

# Policies and Research Priorities for Sustaining Potato Production and Consumption in Asia-Pacific

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**Director**

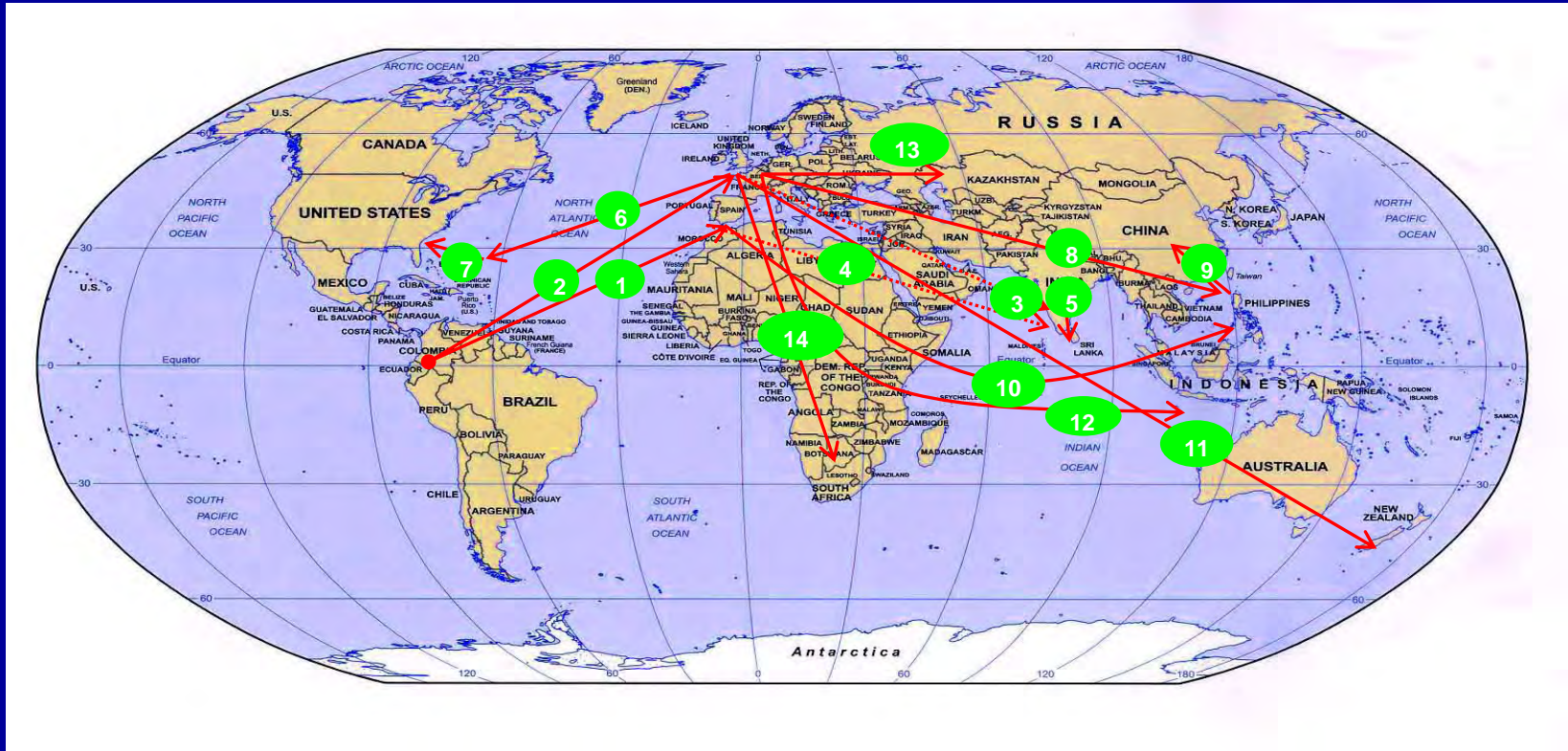
**Central Potato Research Institute**

**Shimla-171001**

**India**



# Spectacular Journey by Potato



- South America (Centre of origin)
- 1. South America → Spain 1570
- 2. South America → UK 1590
- 3. UK → India <1610
- 4. Portugal → India <1610
- 5. India → Sri Lanka <1610
- 6. UK → Bermuda 1613
- 7. Bermuda → Virginia, USA 1621
- 8. Holland → Taiwan <1650
- 9. Taiwan → China <1650
- 10. Spain → Philippines <1700
- 11. UK → New Zealand 1773
- 12. Holland → Java 1794
- 13. Holland → Russia <1800
- 14. UK → South African continent 1830

