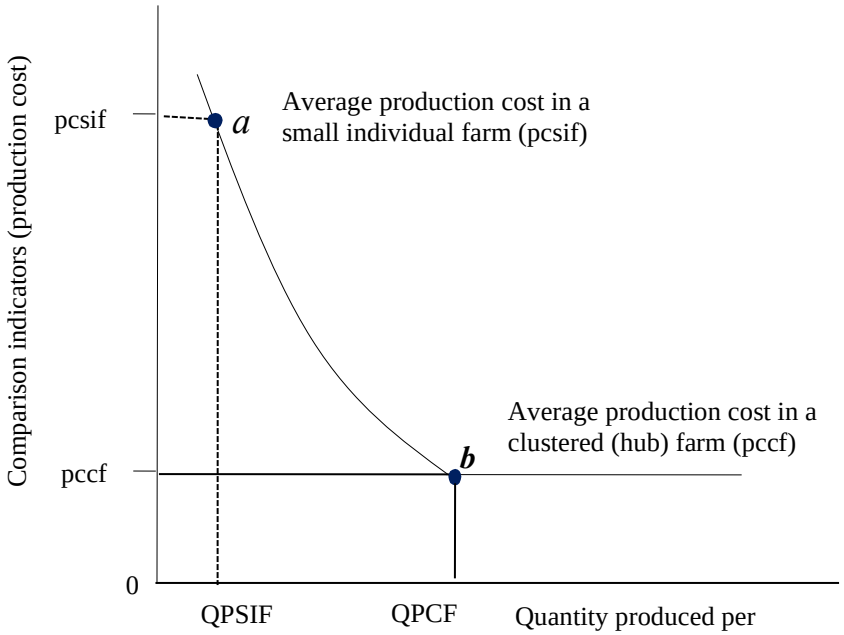

Figure 2. A Comparison of Production Costs between a Small Farm and Clustered Farms

Cluster Farming Development Scenarios

There is not one particular scenario/method/tool/approach and technique that may work as well for all target audiences such as SLRF/SHDF. Therefore, the most feasible policy option could be a combination of a few options that would better empower the target groups. Broadly speaking, the three scenarios presented in Figure 3 seem to be open and applicable to support the target groups (SLRF/SHDF) as a ground up approach. One or both types of farm(s) (demonstration farms and cluster farms) promote the small farmer agricultural cooperatives (SFAC) development. The SFAC was conceptually initiated by Tuskegee University, College of Agriculture, Environment and Nutrition Sciences (CAENS) in 2014 to empower SLRF and SHDF in the Black Belt Counties of Alabama. Many small farms in rural communities are technically, allocatively, and economically inefficient due to relatively high input costs and credit discrimination and, other constraints that prevent them from taking advantage of appropriate technology and other resources (general observation and experience). However, Porter and Scully (1987) argued that cooperatives survive, despite their relative inefficiency, because of free services provided by the USDA, favorable tax treatment, and encouraging credit terms. Also, Ortmann & King (2006) argued that cooperatives should be implemented in regions that have weak and/or failing markets and, high input costs, and product marketing services are lacking.

Scenario 1 can develop a cluster considering one of the four types of farms listed, or all these farms can be expanded into cluster farming approach. A single farm may share/supply resources to many individual farms or multiple small farms may come together and form a cluster. The cluster may work on a single crop or multiple crops. Scenario 2 may consolidate demonstration farms or existing small farms to develop a cluster. However, Scenario 3 may accommodate any demonstration farms or cluster farms or existing farms to form SFAC that promotes cluster farming approach and goal.

