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Exporting Canadian Apple Tree Shoots to Nepal to Graft onto Nepal Apple Trees

Introduction:

The product intended to be exported to Nepal is apple scions from Canadian apple trees, to be grafted onto rootstocks of apple trees in Nepal. Nepal one of the least-developed and poorest nations in the world and is considered to be a fairly small country when compared to others. It has a total surface area of 147,181 square kilometers; which is just slightly larger than the state Arkansas (Nepal Fast Facts, 2015), and has a rectangular shape (Encyclopedia of the Nations, 2015). Within this total area it is approximated that the population is an average of 30,986,975 people, as of July 2014 (Nepal Fast Facts, 2015). 80% of these people within Nepal’s population are involved with some form of agriculture (Nepal, 2015) which is key for the success of an agricultural related export idea.

Nepal is located in Southern Asia in between India and China (Encyclopedia of the Nations, 2015) and can be divided up into three main regions. There is the

| Regions | Cultivated land | Non-cultivable inclusion | Grassy land | Forestlands | Shrub land | Others | Total |
|------------------|-----------------|--------------------------|-------------|-------------|------------|-----------|--------------|
| High Himalayan | 8 | 1 | 885 | 155 | 67 | 2234 | 3350 |
| High mountains | 244 | 148 | 508 | 1639 | 176 | 245 | 2960 |
| Middle mountains | 1223 | 667 | 278 | 1811 | 404 | 59 | 4442 |
| Hills | 269 | 59 | 16 | 1438 | 29 | 75 | 1886 |
| Terai | 1308 | 123 | 58 | 475 | 30 | 116 | 2110 |
| Total | 3052 (21) | 998 (7) | 1745 (12) | 5518 (37) | 706 (5) | 2729 (18) | 14,748 (100) |

Table 1: Land categories in Nepal by physiographic zones, 1985/1986 ('000 ha)

Source: Taken directly from *Agriculture, ecosystems & environment* (Upadhyay et al, 2009)

Mountain region, the Hill region, and the Terai region (Malla, 2009); however, the Mountain region can be divided into High Himalayans and the High Mountains; resulting in 5 total regions.

This can be seen in Table 1; which not only shows the different regions in Nepal, but also the land types within each area and how much of that land is currently cultivated. The regions that will be focused on for this specific export idea though will be the Mountain and Hill regions, because there

are districts

within these regions that

are already producing

apples (Kipitur, 1999).

Some examples of

districts with orchards

for example, are the

Mustang, Jumla, Humla,

Kalikot, Dolpa, Rukum,

Bagjhang, Bajura, Baitadi

and Darchula (Kipitur, 1999). The reason why districts that are already producing apples are

being targeted is to improve the variety of crop that is already being grown, as opposed to

introducing a whole new idea of farming, to a system that is already established. As seen in

Table 2, the apples in Nepal occupy the most area of land for fruit production, which means

apples are already high in demand and grow well under Nepal's environmental conditions

(Kipitur, 1999).

Nepal currently is undergoing a food deficit (Nepal, 2015), which means that it can be assumed that majority of the Nepalese people are underfed and malnourished. This is where the export idea of grafting apple scions from Canadian apple trees to apple trees in Nepal comes into

| Fruit | Total Area (ha) | Productive Area (ha) | Production (Mt/ha) | Yield Mt/ha |
|--------------|------------------------|-----------------------------|---------------------------|--------------------|
| Apple | 4652 | 3006 | 28595 | 9.51 |
| Pear | 3049 | 2381 | 27339 | 11.48 |
| Peach | 2143 | 1765 | 12819 | 7.26 |
| Plum | 1441 | 1179 | 8294 | 7.03 |
| Apricot | 97 | 63 | 431 | 6.84 |
| Persimmon | 71 | 45 | 328 | 7.29 |
| Total | 11392 | 8439 | 77806 | |

Table 2: Area, Production and Productivity of Deciduous Fruit in Nepal (1997)

Source: Taken directly from DECIDUOUS FRUIT PRODUCTION IN ASIA AND THE PACIFIC. (Kipitur, 1999).

play. Apples are a relatively low cost product and are quite affordable for consumption (Pubols, 1954). The apples in Nepal however, are currently a low quality product (Krap, 2012) in terms of vitamins and minerals. If the scions from Canadian apple trees were grafted to the apple trees in Nepal the results could be extremely positive. It will not only result in higher levels of vitamins and minerals in the apples, but also create a healthier tree that is at less risk to environmental stress factors (Kleinhenz, 2012), due to an increase in strength and durability of the tree (Leohle & Jones, 1990). Producing higher yields for production and increasing profits for the farmer (Kleinhenz, 2012). This is why the following report will focus on the use of Canadian apple scions to graft onto Nepal apple trees as a highly potential export idea.

