An Overview of CIP Potato Activities in South and West Asia

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I. Introduction

The potato is an important commodity in the countries of South and West Asia (SWA). Because of the crop's short vegetative cycle, the potato plays an important role in the region's food security. The potato in Asia and especially in the SWA region has experienced the world's highest annual growth rate in production over the past three decades. It is now a valuable cash crop in almost all countries of this region and ranked as the 2nd to 4th most important crop in relation to other crops in SWA.

The potato could play an even more important role in food security for the population in these countries if its yields could be improved. Actual yields of the potato crop in countries of SWA are very close to those in the developing world (14 t/ha); a bit inferior to the world's average (16 t/ha) but very low if compared to the developed countries like the Netherlands (43 t/ha) or North America (36 t/ha)(Table 1).

Table 1. Potato area, production, yield and per capita production in countries of South and West Asia. Average of 1995-97 (*)

Country	Area (ha x 1000)	Production (t x 1000)	Yield (t/ha)	Per capita Consumption (1994-1996) (kg)	Rank in order of importance vs. 20 other major food crops
Bangladesh	133.0	1,489.0	11.0	10.0	2nd
Bhutan (**)	5.0	34.0	11.3	21.1	4th
India	1,116.0	18,627.0	16.9	14.0	3rd
Nepal	105.0	912.0	9.0	30.0	4th
Pakistan	81.0	1044.0	13.2	7.8	4th
Sri Lanka (**)	7.3	10.9	6.5	8.9	
Developing Countries	7,425	105,299	14.0	14.0	6th

* *Source: Maldonado, 1998.*
** *Source: Singh & Chand,1997.*

The major cause for the low yields is mainly due to the low quality seed still used by farmers. Disease is the major factor responsible for the "degeneration" of the seed.

In this paper, the major activities in which CIP is engaged with the countries of SWA to improve potato productivity will be discussed. This discussion will serve also to analyze the CIP technology available in SWA and its utilization as well as the actual situation of the seed systems and their perspectives.

II. Overview of CGIAR, "*Future Harvest*" and CIP.

The International Potato Center (CIP) is a *Future Harvest* Center which receives its principal funding from 58 governments, private foundations and international and regional organizations known as the *Consultative Group on International Agricultural Research* (CGIAR). *Future Harvest* is an organization that builds awareness and support for food and environmental research for a world with less poverty, a healthier human family, well-nourished children and a better environment. *Future Harvest* supports research, promotes partnerships and sponsors projects that bring the results of research to rural communities, farmers and families in Africa, Latin America and Asia.

CIP is a scientific, nonprofit institution dedicated to the increase and more sustainable use of potato, sweetpotato, and other roots and tubers in the developing world. One of the major features of CIP's work is that maintains the world's largest collections of potato germplasm (6,090 accessions), sweetpotato (6,553) as well as of nine Andean roots and tuber crops (1,293).

Part of the materials existing in the collections maintained by CIP are pathogen-tested and can be exported, upon request to CIP. Farmers of the world are cultivating large numbers of genetic materials, distributed by CIP.

CIP maintains Regional and Liaison Offices in 10 different places, in addition to its headquarters in Lima, Peru. The Regional Office for the South and West Asia (SWA), based in New Delhi, covers 6 countries; three of them are included in a special project (Potato Development Project for Bhutan, Nepal and Pakistan), financed by Swiss Agency for Development and Cooperation (SDC) and assisted by CIP's office in Islamabad, Pakistan.

III. Main activities carried out by CIP in countries of SWA.

Summaries of the main activities undertaken on potato development, with the support of CIP, in the countries of SWA are indicated in Table 2.

1. Distribution of Potato Germplasm.

CIP provide segregating and advanced materials for selection in all countries that may request it. Germplasm has been distributed to all countries of SWA. Table 3 shows the types and amounts of genetic materials introduced in 1998 and 1999 to the three country-members of Project CIP/SDC.

