

Agriculture and Food Research Initiative (AFRI) FY 2021-2022 Annual Review

ESTABLISHED BY THE 2008 FARM BILL and most recently re-authorized in the 2018 Farm Bill, the Agriculture and Food Research Initiative (AFRI) is the leading competitive grants program for food and agricultural science in the United States. AFRI addresses the six [Farm Bill Priority Areas](#) and supports research, education, and extension activities to address agriculture-related societal challenges.

USDA-NIFA APPROACH

AFRI supports research, education, and extension work by awarding grants to solve key problems of local, regional, national, and global importance in conventional, organic, and urban agricultural systems. The AFRI portfolio is broad and includes, but is not limited to, projects on farm efficiency and profitability; sustainability; ranching; bioenergy; forestry; aquaculture; rural communities and entrepreneurship; human nutrition; biotic and abiotic constraints on food production; food safety; food waste and food loss; physical and social sciences; family and consumer sciences; rural human ecology; biotechnology; and plant and animal breeding. AFRI advances knowledge in both fundamental and applied sciences important to agriculture.

NIFA works to identify, understand, and solve the challenges of meeting the food, clothing, fuel, and shelter needs of all Americans. To address these critical issues, NIFA maintains partnerships with food and agricultural scientists and educators with expertise in plant health and production and plant products; animal health and production and animal products; food safety, nutrition, and health; bioenergy, natural resources, and environment; agricultural systems and technology; and agricultural economics and rural communities. NIFA partners with the scientific community to provide federal financial assistance grants to address critical issues in United States agriculture in the broad areas of food production and profitability, nutrition security, sustainable value-added bioproducts, and climate change.

FUNDING PORTFOLIO

AFRI's funding portfolio supports research, education, and extension work that address key problems of national and regional importance in sustaining all components of food and agriculture. From 2009 to 2022 (Figure 1), AFRI has received \$4,754,899,000 to advance research, education, and extension activities in the United States. The level of investment shows a gradual upward trend in funding, representing more than a twofold increase in funding from \$201,500,000 in 2009 to \$445,000,000 in 2022.

AFRI is authorized under the 2018 Farm Bill and supports work in six priority areas: A) plant health and

production and plant products; B) animal health and production and animal products; C) food safety, nutrition, and health; D) bioenergy, natural resources, and environment; E) agricultural systems and technology; and F) agriculture economics and rural communities (Figure 2).

In FY2021, NIFA embarked on a 3-year plan to expend three years of funding appropriated for AFRI over the course of two application submission and review cycles. This approach involved expending all of funds appropriated in FY2021 and approximately 50 percent of funds appropriated in FY2022 for grants awarded to applications submitted to AFRI FY2021 Requests for Applications (RFAs) in the first phase of this plan. During the second phase, AFRI would then expend the remaining 50 percent of funds appropriated in FY2022 and all funds appropriated in FY2023 for grants awarded to applications submitted in response to FY2022 RFAs. This approach was initiated so that by the end of FY2023, almost all AFRI appropriations in FY2023 would be fully expended. In future years with approximately the same RFA release dates and application submission deadlines as in FY2021 and FY2022 and using a single year of appropriation to support one application submission and review cycle, AFRI would be back on track of expending almost all appropriated funding within the same year funds are appropriated. The planned exception to this strategy was for the Sustainable Agricultural Systems RFA, which would continue to use a single year of appropriated funds to support a single application submission and review cycle.

AFRI received \$435,000,000 in FY2021 and \$445,000,000 in FY2022 to administer and support basic and applied research, education, and extension programs (Table 1). The programs expanded NIFA's existing investments and created new opportunities to address the food and agricultural sciences. AFRI's statute (7 U.S.C. 3157) gives NIFA the flexibility to implement the program, which can expend available funds outside of the year the funds were appropriated. Thus, all funds may not be obligated to grant awards in one year, which aligns with AFRI's scientific approach of expending funds when they are best able to support work that addresses food and agricultural challenges. AFRI leadership chose to utilize the full FY2021 appropriation and approximately one-half of the FY2022 appropriation to fund applications submitted in response to the 2021 RFA, as indicated previously, although only 17 of AFRI's FY2022 appropriation was awarded by the closed of FY2022.

