Canadian-Nepal Export Product: The Rapitest Soil Test Kit

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Introduction

Maintaining adequate soil quality is essential to enable crop production and ensure soil sustainability (Idowu et al., 2009). Soil testing is a critical component of the soil-management system. The purpose of this paper is to investigate and assess the potential of exporting the Canadian distributed Rapitest soil test kit, an inexpensive and simple test kit, to impoverished Nepalese farmers with the aim of increasing agricultural productivity. This paper will first investigate the product, competition and prospective Canadian benefits in Part I before exploring the logistics of transportation and marketing the product in Nepal along with potential Nepalese benefits in Part II. With this simple product there is a potential to link Canadian business and Nepalese agriculture through an innovative approach that would be mutual beneficial and economically viable.

PART I

Product Description

The Rapitest soil test kit (product #1601) is a 4-part soil testing kit with the capability to test for pH, nitrogen, phosphorous and potassium ("Luster Leaf Gardening Products - Soil Test Kits", n.d.). The kit is produced by the American company Luster Leaf Products Inc. at their manufacturing facility located in Woodstock, Illinois ("Luster Leaf Gardening Products - Soil Test Kits",

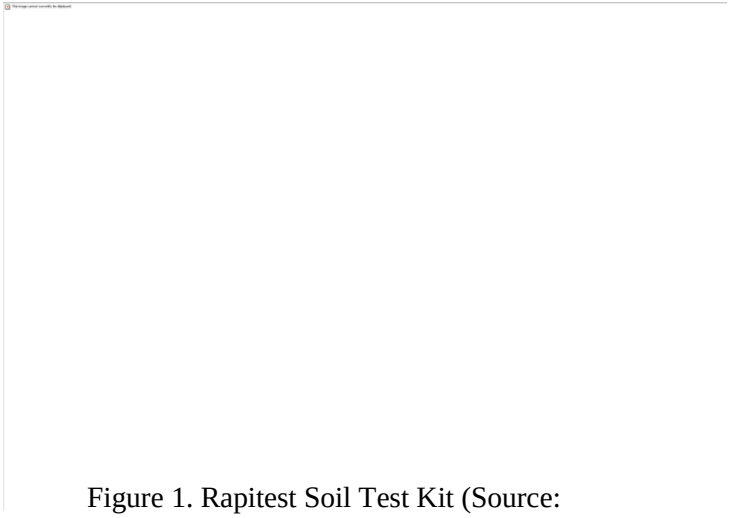

Figure 1. Rapitest Soil Test Kit (Source: http://www.lusterleaf.com/img /downloads/test_kits/1601_inuse.jpg)

n.d.). However, in Canada Lee Valley Tools is a major distributer of the product ("Soil Test Kit", n.d.). Each kit retails in Canada for $21.90 CAD or 1,792 Nepali rupee ("Soil Test Kit", n.d.).

Soil testing is an essential part of crop production; by regularly preforming soil tests, farmers are able to ensure levels of micronutrients and other soil factors are at appropriate levels for the specific crops they are producing (Idowu et al., 2009). With the data produced by soil tests, farmers can make an educated decision on what fertilizers to use to improve crop yield or how to reduce over-fertilization (Idowu et al., 2009). Each of the four soil constituents the kit tests for are critical factors in maintaining crop yields (Someus, 2009). Nitrogen, phosphorous and potassium are the top three limiting factors in plant growth and are responsible for many crucial plant functions (Someus, 2009). Soil pH affects the solubility of nutrients in the soil and therefore, the ability for plants to intake those nutrients (Motschenbacher, Brye, Anders and Gbur, 2014).