Part One – Product Information:

Product Explanation:

The product that is being proposed to export to Nepal is Canadian apple scions to improve the quality of apples produced in Nepal. Scions are detached pieces of a shoot or a twig that contains buds from a wooded plant and is commonly used for grafting in agriculture (Scion, 2002). The great thing about apple scions is that there is a large variety to choose from (Eisele and Drake, 2005) for farmers in Nepal.

The reason as to why the Nepal project will focus on improving the quality of apples is because they can be used for multiple purposes. These purposes include: human consumption in forms of ciders, juices, fruit slices and more (O'Rourke et al, 2003).



Figure 1: Apple Scions
Source: (Scionwood-Burnt Ridge Nursery 2015)

In addition to human consumption, if the apples were to go bad then they could be used as animal feed (O'Rourke et al, 2003) allowing the produce to fulfil its multifunctional purposes.

One major benefit of producing and consuming apples is that they contain a large variety of essential nutrients that humans need to consume on a daily basis. Some examples of these nutrients are vitamin C, fiber, and antioxidants (Boyer and Liu, 2004). Apples are also found to have large quantities of phytochemicals such as: catechin, phloridzin and chlorogenic acid, all of which are known to be antioxidants. Studies show that consuming apples can help lower risk of certain diseases; for example, certain cancers, cardiovascular disease, asthma, and diabetes (Boyer and Liu, 2004). This could be extremely helpful to the people of Nepal as consuming apples could help increase their health and possibly prevent a few costly health bills.

In order for the product to be used, farmers in Nepal would have to know about grafting and various grafting techniques. Grafting is a technique that fuses the scion from one plant to the rootstock of another; attaching the two plants together, that eventually leads to a functioning single plant (Jcinick, 2009). Grafting is a technique that doesn't require a lot of equipment to do, which means that the method of grafting is quite affordable for farmers in Nepal and is possibly already a practice in agriculture there. The tools that are needed for this process are a grafting/budding knife and an adhesive tape to secure the two pieces together (Jcinick, 2009), which the Nepalese farmers should already have.

Canadian Producer:

The producer that will be targeted for the export of apple scions is Summerland Varieties Corp. Summerland is located on Rosedale Avenue in Summerland, British



Columbia Canada (Summerland Varieties Corp, 2015). This is optimal for shipping conditions which is highlighted later on within this report. Summerland is a variety rights management company that licenses a lot of fruit tree varieties internationally. This corporation has exclusive commercialization rights from the Minister of Agriculture and Agri-Food Canada which makes them a prime company for exports. Summerland also is the only company that grows virus free scion wood within Canada; which is another reason as to why this company was chosen (Summerland Varieties Corp, 2015).

Summerland has a large variety of apple scions to choose from; containing three buds per shoot. These scions have two fixed price in terms of whole sale production. The first price is \$0.30 Canadian dollars per scion for any order that has one to five hundred scions (Summerland Varieties Corp, 2015). This is equivalent to \$24.0379 - \$12,018.78 Nepalese Rupees (Currency Converter, 2015). The second fixed price for scion wood orders that Summerland provides is \$0.25 Canadian dollars per scion wood if five hundred or more pieces are ordered (Summerland Varieties Corp, 2015). This is equal to \$10,015.45+ Nepalese Rupees (Currency Converter, 2015), depending on how many stocks above five hundred are ordered.

Competitor Producers World Wide:

Canada is not the only place that is capable of exporting product to Nepal, so there are a few competitors throughout the world that Canada would have to compete with. One competitor, in terms of exporting the apple shoots, is located within the United States of America. This orchard is called Kuffel Creek, and is located in Riverside, California, USA (Kuffel Creek, 2015). However, this company sells rootstocks as opposed to scions; though overall their produce serves the same function of improving the qualities of apple trees in Nepal. The stocks

are \$10.00 USD each (Kuffel Creek, 2015), which is equal to \$1,065.68 Nepalese Rupees (Currency Converter, 2015), per rootstock.