NIFA works continuously to ensure the public understands the relationship between the AFRI portfolio and the six Farm Bill established priorities for AFRI. While it is easy to see the relationship within the Foundational programs, the relationships within the Sustainable Agricultural Systems and the Education and Workforce Development programs may seem less obvious. Therefore, a breakout of the expended 2021 and 2022 funds (Figure 2) shows the multidisciplinary work of the entire AFRI program.

AWARDS OVERVIEW

OVERVIEW OF THE APPLICATION PROCESS

AFRI's FY 2021 requests for applications included 52 programs. A total of 2,815 competitive grant applications, requesting \$2,499,066,796, were received, and reviewed through a competitive peer review process (Table 2). Awards totaling \$475,582,119 (\$405,370,503 in FY2021 funds, \$70,211,616 in FY 2022 funds) were made to 722 highly-ranked applications distributed across the program (Table 3). An additional 1,030 proposals were recommended for funding—rated as Outstanding, High Priority, or Medium Priority—by review panels and could have been supported, provided an additional

\$1,316,941,367 was available to the program (Table 2). The success rate for AFRI applications in FY 2021, calculated in terms of number of proposals funded (excluding conferences, supplements, continuing increments of the same grant, and NIFA Fellowships) divided by the number of proposals submitted for review, was 25 percent.

AWARD TYPES

AFRI awards are made in the form of single-function research; single-function education; single-function extension; and integrated research, education, and/or extension grants (Table 4). Fifty two percent of AFRI awards supported fundamental research to deliver basic knowledge to advance research and conceptual breakthroughs in fields relevant to agriculture. Applied Research awards accounted for the remaining 48 percent to fund work to address specific near-term problems, needs, or opportunities in the food and agricultural sciences. Multidisciplinary teams received 73 percent of the AFRI awards made to FY 2021 submissions (including those funded with FY 2021 and FY 2022 appropriations). Multidisciplinary awards encourage collaborations among institutions, agencies, and fields of study to solve complex problems and seek to initiate research in new areas of science and engineering that are relevant to agriculture, food, forestry, the environment, and rural communities.

AFRI engages a broad range of entities including land-grant universities (1862, 1890, and 1994), public non-land-grant universities and colleges, private colleges and universities, federal agencies, individuals, and industry. In 2021, 1862 land-grant universities were the main recipients of AFRI funding, accounting for 75 percent of applications submitted and 77 percent of grants awarded (Table 5).

In 2021 eleven program area priorities (Plant Breeding for Agricultural Production, Physiology of Agricultural Plants, Diseases of Agricultural Animals, Welfare of Agricultural Animals, Food Safety and Defense, Food and Human Health, Novel Foods and Innovative Manufacturing Technologies, Nanotechnology for Agricultural and Food Systems, Engineering for Agricultural Production Systems, Bioprocessing and Bioengineering, Economics, Markets and Trade) offered a partnership opportunity for applicants to request an additional \$150,000 for projects that included significant collaboration with one or more minority-serving institutions (MSI), small-to-midsize institutions, institutions in Established Program to Stimulate Competitive Research (EPSCoR) states, and/or international partners. The additional \$150,000 above the listed budget maximum was required to be sub-awarded to the partnering institution(s). Among these eleven program area priorities, there were 157 “partnership” applications submitted and 30 awards for an overall success rate of 19.7 percent. Awards had one or more eligible partner institutions of the types listed previously. Nine partnership awards were led by strengthening eligible institutions (7 EPSCoR, 2 MSI). For the remaining 21 awards, partner institutions included those in EPSCoR states (5 awards), minority-serving institutions (5 awards), small-to-midsize institutions (2 awards), and international partners (9 awards).

