

Tomato Variety Development in Nepal: A Policy Brief

KEY MESSAGES

Demand for improved and hybrid vegetable seeds are increasing every year. More than 60% of the area of the commercial vegetable production pockets are under hybrid seeds with increasing trend due to their high yielding ability against open-pollinated (OP) varieties. At present, most of the hybrid seeds in vegetable crops are importing from abroad in Nepal. The production technologies in vegetables need to be superseded by high-yielding, multiple stress tolerance varieties. However, there is a limited choice of Nepalese varieties and farmers are not getting new varieties at the right time and place. The development of vegetable varieties is the prime importance in the country for which Nepal Agricultural Research Council cannot achieve through its single effort. Public-private partnership in vegetable hybrid variety production is necessary. Therefore, national seed companies should have the mandate for parental line maintenance, foundation, and certified seed production in close supervision of breeders and scientists from NARC. In addition, fast tract hybrid variety development strategies should be adopted. This policy brief has been prepared to supplementary information to policymakers on tomato hybrid and OP variety development in Nepal.



Tomato Variety Development in Nepal

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In Nepal, about 689 varieties of 73 crops were notified in National Seed Board's active lists by the FY 2020/21. About 287 (41.65%) varieties were notified by the variety release process and 402 (58.35%) varieties have been notified by the registered process. Among total varieties notified the number of open-pollinated/inbred varieties were 364 (53%) and hybrids were 325 (47%). A total of 210 hybrids varieties of vegetables were registered. Demand for improved and hybrid vegetable seeds is increasing every year due to increasing area under fresh vegetable production both for the main season and off-season in Nepal. Vegetable seeds are high-value and low-volume products. Demand for improved and hybrid vegetable seeds are increasing every year due to increasing area under fresh vegetable production both for the main season and off-season in Nepal (SCPL, 2011). More than 60% of the area of the commercial vegetable production pockets are under hybrid seeds with increasing trend due to their high yielding ability against open-pollinated (OP) varieties (MOAD, 2013).

Among vegetable crops; tomato is the third most important vegetable crop and is cultivated in 22566 ha land with a production of 406434 MT and productivity of 18.01 MT per hectare (MoALD, 2019). Thirty-two varieties of tomatoes

have been registered/released in Nepal where only 4 varieties are open-pollinated and the rest are hybrid varieties. However, one Nepali tomato hybrid “Srijana” registered in 2010 by Horticulture Research Division, NARC became very popular and it covers 80 percent of tomato production under the plastic tunnel. Recently, National Horticulture Research Center (NHRC, former HRD), NARC has released additional two new tomato hybrids varieties ‘Khumal Hybrid Tomato-2’ and ‘Khumal Hybrid Tomato-3’. Few open-pollinated tomato varieties are also in the pipeline for registration/release. Since only four open-pollinated varieties are released so far in Nepal, there is an urgent need to release OP varieties having high yielding and multiple stress resistant characters. Before the release of varieties, multi-location testing in various climates is needed to find out the suitable varieties. In this connection, Asian Food & Agriculture Cooperation Initiative (AFACI) have provided 37 genotypes of tomato through World Vegetable Center, Taiwan. Among these germplasm, some of the germplasm showed better performance than hybrid and have resistance to late blight and viruses. These promising varieties also need testing in different agro-ecological conditions before release and registration. Some 20 promising varieties were tested at Central and Western Terai region for the first time in 2020/21

At present, most of the hybrid seeds in vegetable crops are importing from abroad in Nepal. However, the unavailability of quality hybrid seeds in required time and place may force the farmers to cultivate open-pollinated cultivars. Imported hybrids are not available in the seed supply system over the years while Nepal cannot produce seeds of these hybrids due to a lack of inbreeds for seed production. Nepal is rich in local vegetable germplasm which can be used in the vegetable breeding program. It has been observed that many promising local selections of vegetables are popular but they are not coming into the national mainstreaming because of the unavailability of seed in the national seed system. The seed act came into force in 1988 with the objectives of providing standard quality seeds in a well-planned system of production, processing and testing to increase production and productivity of different crops.

The government of Nepal formulated the National seed Policy in 1999 which focuses on seven areas of seed sectors in Nepal where variety development and maintenance is one of the major sector. Similarly, The Seed Regulations 2013 were formulated to define rules, and regulate the production and marketing of quality seeds in the country. Besides this, National Seed



Figure 1: Tomato Experimental plot at NHRC, Khumaltar

Vision (2013-2025) was formulated with the objectives of promoting local seed security through conservation and sustainable use of agrobiodiversity.