More complex 'do it yourself' soil test kits often use liquid reagents, extractions and titrations to obtain test results (Reed, 1956). However, the Rapitest kit uses patented, colour-coded powdered capsules that dissolve in a mixture of soil and water (Luster Leaf Gardening Products - Soil Test Kits, n.d.). "Luster Leaf Gardening Products - Soil Test Kits" (n.d.) describes the kit as being "designed for simplicity of use and accurate results". Each kit contains 40 tablets (10 for each test subject), 4 test specific mixing chambers complete with colour comparison charts, a dropper for adding water, and instructions. For nitrogen, phosphorous and potassium tests one-part soil is mixed with five-parts of water and allowed to settle before testing the water in the mixing chamber. For the pH test, soil is added to the test chamber up to a fill line, then the capsule and water are added and mixed. Full instructions, albeit in English, are enclosed which explain how each test is preformed and information on how to alter soil chemistry to obtain optimal results ("Luster Leaf Gardening Products" - Soil Test Kits n.d.).

Potential Product Modifications

Some modifications could be made to make to Rapitest soil test kit more suitable for Nepalese agricultural practices and therefore more appealing to its target market. Nepal's primary language is Nepali, which is spoken as a mother tongue by 44.6% of the population (National Population and Housing Census 2011, 2012). This renders the English instructions

included in the kit impractical. A solution would be to have instructions translated into Nepali. This can be accomplished by the Canadian translation company All Languages Ltd., based in Toronto ("All Languages Ltd.", n.d.). In an email All Languages Ltd. provided a quote for the translation of the product instructions which came to $390 CAD including tax (S. Lessard, personal communication, November 28, 2016). When discussing written instructions, consideration must be given to the literacy rate of the people of Nepal. Literacy rate is currently 57.4% of the adult population but is increasing as 2011 statistics indicate that 82.4% of individuals between 15 and 24 are literate (UNESCO, n.d.). This means that the majority of upcoming farmers would be literate. To accommodate illiterate farmers or those with limited literacy, basic pictogram instructions could be included given the simplicity of the product.

Included in the original product instructions were suggestions given on how to interpret and implement the test results based on what is being cultivated as different crops require different nutrient levels ("Luster Leaf Gardening Products - Soil Test Kits", n.d.). This could be replicated in the Nepali instructions with a focus on the major crops grown in Nepal such as rice, corn, wheat, lentils and potatoes (Chapagain, 2016).

Canadian Company Description

Figure 2. (Source: http://www.leevalley.com/en/home.aspx)

Lee Valley Tools is a Canadian company based in Ottawa that specializes in home and garden tool manufacture and retail ("Lee Valley Tools", 2015). Lee Valley has around around 500 employees and total sales in 2015 were over $50,000,000. Lee Valley has experience in international exports and is looking to expand the export side of their business, total export sales were in a bracket of $500,000-$999,000 in 2015. They have previously exported products to the EU, Australia, South Africa and Singapore among other locations ("Lee Valley Tools", 2015) In a phone conversation, a representative of Wally Wilson (Manager of Export Sales and Marketing) stated that Lee Valley would consider exporting their products to Nepal if a demand was established (personal communication, November 25, 2016).

Because the Rapitest soil test kit is not manufactured by Lee Valley, only distributed, there are some limitations as to their exportation and sale of the product. According to a sales

representative of Lee Valley Tools they are able to ship the kit to Nepal for sale as long as it meets Nepalese import requirements (personal communication, November 28, 2016). However, as a representative of Luster Leaf stated they are unable to sell the product to another company for retail distribution (personal communication, November 28, 2016). What this means is that if Lee Valley is to export the product they must sell the soil test kit directly to individuals in Nepal or, more plausibly, to the Government of Nepal. This second option will be discussed in further detail in the second part of this paper.

Product Competition

There are many personal soil test kits on the market, varying in testing methods, test subjects and accuracy. However, no kits are manufactured in Canada as far as can be determined. Generally, tests that use liquid reagents and extractions are more accurate than tests that use powdered capsules (Crossen, 2004). However, capsule tests have the advantage of being inexpensive and simple to perform. In every case, laboratory testing is always the most accurate option but can be expensive (Reed, 1956).

