

# Present Status of Potato Production and Its Potentiality in Nepal

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## Abstract

*Potato is an important crop in Nepal, which plays an important role in country's food security and poverty alleviation. Due to its short vegetative cycle and high cash value, it has significance in food security and cash generation. In spite of its significance in the country, the productivity of this crop is far below to its potentiality compared to the neighboring countries. Poor availability of quality seed potato and proper variety is the major limiting factor accompanied by the appropriate production technology for different agro-ecological zones of the country. National Potato Research Programme (NPRP) and National Center for Potato, Vegetable and Spice crops Development (NCPVSD) are in function with the objectives of generating suitable and stable appropriate technologies, and disseminate them to increase the production and productivity. Since the establishment of these two programs, tremendous progresses have been made. However, this paper reviews the present status of potato in Nepal and attempts to assess its prospects.*

**Keywords:** potato, pre-basic seed, true potato seed, tissue culture, rustic store

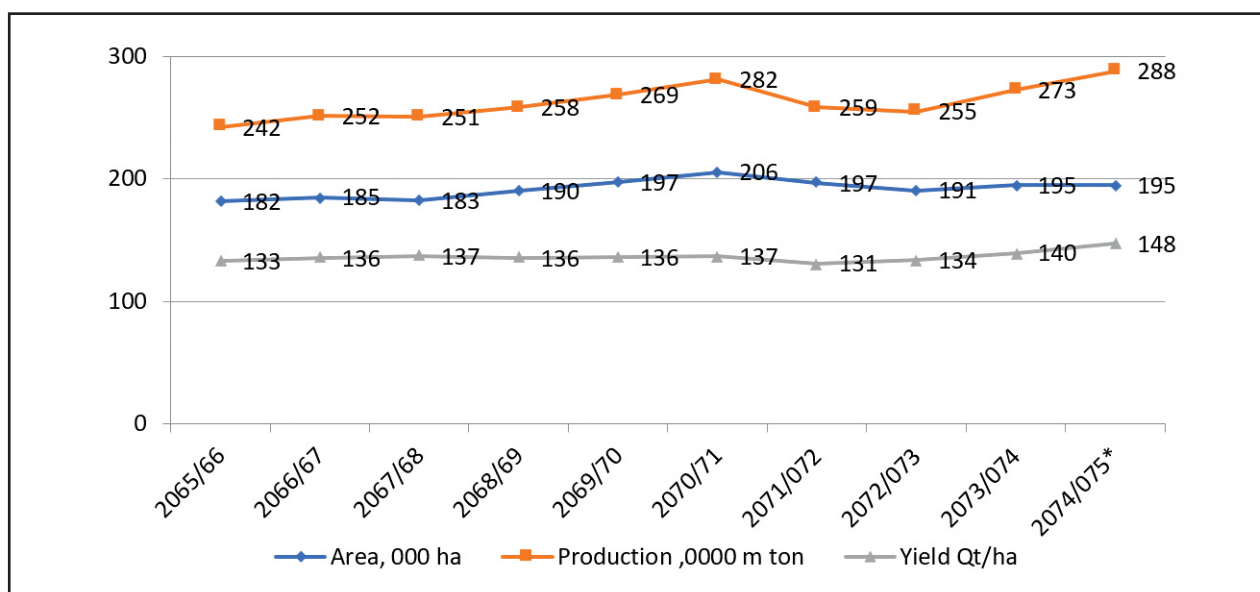
## 1. Introduction

Potato (*Solanum tuberosum* L) is one of the most important crops in Nepal used as a major vegetable crop in mid-hills and terai whereas it is one of the staple food crops in high hills. It occupies the fifth position in area coverage, fourth in total production and the first in the productivity as compared with the main staple food crops, rice, maize, wheat and millet. Nevertheless, potato plays contributive roles in terms of cash generation and food production per unit area for small holder farmers. As this crop has short cropping period (3-4 months), high quality protein content, less consumption of water and fit in all vegetable recipes. Moreover, this crop is a raw material for the potato processing industries thus has its industrial importance too.