The growing of hybrids seeds is increasing both commercial and small growers due to vigorous, resistance to insect pests and diseases and high yielding capacity. The continuous inflow of exotic hybrid varieties and the risk of getting appropriate variety at the right season and place is a great problem for the growers. The production technologies in vegetables need to be superseded by high-yielding, multiple stress tolerance varieties. However, there is a limited choice of Nepalese varieties and farmers are not getting new varieties at the right time and place. So, there is necessary to introduce new germplasm from foreign countries along with collection, selection, and evaluation of local germplasm for release as variety. This requires the testing of new genetic materials (both exotic or indigenous) at local and regional agroecological conditions. The testing of genetic materials in on-station and on-farm requires the standardized procedure of field experiments and highly precise and comparative data.

Nepal Agricultural Research Council (NARC) has carried out vegetable breeding and the development of new varieties. National Horticulture Research Centre (NHRC) along with different research stations across the country are developing vegetable varieties but the technical support is far behind the demand of the farmers. It is mainly due to the process of variety development and notification in the national seed system which is relatively time taking for the breeding in vegetables.

Objectives

- Collection, characterization and evaluation of tomato genotypes for bacterial wilt and late blight resistant, high yielding and consumer-preferred fruit size
- Selection and variety registration/release of potential OP tomato varieties for different agro-ecological zones
- Selection of parental lines for hybrid breeding and variety registration/release of potential tomato hybrids for different agro-ecological zones
- Breeder seed production of registered/released variety and supply in the seed production system.



Figure 2: Three days farmers training on tomato production at DoAR, Parwanipur in Province 2.



Figure 3: Residential training on vegetable and tomato hybrid seed production held at NHRC, Khumaltar

Policies

- Varietal development and maintenance
- Seed multiplication
- Collaboration with government authorities
- Collaboration with NGO/INGO's and private sector

The Process

Germplasm Collection and Entry in the Catalogue

Indigenous and exotic vegetable germplasms are collected from local and foreign sources such as WorldVeg, ICAR, and CGIAR. After the collection of new germplasm, the catalog of each line is maintained.

Observation Nursery

The newly introduced propagating materials (mostly seeds) of vegetable germplasms are grown in the nursery with close supervision of breeders under glasshouse or open field conditions at on station to screen larger diversity of materials, evaluate the overall composition or uniformity of a genotype of germplasm. Specific traits and potentiality of the germplasm are identified.

Initial Evaluation Trial (IET)

This is the first step of evaluation managed by the breeder. It is conducted in a small plot and replication for 2 seasons to get a clear idea about the performance of germplasm.

Coordinated Varietal Trial (CVT)

The promising lines/germplasms selected from IET are tested under on-station conditions of different agroecology across the country for at least two seasons/years and compared with the best adopted and high yielding variety as check variety in specific locations.

Coordinated Farmers Field Trials (CFFT)

This is an interface between breeders and farmers which provides wider participation of farmers and extension workers. In this stage, evaluation of vegetable germplasm is done for at least two seasons.

Farmers Acceptance Tests (FAT)

This is also an on-farm evaluation of promising genotypes. The most promising genotypes selected from

CFFT are promoted to FAT where farmers' preferences are considered based on horticultural traits, postharvest, cooking quality and consumer preferences.

Variety notification

After a series of experiments conducted as IET, CVT, CFFT, and FAT at on-station and on-farm trials, elite genotypes will be forwarded for release or registration as a variety. For a variety registration of local germplasm, at least two years of data is required, while 3 years of data is required for variety release.

Policies in Place

There are some important seed policies, which are guiding the vegetable variety development in Nepal.

- Seed Act, 2045 (First Amendment, 2064 BS)
- Seed Regulation, 2069 BS
- National Seed Policy, 2056
- National Seed Vision, 2013-25
- Hybrid Seed Production and Certification Standards, 2077 BS
- International Treaty on Plant Genetic Resources for Food and Agriculture and Multilateral System (ITPGRFA-MLS) Implementation Strategy and Action Plan (IMISAP) 2018-2025

Policy recommendations

The development of vegetable varieties is the prime importance in the country for which Nepal Agricultural Research Council cannot achieve through its single effort. Different policies and strategies are considered to make the vegetable variety development vibrant and efficient.

