

Exporting Agricultural Lime to Nepal

Brendon Roberts

AGRI1110



Introduction

Soil is a natural resource which plays a critical role in the sustainable production and cultivation of food worldwide. While agriculture remains the main stay to the Nepalese economy, it is important for growing this sustainable sector to maximum potential. Food security remains paramount to meet the growing needs of Nepal's population which is expected to rapidly increase over the next few decades (S. Brown; H.Schreier; P.B. Shah; L.M Lavkulich / 1999). In this new world era where price instability, pest and diseases, high production and transportation costs compounded with vagaries of the weather, makes agricultural production a huge challenge.

Description of Agricultural lime

Biolime, aglime or agricultural lime-stone is a pulverized product derived from chalk or lime-stone and is added to the soil. (Elsevier B.V/2003). Calcium carbonate is the main active ingredient and there are numerous benefits of agricultural lime on soil, making aglime an excellent export initiative from Canada to further aid Nepalese farmers. Mono- cropping of staple crops such as maize, vegetables and wheat by Nepalese farmers greatly affect soil fertility, reducing soil pH and exhausting the availability of soil nutrients (S. Brown; H.Schreier; P.B. Shah; L.M Lavkulich / 1999).

Terraced hills are also a vital part in Nepalese cultivation (S. Brown; H.Schreier; P.B. Shah; L.M Lavkulich / 1999). While this engineering design has tremendously improved crop production, negative side effects are also endured by farmers (S. Brown; H.Schreier; P.B. Shah;

L.M Lavkulich / 1999). Top soil and organic matter in the uppermost part of the soil profile are greatly disturbed by heavy rainfall. As a result, erosion and leaching of nutrients and minerals occurs, affecting crop quality and yields (S. Brown; H.Schreier; P.B. Shah; L.M Lavkulich / 1999). Aglime is primary responsible for increasing the soil pH by reducing the soil acidity while increasing the alkalinity (Elsevier B.V/2003). Additionally, it increases the uptake of macro nutrients (Nitrogen, phosphorus and potassium) of plants grown on acidic soils and provides a rich source of calcium and magnesium for plant growth (S. Brown; H.Schreier; P.B. Shah; L.M Lavkulich / 1999).

Description of where product is processed in Canada

Canada is well known internationally for the production and processing of limestone since the early 1600's (RS. Boynton/1966). There are many examples of companies involved in this primary industry such as Brookville, the Lime Kiln at the Fortress of Louisburg on Cape Breton Island and Mighty White Dolomite Ltd. Additionally, upper Kent Lime Works Ltd and Gillis Quarries limited are also in mining and production. The use of modern technology and equipment has improved limestone product across the country (RS. Boynton/1966).

Brookville Manufacturing Company which is considered one of the biggest manufactures of crushed limestone in Canada with 90,000 tons being shipped alone in 1984 alone. The company was established in early 1920's (R. Miller/D. Buhay/2014). This leading limestone company have been generating in sales 1,000,000 CAD to 4,999,999 CAD on an annual basis as seen in figure 1.

Furthermore, Brookville exports 1 to \$99,999 CAD yearly and employs 30 individual for the smooth day to day operations as seen in Figure 1. Available products for sale include Dolomitic, calcitic lime and Gypsum in powder form as seen in figure 2 below. Finally, the company has an existing exporting history with the United States, Maine and Michigan while actively pursuing markets in Massachusetts, New Hampshire and Vermont as seen in figure 3.

Operating Name: Brookville Manufacturing Company

Mailing Address: P.O. Box 2332, Saint John, New Brunswick, E2L, 3V6

Location Address: 1360 Rothesay Rd. SAINT JOHN, NEW BRUNSWICK, E2H 2J1

TEL: (506) 633-1200 OR (800) 567-5955, **FAX:** (506) 653-9320

Company Description

Country of Ownership:	Canada
Year Established:	1921
Exporting:	Yes
Primary Industry (NAICS):	212315 - Limestone Mining and Quarrying
Alternate Industries (NAICS):	212323 - Sand and Gravel Mining and Quarrying
Primary Business Activity:	Manufacturer / Processor / Producer
Total Sales (\$CDN):	\$1,000,000 to \$4,999,999
Export Sales (\$CDN):	\$1 to \$99,999