# Asia-Pacific, the Leader in Potato Production



|                      | <b>Area<br/>(‘000 ha)</b> | <b>Production<br/>(Million MT)</b> | <b>Yield<br/>(MT/ha)</b> |
|----------------------|---------------------------|------------------------------------|--------------------------|
| <b>Africa</b>        | 1503                      | 16.30                              | 10.84                    |
| <b>Asia-Pacific</b>  | 8742                      | 137.14                             | 15.68                    |
| <b>Europe</b>        | 7440                      | 128.61                             | 17.28                    |
| <b>Latin America</b> | 962                       | 15.99                              | 16.60                    |
| <b>North America</b> | 614                       | 22.63                              | 40.63                    |
| <b>World</b>         | 19262                     | 320.67                             | 16.64                    |

# Potato in Asia-Pacific



- **Grown in 28 countries**
- **Production of 121.7 million t from 7.3 million ha**
- **Share in world potato area and potato production is 39.3% and 37.7%, respectively.**
- **Average productivity 16.49 t/ha (Range 2.50 t/ha in Timor-Leste to 44.25 t/ha in the New Zealand).**
- **China and India alone account for 79% area and potato production in the region.**

# Potato Production in Asia-Pacific

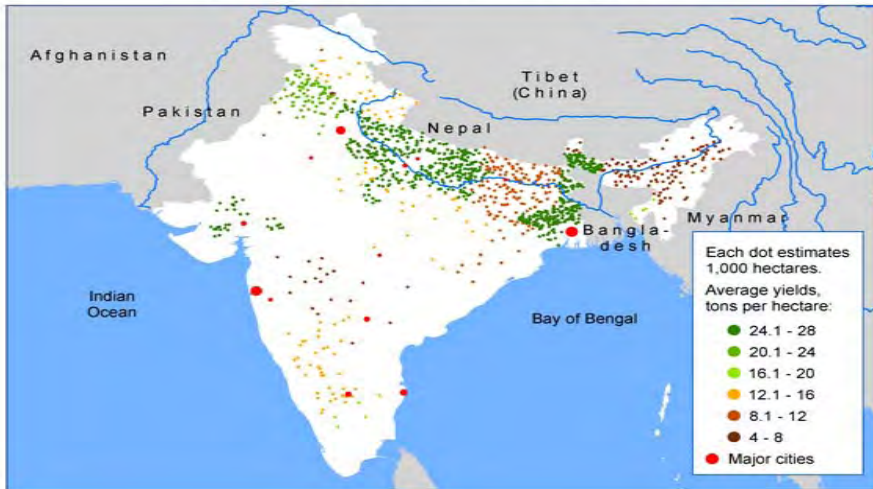


## Three broad trends

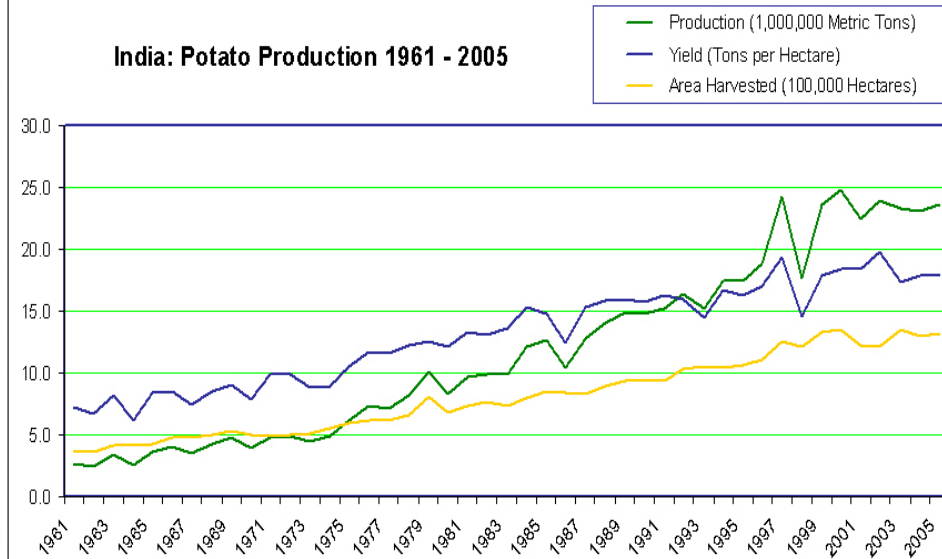
- Subtropical low land cultivation during cool winter season in the Indo-Gangetic belt led by India
- High land cultivation during summer season led by China
- Oceania island cultivation with high productivity led by Australia and New Zealand

