

Status and Prospects of Root and Tuber Crops in Nepal

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Abstract

Nepal has favourable climatic and agro ecological diversity for the production of root and tuber (R&T) crops. Taro, yam, cassava, elephant foot yam, and sweet potato are the major cultivated R&T crops in Nepal. Tuber crops are widely cultivated in Nepal as minor crops. The total cultivated area, production and yield of major R&T crops in Nepal are 7979 ha, 99091 MT and 12.42 MT/ha respectively (MOALD, 2019). Research work on R&T crops is inadequate and extension programme is almost lacking. Only two varieties of sweet potato namely Suntale Sakharkhand-1 and Suntale Sakharkhand-2 with high beta-carotene content have been released by national seed board so far. Poor quality planting materials, low productivity, poor post-harvest handling practices and unorganized markets are major constraints in R&T crop production and marketing. Government policy and program for R&T crops should give high priority in varietal development, quality planting materials management, technology development and dissemination, post-harvest handling, product diversification and value addition, support to processing industries, storage facilities and marketing structures, and other promotional activities. Strong linkage and coordination among research, production and marketing institutions in all three tiers of governments with supportive policy and program will certainly bring significant change in the development of the root and tuber crops industry in Nepal.

Keywords: Status, Prospects, Root and Tuber crops, Germplasm, Value addition

INTRODUCTION

Nepal has favourable agro ecological diversity for agricultural production, especially in the vegetable sector including root and tuber vegetable crops. Different ecological belts are endowed with diverse types of climates due to

its geographical locations and physiography. Most of the important root and tuber vegetable crops of the world can be grown in Nepal. The Agriculture Development Strategy (ADS) 2015 of Nepal has recognized high value horticultural crops including root and tuber vegetable crops as engine of growth for rural economy and poverty

alleviation. Plants yielding starchy roots, tubers, rhizomes, corms and stems are defined as root and tuber (R&T) crops (Scott et al., 2000). Root crops should not be confused with root vegetables like radish, turnip and carrot. Major roots and tuber crops include potatoes and yams are categorized as tuber crops, taro and cocoyam are derived from corms/underground stems and swollen hypocotyls, and cassava and sweet potatoes are storage roots. R&T crops in Nepal are mainly used for human food but very little in processed form either for human consumption or animal feed. Taro, yam, cassava and ground apple also serve as supplementary food sources for the farmers at different communities. In the past, almost all of the R&T crops were the food of rural occasions and to some extent regular food for marginalized poor, however, with the increased awareness towards the value of these crops, rapidly urbanized population in recent years and their changed food habits have started to diversify their food intake from normal cereal-based diets to greater consumption of root and tuber crops. Besides the food and nutritional importance, some R&T crops are very important for celebrating religious festival such as 'Maghe Sankranti', the first day of the month 'Magh' (mid-January). Taro and sweet potatoes are used as pure and holy food during fasting especially in Thulo Ekadashi during Kartik. There is year-round availability of these tuber crops in local markets which signifies the increasing importance of R&T crops in Nepal. Despite their importance in income generation, food and nutritional security and in some cultural context, little research and development attention have so far been given to these crops.

Root and Tuber (R&T) crops contribute as source of food and nutrition as they produce large quantities of dietary energy and have stable yields under conditions in which other crops may fail (Low et al., 1997). R&T crops contain mainly carbohydrates (16-24% of their

total weight) with some protein and fat (0-2% each) (Wheatley et al., 1995). Root and tuber crops are very much adaptive in low input agricultural systems and important for food and nutritional security. Rural people mostly involved in utilizing root and tuber crops and they maintain the traditional knowledge regarding their location, season, preservation, processing and culinary uses. These crops can alleviate poverty and improve livelihood of population live in rural and fragile ecosystems. In the context of climate change, there is a paradigm shift in role of tuber crops. These traditional staple food crops are gradually transferring as "smart crops" which can act as savior crops during disasters, while supplying high value raw materials to the industries (Mukherjee et al., 2019).

Root And Tuber Crop Species

There are more than 30 edible and non-edible R&T crops reported in the world and among them, taro (*Colocasia esculenta* L.) Schott), yam (*Dioscorea alata* L.), cassava (*Manihot esculenta* Crantz), elephant Foot Yam (*Amorphophallus paeoniifolius* (Dennst.) Nicolson), peruvian ground apple (*Smallanthus sonchifolius* (Poepp.) H. Rob.), potato (*Solanum tuberosum* L.) and sweet potato (*Ipomoea* sp.) are the major cultivated R&T crop species in Nepal (Figure 1). Though, further investigation might be necessary to find out the centre of origin of these crops, most of R&T crops possess a huge genetic diversity at variety and landrace levels in Nepal. This diversity can be found in almost all of the agro-ecologies. However, genetic resources of many of these crops are threatened by erosion, mainly due to the human and complex natural factors (Joshi, 2017).

National Potato Research Program (NPRP) Khumaltar has initiated to conduct the research on sweet potato since 2010. A total of 21 orange-fleshed sweet potato germplasm from CIP, Lima, Peru has been introduced





and all the germplasm were tested at multi-locations and characterized at phenotypic level. Similarly, 55 landraces of sweet potato were collected from different parts of the country and morphologically characterized (NPRP, 2015). At Field genebank of NAGRI, 54 taro, 15 yam germplasm are maintained (NAGRC, 2016).