Table 2. Summary of activities supported by CIP in five countries of SWA. July, 2000

Activity	Countries					
	Bangladesh	**Bhutan (*)**	**India**	**Pakistan (*)**	**Sri Lanka**	**Nepal (*)**
Distribution of Germplasm	●	●	●	●	●	●
Variety Selection	(●)	●	–	●	(●)	●
Seed System (s) Support	●	●	–	●	●	●
Integrated Disease/Crop Management / FFS	●	●	–	●	●	●
True Potato Seed (TPS):						
- Var. + Agron. Research	●	–	●	●	●	●
- Seed Production	●	–	●	–	–	●
- Extension and Training	(●)	–	●	(●)	●	●
Cropping System	–	(●)	●	–	–	●
Agronomy Research	–	(●)	–	●	–	●
Socio-Economic Studies	–	(●)	●	–	–	–
Training & Publication	●	●	●	●	●	●

● = CIP Supported Activities. (●) = Limited CIP Supported Activity. – = No CIP Supported Activity
* = Special Project CIP/SDC

Table 3. Potato germplasm introduced from CIP and tested in Bhutan, Nepal and Pakistan during 1998 and 1999. (Compiled by O. Hidalgo, Project CIP/SDC, 1999)

Country	# of Shipments	True Seed Fams.		Tuber Families		True Potato Seed		Advanced materials (*In vitro*)*
		# of Families	# of Seeds	# of Families	# of Clones	# of Prog.	# of Seed (x 1000)	
Bhutan	3	-	-	112	315	3	60	1 + 2
Nepal	8	10	2000	104	372	18	422	5 + 4
Pakistan	9	10	2000	212	2841	12	2299	6+10
Totals	7	20	4000	428	2956	33	2781	28

* Pathogen-tested materials for variety release.

2. Progress made on the Selection of genetic material

Pakistan. All materials were introduced to the Potato Programme of NARC, Islamabad and then multiplied for testing. The new, as well as the material being selected from previous introductions, were tested in all stations according to the protocols for testing genetic material. Significant progress has been made in the selection process. Out of materials introduced in 1995 and 1996 from CIP and Holland, some very good materials have been selected. Among the best are 385270.163 (88-163), 390478.9 (Tacna), Dura (Dutch variety), 384640.3 and 387411.40 (both late blight resistant) and 720157 (Chilean variety = ONA – INIA). In the National Uniform Trial, seven most advanced clones were tested in 6 localities. Outstanding performance of two CIP clones was noted: 385270.163 and 386043.12 (Cipwhite=Kiram), red and white respectively.

Nepal. Tests of introduced genetic materials are being done in the hills as well as in Tarai (low lands) in selected parts of the country. Evaluation procedures are very well established in a special publication prepared for this purpose. Three new varieties were released this year after many years of testing: Janak Dev (CIP 720123 = Mex 750821), Khumal Rato 2 (CIP 676008 = I-1039) and Khumal Seto 1 (CIP 720088 = Achirana INTA). Perricholi is the next one in the release list.

In the Coordinated Farmer Field Trials, of the 7 clones tested in each one of 3 localities, three clones were selected with high levels of late blight resistance: 389660.9, 388574.6 and 388576.3. These clones will be further tested under farmer field conditions and some of them eventually released.

Bhutan. Selection process continued in four Research Centers of REID in the country. One hundred fifty clones were selected in the first trial under screen-house conditions. These clones were re-tested in the summer of 1999 and 133 have been retained for further evaluation, mainly for late blight resistance. The average yield inf 3 localities of the most advanced clones are 378015.13 (39.52 t/ha), 381379.9 (40.6 t/ha) as compared to the best control K Jyoti (36.7 t/ha). Four other clones are being also tested in the Farmer Field Trials. In on-farm trials, farmers preferred (1) Desiree, (2) 378015.13 (TS-1), (3) 377957.5 (LT-5) and (4) 381370.9 (Kisoro).

