‘NextGen’ Scientists Needed to Build on Historic Successes of Agriculture R4D

Huge Successes + Need for More = NextGen

Lindsay Falvey
International Agricultural R&D

- Physiological needs: food, water, warmth, rest
- Safety needs: security, safety
- Belongingness and love needs: intimate relationships, friends
- Esteem needs: prestige and feeling of accomplishment
- Self-actualization: achieving one’s full potential, including creative activities

Needs hierarchy:
- Basic needs
- Psychological needs
- Self-fulfillment needs
World Agriculture Today

Ex-USSR + New World: main food exporters

Western Europe: more than sufficient

Populous Asia: average sufficiency

Sub-Saharan Africa (SSA) + West Asia-North Africa (WANA):

low yield, high animal mortality, food importers
Fifty Successful Years

- famine averted
- >30% of the world hungry in 1960s; today around 15%.
- Population doubled; an extra 3 billion people fed
- aid + civil organizations + national governments
- policy, yields, vaccines, NRM, nutrition, etc
- Australians highly represented - as should continue
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CGIAR: 10,000 staff, 96 countries
Huge Success:
- 3 billion extra fed in 50 years
- reduced malnutrition

What Worked? **Integrated R4D**
Wheat Rust: 117 million hectares protected; >60 million households food secure

Asia 1965-85: income up 190%; food security for 1.8 billion

Improved Maize: now 75% of land under cereal cultivation

Cassava Mosaic Virus & Mealybug: yields up 40%; 29 million fed

Re-Greening the Sahel: > 5 million hectares transformed; 3 million additional people fed

Argentina Pampas: 22 million hectares sustainable; world leader in soybean production

Indo-Gangetic Plain: 1.8 million hectares; income gains $340 per household

Bangladesh: 67% reduction in well costs; doubled rice production; 22 million more fed

China: Yield increases of 15-31%; 63% of rice is hybrids; 60 million more fed

Land-tenure reform in China 1978-84: grain up 34%; incomes by 137%
World population, grain crop production and real prices of staples

R.A. Fischer, D.J. Connor
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ERADICATING RINDERPEST: moments in time
Reported outbreaks of rinderpest steadily declined over the last 100 years.

Share of countries infected with rinderpest in different regions of the world.

- Africa (52)
- Asia (24)
- Europe (54)
- Middle East (14)

2011 FAO declares eradicated

Virus decoded; 2019 Pirbright destroys stocks
SHIFTING RANKS
For the first time in modern history, middle-income countries are investing more in public-sector AgR&D than are high-income ones.

1960
- United States
- United Kingdom
- Germany
- Canada
- Japan
- Australia

Total spend $6.2 billion

2011
- United States
- United Kingdom
- Japan
- Germany
- Canada

Total spend $38.1 billion
Researchers in R&D per million people, 2015

Researchers in Research & Development (R&D) are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned. Postgraduate PhD students engaged in R&D are included.

Source: World Bank
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1. No Poverty
2. Zero Hunger
3. Good Health and Well-Being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation

7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation, and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production

13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice, and Strong Institutions
17. Partnerships for the Goals

Nutrition
Poverty
Ecosystem
IAR = ARI + NRI + CGIAR + CABI + WV + + +
(WB, RegDBs, BRICs, UN, Philanth’ts, NGOs, ...)

ACIAR = Australia’s Globally Unique IAR Mechanism

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Crawford Fund for IAR
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Q. Why Did It Work?

A. Integration of Diverse Factors

✓ Science and technology
✓ Complementary investments
✓ Private incentives
✓ Cooperation and collaboration
✓ Timing and planning
✓ Experimentation and evolution
✓ Community involvement
✓ Leadership and dedication

continuing challenges
Integration of Diverse Factors

- Science and technology
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Yet: 1 billion malnourished
- Progress faltered: food price crisis and global economic downturn
- Sub-Saharan Africa, malnutrition doubled
- South Asia, 314 million remain malnourished
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Challenge of intergenerational cycle of survival, growth and development

Undernourished Mothers
- Early marriage, Early and frequent pregnancy with improper child spacing
- Poor diet and inadequate care during pregnancy, Anaemia
- Physical stress

Undernourished Less aware, vulnerable Adolescent girls

Low Birth Weight
- Inadequate child care
- Improper IYCF practices
- Inadequate food, nutrition and health care
- Burden of diseases, infections
- Anaemia
- Inadequate catch up and growth
- Inadequate education
- Gender discrimination at home
- Lack of awareness

Malnutrition
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Even though Asia still predominates, more than thirty percent of the undernourished in the world live in Africa.