FOOD AND AGRICULTURAL SCIENCE

AFRI offers Food and Agricultural Science Enhancement (FASE) grants (Table 6) to enhance institutional capacity and attract new scientists into careers in food and agricultural sciences. FASE grants provide support for pre- and postdoctoral fellows, new investigators, and strengthening-eligible institutions. Strengthening Grants provide support to institutions and states that are underrepresented in terms of Federal funding. Strengthening Grants are limited to small-to-midsize or minority-serving institutions

with limited institutional success for receiving Federal Funds, or investigators at State Agricultural Experiment Stations or degree-granting institutions within states eligible for USDA EPSCoR funding. NIFA determines the states that are eligible for USDA EPSCoR funding each year based on a three-year rolling average of AFRI funding levels, excluding FASE Strengthening funds granted to EPSCoR states and small-to-midsize and minority-serving, degree-granting institutions. In FY 2021 and 2022, approximately 20 percent of AFRI program funds were set-aside to support FASE strengthening grants, predoctoral fellowships, and postdoctoral fellowships. An additional 12.5 percent of AFRI funds was awarded to new investigators, although these funds were not specifically set aside for this purpose. These awards included New Investigator seed grants, as well as Standard Grants to New Investigators. The former was a new grant type initiated in 2021 to provide additional opportunity for securing AFRI grant funding to New Investigators.

STUDENT SUPPORT BY PROGRAM AREA

Competitive grants administered by AFRI also provide a continuum of support to train the next generation of agricultural professionals. In 2021, AFRI funding supported 2,517 undergraduate students, 1305 graduate students, and 357 postdoctoral scholars for an average of 3.5, 12, and 13 months, respectively (Table 7).

SUSTAINABLE AGRICULTURAL SYSTEMS

In 2021 the AFRI Sustainable Agricultural Systems program area priority solicited projects addressing the following long-term goals: 1) Sustainable Agricultural Intensification - ensure sustainable food supply with judicious use of resources and minimal environmental impacts using advanced technologies, regenerative agriculture, optimal management practices, and protection of plants and animals from biotic and abiotic stresses.; 2) Agricultural Climate Adaptation - allow unmanaged and managed systems to be fully leveraged for mitigating and adapting to climate change; 3) Value-added Innovation - rural Agriculture-based Economy – Foster economic development and prosperity in rural America by catalyzing production of high-value biobased chemicals, food and feed ingredients, and other products using agricultural feedstock, enhancing local human capital, and attracting supportive infrastructure; 4) Food and Nutrition Translation - changes to food and agricultural systems influence the incidence of foodborne diseases and risks for chronic disease, as well as affect food wastage. Out of 76 applications, eight projects were funded from FY2020 funds reserved the previous year (because NIFA was unable to compete SAS in 2020 due to staffing shortage during the agency's relocation) and seven projects were funded from FY 2021 funds (\$66,993,586) with an overall success rate of 20 percent (Table 3). The second program area priority, Sustainable Agricultural Systems Program Evaluation received three applications. One award was funded for \$961,000 (Table 3).

AREAS OF SCIENCE

AFRI makes awards that span 40 topics of major importance to USDA. A few of the overarching topics are shown in Table 8. The topics are addressed through single-function and integrated projects; multidisciplinary and single discipline-focused grants; and projects that span the entire spectrum of AFRI programs.

