Assisting Nepal's Agriculture while Benefitting the Canadian Economy using Qubit Systems' Nitrogen Fixation Unit

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Product Information

Product Description

The Q-Box NF1LP Nitrogen Fixation Package (Appendix, *Figure 1*) is a portable unit used to test the Nitrogen that has been returned to the soil by plants, more commonly, legumes (Qubit Systems, 2014). This system is a great product due to its versatility in the workplace. It was designed as an experimental package to measure the Nitrogen fixation by a Hydrogen sensor. The sensor then measures the Nitrogen that has been fixated by testing the amount of Hydrogen gas produced in the soil, as the Nitrogen fixing organisms produce Hydrogen as a by-product of Nitrogen fixation (Qubit Systems, 2014).

Nitrogen is produced by bacteria, which have an Endo-symbiotic relationship with the legume host (Markmann, Parniske, 2009). This relationship is where the plant shares its carbohydrates with the bacteria in order for the bacteria to thrive, and the plant benefits by having excess Nitrogen available (Kuzma M., 2014). The creation of Nitrogen by the bacteria creates Hydrogen, which is what is measured by this package in order to find the Nitrogen produced (Kuzma M., 2014).

The Q-Box NF1LP Nitrogen Fixation Package is able to test a possible three test samples. The four interchangeable channels allow the system to have three Nitrogen fixation testing channels and a reference channel to display the findings (Qubit Systems, 2014). This product has everything available to perform many different tasks on the physical and biological aspects of Nitrogen fixation

using its open-flow gas exchange system (Qubit Systems, 2014). These many different aspects of Nitrogen fixation can be tested with this product, such as temperature of the fixation process, the oxygen regulation, and the inhibition of Nitrogen fixation by an over-abundance of fertilizers (Qubit Systems, 2014).

The cost of this product is $7500 (US) (Palmer G., 2014). This then translates to the equivalent of 459,786 rupees ($1 = 61.304 rupees) (Bank of Canada, 2014). Included in that cost is a 1-year warranty, covering the product (Palmer G., 2014).

Manufacturing and Producing the Product

Qubit Systems is located in Kingston, Ontario, Canada (Qubit Systems, 2014). It is a company, managed and ran by Queens University. They create biological products to assist with teaching and research associated with schools throughout the world (Qubit Systems, 2014).

Each of these products is hand made by a highly trained individual in Kingston (Palmer G., 2014). They are a simple construction in order to reduce problems associated with its use. It consists of a Hydrogen sensor, a gas pump, an oxygen analyzer, and a monitor. There are four interchangeable compartments, with six different channels that can be inserted (Palmer G., 2014).

Inputs Required to Operate the System

The Q-Box NF1LP Nitrogen Fixation Package must be used in a laboratory type environment (Kuzma M., 2014). This includes temporary laboratories, which can

be set up in the field, as long as it is under stable, uncontaminated conditions (Kuzma M., 2014). The unit consists of a long-lasting lithium battery, which can hold a charge for up to two days (Palmer G., 2014).

This product needs to be accompanied by potted samples of the plants (Kuzma M., 2014). The pot should contain a sample of the legume being grown, along with the soil from the location where the plant is grown. Many samples of each plant should be potted and used to get the best statistical information on the product, in order to make the proper growing decisions for the following crop (Kuzma M., 2014).

The tests conducted with this system rely on the availability of the *Herbaspirillum* bacteria in the soil (Baldani et. al, 1986). This bacterium is found at the root of most legumes, which is where they produce Nitrogen (Baldani et al.). In order to test the soil properly, it must be free of added Nitrogen fertilizers (Kuzma M., 2014). The Nitrogen fertilizers have deadly effects on the *Herbaspirillum* bacteria needed for fixation (Kuzma M., 2014).

Labour Required to Operate this Product

The labour required to operate this product is very minimal. Setting up the surrounding environment and preparing the plants in individual pots is the majority of the preparation needed to test the Nitrogen Fixation.

When potting the plants, it is very important that the samples are taken from separate areas on the desired farm/field. This helps to get a better understanding of the land and its abilities as a whole.

Market Evaluation

When evaluating the market for this product, it is unrealistic for the Nepalese people/farmers to buy it. This is due to the realization that the average person's income in Nepal in 2013 was only $1500 (US) (CIA World Factbook, 2013). This would take seven years wages for the average person in Nepal to accumulate enough money to buy it. Therefore, this product is more suitable for the government and the different organizations associated with it. Organizations such as, the Nepal Agricultural Research Council would be a suitable costumers for this product, as it would have many financial and environmental benefits to them and their country (Nepal Government, 2014).

The Nepal Agricultural Research Council was formed to perform research to help inform the people and to improve the overall economic level of the people (Nepal Agricultural Research Council, 2007). The Soil Science Division of the Council would be the primary user of this product. Their main objective is to develop soil management practices through organic and inorganic products (Soil Science Division, 2007). This product would be useful to this division of the Nepal Agricultural Research Council because it provides them with not only information on the amount of Nitrogen being fixated into the soil, but it is also beneficial that this system can be used throughout their research locations as it is portable. It will help them financially as they can produce income from the farmers for doing soil tests on their farms and by also improving environmental issues that would cost the government money.