Soil Test Kit Comparison

Test Kit	Manufacturer	Test Type	Testable Soil Components	Price per Unit (CAD)
Rapitest Soil Test Kit #1601	Luster Leaf (USA)	Powdered Capsule	pH, N, P, K	$21.90
No Wait Soil Test Kit	Hanna Instruments (USA)	Powdered Capsule	pH, N, P, K	$24.15
Rapitech Soil Test Kit #STK007	Rapitech Instruments Ltd. (Taiwan)	Liquid Reagent	pH, N, P, K	$7.60 (min order of 1000 units)
Garden Kit – Model EL	LaMotte Company (USA)	Liquid Reagent	pH, N, P, K	$39.60

Table 1: Note. data for Rapitest Soil Test Kit #1601 from ("Soil Test Kit", n.d.), data for No Wait Soil Test Kit from ("NPK Soil Chemical Test Kit", n.d.), data for Rapitech Soil Test Kit #STK007 from ("Rapitech Professional Gardening Soil pH, Phosphorous, Nitrogen And Potash Testing Kit Soil
Test", n.d.), data for Garden Kit-Model EL from ("Model EL - Garden Kit", n.d.)

Of the tests above, both powdered capsule tests were practically tested and compared to baseline lab results in an article published in the *Wall Street Journal* (Crossen, 2004). According to Crossen (2004) Rapitest kit results were described as "plausible but unconvincing" (p. 1) while the No Wait kit results were "inconclusive" (p. 1) when compared to lab results. No product reviews could be found for the Rapitech test kit or LaMotte's Garden Kit. In the U.S.A. the Rapitest soil test kit retails for as low as $18.60 CAD from Walmart ("Luster Leaf Rapitest Soil Test Kit", n.d.). When compared to other soil tests the Rapitest kit holds up well in terms of price and reviews. The Rapitech kit from Taiwan could be considered a competitor based on price, however it utilizes liquid reagents that complicate the test procedure. One of the key features of the Rapitest soil test kit is its simplicity of use which is important if it is to be used by small-scale farmers in Nepal.

Canadian Benefits

All Canadian benefits stemming from the export of this product to Nepal would be the result of increased business for Canadian companies. Lee Valley Tools would stand to profit the most as the exporter of the product. Increased sales would result in revenue for the company and the potential for job creation. As Lee Valley is looking to growing the exporting side of their business ("Lee Valley Tools", 2015) this could be a unique opportunity to break into a foreign market. Once established in Nepal there is the potential for Lee Valley to begin exporting other products they produce to Nepal, further increasing sales. The experience gained from exporting to Nepal could also be useful to Lee Valley if they plan to introduce their products to other South-East Asian countries.

Other Canadian companies could also benefit by means of product preparation and the export process. A Canadian company such as All Languages Ltd. could receive business if they

were used to translate product instructions (“All Languages Ltd.”, n.d.) and Canadian shipping company such as A1 Freight Forwarding could be used to transport the product to Nepal (“Freight Shipping & Cargo Shipping by Country”, n.d.). Finally, tax revenue gained from the exportation of the product would benefit Canada as a whole.

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PART II

Introduction to Nepal

Nepal is a South-Eastern Asian country located between India and China ("The World Factbook: Nepal", 2016). Nepal is home to 29 million people, the majority Hindu, and the official language is Nepali. Only 44.6% of the population list Nepali as their mother tongue, however, it is the primary language used in business and government ("The World Factbook: Nepal", 2016). Despite historical political turbulence, in 2006 Nepal made the transition from a monarchy to a federal democratic republic and is experiencing a new era of political stability (International Monetary Fund, 2006).

Figure 3. Map of Nepal (Source: http://huebler.blogspot.ca/2015_05_01_archive.html)

Geographically, Nepal is divided in three regions: Terai, Mid-hills and Mountain (Chapagain, 2016). The Terai consists of subtropical flatlands, most of Nepal's agricultural production is located in this region along with terraced production in the Mid-hill region (Chapagain, 2016). Agriculture is an employs 69% of the population and is responsible for producing 33.1% of the country's GDP (Karki 2015). Despite the emphasis of food production, Nepal experiences chronic food insecurity, 7.8% of the population (2.2 million people) are considered to be malnourished ("Food Security Indicators", 2016). The average farm land holding in Nepal is only 0.7 Ha and 25% of all farmers in Nepal live below the poverty line (Chapagain, 2016). Nepal is one of the world's poorest countries with a GDP per capita of 274,964 Nepalese rupee ("The World Factbook: Nepal", 2016). This is equivalent to $3,365 CAD per year or $280 a month.

