Though potato is a household name today in India, it came to this ancient land only about 400 years ago during *Mughal* dynasty. After its introduction from Europe in the beginning of 17th century, it remained an insignificant crop till independence, largely because of poor productivity of introduced European varieties that were adapted to temperate agro-climate and were suitable for cultivation in hills of India as summer crop. The Government of India established the ICAR-Central Potato Research Institute in the year 1949 to harness the potential of this promising crop for food security. The institute developed suitable varieties and technologies that virtually transformed the temperate potato crop to sub-tropical one enabling its spread from cooler hill regions to the vast Indo-Gangetic plains as a *rabi* crop. It triggered a revolution in potato production causing very fast growth in area, production and productivity during next five decades.

However, the impact of global warming started manifesting during 1990s and it became imperative that further adaptation of potato from sub-tropical to a tropical crop would be necessary in near future to sustain its cultivation in the plains. In fact, the Intergovernmental Panel on Climate Change (IPCC) in its Fourth Assessment Report predicted that the potato growing season in 2020 is likely to be warmer by 0.78–1.18°C and in 2055, by 2.41–3.16°C. Suitable growing period for potato in eastern UP, Bihar, and West Bengal will be not more than 75-80 days. Moreover, the food basket of the country will undergo a drastic change due to economic growth, life style change and dietary preference. The future requirement of foodgrains, vegetables and fruits in 2020 and 2050 indicate a growth rate of 1.12% for foodgrains, 2.41% for vegetables and 3.71% for fruits to maintain self-sufficiency. India would require potato production of about 56.15 and 124.88 million tonnes during 2025 and 2050, respectively. On the other hand, all the natural resources including soil, water, and energy are under severe constraint. Inputs for agricultural production will also become scarcer and dearer with time. It is also imperative that future food production technologies should be carbon neutral and sustainable. Under this background, we have to strike a balance between cutting edge technologies and their environmental cost for sustainable production enhancement of potato.

Since its establishment in the year 1949, ICAR-Central Potato Research Institute played a pioneering role in developing varieties and technologies for growing potato under sub-tropical agro-climate. The scientists, students and other staff of the institute are the best in the country for their original thinking, innovativeness, hard work and national commitment. They have the proven capacity to face any tough challenge and I am sure the imminent threat of global warming on sustaining potato cultivation in the vast Indo-Gangetic Plains (IGP) will be met squarely by our hard-working farmer friends with the technology support from ICAR in which ICAR-CPRI would take a lead role. The institute targeted its R4D work plan to

develop suitable varieties, production, protection and post-harvest technologies particularly for the vast IGP which is at the threshold of losing potato cultivation due to climate change.

Adapting potato to tropical growing condition: Among the root and tuber crops potato is perhaps the only crop whose productivity is likely to be negatively impacted due to climate change. The INFOCROP-Potato model suggested severe yield reduction in southern and peninsular India (9-47%) and moderate reduction in Indo-Gangetic plains (3-13%). The potato production may decline by 2.61 and 15.32% in the year 2020 and 2050, respectively. To overcome this situation and to satisfy the projected demand, it is necessary to initiate immediate work plan for developing varieties and production technologies for cultivating potato under tropical condition. Emphasis will be given for developing (i) short duration varieties (ii) varieties with early bulking and maturity, (iii) varieties that can tuberize at $\geq$25 ^{o}C, (iv) management of heat tolerance, (v) management of invasive and range-expanding pests and diseases, and (vi) cold chain management.

Productivity enhancement: Plateauing of yield gain in potato is a roadblock for achieving production target in a sustainable manner. Out-of-box thinking and innovative technologies are immediately required for breaking this barrier. The following approaches will be adapted for harnessing maximum yield potential of different crop plants: (i) broadening genetic base of varieties, (ii) exploiting genes for direct yield enhancement, (iii) improving photosynthetic energy conversion (ϵ_c) efficiency, and (v) improving sink strength.