Number of Employees:	30
-----------------------------	----

Figure 1

Source: <http://brookvillelime.com>

Products / Services / Licensing

Product Name	Limestone, Pulverized, Agricultural (Dolomitic and Calcitic lime and Gypsum in powder form)
Product Name	Crushed Limestone NES
Product Name	Fertilizers and Fertilizer materials NES
Product Name	Aggregate, gravel
Product Name	Gypsum
Product Name	Limestone, Fertiliser Filler

Figure 2

Source: <http://brookvillelime.com>

Market Profile

Geographic Markets

Export Experience	Actively Pursuing
<ul style="list-style-type: none"> • United States 	<ul style="list-style-type: none"> • Massachusetts
<ul style="list-style-type: none"> • Maine 	<ul style="list-style-type: none"> • New Hampshire
<ul style="list-style-type: none"> • Michigan 	<ul style="list-style-type: none"> • Vermont

Figure 3

Source: <http://brookvillelime.com>

Benefits to Canada

Limestone exports to Nepal would continue to play an integral part in the Canadian economy, agriculture and agri-food system's as measured by its share of the Canadian gross domestic product and number of Jobs (R. Miller/D. Buhay/2014). The expanding of limestone markets which significantly impact employment for skilled, semi- skilled and unskilled labours. According to statics Canada, 66 individuals were employed in Ontario with the highest distribution share of 48.2% (Statics Canada/2014). Overall 145 individuals are employed across the country in this prestigious industry (Static Canada/2014).

Additionally, foreign exchange earnings by limestone companies have played an essential role of the history and development of communities such as the city of saints John, New Brunswick (R. Miller/D. Buhay/2014). Finally, an additional market for the limestone Industries in Canada is a win for all the citizens of this proud nation.

Cost of Product

Limestone is a very expensive product as a metric ton of limestone cost to the tune of \$100 to \$300 US (Alibaba.com/2015). Therefore I am suggesting that the Ministry of Agricultural in Nepal can purchase this commodity in bulk and subsidies product to farmers for improved productivity.

Transportation logistics

Limestone would be package at the Brookville manufacturing centre and placed on trucks to the Halifax auto port terminal as seen in diagram (A). The product will then be stored into forty feet containers protecting it from the elements of the weather and secured on a cargo boat for shipment into India, illustrated in diagram (b) and (c) below.

From India the product can be trucked into Nepal and stay stored in the forty feet containers at a secure site to minimize cost for farmers. The objective is to ensure that farmers have access to an affordable product to stimulate income generation for themselves and their families. Photos below illustrating the transportation chain of limestone from the production site to shipment location.



(A) <http://www.Brookvillelime.com/agriculture>



(B) <http://www.portohalifax.ca/cargo/>



(C) <http://www.portohalifax.ca/cargo/>

Comparing and contrasting competitive aglime products globally

There are several companies worldwide involve in the production of limestone. Zibo Qilu Chemicals Co. Ltd, a known company from China produces hydrated lime 93% for sale at US \$110-115 for any organisation willing to purchase 18 tons minimum (Alibaba:2015). This promotion strategy can affect the Canadian export limestone trade with Nepal seeing that this company is located much closer in Nepal's region as a chief supplier.

Additionally, Shenzhen Chang Long Technology is another Chinses Company producing 95% Hydrated agricultural lime at US \$100-150 for a minimum of 10 tons (Alibaba: 2015). It is far more expensive to ship one ton of limestone from Canada to Nepal at US \$300 a ton compared to the advertised offer available by cheaper Chinese companies. However purchasing in bulk can seriously reduce price arrangement between Canada and Nepal.

Introduction to agriculture in Nepal

Nepal is a small country located between China and India (Nepal Tourism Board/2012). The country has a surface area of 147,181 square kilometres with a population of approximately 27 million people. (Nepal Tourism Board/2012). Agriculture plays a tremendous

role in the economy, employing 70% of the population and contributes 36% towards the Gross National Product (GNP) (Government of Nepal /2015).

Agricultural Production remains a huge challenge and farmers struggle to produce and take care of their families (USAID/2015). Based on the land use statistics, 28% of the land is used for agriculture, while 12% is utilized as grass land and pasture areas for animals and 39% percent is covered with forest and shrubs as seen in figure 4 below (MOAD/2011, 12).