Target Market

As previously discussed, the advantages of this kit are that it is relatively inexpensive and simple to use even if it is not the most accurate method of soil testing. In Nepal this kit would be targeting small scale and subsistence farmers in the remote regions of Nepal where proper laboratory testing is unavailable. This kit should be regarded as a tool to assist in soil diagnoses rather than an irrefutable test. Of the 3.36 million farms in Nepal ("Statistical Information on Nepalese Agriculture", 2012) 60% or 2 million are considered small holder farms (Karki, 2015). The Rapitest kit would be targeting these farmers, specifically those in particularly remote regions where it is not possible to perform mainstream laboratory tests. Many of these targeted farmers do not practice regular soil testing or have ever tested their soil before. This would need to be taken into consideration when developing a marketing strategy.

Exporting Process

As Lee Valley Tools would handle the exporting process, it is up to them to decide which company to use to ship the product. In a phone conversation with a representative of Wally Wilson (Manager of Export Sales and Marketing) it was stated that Lee Valley could not release the names of the companies they use to commercially ship their products (personal communication, November 25, 2016). However, in another conversation with a sales representative of the company they explained that in the case of a single direct sale to an individual in Nepal they would use UPS to ship the product (personal communication, November 28, 2016). Because of the products small size and light weight (approx. 9.5in x 6in x 1.25in and 0.33lbs including packaging) it would likely be easier to ship by air directly to Kathmandu rather than ship by sea. A cost comparison chart is displayed to explore several possible choices of shipping companies available to Lee Valley if they were to ship to Nepal.

Comparison of Shipping Companies: Toronto to Kathmandu

Shipping Company	**Estimated Shipping Time**	**Total Price (CAD)**
A1 Freight Forwarding (Canadian Company)	N/A	$978.43
UPS (American Company)	9 days	$1,274.21

FedEx (American Company)	9 days	$7,190.75

Table 2: For each quote each company shipped 10 20in x 20in x 20in boxes weighing 35lbs (capacity of 100 test kits/box) from Toronto to Kathmandu. Toronto was selected as the point of departure because A1 Freight Forwarding was unable to provide a quote for shipping from Ottawa (Lee Valley head office location). In each case the most cost effective method of air transport was selected.

Note. data for Al Freight Forwarding from ("Freight Shipping & Cargo Shipping by Country", n.d.), data for UPS from ("UPS Calculate Time and Cost", n.d.), data from FedEx from ("Get Rates and Transit Times", n.d.)

Of the companies listed above A1 Freight Forwarding should be considered as the best option simply on a price standpoint and will be used in later cost analyses as the example shipping company. It should be noted that Lee Valley may use international commercial shipping companies that will not provide public quotes and may be less expensive than the examples provided. The product itself would be shipped from Luster Leaf's manufacturing facility in Woodstock, Illinois to Lee Valley's Distribution Center in Ottawa, Canada ("Soil Test Kit", n.d.). The test kits would then need to be transported to Toronto for A1 Freight Forwarding to ship, this can be done by Lee Valley themselves as they have retail stores in Toronto that they supply from their distribution warehouse ("Soil Test Kit", n.d.). A1 Freight Forwarding would then fly the product from Toronto, Canada to Kathmandu, Nepal where it could then be distributed throughout Nepal.