Sustainable production system: Agriculture is the largest private enterprise in India, consisting of more than 138 million holdings, ~ 85% of which are < 2 ha in size. Most of these family farms are engaged in multiple agricultural activities like agri/horticulture, poultry and livestock rearing, fishery, beekeeping, sericulture, and agroforestry. Therefore, technologies developed in isolation for particular crop may be summarily ignored when applied to such multipurpose holdings (family farms). All our future technologies should aim at addressing the farming system in its entirety instead of particular mandate crop of any institute. Achieving this goal will be possible only if we develop and disseminate eco-technologies rooted in principles of ecology, economics, equity and employment generation. To ensure soil health and sustainable land use, emphasis would be given on the following aspects: (i) integrated farming system (IFS) approach for technology development, (ii) water use efficiency (Per drop more crop), (iii) emphasis on nutrient responsive instead of nutrient intensive technologies, (iv) conservation agriculture, and (vi) bio-intensive crop management.

Late blight management: Though potato is affected by several foliar diseases, late blight caused by a fungus-like organism *Phytophthora infestans* is the most important one. The causal organism of this disease came to India with imported seed potatoes from Europe. It was first recorded between 1870 and 1880 in the Nilgiri hills and spread rapidly to North-Indian hills. From hills the disease gradually spread to Indo-Gangetic plains. Presently, it appears every year in the hills and once in 2-3 years in devastating form, in the plains. The pathogen is highly variable and adapt quickly to the newly bred varieties and fungicides. It is necessary to be ever vigilant to contain this menacing disease problem. Marker assisted breeding for horizontal resistance and innovative molecular breeding approaches will be used for keeping this highly adaptive pathogen under check.

Post-harvest management: It is estimated that ~ 2.8-10% in non-perishable, 6.8-12.5% in semi-perishables and 5.8-18% in perishable agricultural products are lost after harvesting. It may be much higher (~ 20%) for a perishable commodity like potato that is harvested at the

onset of summer season. About 50% of these losses can be prevented using appropriate post-harvest measures. Establishing on-farm primary processing facilities would capacitate small farmers in a big way. The family farmers can be trained to undertake post-harvest processing and packaging of farm produce, preferably on-farm or near to the production site. Such technologies would promote entrepreneurship in rural areas by strengthening forward linkage in agriculture. This would generate additional working days to farm family members, add value to harvest and generate additional income. The following areas will be given thrust for lowering post harvest losses: (i) development of processing varieties and technologies, (ii) on-farm storage and primary processing units, (iii) energy-efficient storage structure, (iv) technologies for cold chipping, (v) managing bruising injuries.

Quality seed production: India requires at least 6 million metric tonnes of good quality potato seed for planting in 2 million ha area. ICAR-CPRI supplies about 2,500 metric tonnes of Breeder seed to different states and other organizations that can be multiplied to 1.6 million tonnes after two cycles of foundation seed and two cycles of certified seed, which comes to about 26% of the total requirement. It is, therefore, necessary to encourage both private and public participation for quality seed production to bridge this gap. Emphasis will be given to the following areas to expand quality potato seed production: (i) development & standardization of low cost and efficient mass propagation methods - aeroponics, bio-reactor technology, (ii) involvement of KVK/SAU for seed production, (iii) identification of seed village/progressive farmers for certified seed production.

Strategic research areas: Though great strides have been made in plant metabolic engineering over the last two decades, four long-standing challenges in plant science are yet to be understood in a comprehensive manner. New and exciting information is being generated globally in those fundamental research areas. Besides, the second green revolution is predicted to come from below ground technologies targeting root biology/architecture particularly of root and tuber crops. Emphasis will be given to take up translation research on the following strategic areas: (i) conferring atmospheric nitrogen fixation ability, (ii) improving photosynthetic carbon fixation efficiency, (iii) root biology & architecture for input use efficiency and sink strength, (iv) biofortification of crop varieties, (v) improving biofuel production form biomass.