Similarly, yam 7, taro 14, cassava 2, elephant foot yam 2 germplasm are maintained at Tuber Vegetable Development Center, Sindhuli (TVDC, 2019).

Major root and tuber crop species available in Nepal are presented in Table 1.

S.N.	Common name	Nepali name	Scientific name	
			Cultivated	Wild
1	Cassava (Tapioca)	सिमल तरुल (Simal tarul)	Manihot Crantz esculenta	
2	Elephant foot yam	ओले (Ole)	(<i>Amorphophallus</i> <i>paeoniifolius</i> (Dennst.) Nicolson),	
3	Potato	आलु (Potato)	<i>Solanum tuberosum</i> L.	
4	Peruvian Ground Apple	याकुन / भूँईस्याउ (Yacon)	<i>Smallanthus sonchifolius</i> (Poepp.) H. Rob.),	
5	Sweet Potato	(Sakhar khanda)	<i>Ipomoea batatas</i> (L.) Lam.	<i>Ipomoea cairica</i> (L.) Sweet
6	Taro (Colocasia)	सखरखण्ड (Pindalu /Karkalo)	<i>Colocasia</i> spp. <i>Xanthosoma</i> spp.	
7	Yam	तरुल (Tarul)	<i>Dioscorea alata</i> L.	<i>Dioscorea bulbifera</i> L., <i>Dioscorea versicolor</i> , <i>Dioscorea deltoidea</i> Wall. ex Griseb., <i>Dioscorea triphylla</i> L.
8	Yam bean-	मिश्रिकन्द (Mishrikanda)	<i>Pachyrrhizys erosus</i>	

Source: Khatri et al., 2017.

S.N.	Root & Tuber Crops	Plant	Tuber
1	Yam (<i>Dioscorea alata</i>)		
2	Taro (<i>Colocasia esculenta</i>)		









3	Yam bean (<i>Pachyrrhizus erosus</i>)		
4	Cassava/Taboica (<i>Manihot esculenta</i>)		
5	Sweet potato (<i>Ipomoea batatas</i>)		
6	Elephant Foot Yam (<i>Amorphophallus paeconaiifolius</i>)		

Figure 1. Major root & tuber crop species in Nepal

Released variety of Sweet potato

National seed board has released two varieties of sweet potato namely Suntale Sakharkhand-1 and Suntale Sakharkhand-2 with high beta-carotene content in 2019 (Figure 2). The main characteristics of these varieties are as follows

a. Suntale Sakharkhand-1

- Semi compact type growth habit (vine)
- Crop duration 130-150 days
- High yielding than local genotypes (13-15 t/ha)
- High Beta carotene content
- Yellow skin color
- Orange flesh color
- Good for salad purpose
- Recommended for mid hill and terai



a. Suntale Sakharkhand-1

b. Suntale Sakharkhand-2

- Spreading type growth habit (vine)
- Crop duration 130-150 days
- High yielding than local genotypes (18-25 t/ha)
- High beta carotene content
- Light red skin color
- Orange flesh color
- Good for salad purpose
- Recommended for mid hill and terai



b. Suntale Sakharkhand-2

Figure 2. Released varieties of sweet potato

AREA AND PRODUCTION OF R&T CROPS

Different tuber vegetables are grown all over the country as a minor crop. Very few districts and pockets cultivate yam, colocasia, and sweet potato in commercial scale. Except during special occasion, the tuber vegetables are not considered as an important crops while some of the tuber crops (Yam, Bhyakur, Gittha etc.) are regarded as the food for poor people especially Chepang, a tribble community of Nepal and crops of famine (Sweet Potato). The production and consumption data also not consistent and encouraging as per the food and nutrition value of root and tuber crops.

In 2017/18, the total cultivated area, production

and yield of major R & T crops in Nepal are 7979 ha, 99091 MT and 12.42 MT/ha respectively (MoALD, 2019). The area, production and productivity of major root and tuber crops for the last five years are presented in Figure 3, 4 & 5 (MOAD 2015, MOAD 2016, MOAD 2017, MOAD 2018 and MOALD 2019). Taro is the number one tuber crop in Nepal grown in 5137 ha area with production of 55564 MT in 2017/18 (Figure 3 and 4). Yam ranks second with 1389 ha area under cultivation and 18933 MT production. Similarly, elephant foot yam is the third important tuber crop in Nepal with area and production of 783 ha and 14934 MT respectively. Among the tuber crops, elephant foot yam has the highest productivity of 19.06 MT/ha followed by yam and taro with 13.64 and 10.82 MT/ha respectively in 2017/18 (Figure 5).