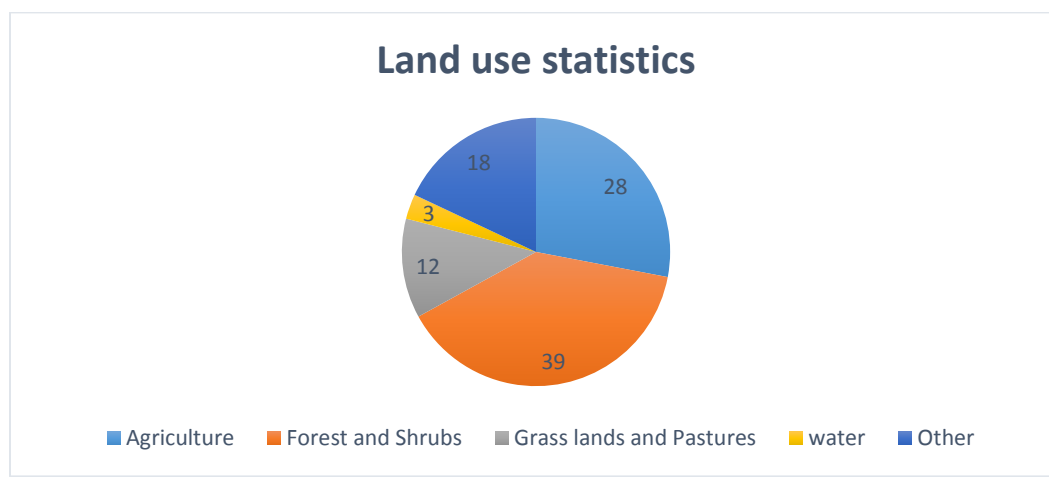


Figure 4

Source: MOAD, 2011/12

Benefits of Agricultural limestone to Nepal

In order to meet Nepal's growing population demand, food and agricultural resource, the improvement of soil fertility is essential (S. Brown; H.Schreier; P.B. Shah; L.M Lavkulich / 1999). Over the last decade, it was estimated that Nepal's population grows by 27% per year (FAO/ 1996), which mean the need for feeding the population will become a serious challenge in the next thirty years (S. Brown; H.Schreier; P.B. Shah; L.M Lavkulich / 1999).

Furthermore, the rapid decrease in soil performance positively correlated with declining results in crop productivity and this poses a huge challenge in the agriculture industry (S. Brown; H.Schreier; P.B. Shah; L.M Lavkulich / 1999). The legume farmers in Nepal have been significantly affected by low and declining soil acidity due to higher rainfall which causes leaching in the eastern part of the country (Pandey, S.P; Yadav, C.R; Sah, K; Pande, S and Joshi, P.K/2000). If the soil pH drops less than 5.0, the producers have recorded sharp reduction in crop yields (Pandey, S.P; Yadav, C.R; Sah, K; Pande, S and Joshi, P.K/2000). Legume production, plays an important role in the Nepalese food system as a major source of protein in their diets (Stefanie Von Westrap; Hans Schreier; Sandra Brown; P.B. Shah/2004).

The Terai region is well known for the high volumes of legume production in a varieties of cropping styles (Stefanie Von Westrap; Hans Schreier; Sandra Brown; P.B. Shah/2004). This productive zone has contributed tremendously to the pulses industry providing, trade, foreign exchange, employment and boosting the country's Gross National Product (Stefanie Von Westrap; Hans Schreier; Sandra Brown; P.B. Shah/2004). Vegetables, citrus and pasture cultivation in the mid hill lands of Nepal also need adequate levels of calcium for optimum growth and production (Stefanie Von Westrap; Hans Schreier; Sandra Brown; P.B. Shah/2004).

Magnesium and potassium levels in the soil is restricted for effective plant uptake, without the availability of calcium present in the soil (Stefanie Von Westrap; Hans Schreier; Sandra Brown; P.B. Shah/2004). Farmers have experienced blossom end rot in tomato production which is a direct result of calcium deficiency in the soil (Franklin L. Davis/1951). This sunken decay at the bottom of fruit makes the fruits unmarketable and can cause reduction of

over 30% in yields, greatly affecting the farmer revenue at the end of the growing season. (Franklin L. Davis/1951).