AFRI 2021 ANNUAL REVIEW DATA

FIGURE 1. AFRI HISTORICAL FUNDING

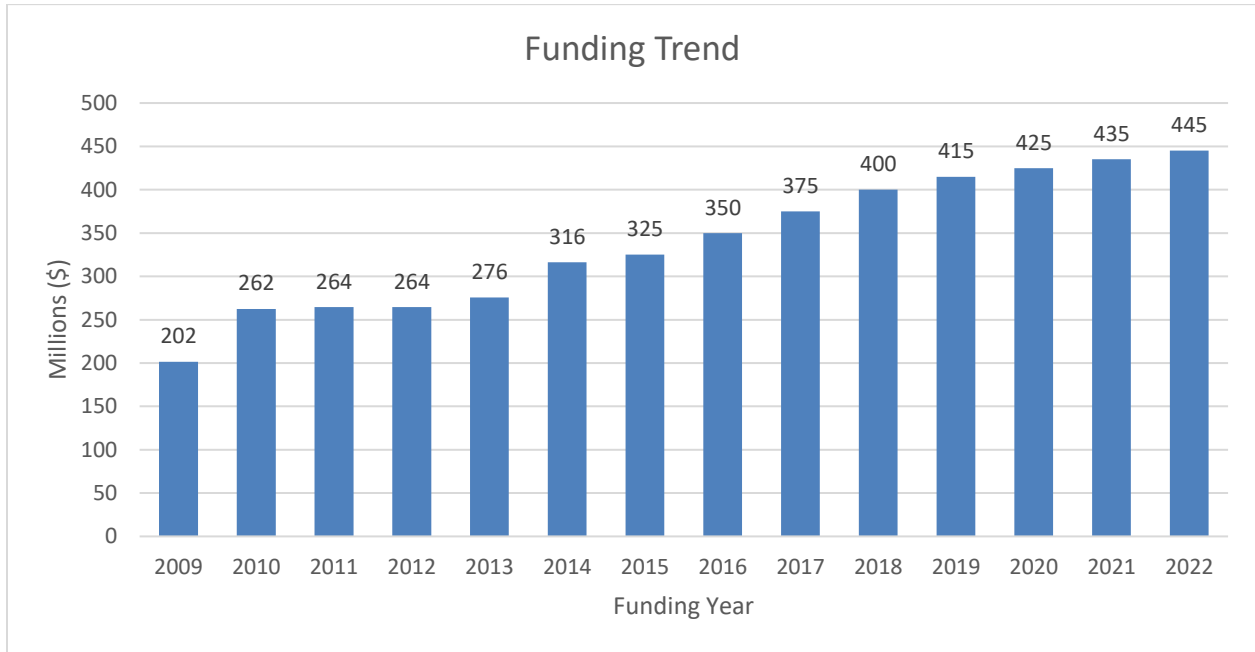
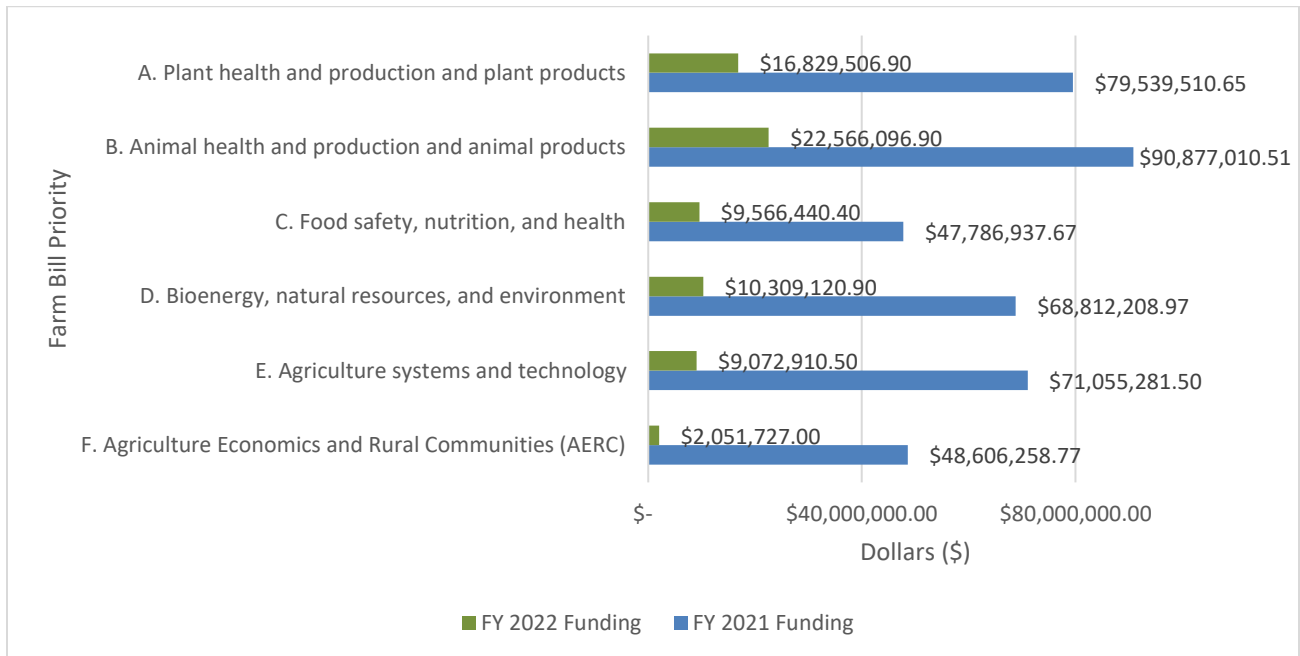


FIGURE 2. AFRI FUNDING BY FARM BILL PRIORITY



Total for awards \$477,073,010.67. In any given fiscal year, funding available for awards is approximately 91 of that appropriated after accounting for NIFA administrative costs of 5% salaries for Panel Managers, honoraria, and travel for panel reviewers, and Congressionally-mandated set-asides to support USDA’s Small Business Innovation Research and Biotechnology Risk Assessment Grants programs.