Mainly two organizations National Potato Research Program (NPRP) under National Agriculture Research council (NARC) and National Center for Potato, Vegetable and Spice Crops Development program (NCPVSD) under Department of Agriculture (DoA) has been working for the research and development of potato crop. The Previous National Potato Development Program (NPDP) is now merged into NCPVSD during recent structural change of the organizations. These programs are in close co-ordination with different horticultural farms under NARC and DoA and Agriculture Knowledge center for field level research and extension.

The area under potato cultivation is around 195 thousand hectares in Nepal (2074/75 BS). By agro-ecological region, out of the total area under potato crop, around 18-19% lies in the high hills/mountains, 42-43% in the mid-hills and remaining 38-40% in the Terai. The area coverage by potato crop was increasing gradually up to 2013/14 (205725 ha) and decreases to 195,171 ha. (MoAD, 2017). Similar trend can be seen in the total production and productivity of this crop up to the fiscal year 2073/74 and has peaked to 14.77 mt/ha yield with 28,81,828 mt production in 2074/75. This remarkable increase of 5.6% yield is the highest compared in past 10 years.

The average yields are still among the lowest in the world (14.77 t/ha). Besides many other reasons, unavailability of seed in terms of desired varieties, quality and quantity with affordable price and low adoption scale of cultivation technologies are the major limiting factors resulting lower yield even though other production inputs are applied at optimal level. There is huge potential of potato crop that could contribute to the national economy within its scope of fresh and processed food demand in the changing socioeconomic contexts.



**Figure 1:** Area, production and productivity of major crops in Nepal (NPVSCD, 2074/75)

## 2. Consumption and Sufficiency

The consumption of potato as fresh or processed items is increasing in Nepal in recent years reaching 85 kg/capita/year in 2018 AD. This might be its daily use as an integral component of the vegetables and increased availability and access in the market. Nepal produces around 90% of the quantity of potato demand for its consumption, most of which is going to the domestic market. Remaining 10% is imported mainly from India and other countries.

## 3. Export- Import

Nepal is importing potato mainly from India and very few from other countries in both fresh and processed forms. The major items are ware, seeds, starch, chips and potato prepared or preserved otherwise than by vinegar or acetic acid. The import data shows that Nepal imports around 3.5 lakhs M ton of potato in the year 2017 and the export is around 273 M ton (MoALD, 2018). Exporting is almost negligible compare to the import, and it is mainly fresh, off-season potato and high quality

seed potato produced in high hills to the nearby cities to India. The trend of Import is increasing in recent years.

## 4. Major Achievements and Efforts

Both of the potato programs are working to resolve different problems on potato through different arrangements in R&D activities in the country and some of them are as following.

### 4.1 Varietal Improvement

To date, the following potato varieties have been released for different agro-climatic region and conditions:

SN	Released Varieties	Agro- climatic zones
1	Kufri Jyoti	High and mid hills
2	Kufri Sindhuri	Terai and inner Terai
3	Desiree	Hills and Terai
4	Janak Dev	High and mid hills
5	Khumal Rato-2	Terai and inner Terai
6	Khumal Seto-1	High and mid hills
7	Khumal Laxmi	Terai to high hills
8	IPY 8	Terai to mid hills
9	Khumal Ujjol	Hills
10	Khumal Upahar	Terai
11	Khumal Bikash	All part of Nepal

In addition, two TPS lines namely TPS-1 (HPS II/67) and TPS-2 (HPS 7/67) are officially registered for commercial cultivation in the country. Rosita, MS 42-3 and Cardinal are under the process of registration for the specific zone of their adaptability very soon.

### 4.2 Technology Development

Several technologies are developed and major of them are:

- Seed tuber treatment and three times foliar spray of Asuro (*Justicia adhatoda*) and EM mixed suspension at 10 days interval has been effective for increasing tuber yield. Black plastic and paddy straw mulching increase yield under less irrigated and moisture stress condition.
- Improved technologies for potato production (seed selection, planting methods, irrigation methods, fertilizer application, plant protection, seed production and storage) have been developed and recommended.
- Integrated disease management technologies have been recommended to minimize the losses due to major diseases such as late blight, bacterial wilt, and black scurf.

- Screen house has been found more cost effective than glasshouse for pre-basic seed production in the country like Nepal where there are tremendous numbers of constraints to run sophisticated glasshouses.
- Black polythene mulching and Metribuzin (pre-emergence herbicide) are found highly effective for controlling weeds in potato crop.
- Khumal Ujawal, HPS II/67, HPS 7/67, Khumal Bikash and Khumal Seto-1 are found promising not only for higher yield but also for processing for chips.