Another competitor that could provide apple scions to Nepal is Miapple Farm in Australia (MiApple Farm, 2015). This orchard sells scions that contain four buds each for \$4.00 AUD for each scion stick, plus a \$2.00 AUD charge for labelling each variety (MiApple Farm, 2015). When converted this is equivalent to \$307.859 Nepalese Rupees (Currency Converter, 2015), per apple scion.

Comparing all the Producers Prices:

| Name of Producer | Price of the Product in Canadian Currency for an Individual Stock (Canadian Dollars) | Price of the Product in Nepalese Currency for an Individual Stock (Nepalese Rupees) | Contact information | Reference |
|----------------------|--|---|--|-----------------------------------|
| Summerland Varieties | \$0.25-\$0.30 | \$20.0240-\$24.0379 | Phone: 250-404-0088 Email: info@summerlandvarieties.com | (Summerland Varieties Corp, 2015) |
| Kuffel Creek | \$13.3037 | \$1065.66 | Email: apples@kuffelcreek.com | (Kuffel Creek, 2015) |
| MiApple Farm | \$3.84333 | \$307.839 | Phone: (613) or (03) 9701 3066 Email: peter@miapple.com.au | (MiApple Farm, 2015) |

Table 3: Comparison of Prices for the Apple Scion/ Stock in Canadian Dollars and Nepalese Rupees

As seen in Table 3, the best place to buy the apple scions based on data in this report in terms of cost for the product is from Summerland Varieties Corp. This is because it the most inexpensive per scion when compared to the other orchards. The second best place to purchase the scions for export would be from MiApple Farms because it is still relatively inexpensive for each individual scion. Kuffel Creek however should probably not be considered to purchase product from due to the cost.

Apple Varieties to Graft in Nepal:

There is currently an average of fifteen different apple cultivars being grown within Nepal, but only a certain few are in high demand. These apples that are in high demand for example are: Red and Golden Delicious, Macintosh and Jonathan. This is because people in Nepal claim to like the taste of those varieties (Christensen and Gaire, 2015). Apples of these varieties can be bought from the Canadian producer Summerland Varieties Corp, although with the large selection of scion wood to choose from, farmers may change their practices. If farmers were to start growing other cultivars of apples then there could be an increase in the orchards biodiversity. Meaning there could be larger amounts of apple varieties for consumers in Nepal to choose from to incorporate into their diets.

Market Opportunities:

The sale of apple scions will be targeted directly to Nepal apple orchard farmers from districts in the Mountain and Hilly regions of Nepal that were listed in the introduction. However the Mountain regions will be the most targeted as this are grows more apples than any other region in Nepal (Shrestha and Gautam, 1999). This is to help increase the quality of apples and apple trees in Nepal; which are currently low in quality and production (Krap, 2012). By grafting in these regions the produce from the improved trees can be sold at various markets and stores; which can benefit the people in Nepal. This is because the improved produce (apples) will contain a higher amount of vitamins and minerals; which will be available for many to consume. The main consumers will be the men, women and children of Nepal however, it is assumed that the larger consumer group would be women and children (Swai, 2005), and possibly any tourists.

Benefits to Canada:

If Canada were to export apple scions to Nepal then the Canadian producers of the export would benefit, by being allowed to sell their produce internationally. Increasing their production sales and income. This will not only help support the producer, but support and create more job opportunities for the company. Exporting the apple scions could also increase Canada's overall level of income and contribute to Canada's economic growth. Making Nepal an exporting nation of Canada could also help strengthen the bonds between the two nations, which could lead into many other trade benefits and possibilities (Canada's State of Trade, 2013).

Overall, Canada will have more job opportunities present for Canadian citizens in order to cultivate the scions and prepare them for export. Job opportunities will also become more abundant for Canadian shipping companies in order to get the product to its final destination (Canada's State of Trade, 2013).