# Potato Revolution in India

India  
Potato Production Areas and Average Yields



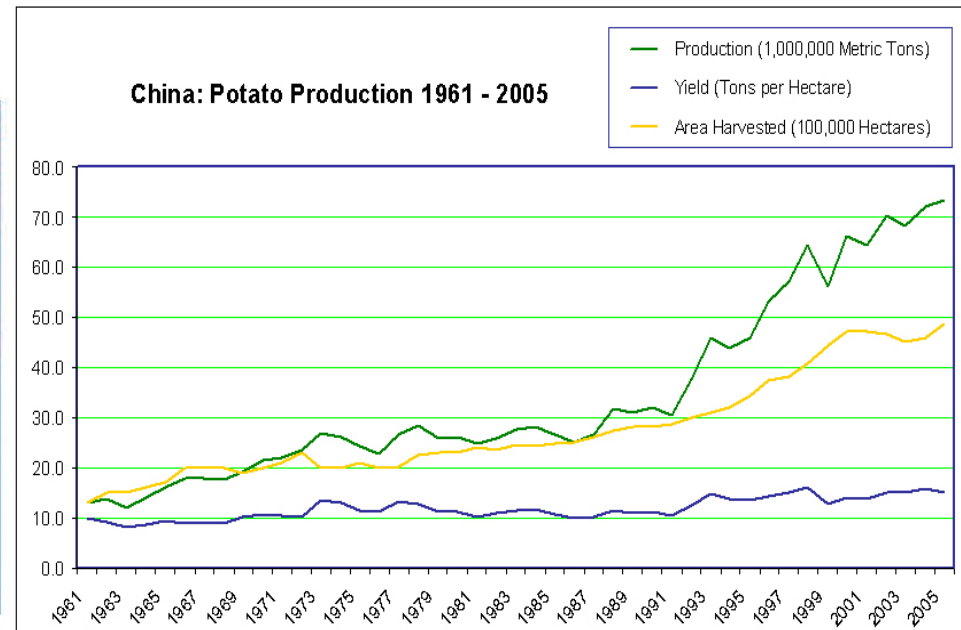
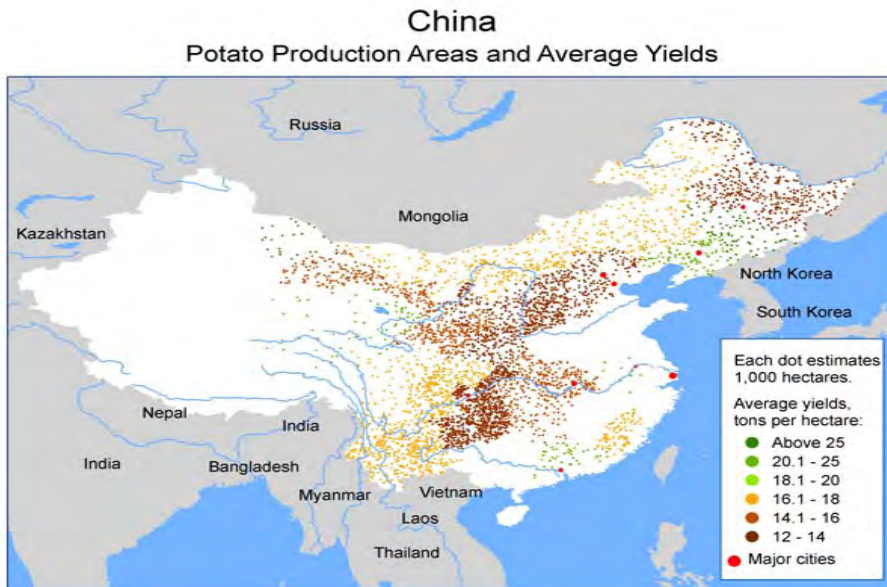
India: Potato Production 1961 - 2005