DISTRIBUTION OF UNDERNOURISHMENT IN THE WORLD (IN MILLIONS) IN 2018*

WORLD POPULATION 7 632.8
UNDERNOURISHED 821.6

ASIA 513.9
AFRICA 256.1
LATIN AMERICA AND THE CARIBBEAN 42.5
OCEANIA, NORTHERN AMERICA AND EUROPE 2.6
OTHER 6.5

NOTES: * Projected values. SOURCE: FAO.
Figure 1. Biofortified crops bred by CGIAR Centers and partners

- **SWEET POTATO**
  - Vitamin A

- **CASSAVA**
  - Vitamin A

- **MAIZE**
  - Vitamin A
  - Zinc

- **BANANA/PLANTAIN**
  - Vitamin A

- **BEANS**
  - Iron

- **PEARL MILLET**
  - Iron

- **COWPEA**
  - Iron
  - Zinc

- **IRISH POTATO**
  - Iron
  - Zinc

- **SORGUM**
  - Iron
  - Zinc

- **LENTIL**
  - Iron
  - Zinc

- **WHEAT**
  - Zinc

- **RICE**
  - Zinc
Connecting the Milk Grid
Smallholder dairy in India
1970–1996

• Challenge: Dairy demand outpacing supply; smallholders unable to access national dairy markets

• Innovation: Creation of a national milk grid and organization of dairy cooperatives to improve production and marketing

• Impact: India becomes a top global dairy producer; incomes double for 9 million direct beneficiaries, 73% of whom are landless farmers

Author: Kenda Cunningham

Farming the Aquatic Chicken
Improved tilapia in the Philippines
1988–1997

• Challenge: Overuse and overexploitation of marine fish stocks endangers fish supplies

• Innovation: Selective breeding and wide distribution of genetically improved tilapia within the region

• Impact: Production increases of 186%; lower prices for tilapia benefitting 19-23 million consumers

Author: Sivan Yosef
Why Animal Research?

**Nutrition:** FAO - 20 g/person/day animal protein (1½ eggs)

**Income:** Dr Jacob Mignouna, Togo

**Mobility:** move as local climate changes

**Integration:** Crop-Livestock Systems
Conception to >1000 days animal-source food for:
vitamin A/retinol (absorbed at 20 times faster than plant beta-carotene); heme iron (absorbed twice as readily as non-heme plant iron); vitamin B12 (from anaerobic bacteria found only in animal-sourced foods), choline (for neurotransmission, memory, learning and gene expression).

“Global efforts to limit or reduce the consumption of meat, milk and eggs over environmental concerns should exclude pregnant and breastfeeding women and babies under the age of two, especially in low-income settings where other sources of protein and micronutrients are not available or not customarily used.”

Grace, D. et al
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Current & Future Needs

• Health
• Climate Change
• Environment
• Migration
• Employment
• Production
  • Sustainable Intensification: crops & livestock, recycling nutrients, emissions
  • Genetic Modification: pests & diseases, climate adaptation, micronutrients
  • Agricultural Education: integrated knowledge, applied research capacity

SSA & WANA:
all above + e.g. yield gap, livestock mortality & reproduction, policy
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## Drivers of Food Crises

<table>
<thead>
<tr>
<th>Economic slowdown or downturn</th>
<th>Conflict</th>
<th>Climate</th>
<th>Conflict and climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slowdown</td>
<td>Central African Republic, Jordan,* Lebanon*</td>
<td>Madagascar, El Salvador, Guatemala, Honduras</td>
<td>Cameroon, Djibouti, Kenya, Myanmar</td>
</tr>
<tr>
<td>Downturn</td>
<td>Mozambique</td>
<td>Nigeria, Uganda</td>
<td></td>
</tr>
<tr>
<td>Slowdown</td>
<td>Ukraine*</td>
<td>Eswatini,* Pakistan*</td>
<td>Niger, Syrian Arab Republic*</td>
</tr>
<tr>
<td>Downturn</td>
<td>Malawi</td>
<td>Chad, Afghanistan</td>
<td></td>
</tr>
<tr>
<td>Slowdown</td>
<td>Palestine</td>
<td>Zambia</td>
<td>Sudan</td>
</tr>
<tr>
<td>Downturn</td>
<td>Iraq, Turkey</td>
<td>Zimbabwe</td>
<td>Burundi, Democratic Republic of the Congo, South Sudan, Yemen, Haiti</td>
</tr>
</tbody>
</table>

**Note:** * marks countries affected by conflict alone.
Next Gen:
- Int. Scholarships
- IAR Volunteering
- Int. Conferences
- IAR Mentors
To summarize:

- Integrated & contextualized
- Malnourishment $\rightarrow$ ?? $\rightarrow$ ?? Education $\rightarrow$ Development
- Yields, pest & disease, zoonoses, AMR, safe foods, recycling, policy
- All within more rapid climate change
- Old/current generation experience $\neq$ NewGen
- Newgen: intercultural, integrationists $=$ ???
To summarize:

- Integrated & contextualized
- Malnourishment → ?? → ?? Education → Development
- Yields, pest & disease, zoonoses, AMR, safe foods, recycling, policy
- All within more rapid climate change
- Old/current generation experience ≠ NewGen
- Newgen: intercultural, integrationists = **the world is in good hands**
World Food Day
26 October

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