## 5. Seed System

In 1989, a tissue culture laboratory was established with the financial and technical support of Swiss government, and the contract growers were encouraged to form a cohesive group for informal production of high quality seed at that period was failure due to high cost involvement and managerial problem. Formal system of seed production is also not feasible in Nepal due to its high cost, specified technical norms, specification, seed certification rules embedded in the prevailing “Seed Act”, and full involvement of government sector. Viewing the problems of seed potato production through formal system a seed producer group (SPG) approach was developed.

**Seed producer group (SPG) approach**– A group of trained and well experienced potato farmers are engaged in seed production program through a formal group. The seed production program is technically supported by designated technicians throughout the crop season including post-harvest management. Recently, visualizing the scope and demand of seed potato in the country the government has decided to produce clean seed potato by using such farmers’ group within the broader umbrella of seed act. A self-sufficiency seed potato program has been launched since 2010 reaching more than 40 districts with 115 groups in the year 2018. These groups are empowered to produce quality seed which is certified by the Seed Quality Control Centre (SQCC) under MoALD, Regional Laboratories and trained seed inspectors. Above model of on-farm informal seed production through SPG approach has been well documented and accepted by MoALD to further scale-up to the semi-formal seed potato production program in the country.

**Utilization of True Potato Seed (TPS) for Seed and Ware Potato Production:** Production of seedling tuber as a quality seed material by sowing TPS in nursery bed and seedling transplanting for ware potato production are two major methods of TPS utilization in Nepal. TPS is an alternative low cost technology especially for those areas where bulky seed tuber becomes expensive and either not available on time. Transfer of TPS technology to Nepalese farmers, for the first time was initiated during 1993-94 season designing a “Technology Verification Demonstration” approach (Lama, 2001). Farmers’ acceptance of the technology resulted initiation of seeding tuber production (first tuber generation from TPS) to fill the gap of seed potato requirement in specific environment of its potentialities. To fulfill the growing TPS demand both government and private sectors are engaged in production of TPS in the country. Average TPS utilization in Nepal is about 30 -40 kg per annum. TPS is still a popular technology in Nepal. However, there seed production is also limited. Only two farms under DoA(Potato Production Centre, Nigale and Tropical Horticulture Centre, Nawalpur) and a private sector in Dolakha are producing TPS. The trend of TPS utilization is decreasing due to its more labour consuming techniques, white tubers and late blight diseases problems.

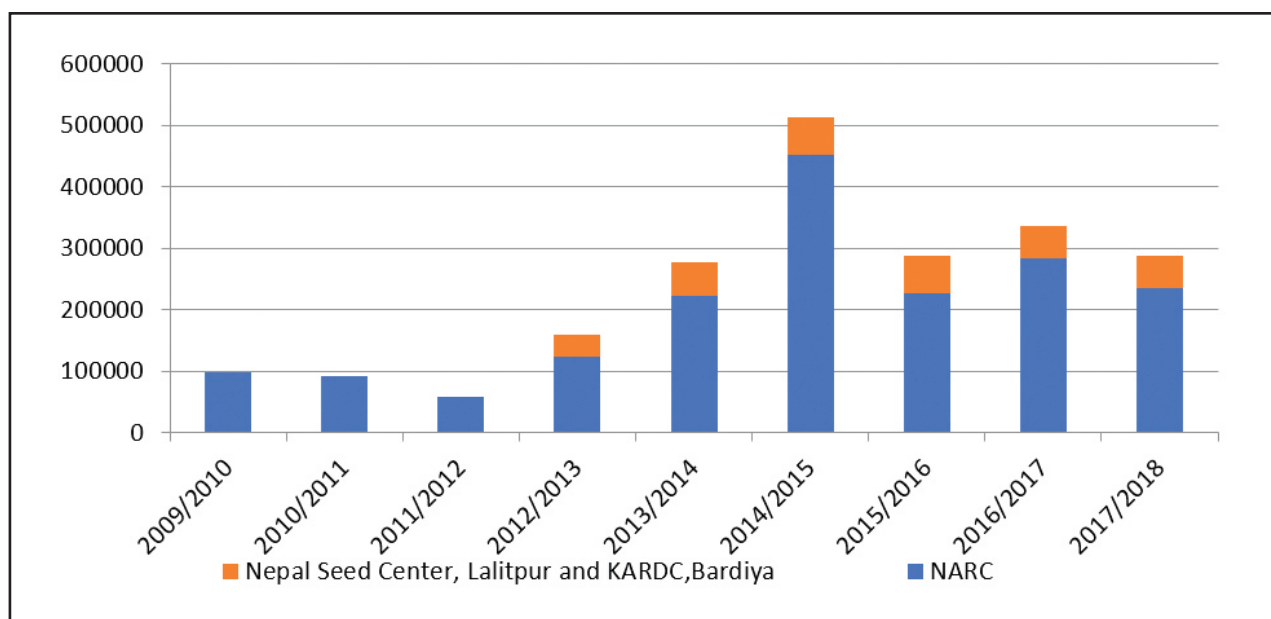
## 6. Integrated Disease Management (IDM) of Potato through Farmers Field School (FFS)

