Role of Public-Private Partnerships in Biopesticides and Biofertilizers Research and Development for Sustaining Agriculture Production

CL Laxmipathi Gowda\(^1\), Hari K Sudini\(^2\), and S Gopalakrishnan\(^2\)

1. Director, GRSV Consulting Services, Mysuru-570023, India, and 2. Senior Scientists, ICRISAT, Patancheru-502324, India

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The Global Scenario

• World population expected to reach 9 billion by 2050
• > 1 billion poor and hungry people (~65% of poor and 70% of hungry people) live in rural areas
• Food and nutrition security will be critical, with certainty of climate change
• > 85% of smallholder farms are in Asia and sub-Saharan Africa
• ~2 billion people depend on smallholder agriculture in Asia and sub-Saharan Africa
• Smallholder agriculture produces 80% of food consumed by Asia and sub-Saharan Africa
Challenges for Smallholder Farmers (SHF)

• Poor soil fertility and erratic rainfall
• High cost of chemical inputs (fertilizers, pesticides, etc.)
• Limited access to output markets and remunerative prices
• Bottlenecks in mechanization to reduce labor costs
• SHF need to be empowered to move from subsistence to market-oriented farming
• Supportive policies essential to ensure access of inputs and technologies to smallholder farmers
Science & Technology to Empower Farmers

• Modern S&T made significant progress in the past 4-5 decades
• Created opportunities to farmers to increase food production:
  • Improved crop varieties and hybrids
  • Options for management of soil, water and nutrients
  • Technologies for managing pests and diseases
  • Improved post-harvest and food processing technologies
• Farmer-participatory R&D interventions to fine-tune technologies
• Many ITKs refined and fine-tuned with modern science
• Asia has long history of using botanicals and local materials to manage pests and diseases
Biofertilizers and Biopesticides

• Excessive use of chemical fertilizers and pesticides during green revolution and beyond
• Unsustainable agriculture leading to environmental degradation
• Plateauing of yields and decline in total factor productivity
• Biofertilizers and biopesticides are effective when strategically used
• Timely availability of quality bioproducts at affordable prices is a major bottleneck
PGPR and related microbes

• PGPR and related microbes gained global acceptance for sustainable agriculture

• Biopesticides and biofertilizers exploited to support organic agriculture in many countries, including:
  • China, India, Japan, Korea, Nepal, Philippines, Vietnam and others

• “Asian PGPR Society” making sincere efforts in this direction

• Public-private partnerships essential to promote bioproducts

• Need to consider a consortium model to harness PPP
Public-Private Partnerships (PPP)

- PPP enable pooling of resources and minimize risks in R&D investments for mutual benefit
- Synergy between the social equity of public institutions and efficiency of delivery of the private sector
- PPP can create linkage in the supply chain to deliver inputs (bioproducts) to small-holder farmers at reasonable costs
- Investment costs are shared leading to lower product costs (= benefit to consumer)
- Builds on the strengths of both public and private sector
Hybrid Parents Research Consortium (HPRC)

- PS companies, especially in India, have derived immense benefits from ICRISAT’s research
- PS companies had confidence in ICRISAT research programs in delivering goods
- MAHYCO support for CMS in Pigeonpea
- Initial consultations with PS companies began in 1998
- HPRC was formalized in 2000, with 6 companies and 24 companies were members in 2003
Synergies in hybrid cultivar development

• ICRISAT conducts basic research on germplasm diversification and enhancement
• Diverse hybrid parents are shared with partners, including PS seed companies
• PS partners test, make further selections, and select useful parental lines
• PS test hybrid combinations and chose promising hybrids for niche markets
Synergies in hybrid cultivar development-2

- Seed companies mass produce seed of promising hybrids using contract farmers
- They market hybrid seed using a vast network of dealers in rural areas
- Small-scale farmers get access to high yielding hybrid cultivars
- ICRISAT is able to show quicker impacts of its research in farmers fields
Hybrid Parents Research Consortium