Distribution

As aforementioned, it would be a violation of contract with Luster Leaf for Lee Valley to sell the Rapitest soil test kit to a retailer in Nepal for distribution (personal

Figure 4. Rapitest Soil Test Kit (Source:http://www.lusterleaf.com/img/downloads/test_kits/1601.jpg)

communication, November 28, 2016). However, Lee Valley Tools would be able to make a sale to the Soil Management Directorate of the Department of Agriculture of the Government of Nepal who could incorporate it into their soil testing programs. This would likely be a much more effective method of distribution than if the product had been made available for retail sale. The Department of Agriculture of Nepal has stated that their current soil testing service is inadequate if Nepal is to overcome its food insecurity issues and has committed to strengthening the service ("Workshop on Soil Fertility Management Activities in Nepal-Past, Present and Future", 1999).

The Soil Management Directorate of Nepal manages five regional soil test labs but until recently farmers had to bring soil to the labs themselves, which would be impractical for many small scale or sustenance producers ("Soil testing mobile van to help Nepali farmers", 2014). In 2014 the Soil Management Directorate was gifted a mobile soil testing lab bus. However, many of the remote rural areas of Nepal are not adequately serviced with roads and the mobile test lab would be unable to reach farmers there ("Soil testing mobile van to help Nepali farmers", 2014). This is where the Rapitest soil test kit becomes useful. As a small, lightweight kit it could be sent to remote farmers, enabling them to preform soil tests that would otherwise be impossible. If Soil Management Directorate adopted the Rapitest soil test kit as an additional soil testing tool, they would be able to reach a new group of farmers and gather additional data on the status of Nepal's soils.

Marketing Strategy

It would up to the Directorate whether the kits would be given to or sold to farmers, potentially at cost. If the Nepalese Soil Management Directorate was to utilize the Rapitest soil test kit as part of their soil management system, a highly effective implementation strategy would be to provide farmers with free trials so they could experience the benefits of soil testing. This method was used by India's Agriculture Management Centre with great success (Asthana and Kumar, 2008). Farmers were randomly selected to receive free soil test trials, were scored on their awareness of soil testing and ranked either marginal, small or large farmers. Once the project had finished 74% (88 out of 119 farmers) of the farmers continued to have regular soil test preformed, of those 88 farmers only 10 had been testing their soil prior to the study. Of the farmers participating in the study, marginal farmers had the second highest adoption rate of soil

testing (76%) (Asthana and Kumar, 2008). This indicates that once farmers have the opportunity to experience the benefits of soil testing they are very likely to continue the practice. This was particularly the case with the small scale and marginal farmers which the Rapitest kit would be targeting.

Benefits to Nepal

Marginal and small scale farmers have the opportunity to benefit significantly from this product and in turn benefit the nation of Nepal. The purpose of soil testing is to identify what nutrients are lacking in soil and allow the tester to determine the most appropriate method to correct this imbalance. This is a particular problem in Nepal where much of the agricultural soil, especially in the hill regions, is derived from schist, sandstone or granite resulting in nutrient deficient soils and decreased crop production (Anderson, 2007). Soils in the Himalayas, including Nepal, are particularly susceptible to high erosion levels and leaching rates that can lead to further soil degeneration and a lack of micronutrients (Anderson, 2007).

With regular soil tests farmers can determine the appropriate fertilizers and quantity to add to the soil order to meet requirements for optimal crop growth and increase yields (Asthana and Kumar, 2008). Even a small increase in production can have a significant impact on small scale or marginal farmers, enabling them to provide for their families and have surplus food to sell. This is why soil testing is a critical step in breaking the cycle of food insecurity. If Nepal is able to rely on its own agricultural production so sustain its nutritional needs it will be able to rely less on foreign aid and can begin to emerge into the developed world.

Soil testing also enables targeted fertilization, by indicating micronutrient levels the amount of fertilizer needed can be determined (Asthana and Kumar, 2008). This reduces over-fertilization, cutting costs to the farmer and decreasing runoff and environmental impact. Babcock, Carriquiry and Stern (1996) preformed a study examining the benefits micronutrient soil testing with nitrogen as an example and found that fertilizer application could be reduced by 15-41% without a reduction in crop production.