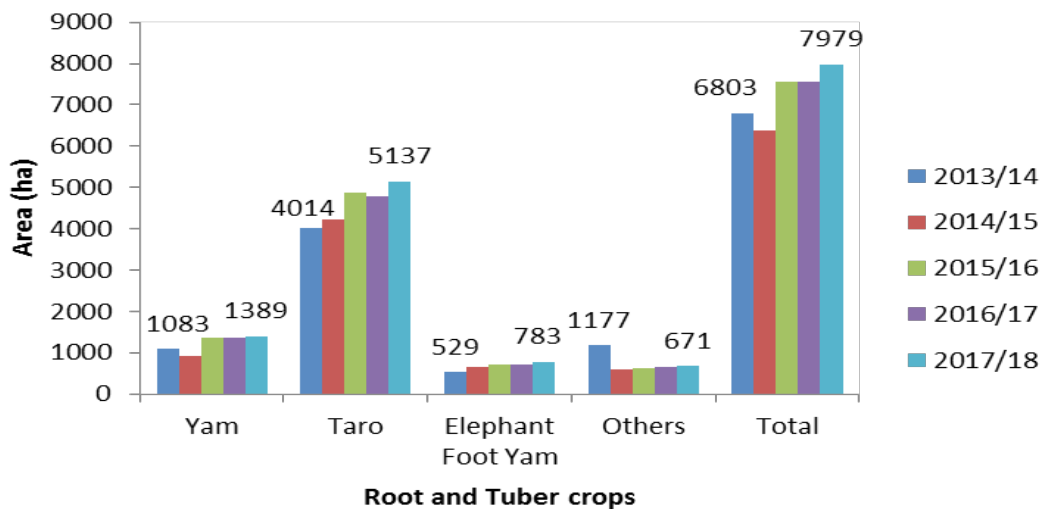


Figure 3. Area of major R & T crops in Nepal

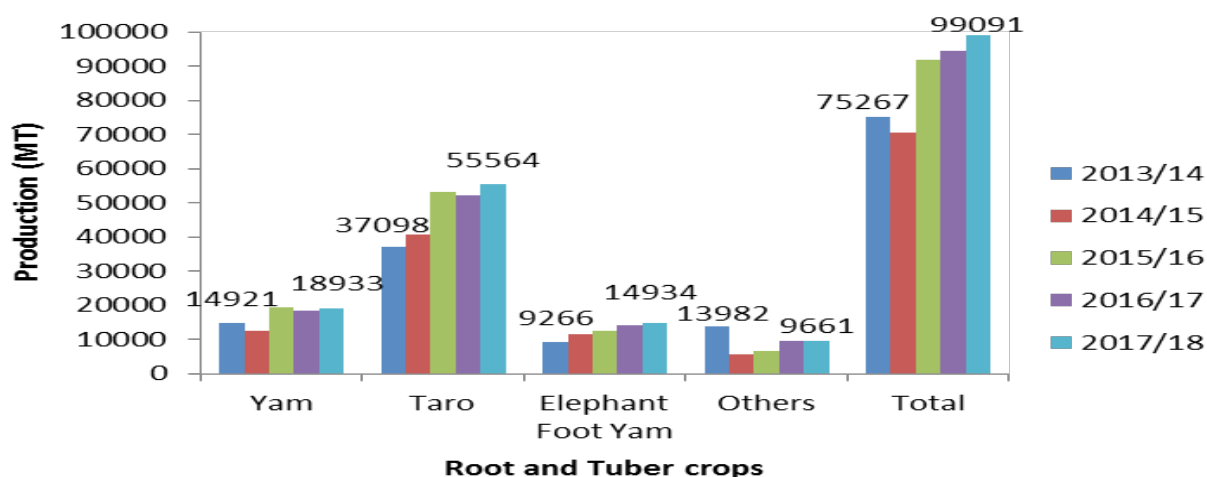


Figure 4. Production of major R & T crops in Nepal

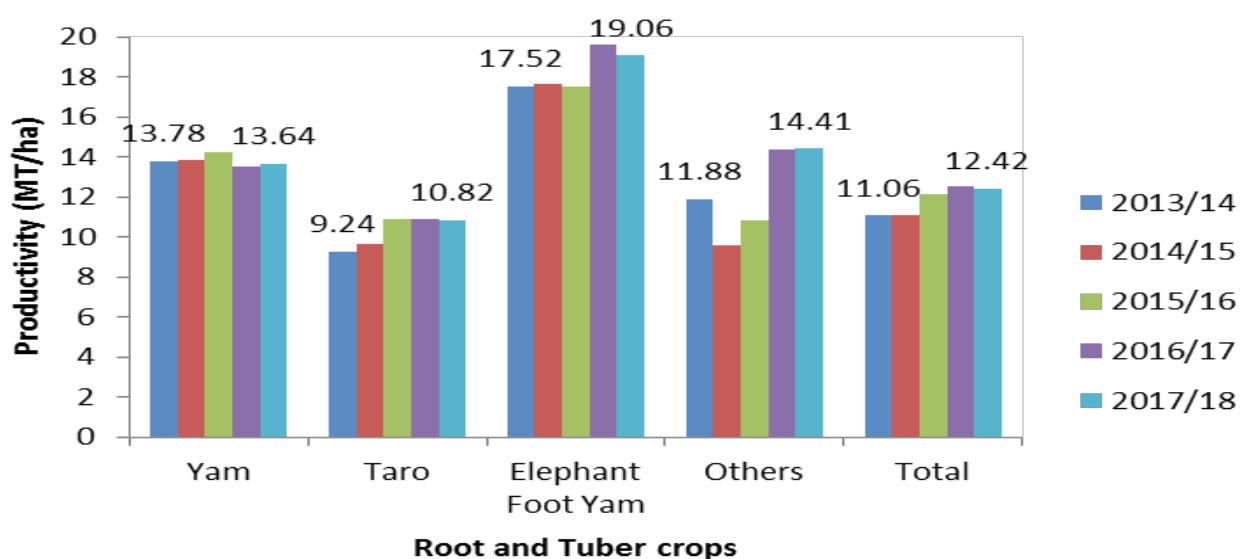


Figure 5. Productivity of major R & T crops in Nepal

The trends of percentage change in area, production and productivity of R & T crops from the base year 2012/13 to 2017/18 in Nepal are shown in figure 6. There was a slight increase of 7.73 percent of area of R&T crops in Nepal in 2013/14 as compared to 2012/13 while it declined by 0.95 percent in the following year. However, there was a significant increment during 2015/16 by 19.79 percent of area. The annual percentage increase in 2016/17 and 2017/18 were 19.51 and 26.35 respectively.