Scenario 1	Scenario 2	Scenario 3
Demonstration farms • Single farm • Multiple farms • Monocropping • Multiple cropping	*Clustered farms* • Consolidation of (3-7) demonstration farms or • Consolidation of (3-7) existing operating farms	*Small farmer agricultural cooperatives* • Multiple demonstration farms or • Multiple cluster farms or • Multiple existing operating farms

Figure 3. Three Major Scenarios of Cluster Farming Development

Conceptual Framework

The conceptual framework of the study is presented in Figure 4 that shows the schematic diagram of the study. CISFRL was established in 2015 with the four agencies of the USDA to commemorate the 125th anniversary of the signing of the Second Morrill Act of 1890. It comprised seven institutions, which collectively intervened in the activities of SLRF and SHDF by establishing and strengthening cluster farming and small farmer agricultural cooperatives (SFAC). The major interventions of CISFRL to empower the target farmers were training programs, workshops, local, regional, and national meetings/conferences, and field days. Likewise, the major support services offered by CISFRL were increasing farmers' access to FSA loans, facilitating farmers' ability to procure inputs/materials and equipment, and producing educational material for farmers' use.

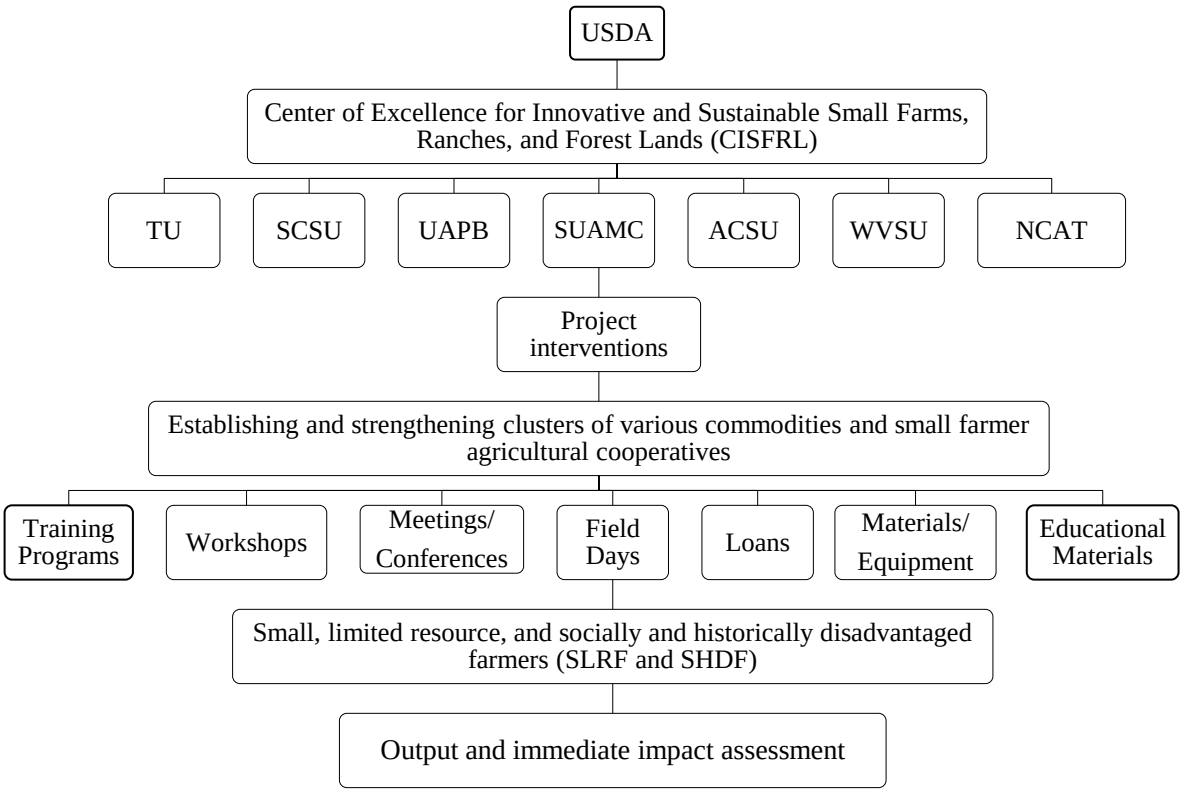

Figure 4. A Schematic Diagram of the Study

Results and Discussion

Strategy Results

Clusters and Cooperatives

CISFRL established and strengthened 29 clusters in four of the seven states (Arkansas, Louisiana, Alabama, and West Virginia). These clusters included 224 target farmers. Thus, the average number of farmers per cluster was 8, which seems to be close to the pragmatic principle of cluster farming (3-7 farms). Simultaneously, the CISFRL established and strengthened 14 small farmer agricultural cooperatives (SFACs) in four of the seven states (South Carolina, Mississippi, Arkansas, and Alabama). These SFACs included 410 target farmers, and the average number of farmers per cooperative was 29. Usually, the number of farmers joining cooperatives increases steadily as cooperatives gradually grow and expand their services. The major cluster groups of farmers formed were for fruits and vegetables, beef cattle, pasture, agronomic crops, cold storage, row crops, and forestland management. The major cooperatives established were for fruits and vegetables, and small-scale livestock producers.

Building and Strengthening Human Capital

