

# **Canadian Variety of Climbing Tomatoes to Grow on Terrace Walls in Nepal**

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For this report, the product being discussed and presented to Nepal will be Canadian tomato plants that are able to climb on terrace walls. The objective is to bring attention to the export potential of the climbing tomatoes to Nepal, through the description of the products benefits to Canada and Nepal.

A tomato also known as *Lycopersicon esculentum* is part of the Solanaceae family, which is an herbaceous species grown for their fruit (Plant Village, Unknown). The tomato is an annual, meaning that it grows once a year, the life of the plant depends on the length of the growing season. Depending on the variety, the plant grows erect with shorter stems, or vine-like. The stems are covered in coarse hairs and have spiral leaves, and the plant produces yellow flowers, which develop the cyme and a berry. The typical height of the plant can range from zero point seven meters to two meters in height (Plant Village, Unknown).

Like any product in Canada, tomatoes have many different strains adapted to survive various growing conditions. Tomatoes are grown in warm temperatures between twenty-one and twenty-four degrees Celsius. The soil requirements are a loamy, well-draining soil, along with a pH level between five point five and six point eight. Typically, tomatoes are started their growing process indoors six to eight weeks before the last frost in the spring. However, in areas where the growing season is longer the seeds can be sown directly into the soil. When planting the seeds the best depth is zero point six centimetres or one quarter of an inch. The ideal soil temperature is twenty-one degrees Celsius to thirty-two degrees Celsius for germination to occur, between six to fourteen days the seedlings should begin to emerge (Plant Village, Unknown). A procedure in growing tomatoes is to stake, cage or trellis the plant for support. **Figure 1** shows an

image of a case where the trellis is used for indeterminate tomatoes. **Figure 2** shows the use of stakes for supporting the tomato plants. The use of trellis's or stakes help keep the fruit off the ground and increases the air circulation around the leaves, which in turn helps prevent the plant from diseases. Indeterminate tomatoes grow depending on the nutrients they receive, meaning they require a support system to prevent them from growing along the ground. Depending on what method is used the amount of pruning required can be from light pruning to heavy pruning. Heavy pruning is used in most cases where a trellis is used to support the plant (Plant Village, Unknown). Tomatoes are processed by harvesting by hand. In larger scenarios, such as field tomatoes, the tomatoes are harvested by larger equipment.



**Figure 1.**



**Figure 2.**

The end use of the tomato determines the type of harvesting that is required. Fresh market products are harvested by hand, while processing tomatoes are harvested by machine. Machinery required for the harvesting of tomatoes is minimal, but the amount

of labour required is immense. The use of mechanical harvesting aids is to reduce the amount of labour and make the process more pleasant. Hand-operated carts or wheelbarrows are used when carrying tomatoes from one spot to another, but the use of motorized machines that transport the workers and product are more efficient. In this industry most of the equipment is modified from its original form to suit the producer's needs. When harvesting there are rules that the "harvester(s)" are required to follow. These rules consist of keeping their hands clean, since they are dealing with a food product for human consumption, and thoroughness as to which fruits are being picked, for example only pick fruits that are mature/ready. The person harvesting is to ensure they do not squeeze or bruise the fruit, and separate the "good" and "bad" tomatoes (Boyette, Sanders, Estes, Unknown). Mechanical harvesting of tomatoes is done through a once over operation. The tomato vines and the fruit are all collected at once and conveyed into a harvester, where the fruit and vines are separated by chains. The tomatoes are then sorted electronically and by hand. Any immature or rotten tomatoes are disposed out the back of the harvester. Harvest takes place when ninety percent of the crop is ripe. Once sorting is complete the tomatoes are sent to the processing plant where a third party grades the crop, using samples collected off the wagon (Utopia, 2014).

Issues with growing tomatoes, like any other crop are the pests and diseases that the crop may contract. Common diseases found in tomatoes are bacterial cankers, bacterial speck, bacterial spot, and anthracnose. Other diseases are blight, wilt, septoria, curly top, and mold. Insect pests commonly found on tomato plants are aphids, the beet army worm, cut worms, flea beetles, leaf miners, loopers, stink bugs, thrips, other beetles,