- **Production: ~24 million MT, more than 850% increase during last 40 years.**
- **Well developed seed production and management system.**
- **Adequate cold-storage facility.**
- **Well developed institutional capacity led by Central Potato Research Institute for seed production and varietal improvement. Developed 43 cultivars to suite different agro-climatic zones and to serve different purposes.**



# Potato Revolution in China



- **Production: 70.34 million MT, more than five fold increase during last 40 years.**
- **Large excess of skilled manpower.**
- **Scope for expansion to Eastern region as winter crop.**
- **Tremendous export potential to East-Asian countries.**

# Need for Potato Policies and Research Priorities in Asia-Pacific



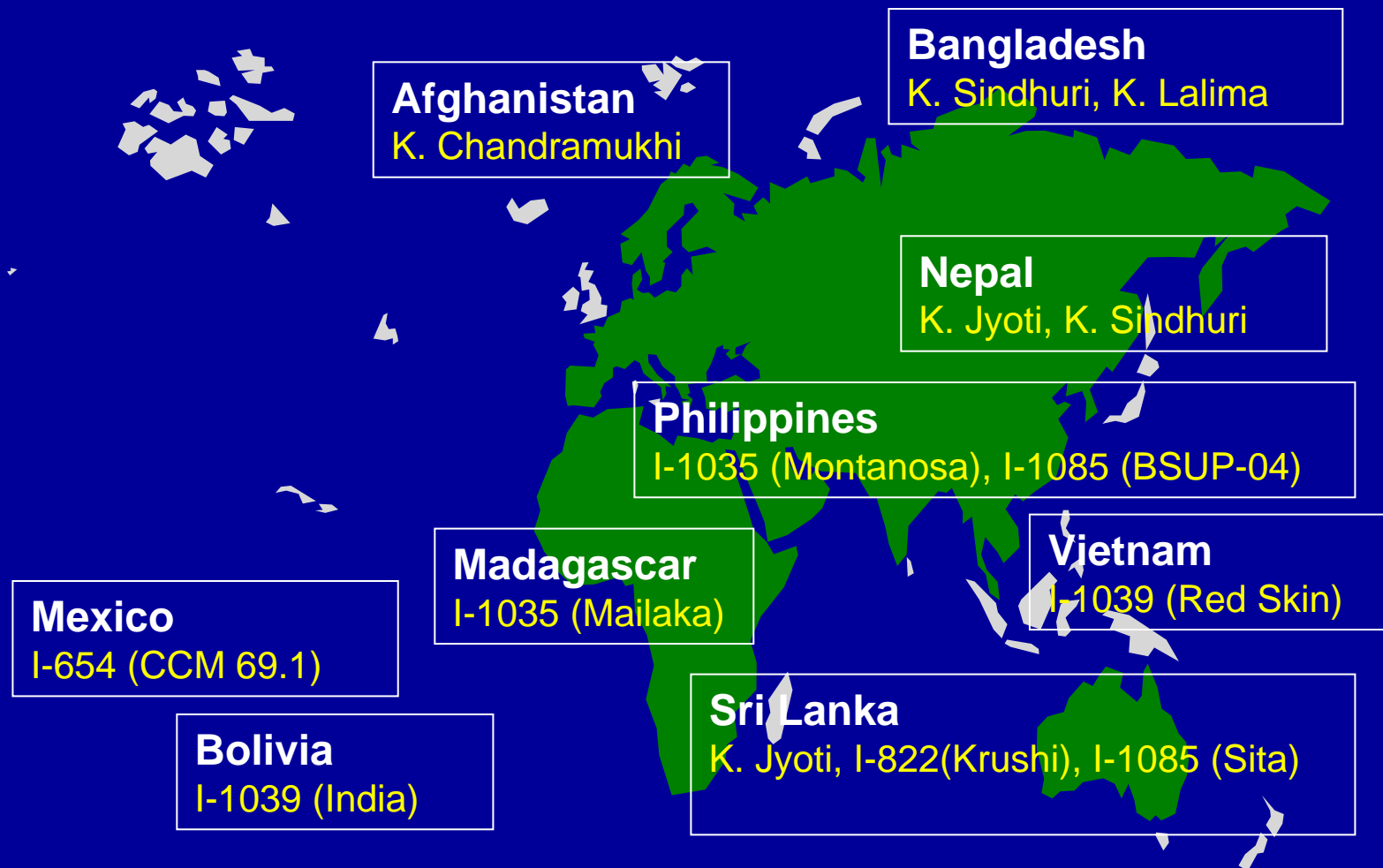
- **Uneven growth of potato crop across the region.**
- **Low productivity.**
- **High pressure on dwindling natural resources.**
- **Changing world scenario in agriculture.**
- **38% contribution to world potato production but lower per capita consumption.**
- **More domestic and international demand for fresh and processed potatoes.**
- **Less export.**