CISFRL implemented four major programs to build and strengthen farmers' knowledge and skills about cluster farming and cooperatives, namely, training programs, workshops, meetings/conferences, and field days. The type of activities in each program and the level of participation are succinctly presented in the succeeding sections.

Intervention Results

Farmers' Willingness to Participate in Workshops

Workshops were organized in 10 different areas to accommodate the interests and needs of the farmers in the respective communities and cluster of a particular state. A total of 4,921 farmers participated in the workshops. An overwhelmingly majority of farmers participated in workshops organized by Southern University and A&M College, LA (60%); followed by Alcorn State University, MS (18%); South Carolina State University**,** SC (10%); and Tuskegee University, AL (25%). The workshops were conducted under ten different areas, of which, good agricultural practices (GAPs), good handling practices (GHPs), managing risks, and insurance (crops and animals) had the largest participation rate (21%); followed by record keeping, financial tools, and farm management (19%), farm safety standards and certification (21%), and soil fertility and nutrient management and integrated pest management (12%). Other areas of workshops farmers participated in were: assessing the needs and challenges of the target farmers; legal risk, transferring the farm; heir property, succession planning (11%); handling post-harvest losses, storage, and marketing (7%); crops, vegetables and fruits production, and processing (7%); cooperative concepts and principles; cluster farming (6%); cold storage and related issues (4%); and longleaf management (1%). All farmers did not participate in all the workshops conducted. Some of them participated in multiple workshops, and others in single workshops.

Farmers' Willingness to Participate in Training Programs

CISFRL organized eight different types of training programs in six different states (AL, MS, LA, AR, SC, and WV). The training programs were grouped into eight categories (Figure 5). A total of 3,095 farmers participated in these programs. Of the total participation, the highest number of farmers participated in three categories of programs. These were farm financial tools/management, record keeping, and farm data analysis (24%); followed by heir property,

estate planning, and farm risk management, crops and livestock insurance (23%), and land use options and alternatives, soil management, and integrated pest management (21%). The other training programs had smaller percentage of participation (Figure 5).