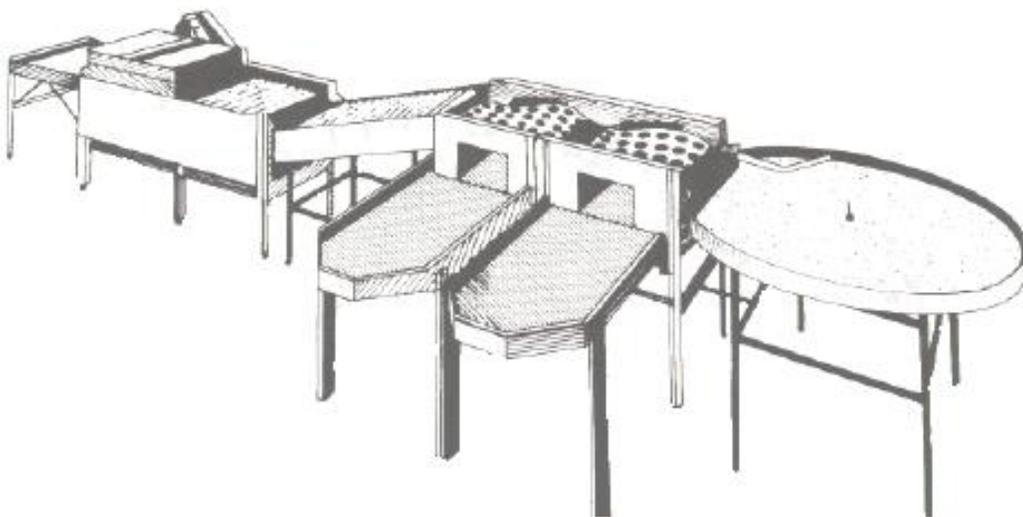
nematodes, spider mites and the couple that everyone knows... the horn worm and fruit worm (Plant Village, Unknown).

The cost of production for growing tomatoes varies depending on the method being used, and the type of market the product is for. Fresh market tomatoes are generally more expensive to grow and harvest. It is estimated that by the time that production, harvest, the grading process, and packing have been completed for one acre of staked tomatoes that the expense is greater than \$9,000 (Boyette, Sanders, Estes, Unknown).

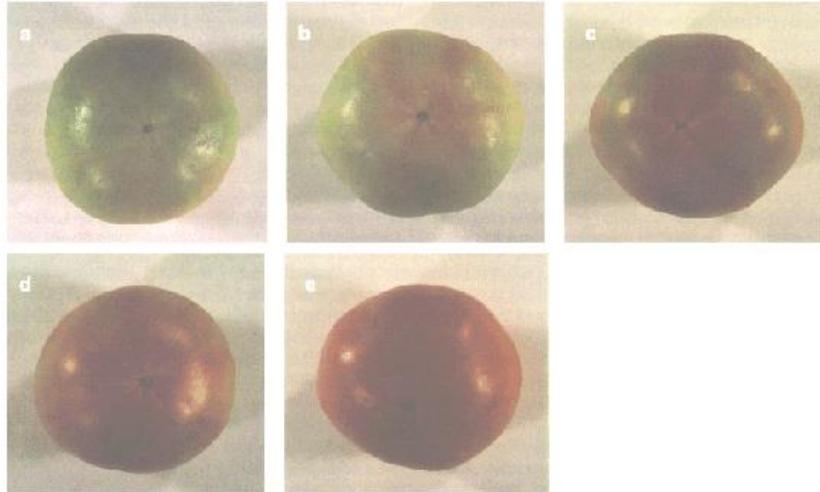
The cleaning and grading process of tomatoes begins by floating the product out of the bulk bins, then passing along a slow roller conveyor which turns the tomato to a position that is best for inspection. A good quality tomato has firm flesh, shiny skin, and uniform colour, all other tomatoes are discarded, especially if they are misshapen, damaged, decayed, or cracked (Boyette, Sanders, Estes, Unknown). In Canada the grades for tomatoes are Grade 1 and Grade 2, there is no grading for cherry tomatoes (CFIA, 2012). The next step is to wash the tomatoes to remove any dust and foreign material, this is done by spraying the tomatoes with a small amount of water and chlorine solution as they move across soft brush rolls. The tomatoes are dried by sponge rolls and an air blast drier (Boyette, Sanders, Estes, Unknown). The water used is several degrees warmer than the temperature of the tomatoes pulp. If the temperature is the same or colder than the tomato pulp temperature, there is an increased chance of water and disease being absorbed into the tomato.

Tomatoes are separated by size on the sizing belt, or by a rotating bar sizer. The roller speed and drop heights should be minimal, and the impact surfaces are to be well

padded to minimize impact and damage to the tomatoes. A daily cleaning with a strong chlorine solution is recommended to prevent the buildup of objects and organisms on the equipment (Boyette, Sanders, Estes, Unknown). **Figure 3** shows a display of a sorting table. Tomatoes are separated by colour, grade, and variety. There are six colour classifications, green, breaker, turning, near the upper end of the turning stage, pink, and light red. Green means that the surface of the tomato is completely green, this can be a light to dark shade of green, breakers indicates that there is a definite break in the colour from green to tannish yellow with pink or red skin, not covering more than ten percent of the surface. Turning is a classification used when more than ten percent of the surface is green but no more than thirty percent, this stage clearly shows a change in colour from green to tannish yellow, pink, red or a combination of the listed colours occur. Pink indicated that more than thirty percent but under sixty percent of the surface area shows a pinkish red colour. Red indicates that more than ninety percent of the surface shows a red colour. **Figure 4** shows five of the classifications.



