Addressing Current and Future Agricultural Workforce Needs to Meet Societal Challenges – a USDA Vision

By Muquarrab Qureshi, DVM, MSc., Ph.D.
Deputy Director
National Institute of Food and Agriculture
What’s in this Presentation

- Introduction
- Scope
- Guiding principles
- What is the current reality?
- What are we doing?
- What is the way forward?
- Conclusion
WONDERS OF CLASSICAL BREEDING
BROILERS

ACRBC (1957) Males – 2001 Feed

Havenstein and Qureshi, 2004

Ross Males (2001) – 2001 Feed

Day 43  Day 57  Day 71  Day 85
GENETIC IMPROVEMENT IN TURKEYS

RBC 1966

Modern 2003

112 days

Havenstein and Qureshi, 2004

196 days
Trends in U.S. Milk Production

In 2007 U.S. Produced 34% more milk with 48% fewer dairy cows than in 1960
Bacterial uptake: phagosome & lysosome

Bacterial phagocytosis

Macrophage with bound tumor cells
Blueprint for USDA Efforts in Agricultural Animal Genomics 2008 – 2017

Example: Livestock Genome Sequence

(Green and Qureshi Co-chairs)
DRIVERS in Solving Societal Challenges

• Technology Choices
  • Advances in Biology
  • Information technology

• Policy Choices
  • Evidence-based decisions

• Partnerships
  • Public-private
  • Technology Transfer
SCOPE & Guiding Principles
Global Challenges

- Produce more food
- By 2050, world population estimated to be 9.6 billion
  = 47% increase
- If true, global agriculture must double in next 30 years

Source: UK Food and Ag Association
The Agriculture Nexus
Top Challenges Facing Agriculture*

• Managing new pests, pathogens, and invasive plants
• Increasing the efficiency of water use
• Reducing the environmental footprint of agriculture
• Growing food in a changing climate
• Accommodating bioenergy opportunities
• Producing safe foods
• Addressing global food security and maintaining abundant yields.

*2012. Agricultural Preparedness and the Agriculture Research Enterprise by President’s Council of Advisors on Science and Technology
Current Reality
Employment Opportunities for College Graduates in Agriculture and Food, 2015-2020:

https://www.purdue.edu/usda/employment/
Employment Opportunities for College Graduates in Agriculture and Food, 2015-2020:

https://www.purdue.edu/usda/employment/
STEM Pipeline — Leaking Badly

In 2001, there were a bit more than 4 million 9th graders. Four years later, 2.8 million of them graduated and 1.9 million went on to two- or four-year college; only 1.3 million were actually ready for college work. Fewer than 300,000 are majoring in STEM fields and only about 167,000 are expected to be STEM college graduates by 2011.

Source: NCES Digest of Education Statistics; Science & Engineering Indicators 2008
Multiple Education Assessments and Reports

**PCAST:** Report to the President: “Prepare and Inspire: K-12 Education in Science, technology, Engineering, and Math (STEM) for America’s Future”. (2010)

**NAS:** “Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation’s Prosperity and Security”. 2012

**PCAST:** Report to the President: “Engage to Excel: Producing One Million Additional College Graduates With Degrees in Science, Technology, Engineering, and Mathematics”. 2012

**PCAST:** “Report to the President on Agricultural Preparedness and The Agriculture Research Enterprise”. 2012

**NSTC Committee on STEM Education:** “Federal Science, Technology, Engineering, and Mathematics (STEM) Education 5-Year Strategic Plan”. 2013
Human Capital Recommendations for U.S. Agriculture from PCAST

• The primary concern is support for a well-trained workforce

• Industry has difficulty recruiting the technical employees for its research programs

• The talent pipeline begins well before college admission

  • At the baccalaureate level we need comprehensive array of undergraduate programs that are Relevant to agriculture and the food industry

  • Recommend that the USDA, in collaboration with NSF Expand its national competitive fellowship program for graduate students and post-doctoral researchers
What Are We Doing at USDA
USDA Organizational Chart

Seven Mission Areas

REE
ARS, NIFA, ERS, NASS
USDA Capacity

Morrill Acts – 1862, 1890, And 1994 Legislation
* Land-grant University Network
* Cooperative Extension System

Mission Areas (7) and Agencies (18)
* Intramural and Extramural Efforts
* Global Engagement
An extensive network of state regional and county extension offices in every state and territory. Cooperative Extension System offices (https://nifa.usda.gov/Extension/index.html) – an avenue to get connected with education and research institutions and to provide stakeholder needs and concerns. Presentation focuses only on selective competitive programs in the areas of biofuels, bioenergy, climate, and conservation.
HISPANIC-SERVING INSTITUTIONS (HSIs) AND HSIs WITH HISPANIC-SERVING AGRICULTURAL COLLEGES AND UNIVERSITIES (HSACU) CERTIFICATION

FACT:
OF 356 TOTAL SITES,
38 SITES CURRENTLY RECEIVE NIFA FUNDING
Our portfolio
Our Portfolio - AFRI

Societal Challenge Areas
+ Food Security
+ Water
+ Climate Change
+ Sustainable Bioenergy
+ Childhood Obesity and Nutrition
+ Food Safety

Discovery of Foundational Knowledge
+ Plant health and production, and plant products;
+ Animal health and production, and animal products;
+ Food safety, nutrition, and health;
+ Bioenergy, natural resources, and environment;
+ Agriculture systems and technology; and
+ Agriculture economics and rural communities.

