Background:
Office of the Chief Scientist, OCS

2008 ‘farm bill’: USDA Chief Scientist, Under Secr’y for Research, Education, & Economics (REE) presently Dr. Catherine Woteki

OCS supports and advises Chief Scientist and Secretary; Fosters collaboration and coordination among USDA science agencies

OCS has a Director; staff incl. Sr. Advisors in 6 areas:
Five USDA Agencies Conduct or Support Plant Breeding

Plant breeding, genetic resources, and related biological research:
• Agricultural Research Service (ARS)
• Forest Service (FS)
• Natural Resource Conservation Service (NRCS)

Economic and policy analyses
• Economic Research Service (ERS)

Capacity and competitive funds for Research, Education, and Extension (i.e. extramural plant breeding)
• National Institute for Food and Agriculture (NIFA)
What is Plant Breeding?

“What human-aided development of plant cultivars with needed characteristics”

The organizing principle of breeding is the genetic gain equation:

\[ \Delta G = h^2 S \]

Gain in a desired trait (\( \Delta G \), or “delta-G”) is a function of

- the heritability of that trait (\( h^2 \))
- the intensity of selection (\( S \))

Plant breeding “puts it all together”, using many different resources, tools, and methods to maximize gain, \( \Delta G \).
Role of USDA Plant Breeding

To provide plant breeding outcomes *that are needed to achieve USDA’s Strategic Goals*,

... *When these have the nature of “public goods”*:  

E.g.,

- Breeding for long–term horizons -- too distant for private investment
- Important goals but probability of success is low or unknown
- Market size is small
An Increase in Stakeholder Attention to USDA’s Plant Breeding

Examples include:

- Land-grant U’s: Plant Breeding Coordinating Committee 2007
- National Assoc. of Plant Breeders (NAPB) (publ+priv) 2009
- American Seed Research Summit (private-sector organized) 2008
- Seeds & Breeds for 21st Century Ag. (organic/sustainable) 2014

Since ~2010,
Increasing number of stakeholders, across sectors,
engaging w/USDA officials
to present plant breeding needs & priorities
USDA Response:

- Plant Breeding Working Group (PBWG) 2012
  - Support to USDA Chief Scientist (REE UnderSecr.)
    - Interagency coordination; advise re issues & priorities
- Public Plant Breeding Listening Session 2013
- USDA Plant Breeding Roadmap 2014/15

Both documents posted at:
What We’ve Learned

What stakeholders—both public and private—see as USDA’s core contributions to plant breeding:

- **The National Plant Germplasm System collections** (NPGS) incl.
  - Collection, curation, rejuvenation, characterization, and pre-breeding

- Genetic Resources Information Network (GRIN):
  GRIN is an *Information management system* for genetic resources:
  Inventory, images, rejuvenation status, IPR status, requests/order status
Additional core contributions -- as seen by stakeholders:

USDA’s breadth of geographic coverage, through partnerships including:

- USDA sites (e.g. ARS, FS, and NRCS)
- State Agricultural Experiment Station (SAES):
  - Agric. research units of the state land-grant univ’s.
  - Co-funded through USDA since in 1887
- Others, e.g.
  - Long Term Agricultural Research sites (LTAR) (multi-partner)
What We’ve Learned, cont’d.

Deliverables “by and for” public plant breeding cited by stakeholders as needed from USDA:

**Intramural**
- **Cultivars** (varieties) for “public-goods situations”
- **New tools & methods**, publically available for any breeder to help maximize gain, ΔG.
  - E.g. new tools / methods to:
    - Incorporate new genetic & biological understanding
    - Reduce breeding cycle time (from cross-to-variety release)

**Extramural**
- Adequate and appropriate funding mechanisms,
  - for the long-term nature of plant breeding;
  - for education
What We’ve Learned, cont’d.

Heard from stakeholders: concerns about...

- **External funding thru’ USDA**
  - Low total funding + many proposals leads to low success rates in compet. programs (<10%, sometimes <5%)
  - Short-duration (2-4 yrs); non-renewable

- **Education**
  - Few funding opportunities for student stipends
  - Even fewer for faculty to develop contemporary plant breeding curricula

Challenges for USDA’s response

- Not enough competitive funding to respond to stakeholder concerns
- Plant breeding needs longer-term funding cycles

Solution?

- Rely on intramural USDA plant breeding?
  ... leads to more questions:
  - Loss of university plant breeding?
  - Loss of closeness to needs and opportunities of local farming?
  - Whence opportunities for educating future breeders -- within active breeding context?
National Institute of Food & Agriculture, NIFA is USDA’s extramural funding agency.

NIFA funding programs that can include plant breeding:

**Capacity programs** (source of ± 40% of NIFA plant breeding funding 2008-13)
- Hatch 1862 state land-grant univ’s.
- Evans-Allen 1890 land-grant univ’s.
- McIntire-Stennis State forestry schools

**Competitive programs** (± 50% of NIFA funding to plant breeding 2008-13)
- AFRI (Agriculture & Food Research Initiative); including:
- OREI Organic Agriculture Research & Extension Initiative (started 2005)
- SCRI Specialty Crops Research Initiative (2008)
- BRDI Biomass Research & Development Initiative (2009)
- SBIR Small Business Innovation Research

Other programs including special grants (less than 10%)
Also from the Roadmap process:
Issues broader than USDA

- **Recruit / Educate**
  - Encourage more young people to be interested in plant breeding
  - Education: K-12, CC’s, undergrad.; grad.

- **IPR**
  - Optimal understanding and use of intellectual property rights (IPR) and tech transfer mechanisms?

- **Public / Private**
  - Most favorable balance of investment in plant breeding?

- **Funding the model**
  - A joint endeavor: intra/extramural; capacity/competitive; public/private
  - Funding the training pipeline

What are ways that USDA can respond?