**Figure 3**



**Figure 4**

For a tomato to be classified as Canada No. 1, in the case of field tomatoes, it must have a minimum diameter of 51 millimeters, and when enclosed, with the exception of 1 specimen a maximum diameter of 25.4 millimeters, or have a minimum diameter of 38.1 millimeters and a maximum of 51 millimeters. If there are pear shape or plum type tomatoes a minimum diameter of 31.8 millimeters is required (CFIA, 2012). For Canada No. 2 classification the tomato must have a minimum diameter of 44.5 millimeters, or have a minimum diameter of 31.8 millimeters in the case of pear and/or plum type (CFIA, 2012).

Prior to packaging the tomatoes will go through an ethylene treatment. Ethylene is a naturally occurring, odorless, and tasteless gas that is produced from many different types of fruits, including tomatoes (Boyette, Sanders, Estes, Unknown). This process helps ensure that the tomato ripens uniformly. This event takes place in a ripening room, which is practically airtight to prevent the ethylene from escaping the facilities. When the tomatoes are packaged there are three common packaging systems, vine-ripened, mature green, and cherry, as follows

**Vine-Ripened**

20-pound two-layer flat  
30-pound 1/2-bushel carton  
50- to 55-pound bushel basket  
10-pound carton  
25-pound carton (seldom used)

**Mature Green**

25-pound loose carton

**Cherry**

15-pound 12-pint flat

The tomatoes are considered properly packed when they are packaged in conditions that will not cause damage during handling or transit, meaning the packaging is not slack or overfilled (CFIA, 2012).

The types of inputs needed for producing tomatoes would be fulfilling the requirements needed for the plant to grow. Ensuring that the soil is fit for the growth of tomatoes by testing the soil pH level, to adjust the pH level lime can be added. If the soil is too light and sandy, or too moist and clay, the addition of organic matter is a way to help improve the soil health. The organic matter helps to retain water, and opens up the soil so water and air penetrate through better (National Gardening Association Editors, 2014). Other inputs would be applying the proper fertilizers such as nitrogen, potassium, and phosphorus to the soil.

Tomatoes have plenty of nutritional value, they are an excellent source of vitamins A, C, folic acid, and are antioxidants (Ware, 2014). Eating tomatoes, along with other vegetables, has shown a decrease in the chances of an individual getting heart disease, cancer, and diabetes (Ware, 2014). Tomatoes have also proven to be good for maintaining healthy hair, skin, body weight, and high energy levels (Ware, 2014).

Market potential for tomatoes is based on what the tomato is being produced for. Since tomatoes are annuals, the supply and demand fluctuates throughout the year. The fresh market for tomatoes has three distinct selling seasons, late spring, early summer, and late summer to early fall. It is predicted that the consumption of tomatoes per person, per year is approximately fifteen pounds (Boyette, Sanders, Estes, Unknown). Tomatoes have many uses, they can be eaten raw or cooked, as well as processed into juice, soup, puree, pastes, or powder (Plant Village, Unknown).

Canada benefits from the production of tomatoes through the economic return, the exports, the consumption of final products, and the health benefits from the consumption of tomatoes.

Using the information provided above about the tomatoes, it is possible to see the potential of growing indeterminate tomatoes in Nepal on terrace walls, and why producing the product would benefit Nepal. Nepal is located in the Himalayas on South Asia between India and China, the capital of Nepal is Kathmandu, which is located in Bagmati, one of fourteen of Nepal's zones. Nepal is considered to be a land of sharp contrasts and spectacular beauty. The overall surface area of Nepal is small, but holds the record for the world's largest height. Eighty percent of Nepal is covered by ten of the world's fourteen tallest mountains, standing over eight thousand meters. The inhabitants of Nepal, with determination, over the years have managed to make use of the land by cultivating up to twenty-seven hundred meters of mountainside. The population of Nepal is approximately twenty-eight million residents (I.W.E.N, Unknown). The climate of Nepal consists of four seasons, similar to Canada's climate, however, the lowest on average temperature during the winter months is three degrees Celsius, and the highest temperature is twenty-four

degrees Celsius. During the summer months the maximum average temperature is thirty-three degrees Celsius, and a minimum of nineteen degrees Celsius (Naturally Nepal, 2012).

The proposal is for Canada to export tomato seeds of indeterminate Canadian varieties to Nepal, to be grown on the terrace walls, harvested, and processed for final consumption or export. In order to transport the seeds to Nepal the methods would be cargo shipping, or by plane, depending on the amount required. Transportation for the final product would be the quickest method, in this case by air.