Part two – Export Potential to Nepal:

Benefits to Nepal:

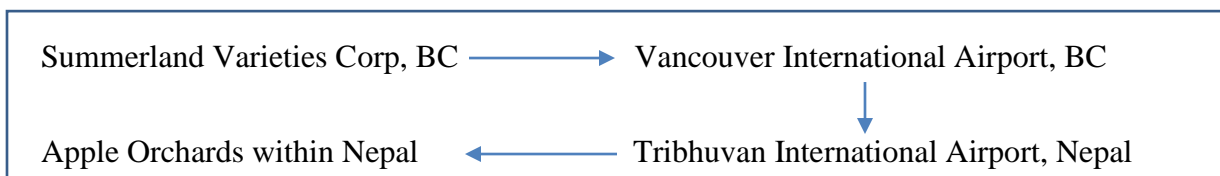
Benefits from grafting Canadian apple scions to apple trees in Nepal are: an increase in plant production, reduce viral, fungal and bacterial contaminations, increase in resistance to saline stress, and more (Rivero et al, 2003). Grafting also allows the apple trees to produce fruit at a faster rate at a reduced risk of disease from soil pathogens (Yassin et al, 2015). Other benefits that could result from grafting in Nepal are: vegetative propagation, avoidance of juvenility, cultivar change, repairs (to fix damaged bark), biotic and abiotic stress resistance, and more (Jcinick, 2009). It is also hypothesized that if the farmers were to increase the quality of their apples produced they could slightly increase the cost for sales if they wish. Resulting in higher income rates for the farmer.

Grafting the apple scions would also have a potential for health benefits for the people of Nepal. After being grafted the apples in Nepal would have a better quality of vitamins and minerals than the apples currently being produced. As mentioned in the product explanation, apples are high in vitamin C, and fiber (Boyer and Liu, 2004). Vitamin C is a critical nutrient for humans and aids in the prevention of certain illnesses (Bendich et al, 1986), which is beneficial to those who are not provided with proper health care in Nepal.

Shipping:

Canadian exports to developing countries has increased a large amount from the years 2002 to 2011, especially to developing areas within Asia. This is critical because it helps increase Canada's total domestic gross product (Canada State of Trade, 2012). Canada is currently setting itself up to ensure that Asia-Pacific transportation is in effect to help create jobs and increase Canada's prosperity (Canada's Asia-Pacific Pathway, 2012). Within this report the method of transportation for the export of goods will focus on air and land transportation.

In order to avoid major trucking fees shipments of the product to be flown directly into Nepal to a major airport. The apple scions could be shipped from Vancouver's International Airport to Nepal's capital Kathmandu, which is where the Tribhuvan International Airport is located (Thapa et al, 2008). The following flow chart is a summary of this shipping process that is easy for all to understand.



Flowchart: Process of Shipping the Export from Starting Location to the Final Destination

The main shipping companies that could be used are: FedEx and UPS. The following table below (Table 4) is a comparison of the two shipping companies in order to compare costs and choose the suitable company that is relatively inexpensive.

| Shipping Company | Price per 30 pound package | Contact Information | Reference |
|-------------------------|-----------------------------------|----------------------------|------------------|
| FedEx | \$540.56 - \$600.60CAD | Phone: 1-800-463-3339 | (FedEx, 2015) |
| UPS | \$688.15 – \$734.52CAD | Phone: 1-800-742-5877 | (UPS,2015) |

Table 4: Prices of Shipping Companies

As seen in Table 4, FedEx would be the more suitable company to choose for shipping the export. This is because it is less expensive than UPS, which would help reduce overall costs; making the export idea more affordable for the Nepalese people. However, shipping in general from Canada to Nepal is very expensive, which could result in this project idea being too costly for the developing country.

Cost Analysis:

In the above paragraphs there were a variety of prices listed in terms of the product cost as well as the shipping fees. The following cost analysis will be based on the lowest costing factors in order to see if the entire export idea as a whole is practical for Nepalese farmers.

As seen above in Table 3, the most inexpensive company to buy apple scion wood from is Summerland Variety Corp. The scion wood from there is quite affordable as it ranges from \$0.25-\$0.30 Canadian dollars per scion (Summerland Varieties Corp, 2015). For the purposes of

calculations it will be assumed that three hundred scions will be purchased. This will result in a total price of \$90.00CAD for the scion wood. In addition to that cost, as seen in Table 4, shipping the product could cost on average, about \$540.56 - \$600.60 Canadian dollars, if the shipping company FedEx is used (FedEx, 2015). When added up the total costs could range anywhere from \$630.56-\$690.60 Canadian dollars, which is equal to \$50,354.26-\$55,148.84 Nepalese Rupees (Currency Converter, 2015). This cost range; due to the large shipping fees, may make this project a bit unrealistic, as Nepal is a developing country. However, there could be ways to help lower the shipping costs for the Nepalese farmers. What that statement means is that the apple farmers in Nepal could order a shipment of scion wood together and split the cost of shipping resulting in reduced overall prices. Or another method to reduce the cost for the farmers is to begin with a small order that does not weigh much; to lower shipping rates, and see if the scion wood improves their apple production, which would result in increased profits. Once this is tested farmers in Nepal could then determine whether or not this project would be financially affordable and profitable for them.

