HORTICULTURE IN NEPAL: JOURNEY IN THE LAST SIX DECADES

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ABSTRACT

Horticulture was limited to growing indigenous fruits and vegetables during 50s and earlierin the private sector, while collecting and growing fancy plants existed in the palaces of Rana Prime Ministers . Horticulture development at the government level started during fifties when the Horticulture Division was created in the newly established Department of Agriculture. Many farms were established during sixties, commodity development divisions were established in seventies, several projects were implemented and NARC was established in eighties, concept of privatization and sustainability of horticultural farms was introduced in nineties, and commodity divisions were promoted to directorates and horticultural farms were given commodity specific mandates and their names were also changed accordingly. In the last sixty years, there has been significant progress in policy development, institutional development, and technology generation and transfer. Fruit production has increased to 965,000 mt, vegetable production to 3,421,035mt, and potato to 2,817,512 mt from almost less than 100,000 mt during the early fifties. With Nepal's membership to WTO and regional trade associations, increasing education levels and nutrition knowledge of the people, increasing demand for fruits and high import, etc. shows high prospects for horticulture development in Nepal. Promotion of horticultural business, promotion of foreign investment, and enhancing production are some of the ways ahead in horticulture development. In order to harness the potentiality of horticultural development in Nepal experience shows that there are challenges such as enhancing production, improving physical infrastructure, enhancing marketing, and promotion of processing, to be addressed.This paper has tried to give a short glimpse of horticulture development in the last sixty years in Nepal. It has focused more on the institutional development history, major successes, prospects and challenges for development.

INTRODUCTION

Nepal is shaped roughly in trapezoidal manner , 800 km (497 mi) long and 200 km (124 mi) wide, with an area of 147,181 km2 (56,827 sq

mi). It lies between latitudes 26° and 31°N, and longitudes 80° and 89°E.

Physiographic situation of Nepal has given rise to diverse climatic condition and that gave large biodiversity. One could find wild plants of Mandarin in Magtewa in the east and many Mandarin cultivation in surrounding districts Khokho, Chintang to name, so also Custurd Apple in Dhankuta; similarly wild Amala plants in the Jasbhire slope way to Indravati river to Chautara; wild Citron and Olive plants in the West.

Prior to Rana Regime (prior to 1950) horticulture grew as a collection of fancy and exotic horticultural plants such as persimmon, loquat, some peaches, pears, figs, litches and mango; and flowering plants like coral, magnolia, Chiniya rose, and evergreen plants like exotic pines, monkey puzzle nut, etc. in Putali Bagaincha (literary in English translation is Butterfly Garden) which was meant for entertaining Rana Prime Ministers. There was a Plant Introduction Unit established in Godawari to maintain the introduced plants in situ.In the private sector, horticulture during that period was limited to growing indigenous fruits such as traditional guava, pear, citrus, etc. and some vegetables such as mustard leaf, pyate – red turnip, different types ofradish, beans, cucurbits, etc. Generally, fruit growing was limited to homestead gardens with few trees scattered here and there.

Horticulture development at the government level started during fifties when the Horticulture Division was created in the newly established Department of Agriculture. Horticulture farms were established at Kakani, Pokhara.

During sixties, Department of Horticulture was established. There were 13 horticulture farms established at Kirtipur, Pokhara, Dhankuta, Dhunibeshi, Kakani, Palpa, Janakpur, Helambhu, Baitadi, Jumla, Marpha, Sarlahi, Rampur and Humla with the support from Indian Cooperation Mission (ICM). GTZ supported Gandaki Zone Agriculture Development Project GADP was started in 1969 that had a significant component on horticulture development. Similarly Japan helped to establish Janakpur Zone Agriculture Development Project (JADP) and has impact in the development of Junar in Sindhuli and Ramechap. Karnali Bheri Integrated Rural Development Project K-BIRD has impact in the west.A fruit preservation unit was established at Kirtipur. Production

and distribution of fruit saplings and some vegetable seeds started from various farms. Many private nurseries andcommercial orchards were established.