# Varietal Improvement

| <b>Constraints</b>  | <b>Production zone</b>   |
|---|--|
| <b>Lack of high yielding early maturing cultivars</b>                                       | <b>East and South-east Asia</b>  |
| <b>Lack of cold-chipping cultivar having high dry matter and low reducing sugar content</b> | <b>All the Asia-Pacific countries, especially East and South-east Asia</b> |
| <b>Lack of durable late blight resistant cultivars</b>                                      | <b>All the Asia-Pacific countries</b>                                      |
| <b>Lack of viral (PVY and PLRV) resistant cultivars</b>                                     | <b>All the developing Asian countries</b>                                  |

# Indian Varieties Popular in Other Countries



# Varietal Improvement

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## Policy Issues

- **Development of indigenous potato R&D system**
- **Exchange of advanced breeding materials for evaluation under local conditions.**
- **Private participation in variety development and evaluation.**
- **Opening of an institute on potato gene bank for Asia-pacific.**
- **Laboratory for creation and maintenance of DNA fingerprint database.**

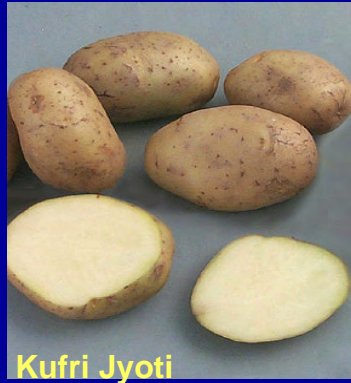
# Varietal Improvement

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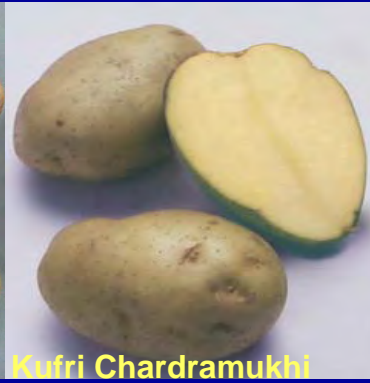
## Research Priorities

- **Pre-breeding using exotic germplasm for development of parental materials.**
- **Development of late blight, viruses and bacterial wilt resistant high yielding early maturing cultivars.**
- **Development of product-specific processing cultivars.**
- **Development of heat and drought tolerant potato cultivars.**
- **Adoption of biotechnological tools to complement conventional breeding.**