Benefits to Canada

There are many benefits to the Canadian economy to sell this product to the Nepalese. Some have very little benefit to the national economy, while the possibility of improved trade from this product may have a large positive effect on the economy.

This product will benefit local Canadians as it is manufactured and produced from Canada (Palmer G., 2014). This will employ Canadian people, which will introduce money into our economy.

The largest benefit for Canada, however, is the future trade opportunities that will arise from this product. Canada's largest trading partners in 2013 include: the United States, China, Mexico, Germany, Japan, and the United Kingdom (Industry Canada, 2013). Of these trading partners, China has the largest population working in primary agriculture with over 33% (CIA World Factbook, 2013). The average percentage of the population in agriculture with Canada's top trading partners is approximately 9% (CIA World Factbook, 2013). This shows evidence to support the theory that economic growth follows the human development of a nation, as people become better nourished they in turn, become healthier, and they are able to better contribute to a better economy (Ranis et al., 2000).

It was shown that in Nepal, education could increase the productivity of wheat by over 25%, because the people are better adapted to modern technologies (Ranis et al., 2000). With this product it will help to educate the

grower on more natural ways of producing fertilizers, which would more efficiently allow them to produce food.

As Nepal increases their knowledge on fertilizer use, this will allow them to become more efficient producers of food. The more efficient they become, the more their economy will grow. This will benefit Canada because it will open new doors for other trading opportunities. It will be many years of improvement and new knowledge for the Nepalese, but it will create an economy that will become a more suitable trading partner for Canada.

Export Potential

Cost Analysis

The Q-Box NF1LP Nitrogen Fixation Package is priced at $7,500 (US) plus the tax (Palmer G., 2014). With the 13 % (Canadian) tax, this product will come to $8,475 (US). Nepal also has many incoming taxes, as the border taxes account for almost 50% of their total tax revenue (Department of Customs, 2014).

In order for this product to be cost productive, the government organizations that would own this product may want to charge a small service charge for the service of testing the soil. It would also be beneficial for the Nepalese government to look into an initiative to reduce the incoming customs taxes, since they are benefitting from this product.

Marketing Strategy

In order to market this product to the Nepalese, it first must be sold to the targeted customer (Government Organizations). Following that, it is these organizations, which are responsible for selling the service of these units to the people of Nepal.

Canada and Nepal already have a firm relationship, as it has flourished since 1952 (Government of Canada, 2014). This product, therefore, should be an easy decision for the Nepalese government to make, as the two countries are in a relationship of growth. This is evident in the great increase in trade between the nations. Although minimal for Canada, the Nepalese have increased their trading to Canada by $23 million per year (Government of Canada, 2014). Getting this product into the hands of these government organizations by providing them with the assurance that this product reeks benefits for not only the present, but mostly for the future of their country.

For the government organizations to sell the services associated with this product to the people of Nepal, it is important that they keep in mind the common courtesies involved. The most successful means for the farmer to understand is to sit down and explain the product and it's benefits to the farmer. Once allowed into their presence and once sharing a cup of Chai (tea), it is important to explain that the farmer will not only save money by using less fertilizer, but they will also increase their yields and crop productivity (Centre for Intercultural Learning, 2009).

Distribution to Nepal

Qubit's product has many different distributors throughout Asia, as there are four in China and five in India (Qubit Distributors, 2014). This creates easy access for the customer to acquire these units as they are on either border of Nepal. The closest location to the Nepalese capital of Kathmandu to the South is Kolkata, India (Google Maps, 2014). This is where Bio-Scan Instruments is located and they are a carrier of Qubit's products (Qubit Distributors, 2014).

India would be a good partner for this kind of short transportation transaction from one country to the other, not only because of geographical reasons, but also due to their long-time relationships (Ministry of External Affairs, 2014). The Nepalese people have gained an open borders relationship with the Indian people, creating a stress free transaction of the product (Ministry of External Affairs, 2014).

Product Competition

There are no products quite like the Q-Box NF1LP Portable Nitrogen Fixation Package. Other products on the market only test for possible Nitrogen deficiencies in the crops or test for the Nitrogen in the soil (Agriculture Solutions, 2014). These products may be resourceful, but testing the plant for a Nitrogen deficiency is too late to tell how much fertilizers should have been added to the field before planting. Testing the soil is also helpful to do in order to tell how much fertilizer to put on, but it does not inform the producer of how much natural Nitrogen has been added to the soil.

Agricultural Benefits

Plants in many ways use Nitrogen as a key nutrient. Nitrogen is very beneficial for plant growth, as it is the key to building proteins (Nachurs, 2010). The plant uses Nitrogen to convert it to amino acids, used to form protoplasm, an essential part of cell division. They also become part of the plants stored proteins in the grain, which is extremely important from a health standpoint. With an insufficient amount of Nitrogen available, the plants will usually become shorter and will grow much slower (Nachurs, 2010). Nitrogen is extremely important to plant growth and to ensuring the plants nutritional benefits are at a maximum.