During seventies, government gave further impetus to horticulture development. Fruit Development Division (FDD), Vegetable Development Division (VDD), Potato Development Division (PDD) and National Citrus Development Programmes (NCDP) were started. Nepal implemented Ten Years Agriculture Plan 1975-85 (2030-40 BS). During this period, horticulture component was introduced in various agriculture stations such as Parwanipur, Bairawa, Nepalgunj and Tarahara Bitarnagar. Horticulture farm Panchkhal was established in 1975. Agriculture farm in Solu and Dailekh were established in 1975 and 1977 respectively. FAO supported Hill Agriculture Development Project (HADP) was started in 1973 which strengthened Horticulture Farms of Kirtipur, Trisuli, Jiri, and Jumla. It also imported and distributed germplasm of many kinds of fruits. JICA supported Janakpur Agriculture Development Project was started in 1973. Commercial orchards were developed at the private sector. Vegetable Seed Production Centre Mushikot was established in 1978. Horticulture Farms/Stations carried out fruit research and developmentactivities under technical guidance of FDD, NCDP, vegetable research activities under the guidance of VDD and potato research activities under the guidance of PDD.

During eighties, a separate post of DDG Horticulture was created in the Department of Agriculture in 1982. Citrus Development was given a national priority. FAO/UNICEF supported Vegetable seed production project was started in 1982. Vegetable Seed Production Centre Dadeldhura was established in 1982. JICA supported Horticulture Development Project (HDP) was started in 1985 and ADB supported Hill Fruit Development Project was started in 1987. Kalimati Fruits and Vegetable Wholesale Market was established in 1986. Agricultural research was given a special focus and a separate research wing named Nepal Agricultural Research and Services Centre was created in 1987 which was promoted to Nepal Agricultural Research Council in 1991.

During nineties, Department of Horticulture was re-established . Some horticulture farms such as Horticulture Farm Rasuwa and Helambu

(Orchard site) were handed over to the Ministry of Forests and Soil Conservation and Horticulture Farm Kakani to the Ministry of Tourism. Some farms namely Horticulture Farms Humla, Dhunibesi, Helambu (Sermathang) and Janakpur were privatised with certain criteria to ensure the continuation of horticultural activities in the farms. In 1979, five agriculture related departments were merged to create the Department of Agriculture Development (DOAD). In 1993, a post of Assistant Horticulturist was created in each District Agriculture Development Office. In 1994, Horticulture Farms Humla, Dhunibesi and Helambu (Sermathang) were re-turned back to the Government by the private sector. In 1980, Department of Livestock Services was separated from the DOAD and the DOAD was renamed to Department of Agriculture. Tea and Coffee development board was established in 1993. In 1995, 20-years' Agricultural Perspective Plan (APP) was formulated and implemented. Of the four priority outputs, high value commodity was one, including horticulture. In this decade, Nepal Horticultural Society was also established (1990). Floriculture Association Nepal (FAN), a private sector initiative was started in 1992.

After the millennium, Ministry of Agriculture and Cooperatives was restructured in 2002. The commodity development divisions were renamed to development directorates such as Fruit Development Directorate (FDD) and Vegetable Development Directorate (VDD). National Citrus Development Programme, and Tea and Coffee Development Programmes were kept under FDD. Potato Development Programme and Spices Development Programmes were kept under VDD. Different horticultural farms were renamed according to the functions they were carrying out, such as Horticultural Farm Sarlahi was renamed to Tropical Fruit Farm, Horticultural Farm Panchkhal was renamed to Spice Development Farm.

MAJOR SUCCESSES

Policy Development

There has been several policies being developed and implemented to promote horticulture development in the country. The major policies include: Ten Years Agriculture Plan (1975-85), Agriculture Perspective

Plan (1995-2015), Seed Policy (1999), National Tea Policy 2000, Fertilizer Policy (2002), National Coffee Policy 2003, Irrigation Policy 2003, National Agriculture Policy (2004), Agribusiness Policy (2007), Agrobiodiversity Policy (2006), Land Use Policy (2012), Irrigation Policy (2013), National Seed Vision (2013-2025), Agriculture Mechanization Policy (2014), Agriculture Development Strategy (2015) the latest.

Institutional Development

There has been significant development in training, research and extension institutions. Tribhuvan University, Agriculture and Forestry University, Pokhara University and Purvanchal University offering higher level degree in agriculture. There are schools giving technical education. There are training centres giving vocational education on agriculture.