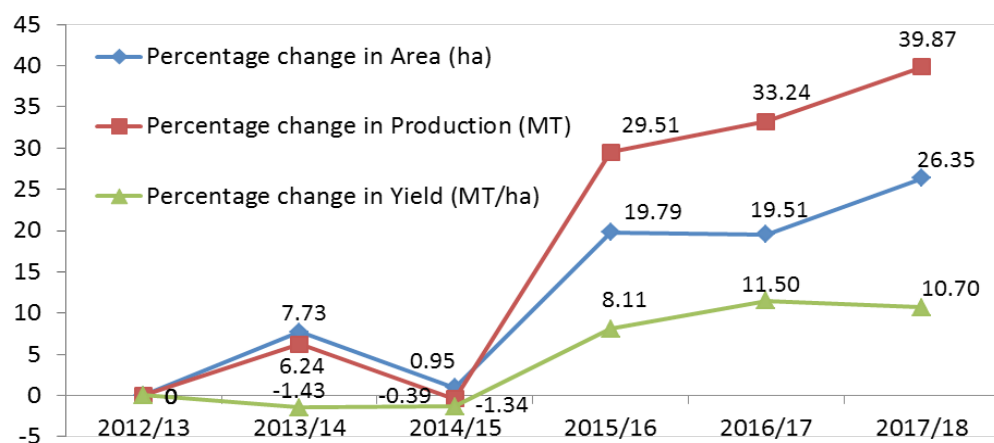


Figure 6. Percentage change in area, production and productivity of R&T crops in Nepal

The production of R & T crops has increased by 6.24 percent from 2012/13 to 2013/14 while it dropped by -0.39 percent in 2014/15. There was a significant increment in 2015/16 by 29.51 percent. There was a gradual increase as compared to base year in the following succeeding years. The productivity of R & T crops has decreased in 2013/14 and 2014/15 as against the base year 2012/13. There was a

slight increment in 2015/16 by 8.12 percent. The percentage increase in 2016/17 and 2017/18 were 11.49 and 10.70 respectively.

Gandaki Province has the highest area and production of R & T crops in 2017/18 with 2912 ha and 31026 MT respectively. This was followed by Province no. 2 with 1420 ha area and 20200 MT production (Figure 7).

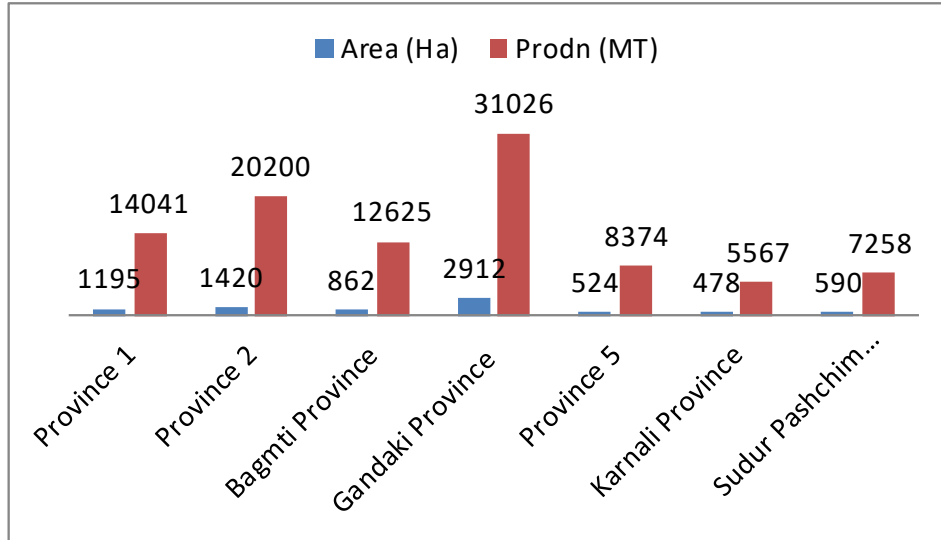


Figure 7. Province wise area and production of R & T crops in Nepal (2017/18)

Gandaki Province ranked first in terms of area of R & T crops sharing 36.5 percent of total area in 2017/18. This was followed by Province 2, Province 1, Bagmati, Province 5, Sudur Pachchhim and Karnali constituting 18, 15, 11, 6.6, 7 and 6 percent respectively (Figure 8).

Similarly, Gandaki Province also ranked first in production of R & T crops sharing 31.3 percent of total production in 2017/18. This was followed by Province 2, Province 1, Bagmati, Province 5, Sudur Pachchhim and Karnali constituting 20.4, 14, 13, 8.5, 7.3 and 5.6 percent respectively (Figure 9).