3. Integrated Disease/Crop Management & Farmer Field Schools.

Sixteen FFS were implemented in Bhutan (8), Nepal (3) and Pakistan (5) to orient farmers in aspects of IDM. This first year of work has been a learning experience, therefore a wide variation in the levels and types of activities conducted were noticed. On average, 7 sessions per school were conducted. A total of 205 farmers attended these schools. "Learning plots" managed by the farmers but guided by scientists (facilitators) yielded significant differences in almost all the plots demonstrating the benefits of improved seed and improved practices (emphasizing late blight control).

4. Seed Systems Research.

In Bangladesh, farmers' field trials on informal seed production system were conducted. Technicians from different organizations have been trained on NCM ELISA for potato viruses detection. Field trials have been planted.

In Nepal the cost per *in vitro* plant has been reduced by 26.7%. Also seed produced by Seed Producer Groups (SPG) is superior to local seed. Transfer of this approach to the Extension Service has been partially completed.

Surveys in Pakistan on the characteristics/efficiency of the *in vitro* laboratories, pre-basic seed operations and seed quality in Punjab have been completed. Seed quality utilized still requires significant improvements.

In Bhutan and Pakistan, for two consecutive years, samples of the seed used by farmers have been taken and planted to evaluate their quality. In Bhutan, the varietal mixtures as well high levels of PLRV infections have been noticed, especially in the mid hills and in the lowland. In the case of Pakistan, severe infection by mosaics and PLRV, as well as high level of varietal mixtures, have been noticed. These studies have confirmed that farmers usually use poor quality potato seeds in these two countries.

5. True Potato Seed (TPS) Research.

Significant progress on TPS research has been made in all countries of SWA, except Bhutan. The selection of the best varieties has been made; HPS II/67 and HPS I/13 are widely used in countries of SWA. All varieties produced by CIP have been tested already on research stations and some at the on-farm level. In India, Nepal and Bangladesh, TPS (seed) is being produced at commercial scale. Work to extend this technology in the farmers fields is being done in all countries of SWA (except Bhutan), but with a more success in India and Nepal. Large numbers of demonstrations, field days and training activities are being conducted and adoption is increasing among farmers of these countries.

6. Training activities in 1999.

Bangladesh

- "Regional workshop on Informal/Formal Seed System" Joydebpur. 3-days March, Scientists from Bangladesh, Sri Lanka, Nepal, India, Philippines, and from CIP-SWA participated.

Bhutan (Organized by RNR-Khangma & Project CIP/SDC)**:**

- “Seed production Course for Technicians”.Khangma,12 participants. May, 4 days.
- "Seed Potato Growers' Training". 4 Courses x 20 participants each. March, 2 days each.
- “In vitro and ELISA techniques”. Individual training at NARC-Nepal. 2 weeks.
- “Organization of Seed Producers Group”. Individual training in Nepal. Two weeks.

Nepal (Organized by NARC & Project CIP/SDC)**:**

- "Research Management Training on Potato". Kathmandu 12 participated from 7 NARC Experimental Stations plus 1 scientist from Project CIP/SDC. January, 10 days
- “Seed and ware potato production training course”. Six days, January 1999. Participated 22 research technicians and Extension Agents.

- "Regional Workshops (2) on Informal Quality Seed Potato Production through Seed Producer Groups (SPG)". Nepalgunj (2 days) and Kathmandu (2 days). 49 participants.
- "Seed Production and Quality Control Training". Jiri, to train farmers members of the Technical Committees of the SPGs. Participated 24 farmers from 3 regions of Nepal.
- "Individual training on Breeding at CIP-Lima". Mr B. Khatri, NARC-Nepal. Three weeks. January.

Pakistan (Organized by Nat. Potato Programme - NARC & Project CIP/SDC**):**

- Several local-training activities for farmers financed by Project CIP/SDC.
- "International Potato production course with emphasis on seed production". Nov. 3 weeks. Participants from Pakistan (9), Nepal (2), Bhutan (2) and Sri Lanka (1).
- "Potato production with emphasis on seed production for Extension workers of the Punjab". A 5-day course. Islamabad, September. 15 participants from Punjab.
- "Potato production with emphasis on seed production for Agricultural Officers (Extension) of NWFP, Balochistan and Sindh". A two-step course. In a step I five-day course. October 99-Islamabad. In step II the course was held in November 99 in the field of NWFP. Participated 15 Extension Agents of the Extension Service
- "Individual training on Breeding at CIP-Lima". Mr. M Iqbal, AARI-Pakistan. Three weeks in January.