There are eight commodity associations: Nepal Ginger Producer and Traders Association, Nepal Tea Planters Association, Nepal Tea Association, Himalayan Orthodox Tea Producers Association-Nepal, Seed Entrepreneurs Association of Nepal (SEAN), Floriculture Association Nepal, Coffee Producers' Association Nepal, Federation of Fruits and Vegetable Entrepreneurs, Nepal (FEFVEN), Nepal Mushroom Association,

There are more than 500 commodity specific cooperatives (Vegetable and Fruit – 202, Tea – 109, Coffee – 146, Junar – 44), and their Federations. Likewise, there are 8,069 Agriculture Cooperatives which also deal with horticultural commodities. At the grassroots level, there are more than 25,000 producers' groups organised in various commodity groups including fruits, tea, coffee, vegetables, spices and vegetable seeds.

Technological Generation and Transfer

From traditional methods of growing and indigenous varieties, Nepal has progressed significantly in developing horticultural technologies. Vermicomposting technology is gradually replacing chemical fertiliser in horticulture and is contributing to improve soil fertility and food quality. Biotechnology such as tissue culture is contributing to produce disease free saplings, TPS technology in potato is contributing in virus filtration, IPM and IPNMS technologies are contributing in reducing the use of

chemical pesticides and fertilizers, water harvesting and multiple use water system, and drip and sprinkler irrigation technology are contributing in efficient utilisation of water, riverbank farming has increased the scope of vegetable farming for landless and marginal farmers.

There has been significant improvement in varietal development. As compared to a traditional cauliflower variety grown in Kathmandu Valley by Jyapu farmers, there are 43 varieties of cauliflower in Nepal. Likewise, there are 33 varieties of cucumber, 28 varieties of cabbage, some are day neutral, 27 varieties of tomato, 17 varieties of radish, 17 varieties of bitter gourd, 8 varieties of potato, 6 varieties of broad leaf mustard, etc (VDD, 2014).

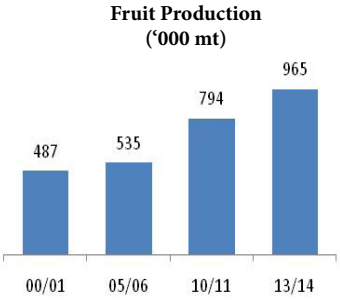
Remittance income and knowledge of returnees

Off season vegetable production was specified in 20 Years Agriculture Plan APP.There have been several off-season production technologies brought by the returnees working abroad. These social remittances (knowledge of new technologies and skills) have contributed in the supply of off-season vegetables, especially tomatoes, cucumber, bitter-gourds, and exotic fruits such as kiwi, avocado and strawberry.

Production and Productivity Enhancement

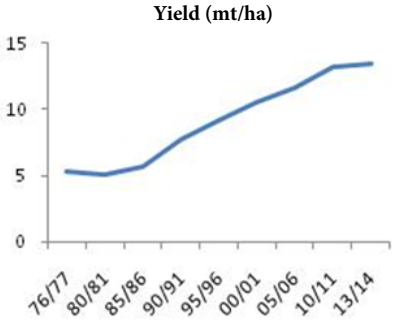
Production and productivity of horticultural crops have increased significantly in the last six decades. Available data shows that production has doubled in the last 25 years, vegetable production has increased almost by eight folds in the last 40 years, and potato by more than 10 folds (Tables 1-3). Though area and production of fruits have increased, fruit yield is hovering around 10 mt/ha. There is still a lot to be done to increase fruit productivity. Supply of quality planting material, proper orchard management including manuring, irrigation, training and plant protection have been found as major areas for intervention. In case of vegetables and potato, production and yield have increased over time. Despite the potential of horticulture, horticultural productivity remains low due mainly to the lack of access to information, technology, inputs (seeds, fertilizers, credit) and market.