TABLE 1. FUNDING ALLOCATIONS BY AFRI PROGRAM AREA

AFRI Programs	FY 2021 (\$M)	FY 2022 Funds Allocated to FY 2021 Submissions (\$M)
Education and Workforce Development	47	24
Foundational Programs	236	119
Interagency Agreements	42	25
Sustainable Agricultural Systems	71	35
Program Administration	39	20
TOTAL	435	223

TABLE 2. NUMBER OF AFRI APPLICATIONS AND TOTAL DOLLARS REQUESTED, RECOMMENDED FOR FUNDING, AND AWARDED FOR FY 2021 SUBMISSIONS

Applications	Number	Funding
Requested	2,815	\$ 2,499,066,796.00
Recommended for Funding	1,752	\$ 1,792,523,486.00
Awarded	722	\$ 477,073,010.67

TABLE 3. NUMBER OF FY 2021 APPLICATIONS, AWARDS, AND TOTAL DOLLARS AWARDED FOR EACH AFRI PROGRAM, BY AREA

AFRI Program	Number of Applications	Number of Awards	FY 2021 Funding	FY 2022 Funding
Plant Health and Production and Plant Products				
Foundational Knowledge of Agricultural Production Systems	70	16	\$6,034,633	\$2,799,543
Foundational Knowledge of Plant Products	38	15	\$4,905,173	\$3,231,520
Pests and Beneficial Species in Agricultural Production Systems	140	26	\$7,305,271	\$0
Pollinator Health: Research and Application	67	15	\$6,201,564	\$0
Plant Breeding for Agricultural Production	92	29	\$16,105,186	\$3,004,481
Conventional Plant Breeding for Cultivar Development	9	2	\$823,966	\$126,315
Physiology of Agricultural Plants	108	25	\$6,300,542	\$3,547,344
Plant Biotic Interactions ^{1, 2}	14	14	\$5,738,002	\$875,000

¹ Indicates interagency programs.

² Indicates grants submitted in other fiscal years that were funded with FY 2021 appropriations.

AFRI Program	Number of Applications	Number of Awards	FY 2021 Funding	FY 2022 Funding
Animal Health and Production and Animal Products				
Animal Breeding and Functional Annotation of Genomes	32	10	\$5,849,034	\$1,032,920
Animal Reproduction	72	20	\$6,805,702	\$3,458,000
Diseases of Agricultural Animals	150	34	\$16,467,852	\$6,344,135
Animal Nutrition, Growth and Lactation	108	32	\$11,275,199	\$4,430,995
Welfare and Well-being of Agricultural Animals	36	12	\$4,600,000	\$2,256,045
Ecology and Evolution of Infectious Diseases ¹	2	2	\$4,003,914	\$0
Food Safety, Nutrition, and Health				
Food Safety and Defense	83	22	\$6,775,826	\$273,000
Food and Human Health	111	22	\$7,755,955	\$3,280,750
Diet, Nutrition, and the Prevention of Chronic Diseases	51	10	\$5,750,750	\$1,242,809
Novel Foods and Innovative Manufacturing Technologies	114	25	\$8,031,947	\$3,889,300
Mitigating Antimicrobial Resistance Across the Food Chain	36	8	\$5,117,165	\$837,044
Food Specific Molecular Profiles and Biomarkers of Food and Nutrient Intake, and Dietary Exposure ¹	2	2	\$1,180,052	\$0
Bioenergy, Natural Resources, and Environment				
Soil Health	75	17	\$8,113,510	\$2,234,092
Water Quantity and Quality	80	20	\$8,846,551	\$3,732,212
Sustainable Biomass Feedstock Systems ²	29	6	\$3,611,823	\$0
Sustainable Agroecosystems: Health, Functions, Processes and Management	97	27	\$6,294,434	\$4,196,027
Agriculture Systems and Technology				
Nanotechnology for Agricultural and Food Systems	93	14	\$7,400,000	\$0
Engineering for Agricultural Production Systems	112	14	\$1,869,793	\$5,709,692
Bioprocessing and Bioengineering	127	14	\$6,323,439	\$1,199,985
National Robotics Initiative ^{1, 2}	8	8	\$4,659,223	\$0
Cyber-Physical Systems ^{1, 2}	1	1	\$1,700,000	\$0
AI Institutes ¹	2	2	\$15,984,905	\$0
Agriculture Economics and Rural Communities				
Small and Medium-Sized Farms	44	11	\$4,895,303	\$0
Economics, Markets and Trade	92	25	\$15,033,183	\$799,872
Social Implications of Food and Agricultural Technologies	10	3	\$1,364,157	\$0
Rural Economic Development	47	11	\$5,810,987	\$0