The Collaborative Efforts

Collaboration with Government Authorities

National Horticulture Research Centre under Nepal Agricultural Research Council should collaborate with different government authorities such as the Ministry of Agriculture and Livestock Development (MoALD), National Seed Board, Seed Quality Control Center Department of Agriculture, national seed company, Trade and export promotion center, Agriculture and Forestry University and Institute of Agriculture and Animal Science for vegetable variety development.

Collaboration with CG Centers and Private sector

Vegetable varieties in Nepal can be developed only through the system approach. International organizations like CG centres (CGIAR such as CIMMYT), WorldVeg, ICAR should be requested for germplasm exchange, technical backstopping, and capacity building of technicians and scientists of NARC. NARC alone in the path of OP and hybrid vegetable variety development cannot be complete excluding private seed companies. Handover of the germplasm, technical advice, and regular monitoring should be done by the NARC in collaboration with other government institutions. The private sector has been the engine of the seed industry in Nepal that handles more than 90 percent of the formal vegetable seed trade and supplies a significant amount of hybrid seeds.

Development of Mega-Project for Vegetable Breeding

Public-private partnership in vegetable hybrid variety production is necessary. Therefore, national seed companies should have the mandate for parental line maintenance, foundation, and certified seed production in close supervision of breeders and scientists from NARC. For this, it requires hybrid operation manual and a package of practices for each hybrid. Before register or release of hybrids, Seed Law is required to enforce. A guideline is being developed to give mandate on parental lines handover to seed companies on licensing basis.

Fast Tract Hybrid Breeding Strategies

Fast track tomato breeding strategies is to be enforced. Molecular marker-oriented selection program is required to be developed. National Horticulture Research Centre have been already started for fingerprinting of tomato germplasm available in the Centre.

Genetic Engineering

Integration of conventional breeding schemes and molecular approaches (DH technology, QTL mapping, GS & molecular characterization of inbred lines) should be started by NARC. The establishment of the molecular breeding facility at NHRC is to be considered.

Multi-Stakeholder Involvement

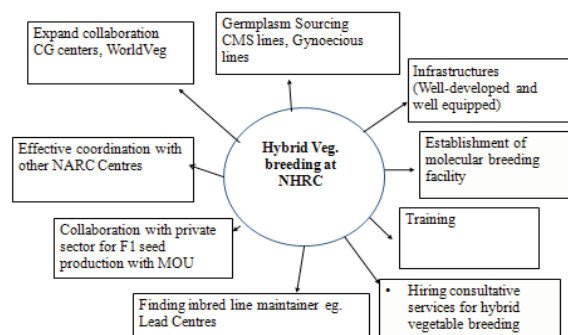


Figure 4: Multi-stakeholder involvement in vegetable Breeding

Patenting

The patent rights of parental lines and their hybrid variety should be provided according to Rule 14.1 of the Seed Regulations, 2068.

Secrecy and Security of Parental Lines

The license holder for hybrid seed production should be kept parental lines information as a secret or can be coded. Seed increase of parental lines (Foundation/Source Seed) should be confined into their own/leased farm/station. In need of producing parental lines at farmer's field, it should be secret and secure. Seed producers should not be allowed to export, hand over, sell, exchange, information and report sharing of the parental lines acquired from NARC to other individuals, parties or organizations, unless with a written and explicit permission from NARC. If they break the rules, their license should be blacklisted and cancelled.

Duration and Cancellation of License

The duration of the license should be for 3 years for the first time, then renewed following the Private Sector Seed Production and Management Directives, 2073, 6.1 (6). The Seed Quality Control Centre should cancel licenses automatically if: licenses are not renewed in time, no satisfactory

progress is made according to the agreement with the concerned commodity program of NARC, the party should not follow the terms and conditions of the agreement.

Concluding Remarks

The development of vegetable varieties is the prime importance in the country for which Nepal Agricultural Research Council cannot achieve through its single effort. Public-private partnership in vegetable hybrid variety production is necessary. Therefore, national seed companies should have the mandate for parental line maintenance, foundation, and certified seed production in close supervision of breeders and scientists from NARC. Fast track tomato breeding strategies is to be enforced. Molecular marker-oriented selection program is required.

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