# Indian Potato Cultivars



Kufri Jyoti



Kufri Chardramukhi



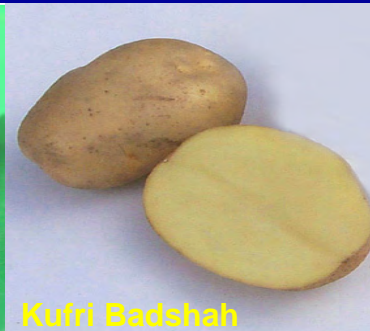
Kufri Sindhuri



Kufri Lauvkar



Kufri Chipsona-1



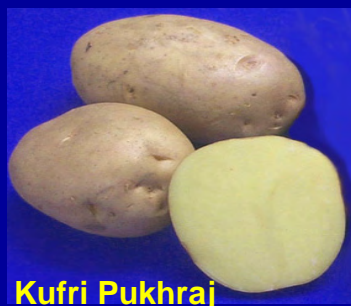
Kufri Badshah



Kufri Pushkar



Kufri Surya



Kufri Pukhraj



Kufri Bahar



Kufri Arun



Kufri Chipsona-3

Bred 43 potato cultivars to suite different agro-climatic regions

# Seed Production and Multiplication

| <b>Constraints</b>  | <b>Production zone</b>                    |
|---|---|
| <b>Inadequate seed availability, inferior seed quality and poor seed management</b> | <b>All the developing Asian countries</b> |
| <b>Seed degeneration because of tuber borne diseases and viruses</b>                | <b>Tropical Asian countries</b>           |
| <b>Inadequate seed storage facility</b>   | <b>All the developing Asian countries</b> |
| <b>Inadequate seed certification and distribution system</b>                        | <b>All the developing Asian countries</b> |



# Seed Production and Multiplication

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## Policy Issues

- **Development of seed exchange mechanism among different countries.**
- **Development of national seed production programme through public-private participation.**
- **‘Seed Village’ for establishment of local seed bank.**
- **Creation of ‘Potato Development Board’.**

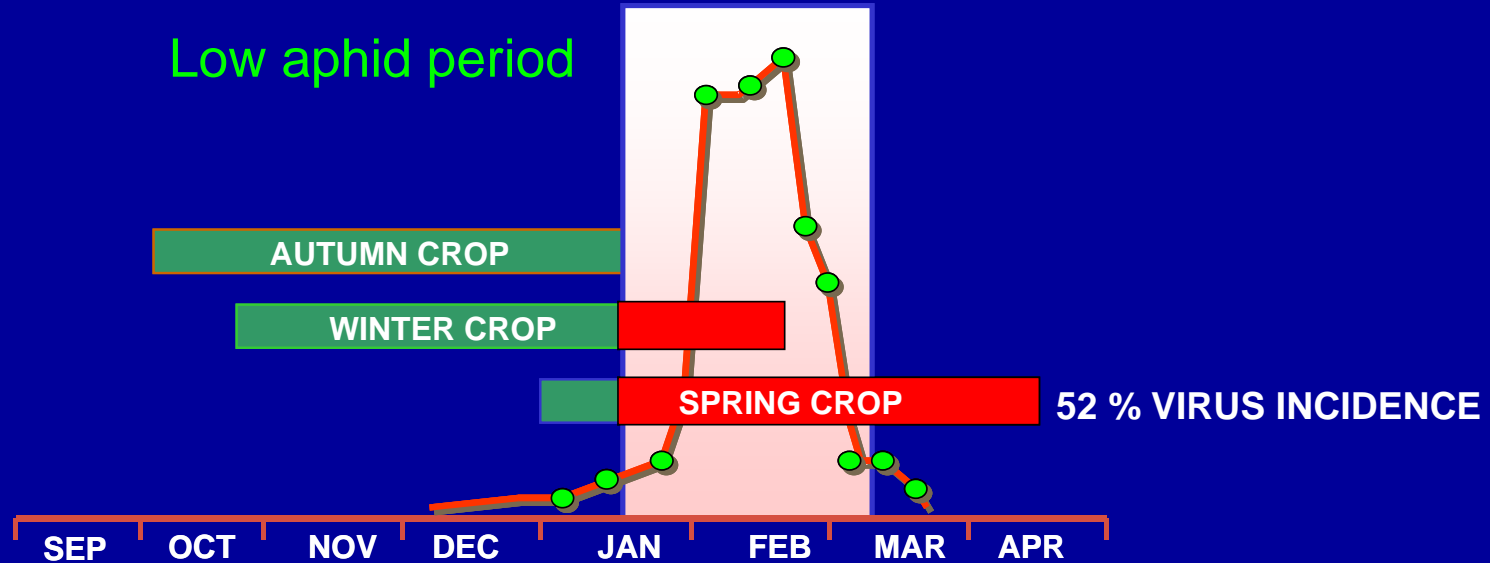
# Seed Production and Multiplication

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## Research Priorities

- Identification of suitable area and season for healthy seed production.
- Adoption of advanced biotechnological tools for seed production, virus diagnosis and certification.
- TPS development by apomixis and parthenogenesis in commercial potato cultivars.