AFRI Program	Number of Applications	Number of Awards	FY 2021 Funding	FY 2022 Funding
Crosscutting Programs				
Tactical Sciences for Agricultural Biosecurity	29	10	\$6,120,047	\$2,557,972
Inter-Disciplinary Engagement in Animal Systems (IDEAS)	34	12	\$8,300,000	\$2,976,000
Agricultural Microbiomes	63	16	\$8,149,472	\$1,936,721
Data Science for Food and Agricultural Systems (DSFAS)	87	17	\$10,851,742	\$0
Critical Agricultural Research and Extension (CARE)	59	23	\$5,000,000	\$1,817,363
Extension, Education & USDA Climate Hubs Partnership	24	6	\$9,000,000	\$0
Meat and Poultry Processing and Food Safety*	0	0	\$4,621,702	\$0
AFRI Commodity Board Co-funding Topics	37	14	\$4,443,852	\$0
Education and Workforce Development				
Predoctoral Fellowships	142	54	\$7,347,875	\$0
Postdoctoral Fellowships	91	47	\$7,742,570	\$2,606,666
Research and Extension Experiences for Undergraduates (REEU)	71	23	\$16,308,554	\$0
Professional Development for Agricultural Literacy (PDAL)	30	9	\$4,225,000	\$0
Agricultural Workforce Training (AWT) Grants	23	8	\$3,900,000	\$0
Meat and Poultry Processing - Agricultural Workforce Training*	0	0	\$4,550,000	\$0
Food and Agricultural Non-formal Education (FANE)	20	10	\$7,629,446	\$0
Sustainable Agricultural Systems				
Sustainable Agricultural Systems ²	76	15	\$66,993,586	\$0
Sustainable Agricultural Systems Program Evaluation	3	1	\$961,000	\$0
Total	2938	780	\$406,677,208	\$70,395,803

TABLE 4. TOTAL DOLLARS AND PERCENT OF TOTAL FUNDING FOR DIMENSIONS OF
FY 2021 AND FY 2022 AFRI AWARDS

Award Dimension	FY 2021 Funding	FY 2021 Percent	FY 2022 Funding	FY 2022 Percent
Fundamental Research Mission-Linked	\$ 134,742,916	46.0	\$ 35,030,373	53.0
Applied Research	\$ 158,199,840	54.0	\$ 31,056,989	47.0
Multi-Disciplinary	\$ 289,474,165	73.4	\$ 52,360,361	74.4
Single Discipline	\$ 104,984,021	26.6	\$ 18,035,442	25.6
Integrated Research				
Education and Extension	\$ 7,754,073	2.0	\$ -	0.0
Research and Education	\$ 11,180,174	2.9	\$ 1,739,631	2.5
Research and Extension	\$ 41,976,262	10.9	\$ 5,966,325	8.5
Research, Education, and Extension	\$ 83,374,263	21.6	\$ 4,724,292	6.7
Single Function Projects				
Research	\$ 223,200,039	57.7	\$ 57,772,119	82.1
Education	\$ 11,469,759	3.0	\$ 65,636	0.1
Extension	\$ 7,737,733	2.0	\$ 127,800	0.2