Table 1: Area and production of fruits				
Year	Total area ('000 ha)	Productive area ('000 mt)	Production ('000 mt)	Yield (mt/ha)
1985/86	NA	NA	364	NA
1990/91	NA	NA	502.36	NA
1995/96	NA	NA	367.49	NA
2000/01	73.775	48.166	487.326	10.12
2005/06	91.923	56.549	535.449	9.47
2010/11	117.932	79.184	794.164	10.03
2013/14	148.208	110.086	965.044	8.77
Source: MOF, 1998; MOAD, 2014				

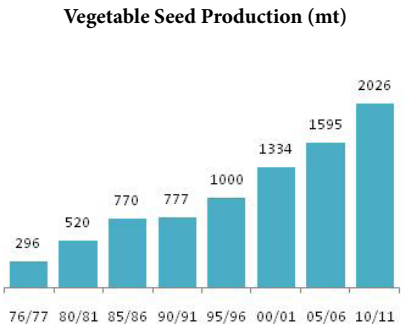


Vegetable production has increased significantly. Data shows that only 13 percent of the vegetables transacted in Kalimati Wholesale Market was imported in 2007 (Awasthi, 2007) while some 15 years ago the scenario was reverse. Local production was meeting only 13 percent and 87 percent of the transacted vegetables used to be imported.

Table 2: Area and production of vegetables			
Year	Area ('000 ha)	Production '000 mt)	Yield (mt/ha)
1976/77	85.00	442.00	5.20
1980/81	104.00	521.34	5.01
1985/86	138.59	782.53	5.65
1990/91	140.50	1074.65	7.65
1995/96	144.37	1327.29	9.19
2000/01	157.162	1652.979	10.52
2005/06	189.832	2190.1	11.54
2010/11	244.102	3203.563	13.12
2013/14	254.932	3421.035	13.42
Source: MOF, 1998; MOAD, 2014			



Vegetable seed production has increased significantly. It has increased almost by seven folds. Nevertheless, the area under improved seed is estimated to be still less than 50 percent. The current level of vegetable yield is 13.42 mt/ha while the potential yield with the current level of technological development is 17 mt/ha. Though seed alone increases yield by 30 percent, the seed replacement rate in vegetables has been only 67 percent.



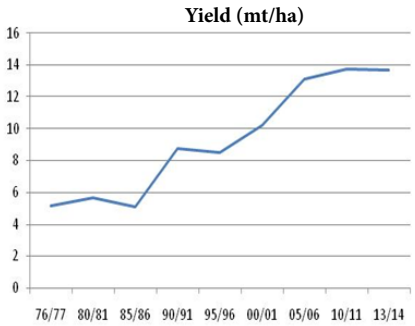


Table 3: Area and production of potato

Year	Area ('000 ha)	Production '000 mt)	Yield (mt/ha)
1975/76	52.29	270.25	5.17
1980/81	49.58	280.54	5.66
1985/86	69.96	356.72	5.10
1990/91	84.28	738.03	8.76
1995/96	106.00	898.35	8.48
2000/01	129.02	1313.72	10.18
2005/06	150.86	1974.76	13.09
2010/11	182.60	2508.04	13.74
2013/14	205.73	2817.51	13.70
Source: MOF, 1998; MOAD, 2014			

Contribution to total agricultural production

Segregated data on contribution of horticulture to total agricultural production is available from Ninth Plan. The weight of horticultural production including potato was 16.86 in 1996/97 which grew to 19.48 in 2001/02, and to 21.42 in 2006/07 (NPC, Periodic Plans).

PROSPECTS FOR DEVELOPMENT

- Nepal has become a member of SAPTA (South Asia Preferential Trading Agreement) since 1993, BIMSTEC (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation) in 2003, SAFTA (South Asia Free Trade Area) in 2004, WTO (World Trade Organization) in 2004. It has supported the export of Nepalese products.
- Education level and nutrition knowledge has increased significantly. Adult literacy increased to 57 percent in 2011 as compared to less than five percent some 60 years ago. It has increased people's awareness about the importance of fruits and vegetables in daily diet thereby increasing demand for fruits and vegetables.
- Demand for quality fruits and vegetables will be much stronger as the middle income group grows. There will be increased demand for raw horticultural products together with the expansion of processing industry sector.
- As prioritized by the government, opportunity to establish joint ventures with foreign companies has also been open. It has become more feasible with the growing financial institutes in Nepal coupled with the opportunity of introducing modern technology and management system from developed countries.
- Increased per capita income overtime and adoption of western culture has increased demand for floricultural products compared to yesteryears (Gauchan et al, 2009). Fresh cut flowers are used for decorative purposes such as vase arrangements and bouquets at formal events; designs for weddings and funerals; gifts on occasions.
- Along with availability, fruit consumption culture has increased in Nepal. There are several fruit shops and hawkers seen around the major cities.