Feasibility

Economically this export idea has potential, logistically however, there are some issues to resolve. Lee Valley Tools purchases each Rapitest soil test kit wholesale from Luster

Leaf Ltd for $10.28 CAD (Luster Leaf Sales Rep., personal communication, November 29, 2016). Lee Valley was unable to reveal shipping costs per unit to ship each test kit from Luster Leaf's manufacturing facility in Woodstock, Illinois to Lee Valley's distribution center in Ottawa, Canada. However, based on UPS freight shipment quote it should cost approximately $539.17 CAD to ship 1000 test kits to the distribution center ("UPS Freight Services", n.d.). This translates to $0.54/unit. International shipping using A1 Freight Forwarding costs an additional $978.43 CAD per 1000 units or $0.98/unit ("Freight Shipping and Cargo by Country", n.d.). Including $1.50 for miscellaneous costs such as employee salaries, transportation to the A1 Freight Forwarding warehouse, export tax and tariffs, etc. the total input cost of the Rapitest soil test kit is $12.80 CAD. If Lee Valley was to sell the kit at its current retail price of $21.90 to the Nepalese Soil Management Directorate, profit margins would be $9.10/unit. In Nepalese rupee the kit would sell for 1791.65.

Approximate Summary of Product Inputs

Inputs	Price (CAD)
Wholesale Product	$10.28
North American Shipping	$0.54
Miscellaneous	$1.50
International Shipping	$0.98
Total	$12.80

Table 3: Note. data for Wholesale Product from (Luster Leaf Sales Rep., personal communication, November 29, 2016), data for North American Shipping ("UPS Freight Services", n.d.), data for International Shipping ("Freight Shipping & Cargo Shipping by Country", n.d.)

Approximate Profitability

Retail Price	$21.90
Inputs	-$12.80
Profit margin	$9.10

Table 4: Prices are in CAD
Note. data for retail price from ("Soil Test Kit", n.d.)

Logistically, problems exist regarding the acceptance of the product in Nepal. Nepal's Department of Agriculture and Soil Management Directorate would need to be contacted to see if interest in the product exists. They may take issue with the level of accuracy of the soil test as it is not as accurate of liquid reagent test and extractions preformed in laboratories. The Soil Management Directorate may also find the price too expensive. If they were to purchase the test kits they would likely have to distribute them at cost to Nepalese farmers. The Nepalese GDP per capita of 274,964 Nepalese rupee translates to 22,9133 Nepalese rupee per month ("The World Factbook: Nepal", 2016). Many Nepalese, particularly impoverished farmers would earn even less and be unable to afford a 1,792-rupee soil test kit. The Soil Management Directorate would either have to give the kit to farmers free of charge or charge a reduced price for the kit. Lee Valley Tools may be able to provide a discount on bulk orders, as in this case, but was unable to confirm (Lee Valley Sales Representative, personal communication, November 28, 2016). The Nepalese government may also be reluctant to order the product from Lee Valley Tools if they would potentially be able to order directly from Luster Leaf at a wholesale price.

Soil Management Directorate Contact Information

Phone: 01-5520314
Fax: 01-5552791
Email: www.doasoil.gov.np

Note. data from (Contacts, n.d.)

Conclusion and Recommendations

In conclusion, the Rapitest soil test kit (product #1601) is potential feasible export item that would benefit both Canadian business and Nepalese agriculture. It has been proven that exporting the kit to Nepal could be profitable for Lee Valley Tools if the Nepalese Department of Agriculture and Soil Management Directorate would be willing to purchase the product and incorporate it into their soil test program. Benefits to Nepalese agriculture are apparent when the increased yields soil testing enables are taken into consideration. To move forward with this concept, the Soil Management Directorate should be contacted to determine if they have any interest in the product. A study should also be implemented to determine the accuracy of the test kit and define how accurate the results must be to allow for effective fertilizer application and crop yields. With co-operation between Canadian business and Nepalese government the Rapitest soil test kit has the potential to benefit all.

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