IV. Seed Systems in countries of SWA

Over 90% of the seed used by farmers in SWA comes from the informal system. Usually farmers keep their own seed or buy it in the local market without any guarantee of quality. In most cases small farmers still select small tubers as "seeds" and sell the commercial tubers. In India, however, the formal seed system is more established; it is reported that over 20% of the potato seeds used by farmers are Certified. This represents an annual production of half a million tons of seed every year. This is quite an accomplishment since farmers in SWA usually renovate their seeds every 3 to 4 years. The formal system is also present in Bangladesh, Pakistan and Sri Lanka but the production of Certified seed accounts for less than 3% of the national needs. In Bhutan and Nepal, seed Certification systems do not exist and the informal system predominates. In Bhutan and Nepal, however, there are natural conditions very favorable for the production and maintenance of potato seed. Pakistan and Sri Lanka still depend partially on seed imports. In both cases, imports have been significantly reduced.

CIP work is oriented to strengthen the traditional seed systems in Bhutan, Nepal, Bangladesh and Pakistan. In Nepal, with the Seed Producer Groups approach, implemented by CIP, the production of pre-basic seed from *in vitro* has produced good quality seed under an informal seed system (Project CIP/SDC, 98).

Seed technology available.

The *in vitro*, rapid multiplication and ELISA techniques are being used in all countries of SWA, except India. The so-called "modern" scheme is widely practiced, but requires improvements and up-date in some places (Hidalgo, 1999).

Pathogen-tested *in vitro* cultures have been received from CIP. India however has generated and still practices an old but effective methodology (tuber/plant index-field plot technique). The same technique, but called "autumn to autumn cycle" is also practiced in Pakistan. Indian scientists know well the "modern" scheme, but their technology is cheaper and useful. Simple and effective methods like rouging, positive, negative and clonal selection are known but not practiced much. Rouging must be emphasized among farmers and seed technologists (Hidalgo, 1998). Work being done in Pakistan is more oriented to take more advantage of the "autumn to autumn cycle".

Situation and perspectives by country.

Bangladesh. The traditional system prevails and the seed of the local varieties is of bad quality. A "modern" seed scheme is practiced but requires refinement. Certified seed is scarce and expensive and small farmers can not afford it. The production methods have to be simplified. Private sector involvement is necessary and much more investment on research and training is required (Hidalgo, 1999).

Bhutan. Potato is an important cash crop. Bhutan exports table and seed potatoes to India. The mountain conditions are highly favorable for potato and seed production. The "modern" seed scheme is utilized, but requires significant technological improvements. A semi-private Corporation (DSC) that has the monopoly of seed production produces through contracted growers and exports to India. Farmers usually do not buy seed from DSC every year because seed quality is easily maintained in the high altitudes in which potato is grown. Nevertheless, seed produced in an improved scheme in Bhutan could be of tremendous benefit for the country. To meet these objectives, technical and managerial aspects of the program are being improved. Strong and long-term linkages with the private sector and intensive training will be required.

India. The Central Potato Research Institute (CPRI), which recently celebrated its 50th jubilee has made a great contribution to research, extension and education. India has been producing their own seed, of their own varieties since the 1950's. Pathogen-tested indexed tubers are multiplied to obtain pre-basic seed. After several multiplications, done by CPRI under the "seed plot technique" in the plains in the autumn (Nagaich et al, 69), seed lots are passed to the States and to a government Corporation for further multiplication with farmers. The scheme is simple and based on an old but effective methodology. It is estimated that India produces 20 to 25% of the national demand for Certified seed. However, the actual system requires a large number of multiplications, which may favor disease accumulation. More *in vitro* and rapid multiplication techniques may be required to accelerate the process and to improve the sanitary quality of the seed (Chandra & Upadhya, 1998)