The agricultural benefits from this product are tremendous when used properly. Nitrogen is the most important nutrient in crop production as it is the biggest limiting factor (Fageria, Baligar, 2005). Nitrogen control is also extremely important for sustainable cropping systems. Coordinating the Nitrogen supply with the demand ensures that there is a sufficient amount of uptake for optimum yields (Fageria, Baligar, 2005).

Qubit's product will help to ensure these practices are done properly and more efficiently by ensuring that there is enough Nitrogen, but not necessarily by putting synthetic fertilizers. Instead of synthetic fertilizers replenishing all of the lost Nitrogen from the previous crop, this product will help the farmer to better detect what can be returned to the soil by other plants (legumes).

It has proven on corn that a proper crop rotation can potentially bring yields to a maximum, but with the proper addition of inorganic Nitrogen fertilizer, yields increased by up to 50% (Cline, Silvernail, 2002). This shows that it is

beneficial to take advantage of the fixated Nitrogen in the soil. It also shows that applying the proper amount of fertilizers is extremely important to efficient crop production as the yields were greatly increased.

Environmental Benefits

There are many environmental issues caused by Nitrogen fertilizers due to different means, such as ammonia volatization, denitrification and leaching (Choudhury, Kennedy, 2005). This has been known to cause more permanent problems, such as, atmospheric problems, aquatic problems and most important in regards to peoples health, groundwater pollution (Choudhury, Kennedy, 2005). Improving management practices can reduce these problems.

Reducing the amount of synthetic fertilizers will allow the nutrient runoff to be lessened, which will help with ground water pollution. Fertilizers used for agriculture are usually thought to be the major cause of Nitrate pollution (Addiscott, 1991). This is very important to control because people must have clean drinking water to survive, but they must also have a sufficient amount of food. This system will help them find this balance by introducing the proper amount of Nitrogen needed by using Nitrogen fixation and fertilizers where needed.

Economic Benefits

There will be economic benefits for both the Nepalese. From the primary source, the farmer, they will benefit from Qubit's Q-Box NF1LP Nitrogen Fixation package because it will allow them to gain more from what they have. This product will allow the farmer to spend less money in inputs and gain more out of the crops that he has planted. This may not only benefit the farmer because he is able to make more money off of his land, but it also could benefit the farmer's family by allowing the family to have to spend less on their food. This is greatly beneficial to the families of Nepal in order to advance in the economic class of the world. If the family goes through the calendar year with increased funds still available, this will also help benefit the country as a whole.

As the farmer keeps more of their income, this will increase the amount of taxes owed to the government. It will be very insignificant amounts to the farmer, but as a whole, the government would see gains off of the increased earnings from all of the farmers and their families.

The economy will increase as the agriculture improves. In Asia, there have been increases in infrastructure and decreases in the poverty level and this is due to the ability to perform better agriculture (Datt, Ravallion, 2003). It has shown trends in poverty related to the yields per acres growth rates among the farms in Asia (Datt, Ravallion, 2003).

Overall, this product has many economic benefits, from the farmer's finances, to the government, and most importantly, the entire economy benefits from this product.

Unknown Factors

It is still unknown what it would cost to ship these units to Nepal from India. No shipping prices were found. The exact cost of taxes for this product to get into Nepal is still unknown.

It is also unknown whether or not there are any government subsidy's or aid resources available to help the Nepalese government and it's people using this product.

Product Recommendations for Canada and Nepal

This product is great for the people of Nepal because it provides them with a means of improving their agriculture and overall, their economy. This product will allow farmers to more efficiently grow crops by managing their crop rotations better, along with the proper amounts of synthetic fertilizers being added. This is an advantage, as the cost of production will decrease with less fertilizer used and the yields will increase due to proper Nitrogen amounts.

This product will allow the Nepalese to thrive as a country and will allow them to begin to grow as one of he worlds premier trading partners. This will improve Canada's economy as well as it will eventually allow them to gain stronger partners throughout the world.

Conclusion

Qubit's Nitrogen Fixation Package is very beneficial to not only the user, but also the environment, and most importantly to the many generations to follow.

This product will allow the current generations to thrive in agriculture, paving the way for the future farmers and civilians to live a better, more productive life. It will allow current farmers to practice sustainability, allowing them to realize that the changes they make today, will affect everyone someday.

Qubit's Nitrogen Fixation Package will allow countries to become better at being a part of our world, by reducing pollution of the air and groundwater. By becoming more environmentally friendly this will help the people become healthier, and therefore the people will become a better contributor to the society.

Not only is this product suitable for Nepal, it is appropriate for everyone. Not only will they improve their yields and reduce their expenses, but it is also for people who want to make a change and create a better life for those after them. This product has many benefits that are involved in it, and these are the reasons that the Q-Box NF1LP Nitrogen Fixation Package will become a great aspect of not only Nepalese agriculture, but of the world's.

Appendix

Figure 1 *: Qubit's NF1LP Nitrogen Fixation Package*

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