Conclusion:

In summary, despite the large shipping fees, it is strongly believed that the export of Canadian apple scion wood could be quite beneficial for both Nepal and Canada. For Canada, not only would jobs and increased profits be created for the scion wood produces, but Canada as a whole would benefit. Due to the fact that Canada will grow economically as Canadas overall income levels increase. Exporting from Canada to Nepal could also increase the bond between the two nations, which could possibly result in new import and export ideas in the future (Canada's State of Trade, 2013).

As for Nepal there would be an extreme amount of benefits from this export idea. Grafting the Canadian apple scions in Nepal could result in more durable apple trees that would be highly resistant to many biotic and abiotic factors that could possibly harm the tree (Leohle & Jones, 1990). Leading to higher yields from the apple trees in Nepal (Kleinhenz, 2012), containing apples with increased nutritional values; such as increased fibers and levels of vitamin C (Boyer and Liu, 2004). This would then lead to health benefits for the Nepalese people as they would be absorbing the nutrients from the apples that they need upon consumption of the produce.

In order to make this project more realistic it would be highly recommended to look more into shipping and exporting companies; to see if there is a way to lower the final costs. Another recommendation would also be to look into government loans or charities that would like to get involved with this possible project idea. To conclude, it is once again highly recommended to export Canadian apple scions that would be grafted to Nepal apples trees in order to improve the orchards that are currently there, while providing the Nepalese people with a more nutritious product in the market.

References:

- Bendich, A., Machlin, L. J., Scandurra, O., Burton, G. W., & Wayner, D. D. M. (1986). The antioxidant role of vitamin C. *Advances in Free Radical Biology & Medicine*, 2(2), 419-444.
- Boyer, J., & Liu, R. H. (2004). Apple phytochemicals and their health benefits. *Nutr J*, 3(5), 12.
- Canada's Asia-Pacific Gateway. (2012). Retrieved November 28, 2015, from http://www.asiapacificgateway.gc.ca/media/documents/ACCESSIBLE_APGCI_factsheet_e.pdf
- Canada's State of Trade. (2012). Trade and Investment Update- 2012 Retrieved November 28, 2015, from http://www.international.gc.ca/economist-economiste/assets/pdfs/performance/SoT_2012/SoT_2012_Eng.pdf
- Canada's State of Trade. (2013, April 30). *Trade and Investment Update 2012*. Retrieved November 27, 2015, from http://www.international.gc.ca/economist-economiste/performance/state-point/state_2012_point/2012_7.aspx?lang=eng&_ga=1.218092638.979697650.1444196143
- Christensen, J., & Gaire, K. (2015). Understanding sustainable landscapes through the lens of apple growing: cases of Jumla, Nepal and Harcourt, Victoria. *Sustainability Science*, 10(2), 275-284.
- Currency Converter. (2015, November 27). Retrieved November 27, 2015, from <http://www.xe.com/currencyconverter/convert/?Amount=150&From=CAD&To=NPR>
- Eisele, T. A., & Drake, S. R. (2005). The partial compositional characteristics of apple juice from 175 apple varieties. *Journal of food composition and analysis*, 18(2), 213-221.