Using indeterminate tomatoes is a crucial aspect when it comes to growing them in Nepal, since the residents want to get the best and most efficient use of their land. Indeterminate tomatoes, also considered as vining tomatoes, spread laterally, and continue to grow depending on the amount of nutrients available to the plant. The plant is able to produce fruits for the entire length of the season, and the fruits will develop at different stages and ripen at different times (Plant Village, Unknown). Examples of indeterminate tomatoes are Amish paste tomatoes, which grow for eleven to twelve weeks, and produce a hardy, vigorous tomato that is suitable for most climates (McFarlane, Unknown). Daydream, and Grosse Lisse varieties are another potential variety of climbing tomatoes that may do well in Nepal since they do well in hot dry areas, and have a wide climatic adaptability (McFarlane, Unknown). The idea is to have the seeds sown close enough to the terrace walls, that the plants, once they start to “vine-out”, use the terrace walls the same way that they would use a trellis to climb. In **Figure 5** is an example of a terrace wall.



**Figure 5**

In Nepal, the land use is for arable agriculture, livestock grazing or forestry (Brown, 1997). The inhabitants of Nepal grow majority of their own food, and sell what excess they may have to create an income. The use of vining tomatoes that can grow along the terrace walls would make great use of the land, since they will take up little space. Tomatoes are a relatively inexpensive crop to produce, but in order to manipulate the plant to get the best results is to provide the required inputs. These inputs may consist of lime, used to adjust the pH level of the soil, fertilizers, and nutrients. Location of where the plant is being planted is also important since tomatoes like full days of sun. The labour required for producing tomatoes would be at the planting stage, when it comes time to prune the plant, and at harvest.

If the producer decides to use the product for export purposes, to create an additional income, the plant would have to reach the standards of the place it is exporting to, for example Canada. Tomatoes that Canada imports must meet the criteria of Canada

No. 1 or Canada No. 2 tomatoes (CFIA, 2012), classification of No.1 and No. 2 tomatoes is seen above in section 1. Competition that would occur with Nepal producing tomatoes would be when it comes to Canada importing the final product. Depending on the season, the demand for tomatoes could be low, since an abundance of supply may occur. Main competitors would be Florida and California, along with Mexico, as they are the main suppliers of tomatoes in the fresh market of tomatoes during peak seasons (Boyette, Sanders, Estes, Unknown). Nepal could also export the product to other locations that would be able to benefit from the nutritional values, and processing benefits of tomatoes. Other challenges that the producer may face is management against disease and pests. If the tomatoes are not commonly grown in the area, it is hard for the producer to know what pests and/or diseases are around that may affect the health and overall production of the plant. A list of common diseases and pests is given in the first section of the report.

Canada would benefit from the Nepal producing tomatoes by acting as a supplier and a wholesale position in the chain of production. Canada would supply the seed, and import the final product back into Canada, for consumption. Nepal would benefit greatly from altering their crop rotation and utilizing the land to produce tomatoes. Other benefits for Nepal, from the consumption of tomatoes would be the reduction of vitamin A deficiency, and help decrease the rate of people affected by anemia. In Nepal the amount of people who have vitamin A deficiency is approximately 19.6% of women (Ministry of Health, New ERA, ORC Macro, 2001), and 32.3% of preschool aged children (Ministry of Health, Child Health Division, New ERA...,1999). Anemia affects approximately 48.4% of children and 42.4% of pregnant women in Nepal (Ministry of Health and Population (MOHP), New ERA, Macro International Inc. Nepal Demographic and Health Survey...,

2006). From the health benefits given earlier in the report, it is possible to see that the consumption of tomatoes, since they have a high nutritional value, can improve the health, and reduce the main issues of the current health of the residents in Nepal.

In conclusion, both countries would be able to benefit from Canada supplying the indeterminate tomato seeds for the purpose of Nepal growing the crop along the terrace walls, by using the walls for support, in the same way a trellis would work. Canada and Nepal will have potential for a positive relationship, and expansion of import and export commodities. Canada will be a helping hand when it comes to the growing processes of tomatoes since it is more advanced in research on the nutritional and soil requirements, pests, diseases and viruses that can affect the production of tomatoes, it would be a learning experience for Nepal, to improve their knowledge on growing crops such as tomatoes. The health improvements for the country of Nepal will be greatly beneficial, since tomatoes have multiple uses, the consumption of the product would never get “boring”. Depending on the length of the growing season, and since indeterminate tomatoes grow all season long and produce multiple fruit at different stages (Plant Village, Unknown), the chance of there being excess tomatoes available for the producer to market is high. This will be a chance for the producer to create an additional income, an income is ensured in the case of tomatoes since they are rather inexpensive to produce. A package of seeds can be purchased for under three dollars, and the fruit can be sold at a certain amount per pound, therefore the producer will receive profit. The hope is to help increase the economic stability and overall health for the people of Nepal.

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