- Local production of fruits is so low that nearly 70 per cent of the fruits consumed in the country accounting to annual 6 billion come from outside and beyond (Republica, 15 April 2014). Some fruits like lime and lemon in Kalimati wholesale market is supplied almost (95%) from outside (Dhakal et al, 2005).
- Most district headquarters are connected by roads. Now Remote districts (Manang, Mustang, Kalikot and Jumla) are also connected by road. It has opened new avenue for the promotion of high value horticultural products such as apple, walnut, almond, saffron, etc for both export and import substitution.
- Regarding export potential, Commerce Policy 2072 has identified Ginger – fresh and dry, Cardamom, Coffee, Tea, Vegetable and vegetable seed, fruits, flowers, as potential horticultural commodities for export.
- Access to technology and market information has made it possible to explore international markets and integrate Nepalese horticultural products into those markets.

Ways ahead

From a long-term experience and review of development efforts and opportunities for development, the following prospects appear as ways ahead.

Promotion of horticultural business: The commodities with high prospect are as follows.

- Apple - grading, branding, and product diversification from raw apple
- Citrus fruits - grading and branding to match the high demand in the international market
- Cardamom - drying, packaging, branding as per the demand in export market
- Tea - organic and green tea
- Coffee - organic and grain coffee
- Ginger - production zoning, certification, branding and drying
- NTFP - processing and value addition

- Vegetable seeds - processing, packaging, and branding

Promotion of foreign investment: Agro-based industries suitable for the attraction of foreign investment are as follows.

- Vegetable processing and marketing
- Floriculture production for import substitution and export promotion
- Fruit processing and export
- Vegetable seed production and export
- NTFP processing and export
- Tea Coffee processing and export
- Spices processing and export

Enhancing production: Production of horticultural products is being enhanced through the following interventions.

- Expanding production zone to diverse agro-climatic zones based on climate change patterns
- Adopting improved technology to increase productivity which is currently very low. For example, high density planting of apple, hybrid technology, tunnel technology, riverbed farming, etc. have already shown promising results.
- Adopting organic production technology to meet the growing demand for organic fruits and vegetables.
- Identifying niche markets and adjusting production accordingly. For example: Hybrid watermelons have taken the major institutional demand for watermelon. However, medium and small income group shoppers look for small sized watermelon (2-3 kg) for domestic consumption.
- Harnessing seasonal price variation in the Terai, India and Bangladesh markets during off-season and adjusting production accordingly.

CHALLENGES

- For various socio-economic reasons, fruit and vegetable intake in the community is low. Only a few percent (2.1%) people are consuming fruits and vegetables as recommended by WHO (Vaidya et al, 2013).

- Despite the fact that local fruits and vegetables are rich in nutrition, local fruits are vegetables are gradually replaced by improved varieties and imported costlier ones making it a bit difficult for common people to consume vegetables.

Box 1: Meeting a volume for export is a major problem

In the year 2001, about 12 metric ton of apple was exported from Jumla to Bangladesh via the Biratnagar custom port outlet. The Bengalis liked the Nepalese apples from Jumla. The following year, a team of few traders from Bangladesh reached Jumla and met with the apple producers there. They disclosed that the apples from Jumla are of better quality than Indian apples and hence they would like to continue importing apples from the Karnali region. But when the farmers were told of the quantity required (50,000 mt per year), they had their fingers crossed. It was not possible to produce that quantity of uniformly graded apples. The traders said they would not like to import apples to Bangladesh from several sources and hence, if Nepal can meet that supply level, they would resort to Nepal's export. The farmers were not organized enough to meet that supply level thus resulting in no export from subsequent years.

- It has been also reported that locally available fruits and vegetables are often wrongly considered inferior in terms of use of pesticides, artificial colour and ripening chemical. It has detracted nutrition conscious educated mass from consuming locally produced fruits and vegetables.
- Artificially coloured and flavoured juices (instant drinks) are becoming more common drinks rather than consuming fresh fruits, especially amongst children who should, in fact, eat fruit every day.
- Nepalese agriculture has been is grossly underfunded to address the research needs of time (Paudel, 2011).
- Cultural taboos have also affected vegetable production and consumption in Nepal. Some people think that vegetables should not be consumed if the person has an illness. Lactating mothers are sometimes advised to avoid green vegetables lest they harm the mother and her infant. Some people feel a loss of dignity if they

grow and sell vegetables (Schnelle, 2012). Vegetables are credited for adding taste and variety but are not necessarily regarded as being rich in nutrients (Thapa and Paudyal, 2009).