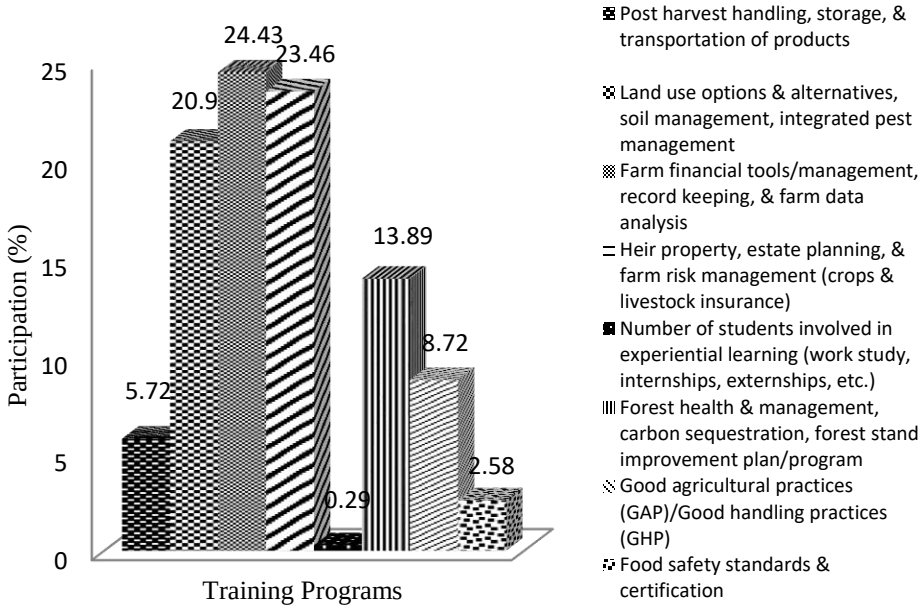

Figure 5. Farmers' Participation in Various Training Programs

Farmers' Willingness to Participate in Farmers' Field Day

Table 1 reflects participation in field days. CISFRL organized field days in six different states (AL, MS, LA, AR, SC, and WV). Each field day was focused on a specific theme based on the needs and interests of farmers in that community. A total of 1,426 farmers participated in the field days. The highest number of participation (28%) was in the field days organized on the theme of good agricultural practices (GAPs), good handling practices (GHPs), environment quality improvement program (EQIPs), integrated pest management (IPM), conservation management practices (CMPs), and conservation stewardship programs (CSPs); this is followed by a participation rate of 19% in Morehouse Parish (a County/Location in Louisiana where agriculture and industry play a great role in the economy), then 16% for goats, sheep, beef cattle, and (15%) for tunnel/hoop house, vegetable production.

Table 1. Farmer Participation in Field Days

	GAP *	Animal @	Pasture, forage	More house Parish	Louisiana small farm tour	Vegetable production	Farm machinery	Water mgt.	Pine mgt.	Total
Total participation	395	221	170	275	55	216	37	25	32	1426
Percentage	27.70	15.50	11.92	19.28	3.86	15.15	2.59	1.75	2.24	100

*GHP, EQIP, IPM, CMP, CSP, @ goat, sheep, beef cattle,

Farmers' Willingness to Participate in Meetings and Conferences

Four different types of small farmers' meetings and/or conferences, namely, (i) local, (ii) state, (iii) regional, and (iv) national were organized in six states (AL, MS, LA, AR, SC, and WV). In total, 1,285 farmers participated in these meetings/conferences. Of the total participation, 63%, 24%, 8%, and 6%, respectively, participated in the local, state, regional, and national level meetings. The local meetings were organized locally focusing on specific issues at the County level in each of the participating states. Similarly, state-level meetings focused on issues at the state level. The regional meetings were organized, including multiple counties within the state, and sometimes at the inter-state level as well. Meetings or conferences at the national level included multiple states concentrating on issues pertaining to multiple states.

Support Services Results

Farmers' Access to Production Inputs

In total, 190 farmers from four states (AL, MS, AR, and WV) increased access to production inputs, also called support services, which were categorized into seven different groups (Table 2). The data revealed that the largest percentage of the farmers (24%) received FSA loans that included farm ownership, conservation, operation, micro, emergency, and youth loans. The need for loan data implies that production credit is the prime need of the farmers. Also, 21% of farmers received assistance for marketing equipment and farm machinery, followed by 14% received high tunnel assistance, 13% received seed/fertilizer equipment assistance, and 11% each were supported by mobile and stationary cold storage units. The type of cluster and nature of the program activities may determine the need for support services. Through this cluster project, the highest percentage of the clientele receiving support services were in WV (43%) followed by AR (38%), MS (11%), and AL (8%).