In order to arrest this situation, a soil test should be taken to determine the soil pH and aglime can be used to increase pH around 6.0-7.0 which is ideal for successful crop of tomatoes, suppressing the occurrences of blossom end rot. (Franklin L. Davis/1951). Good agricultural practices such as these will maximize production and minimize the losses experience by famers in Nepal. Splitting of citrus fruits is also a key sign indicating to producers that the calcium levels should be monitored and amended (Franklin L. Davis/1951). Farmers in Nepal will be forced to take active measures to protect their citrus fruits by in-cooperating biolime early in the production season. Pasture cultivation in the mid hill land for animal consumption is an essential part of the Nepalese agricultural system (Franklin L. Davis/1951).

Agriculture lime play a critical role in the quality of forage and silage material to meet the nutritional needs of livestock production. Soils acidic in nature produces low quality pastures, which normally struggles to achieve proper growth and development due to inability to access calcium and other major soil nutrients. (Franklin L. Davis/1951). In figure 5, the diagram clearly indicate that when aglime is incorporated into the soil it significantly improves crop growth as seem in plant (a). On the other hand when the soil becomes acidic as seen in the illustration with plant (c), it is observed that the plant struggle to grow and fully develop reducing yields.

Effect of aglime on crop growth

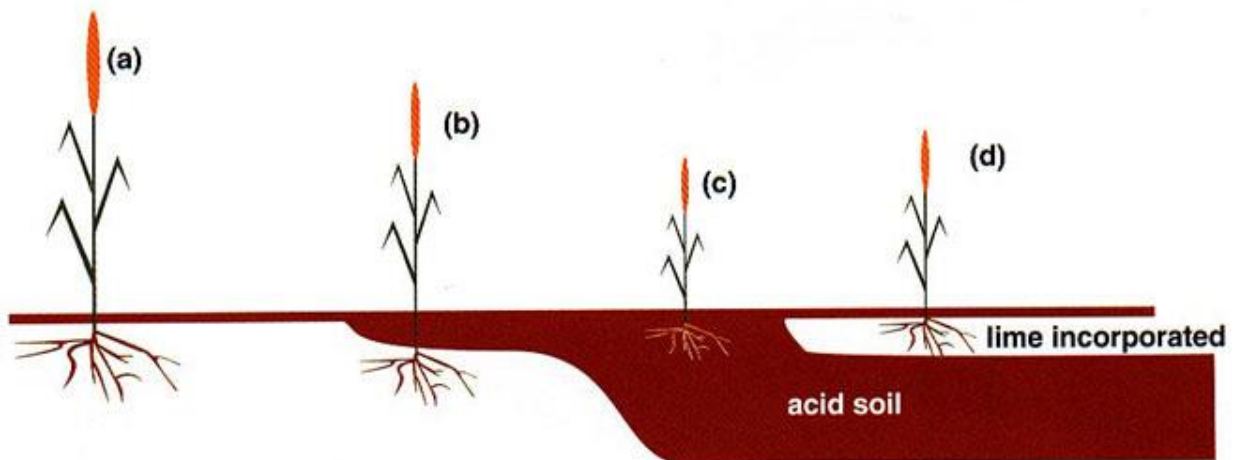


Figure 5.

Source: agriculture.vic.gov.au

Corn is a staple crop which is grown in large quantities by Nepalese farmer in wide range of cropping systems in the mid hill lands on terraced slopes in Nepal. (Stefanie Von Westrap; Hans Schreier; Sandra Brown; P.B. Shah/2004). In order to cultivate corn successfully, the ideal pH range for best results in falls at 6.0 to 6.5 as seen in figure 6 (M.M Alley/1996). Soils pH below 0.3 on a pH scale should be recommended for liming and this can have numerous benefits for soil health, crop and pasture benefits to farmers (M.M Alley/1996).

Materials such as aluminum (Al) can be extremely toxic to plant health and aglime used to correct soil pH will decrease this risk. Liming also enhances the physical structure of soil and

encourages microbial activity (M.M Alley/1996). Macro nutrient uptake including Nitrogen (N), Phosphorous (p), Calcium and Magnesium as well as micro nutrient such as molybdenum become readily available for plant use. (M.M Alley/1996). During the application of aglime, the particles of calcium and magnesium will dissolve, displacing hydrogen (H⁺) ions reacting with the limestone elevating the soil pH (M.M Alley/1996).

The finer particles of limestone will in-cooperate and take effect much quicker compared to the coarser limestone material which will react more slowly (M.M Alley/1996). Common sources of aglime material include Calcium oxide (CaO), normally in the form of lime, burned lime or quicklime (M.M Alley/1996). Calcium Hydroxide Ca (OH)₂ known as hydrated lime, and slaked lime also Calcium carbonate CaCO₃ as calcitic limestone (M.M Alley/1996). Finally, Dolomitic lime stone CaCO₃, MgCO₃ is another source (M.M Alley/1996).