- Improper intercropping in orchards is still a negatively contributing to orchard health and fruit yield. For example, in Solukhumbu, apple orchards are generally intercropped with maize, wheat, potato and vegetables. Damage to the plants and root zone of fruit trees while ploughing the field for intercrop plantation is conspicuous for poor orchard health (Shahi, 2005).
- Though many district headquarters are connected by road transportation network, the horticultural production pockets are yet to be connected by roads, Although APP emphasised connecting potential production pockets by roads, the budget allocated for agricultural roads have been diverted to connect townships (FAO, 2010).
- Meeting a volume for export is a major problem. As shown in Box 1, Nepali traders could not export apple just due to not meeting the required volume for export.
- Policy issues were also encountered. For promoting a new variety, GON has limited ability and a long process to approve new seed varieties. The Competition Promotion and Market Protection Act of 2007 is in place. However, this law needs to be implemented in practice to deal with disputes in transport syndicates. There is a lack of Contract Farming Act to promote plantation crops such as tea, coffee, fruits, etc. The existing policy of supporting communities/ cooperatives to construct collection centre/marketing structure is yet to be made favourable to promote horticultural markets. This is because farmers cannot avail land in a place where marketing can really take place and the place where farmers can avail land, marketing does not take place
- Availability of planting material was also limited. In many cases, even when planting materials were available, quality of planting materials was low (FDD, 2013)
- Despite the increased knowledge of the harmful effects of pesticides, due to weak monitoring, indiscriminate use of pesticides

has increased beyond the threshold level. For example, in Terai district such as Siraha, Dhanusha 67 percent farmers spray their crop more than 8 applications and in hill district such as Kavre farmers spray their vegetable crops such as tomato 6-7 times with Endosulfan against tomato fruit worm (Helicoverpa armigera) and more than 5-6 times with Dithane M-45 against late blight in a single cropping season (GC, PPD). In crops like tomato from Kavre, pesticide residue has been found above the Acceptable Daily Intake (ADI) or maximum residue level (MRL) (Aryal, ED).

- There is still a high postharvest loss (20-30% in fruits and 30-40% in vegetables) due to lack of grading, inappropriate packaging techniques and materials, and means of transportation.

CHALLENGES AHEAD

Enhancing production: Major challenges ahead in production include the following.

- Conducting problem-based research
- Providing research-based production technology
- Enhancing managerial skills of the producers
- Enhancing access to financing with adequate consideration of gestation period

Improving physical infrastructure:

- Increasing cold storage facilities, especially zero-energy cold storages in remote areas
- Increasing road network facilities to connect major production pockets
- Increasing marketing infrastructures at strategic points
- Promotion of alternate energy to address the problem of frequent load shedding

Enhancing marketing:

- Promotion of cooperative to solve the problem of scattered and small production units
- Promotion of horticultural business providers to address the

business service needs
- Facilitation to establish appropriate linkage and coordination
- Promotion of contract farming system to address the problem of fragmented and small land size
- Facilitation to obtain price information and market integration
- Enhancing farmers' capacity to analyse the market signals

Promotion of processing:
- Promotion of production zones for processing to ensure reliable supplies of raw materials in terms of quality and quantity
- Facilitation to link small producers with processing industries
- Quality standardization and certification
- Technological intervention to reduce the cost of production to address the problem of high competition due to import of cheap products
- Enhancing access to finance by introducing a system of pledging processed products in the storage

Reducing postharvest losses: Major intervention areas include the following.
- Enhancing farmers' capacity on appropriate harvesting techniques
- Improving packaging materials and packaging techniques
- Enhancing farmers' capacity on pre-cooling (for removal of field heat in leafy vegetables and beans), grading (ginger, apples, mandarins), packaging (apples and pears, tomato, cauliflower, peas and beans) and transportation
- Promoting multi-chambered cold storage facilities for fruits and some vegetables such as carrot and cabbages in the major consumption market centers

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