Three New Programs
+ Food, Agricultural, Natural Resources, and Human Sciences Education and Literacy Initiative (ELI)
+ Critical Agriculture Research and Extension (CARE) program
+ Exploratory Research Program (ERP)
NIFA Budget

Proposed FY2015: ~$1.5B

- Research & Education: $842,773,000
- Extension: $468,968,000
- Integrated: $28,821,000
- Mandatory & Endowment: $159,880,000

Process – Priority Setting
- Congress
- President – OSTP
- Departments
- Mission Areas
- Agencies
- Stakeholders
- Program Staff
- Make AWARDS
Education at USDA
USDA’s Education Portfolio

Spans Across Several Agencies

NIFA
ARS
NASS
ERS
FSA
FSIS
FNS
APHIS
RD
FS
NRCS

COMMON THEMES

• Learning and Engagement
• Trainings and Education
• Internships
• Capacity Building
• Educational Campaigns and Outreach
Education Coordinating Committee

• Part of the USDA Science Council
• Formed late 2012 to better coordinate USDA education activities and leverage resources
• Representation from all 7 mission areas, 12 agencies
• Organized a listening session in 2013
2013 USDA Education Listening Session Recommendations

1. Teacher Training is critical
2. Agriculture Needs to Transform its image
3. Agriculture offers “Jobs” for all SMEs
4. “Blended” learning is the best approach
5. Job shadowing, mentoring, internships, scholarships are important for students retention
6. Research grants must include teaching and outreach components
7. More engagement with the Stakeholders
8. USDA needs to define Agriculture Education
9. Connect “non-formal” education with the formal
USDA’s Vision

K-20 Continuum

Input

Learning & Engagement

Workforce

Next Generation of Scientists

Capacity Building

Output
Education and Literacy Initiative (ELI)

1. Develop pathways to identify and replicate best practices to engage youth in STEM fields within food, agricultural, natural resources, and human sciences.

2. Enhance capacity of institutions to produce graduates with skills needed to address the new challenges of the 21st Century – e.g. REEU

3. Advance science by supporting graduate and post-graduate (post docs)
Community Colleges' Role

Community Colleges constitute roughly 46% of all U.S. undergraduates:

- 45% of first-time freshmen
- 57% of Native Americans
- 47% of Asian/Pacific Islanders
- 47% of African-Americans
- 55% of Hispanic-Americans

Therefore, these colleges represent a critical link in the pipeline, especially, if we hope to diversify the workforce of the future.
What We Are Doing Now

In 2003, we began 2+2 \rightarrow and to connect the pipeline

K-12 High Schools \rightarrow 2 Year \rightarrow 4 Year \rightarrow MS \rightarrow Ph D

\$\$ Funding \$$
A Simple Model

USDA

NIFA

Funds to HSI’s

HSI’s

HSACUs

Train Students 2-4 years

Summer Internship at USDA

Complete 2yr, 4yr or MS+

Outstanding GRADUATES

PLACEMENT

PLACEMENT
Youth and 4-H Programs

Vision and Goal
A world in which youth and adults learn, grow, and work together as catalysts for positive change

All youth are prepared for life and prepared for work.

Youth Engaged: 6.0M
Adults Engaged: 0.5M

Partnerships
LGUs
CES
4-H Council
Federal Agencies
DoD
Others
Youth and 4-H Programs

- A recent study by Tufts University reported
  - 4-H youth had (compared to other non-formal programs)
    - Better grades
    - More wanted to pursue careers in STEM disciplines
    - A greater number planned and applied to college
  - Indicates that involvement in 4-H increases life skills and development

Beginning Farmers and Ranchers Development Program (BFRDP)

• The 2014 Farm Bill has made available $19.2 million in FY 2014 for the Beginning Farmer and Rancher Development Program (BFRDP).

• Funding is only for education, training, outreach and mentoring of beginning farmers and ranchers in entering, establishing, building and managing successful farm and ranch enterprises.

• BFRDP projects exist in 48 states and every year about 40,000 people attend training events offered by the program.
Small Business Innovation Research Program

• Funds research for development of a profit-making technology, product or service
• Two-phase program:
  1. Feasibility       $100,000
  2. Development       $450,000
• Small = businesses of 500 employees or less
• 2.5% set-aside of USDA extramural funding for research
Cooperative Extension Service

* The Cooperative Extension Service is the largest education system of its kind in the world.

* It is active in rural, suburban, and urban communities and, in addition to agricultural and home economics programs, offers programs in social and economic problems and cultural, recreational, and leisure-time activities.

* Take Bench Science to the “End User”
Conclusions
Circling Back: Vision

K-20 Continuum

Input

Output

Learning & Engagement

Workforce

Next Generation of Scientists

Capacity Building

Target Audience

Youth Students
Educators
Farmers
Public
Global Dimension
Morrill Acts: 1862 and 1890

Practical Education
Mission-relevant experiential learning in food, agriculture, human sciences, and natural resource disciplines

Foundational Knowledge
Cognitive / STEM education in the classroom

#3 Discpline Knowledge

#1 Soft Skills

#2 Technical Skills

Military Leadership

Non-cognitive

Target
54,400 work-ready employees in food and agricultural sciences between 2010 – 2015*

Employer Priorities

-Source: Employment Opportunities for College Graduates, in Food, Renewable Energy, and the Environment, United States, 2010-2015, Purdue University
Thank you!
Questions?
U.S. Department of Agriculture (USDA)