Effect of Liming Acidic Soils on Corn Production

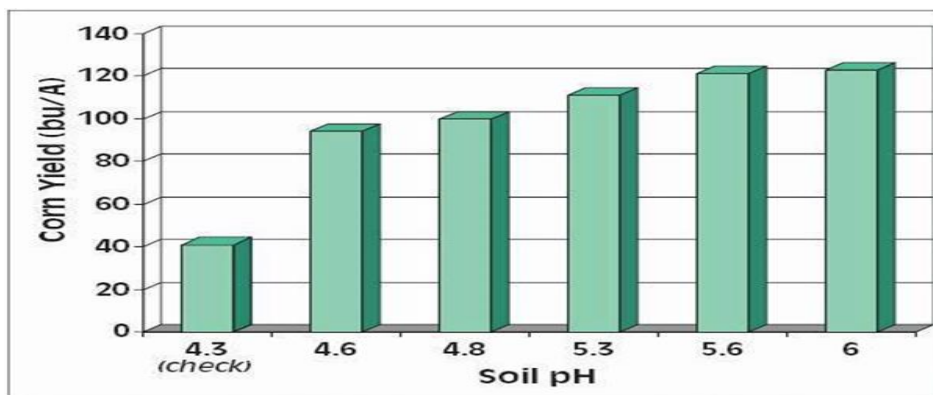


Figure 6.

Source: www.farmwest.com

Application of Aglime

There are many predisposing factors which determine the application of aglime lime to soil such as crop chosen to be grown, liming particle size, soil type and pH as well as convenience (J.B. Peters and K.A Kelling/1998). It is recommended that aglime should be applied once yearly to maintain soil conditioning and improve yields as seen in figure 7, canola production in Canada (J.B. Peters and K.A Kelling/1998). In figure 7, as the pH range increased, crop yield increased. This illustrated a positive correlation between pH and crop yield, this same principle can be apply by Nepalese farmers in their crop cultivation.

Recent experiments have proven that aglime provide the best results when applied after a leguminous crop in a rotation system, indicating that the pH will be raised to acceptable levels by the time any famer is ready to cultivate an acid base crop (J.B. Peters and K.A Kelling/1998).

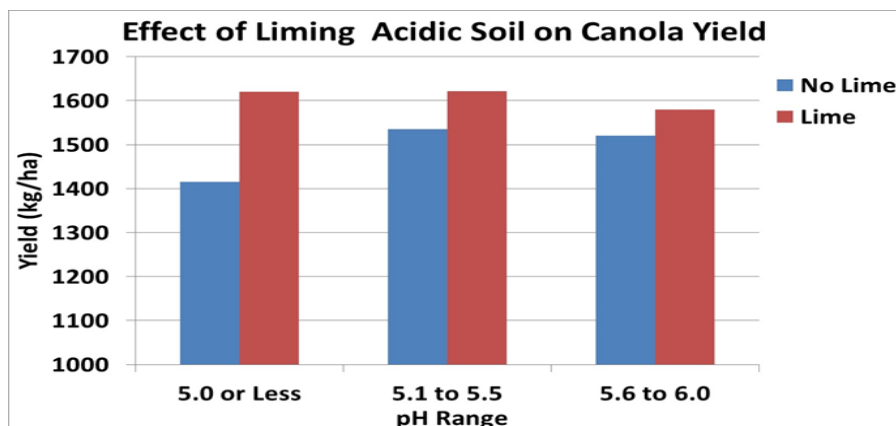


Figure 7.

Source: www.canolacouncil.org

Biolime is best applied before seeding or transplanting, it will not impact crop growth directly after its application, unlike fertilizers. This process takes time as the biolime reacts slower but once applied it can take up to several years before the next application. The finer the liming material the quicker reaction towards neutralizing the soil. (J.B. Peters and K.A Kelling/1998). The coarse liming material is most effective when applied in higher ratios for optimum results and is less expensive.

This product is easy to apply and can be applied to the soil at any time, preferably the dry season after the harvesting of a legume crop or forage utilizing low cost techniques. Nepalese farmers can broadcast this product evenly on the surface of the soil and use garden forks to plow material into lower levels of top soil for maximum distribution and neutralization.