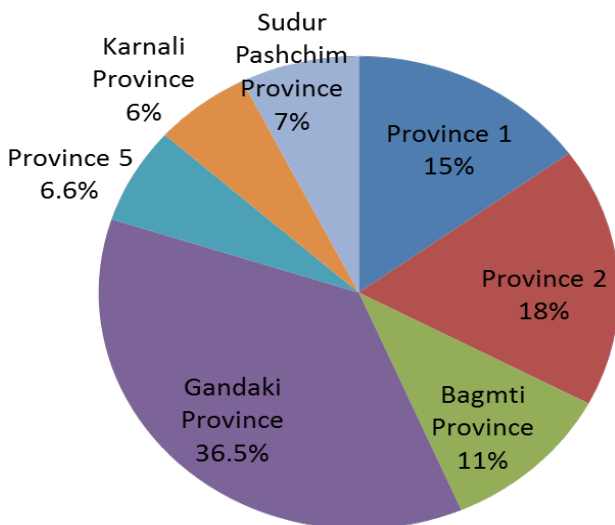


Figure 8. Province wise share in the area of R&T crops (2017/18)

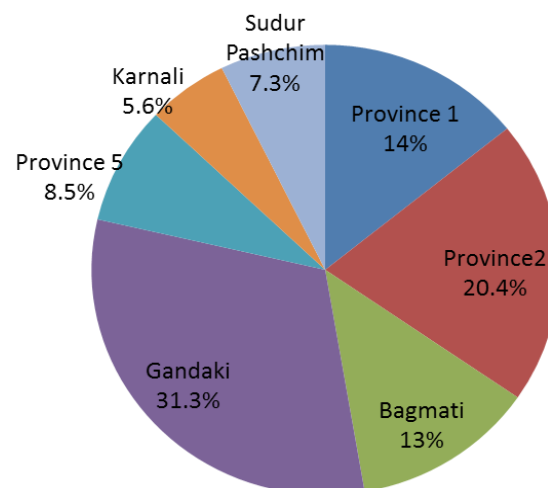


Figure 9. Province wise share in the production of R&T crops (2017/18)

The highest yield per unit area is given by R & T crops in Province 5 with 15.98 MT/ha. This was followed by Bagmati, Province 2, Sudur Pashchim, Province 1, Karnali and Gandaki respectively (Figure 10).

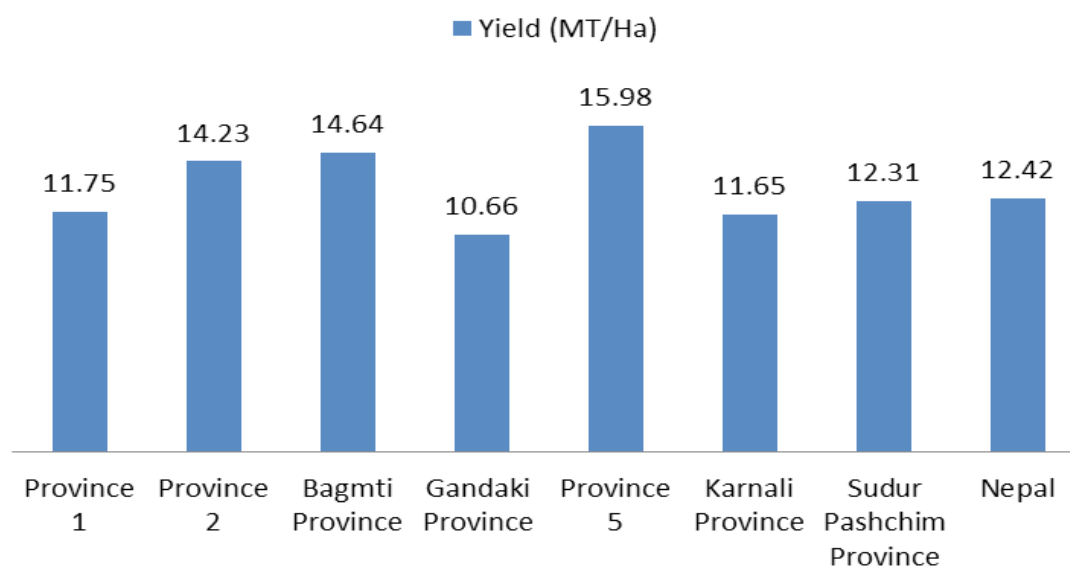


Figure 10. Province wise productivity of R&T crops (2017/18)

MARKETING SYSTEM

Generally all root and tuber crops are cultivated in marginal lands without irrigation as rain fed crops. Most root crops are hardy and stored in the field for sometime. They are harvested and supplied to the market as per the demand of market. There is no cold storage facility in the production areas. As the root and tuber crops are harvested and stored in open for few days and sold after harvest. Farmers seem not to have felt the requirements of such storage. The organized wholesale markets in all market centers are about 4-80 km away from the production pockets. From the production areas the products are supplied to market centers, wholesalers and to retailers. The street vendors (Pheriwala) also buy products from market centers and sell door to door in push cart and rickshaw. The price of root and tuber crops increases by 20 to 100 % during festivals depending on supply.

Wholesalers and retailers dominate the sell of root and tuber crops. Large market center handle large amount of produce that comes from distant

production areas in pick ups and trucks and bus top sent by or brought by local collectors. These markets have linkages to both local wholesalers and retailers. These wholesalers and retailers collect in bulk quantities from market centers and sell to small retailers/vendors and consumers. The marketing system is mixed. Some local producers supply their produce directly to wholesalers and even to retailers. During festival times the selling of yam, colocasia and sweet potato is dominated by street vendors who sell by running door to door in push carts, cycles and rickshaws. Thus, the marketing system is mixed and fixed as horizontal flow. It is both horizontal and vertical flow system. Mostly, root and tuber crops are sold along with field soil. No cleaning, sorting and packaging is done. Value addition is just the increase in selling price at different nodes of value chain based on bargaining at the consumer's level.