# Seed Production and Multiplication



**“Seed Plot Technique” for growing potato seed under low aphid periods developed by CPRI, Shimla**

# True Potato Seed (TPS)



The true potato seed (TPS) technology developed by India has a great potential in this region. The TPS technology is already popular in India, Bangladesh, Nepal, Sri Lanka, Vietnam, Indonesia, and the Philippines. Basic research is required on TPS development by apomixis and parthenogenesis in commercial potato cultivars.

# Crop Production

| <b>Constraints</b>  | <b>Production zone</b>                    |
|---|---|
| <b>Inefficient management of potato-based cropping system</b>       | <b>All the developing Asian countries</b> |
| <b>Poor management of soil fertility</b>                            | <b>All the developing Asian countries</b> |
| <b>Poor management of surface &amp; ground water for irrigation</b> | <b>All the developing Asian countries</b> |
| <b>High cost of production</b>                                      | <b>All the developing Asian countries</b> |

# Crop Production

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## Policy Issues

- **Development/identification of short-duration cultivars for fitting into existing cropping system.**
- **Construction of minor irrigation structures for rainwater harvesting and use of drip irrigation.**
- **Capacity building of farmers for adoption of improved potato technologies.**
- **Launching of 'Soil Health Improvement Programme' and adoption of precision farming.**
- **Formation of Consortium for sharing of river water.**



# Crop Production

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## Research Priorities

- **Optimization of potato based cropping system to increase crop intensity.**
- **Optimization of fertilizer application doses based on soil nutrition status.**
- **Development of cultural practices with higher land conservation efficiency.**
- **Improvement of soil organic matter by green manuring, FYM, vermi-compost, bio-fertilizer etc.**
- **Integration of information technology tools like GIS, crop modeling, precision farming etc. for sustainable utilization of natural resources.**

# Plant Protection

| <b>Constraints</b>   | <b>Production zone</b>             |
|--|------------------------------------|
| High infestation of late blight, viruses and bacterial wilt  | All the Asia-Pacific countries     |
| High infestation of aphids, Colorado potato beetle and potato tuber moth                             | Central and South Asia             |
| Ground water pollution and resistance development in pests due to large quantities of pesticides use | All the developing Asian countries |

# Plant Protection

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## Policy Issues

- **Pest risk assessment and strengthening of quarantine offices in each country of the region.**
- **Establishment of plant clinics with latest equipments and trained personnel for diagnosis and detection of potato pathogens.**
- **Popularization of pest forecast information and eco-friendly technologies.**

# Plant Protection

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## Research Priorities

- **Standardization of advanced diagnostic tools for pathogen detection.**
- **Development of database on prevalent pest and diseases.**
- **Development of pest forecasting model, especially for late blight.**
- **Development of integrated pest management practices against key pests.**
- **Identification of natural enemies and bio-pesticides for controlling pests and diseases.**

# Post-harvest Management

| <b>Constraints</b>   | <b>Production zone</b>                    |
|--|---|
| <b>Inferior storage technologies and inadequate storage facility</b> | <b>All the developing Asian countries</b> |
| <b>High cost of cold storage</b>                                     | <b>All the developing Asian countries</b> |
| <b>Insufficient potato processing</b>                                | <b>All the developing Asian countries</b> |
| <b>Lack of supply of processing grade potato round the year</b>      | <b>All the Asia-Pacific countries</b>     |

# Post-harvest Management

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## Policy Issues

- **Development of specialized cold-chain system to support the farm-to-market infrastructure for potato.**
- **Technological and financial support for establishment of cold-storage facility.**
- **Popularization of traditional and low-cost and non-refrigerated storage structures.**
- **Development of linkage mechanism at the regional level for year-round supply of raw material to major potato processing industries of the region.**
- **Development of indigenous potato processing varieties.**



# Indian Potato Processing Cultivars and their products

**Kufri Chipsona-1**



**Kufri Chipsona-2**



**Kufri Chipsona-3**



**Kufri Himsona**



**These four cultivars could be utilized for processing purpose in the region**

# Post-harvest Management

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## Research Priorities

- **Determination of optimum harvesting period for processing cultivars.**
- **Development of energy efficient storage conditions without compromising processing attributes.**
- **Development of new processing techniques having minimal effect on the environment.**
- **Reduction or elimination of enzymatic oxidation of cut surfaces.**