In 1999/2000, NPDP in collaboration with CIP and Users' Perspective with Agricultural Research and Development (UPWARD) initiated IDM practice on potato through FFS approach simply to enhance farmer's decision making capacity in utilizing their resources judiciously making potato farming as a profitable enterprise (PDS, 2001).

Integrated Diseases management (IDM) practice is driven by FFS approach which is one of the recent participatory R&D methods benefiting farmers "doing better science together". This approach is a new dimension for enhancing farmers' capacity to understand the agro-ecosystem to apply appropriate management practices through informed decision making process. Basic principle of these approaches is to grow a healthy crop profitably applying sustainable and environmentally safe technologies. IDM practitioners significantly decreased the frequency and quantity of chemical pesticide application with increased income. It also contributed to reduce pesticide hazards to human as well as environment health.

## 7. Seed Potato Self Sufficiency Program

Seed Potato Self Sufficiency Program was launched in more than 40 districts for five years (2068-69 to 2072/73) to promote potato production, seed potato production and distribution and to empower potato producers groups in the country. Several rustic stores were constructed and equipped, farmers were supported by PBS and TPS and series of trainings were organized to farmers groups on potato production, seed potato production, pest management and others. The current web of increased potato production is based by this program. Continuous technical backstopping was done for these groups for seed potato production and its certification. Government, National Potato research Program (NPRP) with two private tissue culture labs are producing the PBS which is insufficient and not enough for the demand of seed producer group for the seed production program (figure 2).



**Figure 2:** PBS production trend in Nepal

To make PBS sufficiency, Government supported to private sector for the establishment of six tissue culture labs, out of them 4 were newly established with 50 % grants by the National Potato Development Program and 2 labs were strengthened for the increment of PBS production on their existing equipment and screen house. Two labs constructed by private sector were supported technically. Estimation of PBS production from these eight private and two government labs and one screen house (Spice Crop Development Center, Panchkhal) estimated around 13 lakhs 70 thousands per year (Table 4). All private and Government sectors labs and screen houses will be run smoothly from 2019. It is estimated that Seed Replacement Ratio (SRR) after 4 years will be around 55 % in potato crop with at least 30 % increment in yield.

**Table 2:** Tissue Culture labs and Estimation of PBS production

S.N.	Name of tissue culture Lab	Net house area for PBS production (m <sup>2</sup> )
1	Ficus Biotech P.Ltd, Gaauradaha, Jhapa	230
2	Nepal Agriculture research and Development Center, Jalari, Hetauda, Makawanpur	333
3	Khaddenna tatha Biu Aalu Alaichi phalphul Narsury Uddhog, Kushadevi, Kavre	261
4	One Stop Agriculture Solution Center, Dhangadhi, Kailali	252
5	Nepal Seed Production Center Taukhel, Lalitpur	234
6	Kushal Agriculture Research and Development Center, Laxmana, Bardiya	480
7	Shree Ram Niketan Biotech P.Ltd, Godawari Lalitpur	148
8	Pragatisil Yuba Krishak Samuha, Nala, Kavre	117
9	Seed Potato Production Center Nigale	121
10	Spice crop Development Center, Panchkhal	85
11	National Potato Research Program, Khumaltar	480
	<b>Total</b>	<b>2741</b>