In most market centers, some sweet potato and yams comes from India. However, there is no data for such crops. Generally yam is imported during Maghe Sakranti festivals from India and Sweet potato during Thulo Ekadashi. From Birtamod, Biratnagar and Dharan market center

Chayote root goes to India unofficially, however quantified data is not available. When root and tuber vegetables from eastern market moves to the market of Central, Western and mid-western market in truck, generally marked as imported from India.

Being highly biodegradable, R&T vegetable crops require greater attention during harvesting, packaging and transporting from the point of production to the final market. The marketing cost of the root and tuber vegetable crops involves all costs of the product incurred before it reaches the terminal market (consumer). This includes cost of harvesting and packaging (material and labor costs), handling (sorting, cleaning, grading, loading and unloading), transportation and tariff, tax etc. Generally, these components

constitute a large share in the total margin between the final retailer price and the cost of production (or farm-gate price). The margin is calculated to show the distribution of profits throughout the various actors as the root and tuber vegetable crops move from production to collector, wholesalers, retail markets and finally to the consumers. From producer to consumer, root and tuber vegetables pass through different stages i.e. farm gate, collection centre, wholesale and retail market. The rate of margin at different level is differed in each level. Here, for each commodity, the retail price or consumer price is more than double its farm gate price. A general view of market margins is presented in Table 2.

R & T Vegetable Crops	Farm gate price (Rs./kg.)	Collector's commission (Rs./kg.)	Packaging cost (Rs./kg.)	Transportation cost (Rs./kg.)	Wholesale price (Rs./kg.)	Retail price (Rs./kg.)
Yam	25	3	1	1.5	40	60
Taro	25	3	1	1.5	40	60
Sweet potato	35	3	1	1.5	50	70
Chayote root	70	3	1	1.5	90	110

Source: NHPC, 2019

A value chain study of R&T crops in 2017/18 reported that the annual transaction of R&T crops in Kalimati Market, Kathmandu was 2602 MT (NHPC, 2019). The major R&T crops are yam, sweet potato, colocasia (taro), tapioca (cassava) and elephant foot yam. Yam ranked first in terms of total volume transaction sharing 45.7 percent of total marketed volume of R&T crops. This was followed by colocasia, sweet potato, chayot root, cassava and elephant foot yam constituting 14.5, 13, 11.5, 7.7 and 7.7 percent respectively (Figure 11).

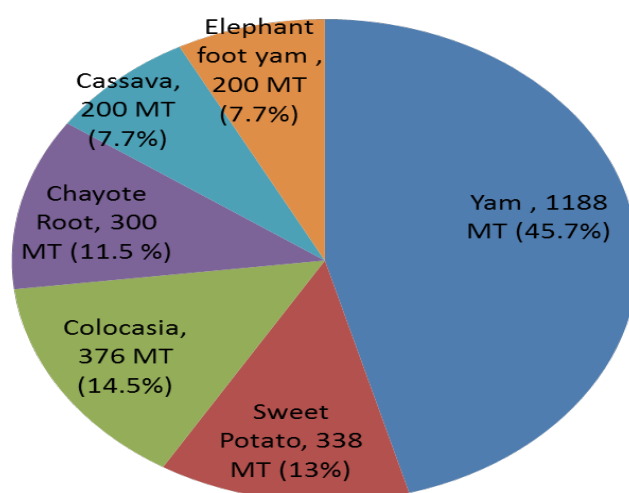


Figure 11. Marketed Volume of Different R&T crops at Kalimati in 2017/18

CONSTRAINTS

There are several constraints in root and tuber crop production and marketing. Categorically, these constraints are described as follows:

i. Input and Planting Material Management

Root and tuber crops are vegetative propagated and required in bulk amount. Quality planting material management is primary constraint. Most farmers are using poor quality planting materials saved by themselves, as high quality planting materials are often not available at planting time and are expensive. They are unknown to proper planting material selection, its storage and proper use. Regarding manure and fertilizer use, most roots and tuber crops love organic manure. However, traditional practices of manure use are decreasing as a technological constraint.

ii. Production

There is no production plan based on market analysis and demand. Production is ad-hoc and based on traditional knowledge. Root and tuber crops are cultivated mostly in marginal lands without irrigation. Irrigation plays a major role for yield and productivity of colocasia and sweet potato. Lack of irrigation facilities causes inadequate production. For sustainable production of these crops organic manure is important. However, commercial farmers are becoming more dependent on chemical fertilizers rather than farm yard manure and compost. The productivity in Nepal is considerably low when compared to other countries of the world. The productivity is almost stagnant since long (Figure 5).

iii. Harvesting and Post-Harvest Handling

Unlike fresh vegetables, the harvesting of root and tuber vegetables can be postponed till the favourable market demand and can be field stored. However, harvesting of succulent root and tubers are more prone to damage, breakage

and cut. Harvesting and post harvest loss is as high as 5 to 20% depending on crops (NHPC, 2019)). Harvesting loss is high in yam, tapioca and chayote root compared to sweet potato and elephant foot yam. Poor post-harvest handling practices regarding cleaning, sorting, grading, and packaging are largely responsible for post-harvest losses in these crops.

iv. Research

Despite huge nutritional and food value and all above positive attribution, root and tuber crops are under utilized, low research priority and lacking in varietal and yielding optimizing technology development. Better types of sweet potato varieties with high beta-carotene content and high yielding are recently released by seed board. However, other important tuber crops namely yam, tapioca, elephant foot yam and colocasia are not commercialized as expected because lack of research and technology generation in all aspect of value chain despite of huge diversity available within the country. No research station especially mandated to research for under utilized root and tuber crops.

v. Marketing

There are limited collection centers at production sites of root and tuber crops, so marketing and handling of these crops is difficult. There is limited access to reliable market information on price, quality, and quantity for farmers and local collectors' price offer is the final to the farmers in production pockets. Most of the markets are not organized, and existing markets are congested with inadequate storage facilities for root and tuber crops. Poor packaging systems and lack of special transportation facilities for succulent vegetables have affected the timely and safe handling of root and tuber crops to destination markets.