# Marketing and Export

| <b>Constraints</b>   | <b>Production zone</b>                    |
|--|---|
| <b>Poor market intelligence system</b>                     | <b>All the developing Asian countries</b> |
| <b>Production instability and fluctuating market price</b> | <b>South and South-east Asia</b>          |
| <b>Poorly developed farm-to-market infrastructure</b>      | <b>All the developing Asian countries</b> |
| <b>Meager share in international potato trade</b>          | <b>All the Asia-Pacific countries</b>     |

# Marketing and Export

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## Policy Issues

- **Establishment of Agri Export Zones.**
- **Development of market intelligence network.**
- **Fixation of zone/variety wise export targets well before planting season each year.**
- **Development of infrastructure for export marketing.**
- **Provision of Market Intervention Scheme, export incentives and promotion, and introduction of minimum support price.**

# Marketing and Export

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## Research Priorities

- **Preparation of database on potato exports; price grade, phyto-sanitary, seed and processing standards; and consumer preferences.**
- **Adoption of cooperative and contract models of farming.**
- **Development of sensitive diagnostic tools for detection of prohibited diseases in export potato.**

# Environment

| <b>Constraints</b>  | <b>Production zone</b>                    |
|---|---|
| <b>Improper use of pesticides and resistance development in pest</b>            | <b>All the Asia-Pacific countries</b>     |
| <b>Chemical fertilizer and pesticide pollution of food, water and livestock</b> | <b>All the developing Asian countries</b> |
| <b>Water body contamination by potato processing activities</b>                 | <b>All the Asia-Pacific countries</b>     |
| <b>Declining potato biodiversity</b>  | <b>All the Asia-Pacific countries</b>     |

# Environment

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## Policy Issues

- **Implementation of policies and initiation of domestic sectoral reforms to discourage inefficient use of pesticides.**
- **Establishment, monitoring and enforcement of appropriate norms and regulations for processing industry regarding proper safety provisions.**
- **Opening of a 'Potato Variety Management Institute' in each country for promotion of cultivation of diverse potato cultivars including landraces to increase potato biodiversity.**

# Environment

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## Research Priorities

- **Development of disease and insect pest resistant varieties to reduce pesticide application.**
- **Creation of soil testing facility, and formulation of package of recommendations for fertilizer applications.**
- **Use of integrated crop management practices.**



# Others

| <b>Constraints</b>                       | <b>Production zone</b>                    |
|--|---|
| <b>Gender inequality</b>                 | <b>All the developing Asian countries</b> |
| <b>Lack of public-private synergy</b>    | <b>All the developing Asian countries</b> |
| <b>Insufficient regional cooperation</b> | <b>All the Asia-Pacific countries</b>     |

# Others

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## Policy Issues

- **Promotion of gender equality in access to food, control over and management of natural resources and agricultural support services.**
- **Development of public-private synergy model on basic research, development and commercialization of products, and intellectual property management.**
- **Policy support and safeguard measures to farmers for contract farming.**
- **Creation of 'Potato Association for Asia-Pacific' (PAAP).**

# Others

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## Research Priorities

- On and off-farm training and participatory approaches such as 'farmer field school' to bring gender issue into potato development.
- Improvement in capacity building of farmers for utilization of IT technologies.

# Conclusions

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- Improved seed production, management and certification employing advanced technologies jointly by public-private collaboration.
- Development of high yielding early maturing cultivars having resistance to biotic stresses like late blight, viruses, bacterial wilt and potato tuber moth, abiotic stresses like heat, drought and cold, and having better processing attributes.
- Identification of best-fit cropping system with optimized packages of practices giving more emphasis on bio-fertilizer and bio-pesticides, and development of IPM using IT technologies.
- Identification of energy efficient storage condition to harness processing attributes of the cultivars.

# Conclusions

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- **Development of novel processes and potato products, and environment-friendly waste management system.**
- **Adoption of IT-based tools for market intelligence and its efficient percolation to growers.**
- **Impact analysis on health and environment, human resource development and international collaboration for sustainable growth of potato production .**
- **Providing farmers and entrepreneurs non-distorting incentives to invest in potato production and diversified post-production innovations.**
- **Accelerated exchange of germplasm between countries and continents.**

# Acknowledgements

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SCRI, UK



# Thank You