Table 2. Number of Recipients of Facilities/Materials/Loans

Institutions	Mobile	Stationary	Irrigation	Marketing, Machinery	Production inputs	FSA loans #	High tunnel	Total
TU	-	-	12 (6%)	4 (2%)	-	-	-	16 (8%)
SUAMC	-	-	-	-	-	-	-	-
WVSU	20 (11%)	20 (11%)	-	20 (11%)	20 (11%)	-	2 (1%)	82 (43%)
UAPB	-	-	2 (1%)	-	-	45 (24%)	25 (13%)	72 (38%)
ACSU	-	-	-	15 (8%)	5 (3%)	-	-	20 (11%)
SCSU	-	-	-	-	-	-	-	-
NCAT	-	-	-	-	-	-	-	-
Total	20 (11%)	20 (11%)	14 (7%)	39 (21%)	25 (13%)	45 (24%)	27 (14%)	190

Farm Ownership, Farm Operating, Conservation, Micro, Emergency, Youth
! Cold storage

Farmers' Willingness to Adopt the USDA Programs

USDA programs in this study included three major agencies (i) FSA farm loans; (ii) RD programs, for example, rural energy for America program (REAP), rural cooperative development grants, socially disadvantaged group grants, rural business development grants, and value-added grants; and (iii) NRCS programs, for example, EQIP (conservation, forage/pasture production, water

quality, precision land leveling, cover crops, weed control); conservation management practices (CMP), and conservation stewardship program (CSP). A majority of the farmers (71%) indicated their willingness to participate in the programs of the three agencies. Correspondingly, 29% also indicated their willingness to participate in the programs in the future. The results indicate that farmers have a huge need for USDA support programs to sustain and/or promote their farming operations. Table 2 illustrated seven major areas of the need to operate, sustain, and improve their farms and forestlands.

Farmers' Access to Educational Materials

In total, CISFRL published 22 publications regarding cluster farming and small farmers' agricultural cooperatives within a year. Of these, 11 articles were published in, for example, newspapers/newsletters, and another 11 were published as Extension materials (factsheets, articles, abstracts, presentations, notes, highlights, flyers, pamphlets, brochures, and training manuals). These publications have resonated with farmers' participation in cluster farming and cooperatives development interventions. The availability of these educational materials has benefited the participants of the workshops, training programs, field days, and meetings/conferences. The results indicated that 930 farmers strengthened their knowledge, and attitude, skills, as well as changed their behavior on cattle, vegetables, crops, and forestland use and management and related activities.

Other Results

Beneficiaries

The collective results reveal that 930 farmers from six states (AL, MS, LA, AR, SC, and WV) directly benefited from the interventions (Table 3). Of the total beneficiaries, 69% benefitted through cluster farming activities, whereas 31% benefited through cooperatives development programs. The results confirm that farmers would like to be served either through cluster farming activities or cooperatives development programs to sustain their small-scale agricultural operations along with forestland use and management. Of the total farmers who benefited through cluster farming, AL, had the highest participation, followed by LA, AR, and WV; whereas, SC had the highest participation in cooperative development, followed by MS, AR, and AL.

Table 3. Number of Beneficiaries through Cluster Farming and Cooperatives

Implementing Institutions	Clusters Farming	Percentage	Cooperatives Development	Percentage	Total
TU	503	77.98	4	1.40	507
SUAMC	90	13.95	-	-	90
WVSU	2	0.31	NA		2
UAPB	50	7.75	10	3.50	60
ACSU	-		15	5.26	15
SCSU	-		256	89.82	256
NCAT	-		-		-
Total	645	69%	285	31%	930

Major Outputs and Immediate Impacts of the Cluster Farming Initiative

The details of major outputs and immediate impacts of the cluster farming initiative reported by the participating institutions (CISFRL) based on the survey conducted at the institutional level are presented in Table 4. Participating institutions have their focused priorities based on farmers' needs, wants, and preferences. However, the most common outputs accomplished were adoption of GAP, IPM, conservation stewardship, post-harvest practices, cold storage technology, and accessible information on various USDA programs. As an aggregated effect, producers' capacity strengthened and production cost got lowered due to the adoption of improved technologies and cultivation/production practices.