- Encyclopedia of the Nations. (2015). Nepal - Location and size, Population, Modern industries, Cottage industries, Services. Retrieved November 26, 2015, from <http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Nepal.html>
- FedEx. (2015). Retrieved November 28, 2015, from <https://www.fedex.com/ratefinder/standalone?method=goToResultSummaryPage&isPrevFlag=false>
- Jcinick, J. (2009). A history of grafting. From <http://pubag.nal.usda.gov/pubag/downloadPDF.xhtml?id=39857&content=PDF>
- Kipitur. (1999). Deciduous Fruit Production In Nepal. *DECIDUOUS FRUIT PRODUCTION IN ASIA AND THE PACIFIC*. Retrieved October 16, 2015, from <http://www.fao.org/docrep/004/ab985e/ab985e09.htm>
- Klienhenz, M. (2012). Grafting Gains Momentum. *American Vegetable Grower*, 60(3), 8-8. Retrieved October 16, 2015, from <http://search.proquest.com/subzero.lib.uoguelph.ca/docview/1010768377?OpenUrlRefId=info:xri/sid:primo&accountid=11233>
- Krap, T.D. (2012). 'Markets and livelihoods. Bringing a livelihood perspective to the apple value chain in Jumla, Nepal', M.Sc. thesis, International Development Studies. Utrecht: Utrecht University, from <http://dspace.library.uu.nl/handle/1874/234635>
- Kuffel Creek. (2015). Retrieved November 27, 2015, from <http://www.kuffelcreek.com/applenursery.htm>
- Loehle, C., & Jones, R. (1990). Adaptive significance of root grafting in trees. *Functional Ecology*, 4(2), 268-271.

- Malla, G. (2009). Climate Change and Its Impact on Nepalese Agriculture. *Journal of Agriculture and Environment J. Agric. & Environ.*, 9(0), 62-71. Retrieved November 26, 2015, from <http://www.nepjol.info/index.php/AEJ/article/view/2119/1952>
- MiApple Farm. (2015). Retrieved November 27, 2015, from <http://www.miapple.com.au/mianursery.htm>
- Nepal. (2015). Agriculture. Retrieved November 26, 2015, from <http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Nepal-AGRICULTURE.html>
- Nepal Fast Facts. (2015, July 10). *Canadian National News*. Retrieved November 24, 2015, from <http://go.galegroup.com/subzero.lib.uoguelph.ca/ps/i.do?&id=GALE|A430298276&v=2.1&u=guel77241&it=r&p=AONE&sw=w&authCount=1>
- O'Rourke, D., Ferree, D. C., & Warrington, I. J. (2003). World production, trade, consumption and economic outlook for apples. *Apples: Botany, production and uses*, 15-29.
- Pubols, B. H. (1954). Factors Affecting Prices of Apples. *Agricultural Economics Research*, (3).
- Rivero, R., Ruiz, J., & Romero, L. (n.d.). Role of Grafting in Horticulture Plants under Stress Conditions. *Food, Agriculture and Environment*, 1(1), 70-74. Retrieved October 16, 2015, from http://www.researchgate.net/profile/Rosa_Rivero/publication/236211274_Role_of_grafting_in_horticultural_plants_under_stress_conditions/links/00b495170043787b85000000.pdf
- Shrestha, N. P., & Gautam, S. (1999). Crop-animal production systems in Nepal. In *Proceedings of a* (pp. 77-89).

Scion. (2002). *The American Heritage Science Dictionary*. Retrieved November 26, 2015. From <http://dictionary.reference.com/browse/scion>

Scionwood-Burnt Ridge Nursery. (2015). Retrieved November 27, 2015, from <http://www.burntridgenursery.com/Scionwood/products/94/>

Summerland Varieties Corp. (2015). Retrieved November 27, 2015, from <http://www.summerlandvarieties.com/>

Swai, R., 2005. Utilization and commercialization of indigenous fruit trees in Tanzania. Paper Presented at a Regional Workshop at Kitui, Kenya. http://www.worldagroforestry.org/eca/downloads/Kitui_workshop_report.pdf.

Thapa, R. B., Murayama, Y., & Ale, S. (2008). Kathmandu. *Cities*, 25(1), 45-57.

Upadhyay, T. P., Sankhayan, P. L., & Solberg, B. (2005). A review of carbon sequestration dynamics in the Himalayan region as a function of land-use change and forest/soil degradation with special reference to Nepal. *Agriculture, ecosystems & environment*, 105(3), 449-465.

UPS. (2015). Retrieved November 28, 2015, from <https://www.ups.com/content/us/en/contact/index.html?WT.svl=Footer>

Yassin, Hussen, S., & Hassen. (2015). Review on Role of Grafting on Yield and Quality of Selected Fruit Vegetables. *Global Journal of Science Frontier Research: D Agriculture and Veterinary*, 15(1), 1-17. Retrieved October 16, 2015, from <http://www.journalofscience.org/index.php/GJSFR/article/view/1492/1353>