TABLE 5. APPLICATIONS BY TYPE OF INSTITUTION FY 2021 SUBMISSIONS

Type of Institution	% of FY 2021 Applications Submitted	% of FY 2021 Applications Awarded	% of Total Dollars Awarded
Land-Grant University			
1862 Land-Grant University	74.8	77.0	70.1
1890 Land-Grant University (including Tuskegee)	2.1	1.7	2.7
1994 Land-Grant University	0.0	0.0	0.0
Public Non-Land-Grant University or College	10.8	9.3	9.8
Private University or College	3.9	4.8	5.5
Federal Agency/Department	1.7	1.7	1.7
Other ³	6.7	5.5	5.4

³ Includes Non-Federal Government, Private For-Profit, Non-Profit, and other entities

TABLE 6. NUMBER AND TOTAL DOLLARS OF FY 2021 AND FY 2022 AWARDS PROVIDED FOR EACH CATEGORY FASE GRANT SUBMITTED IN FY 2021

Award Type	Number ²	FY 2021 Funding ⁴	FY 2022 Funding
Predocctoral Fellowships	54	\$ 7,347,875	\$ -
Postdoctoral Fellowships	46	\$ 7,742,570	\$ 2,606,666
New Investigator Awards	129	\$ 47,239,104	\$ 9,932,872
Strengthening Awards			
Sabbatical Grants	3	\$ 168,561	\$ 103,133
Equipment Grants	1	\$ 9,616	\$ -
Seed Grants	94	\$ 11,831,355	\$ 3,062,107
Standard Strengthening Grants	76	\$ 20,752,592	\$ 8,154,971
Strengthening Coordinated Agricultural Projects	7	\$ 14,928,618	\$ -
Strengthening Conference Grants	3	\$ 72,569	\$ -
Total	284	\$ 62,853,756.41	\$13,926,877.00

TABLE 7. NUMBER AND LENGTH OF TIME OF UNDERGRADUATE, GRADUATE, AND POSTDOCTORAL JOBS PROVIDED BY AFRI FY 2021 AWARDS

Program	Undergraduate (Number / Months)	Graduate (Number / Months)	Postdoctoral (Number / Months)	Subtotal (Number / Months)
Foundational and Applied Science RFA Program Areas				
Plant Health and Production and Plant Products	148 / 1402	204 / 3329	121 / 2312	473 / 7043
Animal Health and Production and Animal Products	64 / 618	169 / 3555	44 / 830	277 / 5003
Food Safety, Nutrition, and Health	50 / 586	128 / 3325	37 / 893	215 / 4804
Bioenergy, Natural Resources, and Environment	142 / 1019	86 / 2542	34 / 1008	262 / 4569
Agriculture Systems and Technology	186 / 193	442 / 942	127 / 296	755 / 1431
Agriculture Economics and Rural Communities	0 / 0	265 / 804	0 / 0	265 / 804
Critical Agricultural Research and Extension	13 / 122	20 / 446	3 / 41	36 / 609
Education and Workforce Development RFA				
All Programs	1920 / 5214	106 / 1816	1 / 7	2027 / 7037
Sustainable Agricultural Systems RFA				
Sustainable Agricultural Systems	141 / 756	101 / 1282	63 / 346	305 / 2384
Total	2664 / 9910	1521 / 18041	430 / 5733	4615 / 33684

⁴ Application numbers indicate applications submitted in Fiscal Year 2021 and funding indicates FY appropriated funds used (funding from other appropriation years may have been used for FY 2021 submitted applications)

TABLE 8. AREAS OF SCIENCE IMPORTANT TO AFRI AND USDA

Area of Science	Number	FY 2021 Funding	FY 2022 Funding
Animal Genome	12	\$ 3,991,781	\$ 651,408
Animal Health	83	\$ 36,732,118	\$ 13,436,728
Forest Biology	21	\$ 9,561,776	\$ 2,636,985
Food Safety	52	\$ 29,763,751	\$ 3,637,823
Climate Science	74	\$ 59,003,044	\$ 5,420,106
Integrated Pest Management	38	\$ 31,485,621	\$ 2,657,448
Plant Genome and Breeding	54	\$ 17,067,084	\$ 6,620,076
Bioenergy	9	\$ 13,466,590	\$ 1,339,617
Sustainable Agriculture	176	\$ 128,884,103	\$ 19,391,028
Social Science	61	\$ 51,339,293	\$ 1,449,517
Water Quality	36	\$ 31,736,781	\$ 5,176,450