Summary

The beneficial and tremendous effect of suitable soil pH on crop production is too essential to go unnoticed. Vegetables and citrus preference for chief macro nutrients such as Nitrogen, Phosphorus, Potassium, calcium and magnesium and important micro nutrients are taken up much more efficiently when pH is above 6.0.

An effective liming program will reduce the money spent by farmers annually to purchase fertilizer products to improve crop yield while promoting soil health and environmental ecology.

The Canadian and Nepal relationship will greatly benefit both parties, Canada will continue to gain employment in its existing mining and limestone production sector. While on the other hand Nepalese farmers will improve crop yields and broaden income stream for themselves and their families. Since limestone is shipped in bulk and is very expensive, this limits poor farmers, the majority in Nepal to afford this product.

My credible suggestion to Canadian limestone producers to improve export will focus on packaging of smaller limestone bag. Packaging material can include a tough plastic material which can stand harsh weather elements and preservation of product. In poor and developing countries like Nepal and Africa where farmers economic resources are limited and they cannot afford proper storage sheds.

Resistance packaging material withstanding inclement weather would create a competitive edge among other competitors. This is key in securing a unique position in a market in these countries and addressing real world problem faced by potential customers (Farmers).

References

Alibab.com. (2015) Limestone and limestone manufactures and Alibaba.com

From; <http://www.alibaba.com/showroom/limestone.html>

BH Adhikary and R. Adhikary (2003) Enhancing effects of nitrogen on grain production of hybrid maize in chitwan valley. Vol 3, pages 33-41

Brookville Manufacturing Company aglime and crush stone (2015). Retrieved 11: 12: 2015

From <http://www.brookvillelime.com/>

Diane N. Buhay and Randal F. Miller (2014) The historic limestone quarry on green head island in Saint John, New Brunswick, Canada. Vol15, pages 221-225

Elsevier B.V (15June 2005) Agriculture, Ecosystems and Environment. Volume 108, issues 2, pages 145-154.

Elsevier B.V (August 1987), Mineralogical and micro textual changes associated with lime stabilization of murine clays from eastern Canada. Volume 2, issue 3, pages 215-232.

Government of Nepal (2014) Welcome to ministry of agricultural development. Retrieved 11:19 2015, from: <http://www.moad.gov.np/en/>

John K. Muse and Charles C. Mitchell (March 23, 1994) Paper Mill Boiler Ash and lime By-Products as soil liming material. Vol. 87 NO.3, pages 432-438.

Franklin L. Davis (June 1951) Effects of Fineness of Agricultural lime upon crop response. Vol. 43 No.6 page 251

Elsevier B.V (June 2003) optimal frequency and quality of agricultural lime application. Volume 76, Issue 3, pages 949-967

BH Adhikary and R. Adhikary (2003) Enhancing effects of nitrogen on grain production of hybrid maize in chitwan valley. Vol 3, pages 33-41

M.M Alley: 1996 Short term soil chemicals and crops yield response to aglime applications. Vol 80, pages 1-9

Nepal Tourism Board (2012). Know Nepal: Geography. Retrieved 11:26: 2015

From <http://www.welcomenepal.com/>

Pandey, S.P and Yadav, CR and Sah, k and Pande, S and Joshi, PK (2000) Legumes in Nepal pages 71-97

Robert S. Boynton (1966) Chemistry and Technology of lime and limestone, pages 519-542

Shenzhen Chang Long Technology Co. Ltd: Retrieved 11:27:2015

From: <http://www.sz-changhong.com/>

Stefanie Von Westarp, Hans Schreier, Sandra Brown, P.B Shah (2004) Agricultural Intensification and the impacts on soil fertility in the Middle Mountains of Nepal. Pages 323-332.

S. Brown, H. Schreier, P.B Shah and L.M. Lavkulish (June 1999) Soil use and management. Volume 15 issue 2, pages 101-108.

Static Canada, National Static Agency: Limestone Retrieved 11: 27:2015

From: <http://www.statcan.gc.ca/start-debut-eng.html>

USAD. (2004) Agriculture and food security. Retrieved 11:28, 2015

From: <https://www.usaid.gov/nepal/agriculture-and-food-security>

Zibo Qi long Chemical industry Co. Ltd Global Manufactures: Retrieved 11:27:2015

From <https://www.gmdu.net/corp-465026.html>