OPPORTUNITIES

Nepal has diverse agro-ecological and climatic conditions favourable for the production of R&T

crops. Except potato; sweet potato, taro, yam, elephant foot yam and cassava are considered as underutilized crop species. R&T crops particularly potato, sweet potato, taro and yam contribute a major share in the traditional food systems of many people in Nepal and these crops play a major role in the food security of the people especially mid and High Hills of Nepal (Khatri et al., 2017). Root and tuber crops are important for Nepal because of cultural/religious value, food security (carbohydrate source), and nutrition security (mineral nutrient vitamins source). These crops are also suitable for marginal land and stress condition (climate smart) and many of them can be stored in normal condition for longer duration.

Tremendous scope and opportunities exists in root and tuber crops development as the means of food security in the future; friend during famine and natural disaster and still a means of livelihood for Chepangs, Tharus and several other ethnic groups in Nepal; raw material for industry in the future e.g. flour, starch powder, cakes, flakes, beverages, etc.

i. Input and Planting Material Management

Root and tuber vegetables are vegetative propagated plants. Therefore, once better clone is selected and maintained well, there is very little varietal deterioration. These crops are highly responsive to organic manure while diseases and pest attack is minimal except colocasia. Even in colocasia, the blue beetle pest management is easy by manual collection and destruction. Thus good planting materials can be produced locally and its quality can be maintained which is an opportunity over seed propagated crops.

ii. Production

There is good opportunity to produce root and tuber vegetables even in unirrigated marginal lands. Nepal has comparative advantages for different R&T crops production due to availability

of temperate to tropical types of climates. Agro-ecological diversity from tropical to alpine climate offers good opportunity for R&T crops production. Nepal has potential market access to neighbouring countries such as Bangladesh, India, and other SAARC countries, China and abroad etc. for processed and fresh tuber crops. Demand for specific varieties for special occasion and seasonal supply and import substitution is felt opportunities. The Agriculture Development Strategy, 2015 (ADS) has recognized R&T Crops as high value commodity and researches by Nepal Academy of Science and Technology (NAST) has reported high nutritional and medicinal value of yam. Linking resource centers with problems and solve them through encouraging public private partnership are the potential opportunities.

iii. Field Storage Crops

Root and tuber crops are field storable crops compared to other fresh vegetables. These crops can be harvested as per the demand of market. For long time it can be field stored by delaying harvest. These crops can be supplied as fresh organic product with long term field storage and fresh and cleaned harvest to the high class people. The cleaned and packed root and tuber vegetables have great opportunity in the departmental store and big food mart in the urban areas.

iv. Processing and Marketing

Opportunities exist for well cleaned and packed, processed and standardized products of root and tuber crops. The market exists all over Nepal and also for export to neighbouring countries for high quality hill yams and chayote roots. Cleaned, sliced and dried yams could be an opportunity for year round sell in the developed food mart along with other dry vegetables. Opportunities exist to trade at national, regional, and global levels, and the government has a liberal policy to support more open export markets to the farmers/traders. For the export promotion of

the Nepalese root and tuber vegetables to the Indian markets, the government has to play an effective role to include these items in the exportable list to India. Some of the current issues and challenges include transferring of the Nepali products to Indian trucks at the borders if removed has better opportunity. Diaspora in USA, Australia and Europe are tempted to receive Masyaura and sliced dried yam and elephant foot yam has great opportunities to export.

PRIORITY AREAS OF INTERVENTIONS

The priorities area of interventions and actions for the research and development of R&T crops are as follows.

i. Research and Variety Development

- a. Nepal Agriculture Research Council (NARC): NARC should start a separate research division on root and tuber crops and work on introduction/collection of germplasms, domestication, evaluation and selection based on performance and farmers/consumers' preference, technology generation and value added products development in collaboration with Tuber Vegetable Development Center (TVDC), Sindhuli.
- b. TVDC, Sindhuli: It should work on germplasm characterization, evaluation and promotion in collaboration with Gene Bank of NARC. Further, it should conduct adaptive study on varietal development, cultivation technology development, product diversification for sustainable market.
- c. Agricultural Universities: Should include root and tuber crops in education system; and conduct fundamental or basic researches by the post graduate students for their thesis work in these crops.
- d. Department of Food Technology and

Quality Control (DFTQC): Analysis of food and nutritional value of all root and tuber crops and research on food diversification through processing and developing different dry and processed products and raise nutritional awareness.