• Three consortia operating since 2000
  ❖ Sorghum, pearl millet and pigeonpea (2003)
• PS can join one or more consortia paying membership fees
• Funds from consortia augment ICRISAT core resources for hybrid parents research
• Members have access to breeding materials developed at ICRISAT
• No exclusivity to any consortium partner
• Unrestricted access to materials by public sector institutions
Consortium operating guidelines

- A 5-member Advisory Committee provides advice and guidance
- ICRISAT organizes field days to show materials
- Partners select materials at different stages of development
- PS provide input and feedback on research priorities and deliverables
- Seed supply as per Standard Material Transfer Agreements (SMTA)
ICRISAT Material Transfer Agreement (MTA)

• ICRISAT supplies germplasm material for R&D to scientists freely worldwide

• Recipient may use germplasm for research, breeding and training

• Breeding material (value added product) supplied for use of recipients only

• Recipient not to claim ownership (IPR or PVP) over the material in the form received

• Material is not transferable to other organizations/users

• ICRISAT Reserves right to distribute material to other parties
Impacts of Hybrid Parents Research in India

- Half of India’s 8.5 m ha of sorghum is planted to hybrids
- 30 of the >50 commercial hybrids are based on ICRISAT-bred lines
- About 60% of 10 m ha of pearl millet planted to hybrids
- 60 out of >85 commercial hybrids are based on ICRISAT-bred lines
- HPRC was the first PPP arrangement in the CGIAR system
- HPRC is precursor of Agri-business and Innovation Platform (AIP)
- ICRISAT is acknowledged as mentor by many PS Companies in India
Promoting Bioproducts using PPP approach

• Biofertilizers and biopesticides are good alternatives to chemical products
• Quality (purity, etc) and consistency is a major constraint, and prices attend to be high
• Farmer or village-level bioproducts are affordable, but quality is poor
• Scientists and farmers need to work together to blend modern science with traditional knowledge and practices
• Methodological breakthroughs have enhanced capacity for large-scale production of inoculants and bioproducts
Bioproducts Research Consortium (BRC)

- ICRISAT and PS companies initiated the Biopesticides Consortium
- Later renamed as Bioproducts Research Consortium (BRC)
- Eleven companies were founder members of BRC
- Goal was to make quality bioproducts available to farmers at affordable prices
- BRC shared promising microbes, small-scale fermenters, expertise on policy issues, etc.
- BRC Phase 2 started in 2008, but only 3 companies remained
- BRC became inoperative due to lack of critical mass
Lessons learnt from BRC experiment-1

• Private sector companies demand and need ready-to-use, on-the-shelf technologies that can be mass produced and launched in 1-2 years to maximize their profits

• Most companies were unwilling to invest in long-term strategic and basic research to develop potential future technologies

• CGIAR policy did not allow PS companies use their institution’s name in marketing of products

• Currently available PGPR were unable to show large and significant effects on-farm to convince the farmers
Lessons learnt from BRC experiment-2

• Most manufacturers were willing to provide high quality products (PGPR, inoculants, biopesticides, etc), but not invest in research to ascertain why the products do not work in the real world (on farmers’ fields)
• Most companies wanted BRC to facilitate government clearance and lobby for favorable policies. This was initiated in Phase 2, but was not fully pursued as very few companies remained in the consortium
• Success of spinosad-like products indicate that purified forms of biopesticidal components do have future potential
Future Scenario-1

• Governments have a role in promoting PPP in biofertilizers and biopesticides for sustainable agriculture
• BIRAC, India brings together multiple stakeholders to deliver products to consumers
• Chemical fertilizers received government support for decades (that led to overuse of fertilizers)
• Govt should stop subsidy or give similar support to bioproducts
• Preferably, Govt should incentivize farmers to be sustainable
• Need inoculants/PGPR that survive in varied ecosystems to enhance farmer acceptance
Future Scenario-2

- Potential for biopesticides and biofertilizers huge in domestic and international markets
- Need paradigm shift in perception and attitudes of both public and private sector partners
- Strategic partnerships on the lines of ICRISAT-PS HPRC model needed
- Asian PGPR Society should facilitate formation of synergistic partnerships
- Future partnership model should be mutually beneficial to become viable in the long run
- Promotion of viable PPP models critical for empowering smallholder farmers