Table 4. Major Outputs and Immediate Impacts of the Cluster Farming Initiative

Institutions	Outputs	Immediate impacts
TU	- Adoption of IPM and GAP practices for commercial markets/production. - Knowledge of and application to NRCS/FSA programs for conservation of private forestland.	- Reduction in equipment & supply costs for small farmers. - Initiation of on-farm experimentation for cattle nutrition.
SUAMC	- The number of new farmers requesting assistance and guidance from SUAGC has increased. - The relationship between SUAGC and Louisiana's NRCS and FSA has been strengthened. - 15 new farmers started/registered their operations.	- Collectively farmers are going to save $7,200.00 annually transitioning to pasture from feed for cattle. - The purchase of a palpation cage allowed for synchronized breeding of cattle.
WVSU	- All (100%) of the participants adopted post-harvest practices. - Five of the total participants have adopted cold storage technology. - One farm grew a new product that they previously would not have been able to grow prior to the initiative.	- Forty-two percent of the participants started using some form of cold storage and post-harvest practices. - Five of the total participants are currently constructing cold storage units with Coolbots that the program supplied. - Three of the total farms increased their sales. - All participants (100%) have changed their harvesting and packaging containers.
UAPB	- Local clusters became aware of agronomic practices. - VegeVegetablesters became aware of GAP and the requirements for certification.	- Crop producers implemented a weed control plan that helped producers collectively save approximately 1.2 million dollars. - Cluster members started testing the soil of their cropland.
ACSU	- Acquired knowledge of mushroom production. - Provided information about USDA cost-sharing programs. - Gained knowledge on sustainable production practices.	- Farmers started being able to sell their produce to Walmart, Kroger & Mpalazola. - Four farms and 1 vegetable plant obtained GAP Certification.
SCSU	- 46 cooperatives and association members expressed a profound understanding and appreciation of the state of small farms, ranches, and forestland.	- Fifty percent of cooperatives (3) restructured their organizational management and elected new officers. - forty-five percent of small farmers increased awareness of local USDA agencies' programs. - Twenty forestland owners started the land ownership process to include basic title search, heir's property. - Five forestland owners started the process of establishing a forestland management plan.

Institutions	Outputs	Immediate impacts
NCAT	- Prepared two forest management plans for 60 acres. - Participants became aware of prescribed forest burning practices.	

Conclusion

The development and upgrading of clusters were initiated through a virtual "Center of Excellence for Innovative and Sustainable Small Farms, Ranches, and Forest Lands" (CISFRL) created by the USDA to collaboratively work with 1890 institutions to expand services to their clientele. The study revealed that the cluster approach is a suitable tool to enhance operations of small and limited resource farmers/socially and historically disadvantaged farmers (SLRF/SHDF). The tool applies pragmatic economic principles, such as economies of scale, efficiency, least cost approaches, and profit maximization that are required to empower the target groups. In order, to expand the clusters and small farmer cooperatives, government agencies should help remove all barriers to the growth of clusters and small farmer agricultural cooperatives such as high interest on loans, asymmetry of information, not easy and direct access to loans, and unaffordable technology. Also, they should help to improve the operations of existing ones. Simultaneously, the government should formulate policies that induce SLRF/SHDF small famers to unite into small farmer associations to move forward collectively. The 1890 land grant institutions also have a role to play, such as reaching out to the rural communities, identifying pressing needs of the target farmers, launching education activities to increase their household income through agricultural operations, providing technical and input supports, helping them to adopt recommended technology (such as creating a specific cluster and forming a cooperative), monitoring and supervising regularly, and assessing the impact of the interventions to confirm desired changes at the field condition.

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