## 8. Potato Super Zones and Zones

Government has initiated Prime Ministers' Agriculture Modernization Project (PMAMP) from the year 2073/74. Potato is one of the prioritized commodities in this project. For accelerating the productivity and development of value chain of this crop, two super zones in Kavre and Dadeldhura district, 5 zones in Bhaktapur, Nuwakot, Okhaldhunga, Baglung and Achham districts and blocks in Taplejung, Solukhumbu, Udayapur, Rasuwa, Dhading, Manang, Mustang, Jumla, Bajhang, Bajura, Darchula, Doti have been selected. These areas will get extensive programs and supports for potato production and its value chain in Nepal.

## 9. Seed Potato Production, Certification and Distribution

Seed potato production commences from the Pre-basic Seed (PBS) production and production of subsequent generations (Foundation, Certified-1, Certified-2 and Improved). Till date PBS is produced mainly by National Potato Research Program (NPRP) Khumaltar. Private companies (table 2) so far established for PBS production, only two of them are producing PBS, and rests are on the process of production. The basic and subsequent generations of seeds are produced by horticultural farms and Seed Potato Producers Groups/co-operatives. At least 115 such groups are working around the country for seed potato production. The demand of PBS in the field level by these seed producers groups will be addressed after the private farm produces the PBS.

Potato seed certification scheme has been initiated in the country recently. Few seed producer groups (SPGs) and cooperatives are starting the certification. However, it is not so strictly implemented. It has estimated that only about 20% of total seed potato used in the country is of good quality standard. (NPDP, 2017).

## 10. Potato Storage

In higher elevations above 1500 masl ambient temperature is favorable for potato storage. On the contrary, in lower elevations in Terai and Dun/Bhabar potato is harvested during beginning of hot and dry summer making it difficult to store potatoes under ordinary environmental conditions and potato is stored in cold stores. Mostly seed potatoes are stored in cold storage and rustic storage in the country. There are 51 cold storage having the capacity of 105100 mt established in terai and urban areas. In high hill areas rustic store construction were supported and promoted by the NPDP for the seed potato storage. About 171 rustic stores having the capacity of 1710 mt storage capacity are constructed by different seed producers groups, and are running (NPDP, 2073). Prime Ministers' Agriculture Modernization Project (PMAMP) and Raising Incomes of Small and Medium Farmers' Project (RISMFP) are supporting for the private sector for the construction of cold storage in different location of the country will be on working phase within few years.

## 11. Major Constraints

Some of the major constraints to enhance overall potato industry in Nepal are as below:

- Inadequate human resource and physical facilities for seed potato production and certification.
- Lack of suitable varieties for fresh potato as well as processing. Industries are importing potato from India for processing purpose.
- No effective seed distribution system, wider gap in seed production and demand.
- Increasing agriculture labor scarcity in rural areas
- Weak market information system (MIS)
- Lack of coordination/linkage among production, marketing, and processing
- Insufficient marketing and storage structures and linking roads
- Low level of mechanization.

## 12. Conclusions and Future Prospects

Potato could be an important demanding commodity in Nepal with higher transaction in the growing market due to rapid urbanization, fast growing population and changing food habit of the people. Potato bears full potential to contribute to food security and poverty alleviation in the country due to its high capacity to produce more food per unit area and per unit time. However, existing constraints mainly; management of clean seed production, its certification and distribution, diseases and insect pests, variety improvement and processing system must be realized, given focus and resolved.

Larger potential benefits are likely to come from quality seed as recognized as one of the major constraints remained to improve in Nepal. Enrolment of seed certification system and effective production and distribution system of seed potato will be the pinpoint to solve the production problems. The ecological opportunity in Nepal is far more suitable and gifted for year round fresh potato production to fulfill the increasing demand of internal (fresh and industrial) as well as export market. Furthermore, consumers' awareness on hazardous pesticide use in agriculture sector should be considered in potato cultivation as well as for safe and healthy product applying integrated crop management (especially of potato tuber moth, scab and late blight), and marketing systems improvement should be the highest priority needs. Appropriate variety development with appropriate mechanization will benefit farmers, intermediaries and consumers is a collective agenda of both research and development agency which needs to be supported by the nation.

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