Nepal. The actual large area cultivated in potatoes (86,000 ha) makes this crop an important one in the national economy and also as staple food, especially for the high hills. Potato is cultivated all over the country and there are very good conditions for its cultivation. Poor quality seed is still the main limiting factor. Nepal has the advantage of having high mountains that favor seed multiplication. The Potato Research Programme (PRP) produces pre-basic seed from *in vitro* and sells it to farmers. Farmers in Seed Producer Groups (SPG), supported by a CIP project are producing very good quality seeds under an informal system (Project CIP/SDC, 98). In 1996, SPG obtained 50% of the 200,000 pre-basic tubers produced by PRP (NARC-Nepal, 1997).

Farmers multiply these seeds and produce other categories. The SPG is a successful approach being practiced all over the country in a self-sustainable manner. Better management practices, better commercialization procedures and new internal quality control rules are being promoted among all SPG's. TPS, within the contexts of IDM/FFS, is being actively promoted, with the support of CIP, to improve the quality of the planting materials in certain regions.

Pakistan. The area under potato has almost double in the last 10 years and production increased 2.6 times in the same period. Potato is mainly grown in the plains of Punjab as an autumn crop. Yield and production can be significantly improved, but bad seed quality is still the major limiting factor. The "modern" scheme is widely utilized in Pakistan: six public laboratories produce more that 350,000 tubers of pre-basic seed/year using pathogen-tested *in vitro* plants. The rapid increase in area and production is mainly due, however, to the practice of multiplying seeds in the "autumn to autumn cycle" (Devaux *et al*, 1988) that has the same basis of low aphid pressure in the autumn (Mirza *et al*, 1982) as for the Indian's "seed plot technique". Seeds are maintained in cold stores until the next autumn. Unfortunately, farmers are not investing much to obtain increasing amounts of pre-basic seed to plant in autumn. The Potato Programme and CIP are promoting a more active participation from the private sector.

Sri Lanka. More that 10,000 ha are being cultivated using imported seed from the Netherlands (US$ 23 M per annum). The "modern" scheme, in a small scale, has been practiced. Very recently however, the government has made a large investment to produce seeds in the country in an attempt to reduce seed imports. Very large new facilities for the production of pre-basic seed from *in vitro* and for ELISA, have been implemented. It is expected to produce more than half million tubers/year from 3,600 m^2 of net beds under "poly-tunnels". The pre-basic seed produced will be multiplied first in the government farms and later on multiplied by private seed growers (Hidalgo, 1999).

V. References

Devaux, A. *et al*. 1988. Study on the seed degeneration of potential improved potato seed sources through the autumn to autumn cycle in the Punjab plains. PSPDP-RARC, Islamabad. 21p.

Chandra,R. and M.Upadhya. 1998. Comercialization of potato micropropagation. in Khurana P., et al (Eds.). Comprehensive Potato Biotechnology. MPH-Delhi, India. 253-268.

Hidalgo, O. A. 1999. Technology available and present status of seed potato systems in countries of SWA. Regional Workshop on Seed Potato Systems. Dhaka, Bangladesh. March 9-11. 20p.

Hidalgo, O.A. 1998. Basic concepts about seed potato production and their institutions. International Course for Potato Production. PNP-NARC / Project CIP/SDC. Pakistan. 17p.

Mirza, M.S. *et al*. 1982. *Myzus persicae* and seed potato production in Pakistan. I. Agric. Res. 20(4): 191-200.

Nagaich, B. B. *et al*. 1969. Production of disease-free seed potatoes in the Indo-gangetic plains of India. India J.Agric.Sci. 39: 38-43.

NARC - Nepal. 1997. Annual Report 1996-97. Potato Research Programme. Nepal. Agricultural Research Council(NARC). p40.

Project CIP/SDC. 1998. Report of Project I. Informal high quality seed production and marketing by Seed Production Groups in Nepal. CIP/SDC-PRP-NARC, Nepal. 40p.