- e. Provincial government: Farmers' field verification of new technology, planting materials management, support to processing industries, storage facilities and market development trials
- f. Local government: Under the present federal system with three tiers of government, local government has the vital role in technology verification, extension and production input support and promotional demonstration and production technology demonstration, result demonstration and exhibitions.
- g. Private sector: This sector has proactive role in value addition, product diversification and marketing as well as awareness raising in changing food habit and product promotion program etc.

ii. Product Promotion

Commercial production of vegetable crops starts with efficient technology and good agricultural practices. Provisions of technological guidelines for production and post-harvest handling at farmers' level are necessary. There is also the need to introduce appropriate varieties for particular regions to ensure superior quality production.

- The promotional strategies for production may be prioritized for Chayote root in the mountains,
- Colocasia, yam and sweet potato in the mid hills, narrow rain fed terraces and under agro-forestry system and under high tension electricity line
- Elephant foot yam, Tapioca, yam and sweet potato cassava – in Terai. Siwalik, River basin and low hills - Dry area.
- Yam and colocasia – Terai to mid-hills –

narrow terraces, rain-fed areas and also agro-forestry system and under high tension electricity line.

Demo farm establishment, community field gene bank, taro Park, food and diversity fairs, publication sharing, mass media dissemination of food value, nutritional value should be promotional strategies for increasing production and consumption of root and tuber crops. All these root and tuber crops should be included and demonstrated in home gardening and roof-top gardening. Mass multiplication of propagating materials, information flow on nutritive value, sustainable input supply, production and product diversification for value chain are deemed necessary. Practical training at the field level with quality planting materials, modern skill development training for easy plantation and easy harvest in yam, tapioca and other tuber crops will increase the quality production of all root and tuber crops. Entrepreneurship development training to the cooperative members in product utilization and management, analysis of net cash income, net profit, risk analysis and market management knowledge and skills should be provided.

iii. Market Promotion and Post-harvest Handling

In Nepal, there is a 25 to 50 percent post-harvest loss in vegetables (Bhattarai, 2005). In underutilized root and tuber crops post-harvest loss study has not been done specifically. It is assumed on the basis of survey information post-harvest loss in these crops ranges from 5-15 % depending on distant market and transportation means. Reducing these losses is more economical solution, rather than increasing production. Therefore, there is need to provide training to the farmers and traders for increasing their knowledge on post-harvest handling technologies. To extend the shelf life of vegetables and to create time and space utility, the establishment of cool and dry chamber

storage in the Mandi (wholesale market) is recommended. This will reduce post-harvest losses.

iv. Cleaning, Packaging and Marketing

Most root and tuber crops are marketed without cleaning. Cleaning, washing and sorting of cut and damaged products will add value. Introducing cleaning, grading and proper packaging at collection centers can reduce post-harvest loss and also ease bulk collection and transportation. Packaging is a fundamental tool for post-harvest management of perishable vegetables. At present, packaging systems still depend on traditional forms, such as bamboo baskets (Dokos) and gunnysacks. Development of market structure is an important requirement for effective marketing. The use of plastic crates and corrugated fibre board boxes must be encouraged. Similarly, proper temperature and humidity management are very effective tools in ensuring that produce remains in good condition throughout storage. Training in packaging and storage is recommended at the farmers, traders, wholesalers and retailers level.

v. Value addition and Processed Product

At present these root and tuber crops are marketed without cleaning, sorting and proper packaging. Introduction of simple cleaning, washing and packaging at 2 to 5 kg range pack will increase the value and ease the marketing.

Processed product with product diversification like powder and cake and Sabudana has huge potentiality through product diversification. Massive cultivation of tapioca in Siwalik and Inner Terai and processing into Sabudana is possible

WAY FORWARD

Considering the smart attributes of R&T crops, following short, medium and long term action plans have been recommended for the overall

development of these crops.

i. Short-term Plan of Action (2 years)

- Formation of research and development coordination committee representing all five stakeholders (NARC, Universities, Department of Agriculture, TVDC, and private sectors).
- Establish a separate research division on root and tuber crops in NARC.
- Mandate TVDC, Sindhuli for R & T crops action research and initiate research in all aspects of value chain of root and tuber crops
- All the government farms must have some activities for R&T crops along with adequate budget.
- Simplify and facilitate registration of popular varieties and regulate registration
- Identify and develop new varieties and production technology and conduct farmer's field trials of such varieties and also distribute quality planting materials to local governments (municipalities) for promotional activities.
- Provide technical services in the command areas in collaboration and coordination with province and local level extension offices.
- Develop farm as a practical training resource centre for field level technicians, cooperatives/farmers to transfer modern production and post-harvest technology.
- Campaign utilization of fallow land (Banjho Jagga), marginal land, small farmers and awareness creation about its value.

ii. Medium-term Plan of Action (5 years)

- Develop expert's team consisting of Breeder, Plant Protection Specialist, Soil and Crop Nutrition Specialist, Post-harvest and Marketing Specialist etc. at central and provincial government level.
- Develop suitable varieties of root and tuber crops for processing industries and Explore possibility of industrial use/

processing through private sector.

- Develop root and tuber crop zone and super zone in appropriate feasible production pockets.

iii. Long-term Plan of Actions (20 years)

- Develop well equipped research centres and export production zones based on selected commodity and declare root and tuber crop zones.
- Make farmers of selected areas able to produce high quality planting materials
- Develop and manage root and tuber crop horticulture technicians at ward level who can provide imbedded service to the clients.
- All research, teaching and development services are linked by a chain of command from Central, Province and Local government.
- Study external demands for raw R&T, produce flour and powder products, encourage private sectors for opening industries along with commercialization of the produces.

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