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Agriculture 1110  
Section 104 Monday 2:30pm  
Due date: November 24<sup>th</sup> 2014  
Nepal Final Project: Polypropylene and Synthetic Mulch Export

## Part One

### Introduction

Agriculture is a large part of people's lives all over the world. The main point of this project was to develop an idea or product, which would be suitable and beneficial to export to Nepal from Canada. Since agriculture is such a big part of many peoples lives, especially in Nepal it seems best to start where it all comes from; the soil. Mulch is a great cover, which will improve the soil and allow it to be suitable for the future generations. It would help farmers, and create opportunities for both Canada and Nepal. This could also benefit people in Nepal allowing new learning experience for people studying soil improvement and conducting research at universities.

### Description of Mulch

Mulch is an organic material that is placed as a layer on top of soil to help improve the quality of soil (Home Depot, 2014). Mulch helps to conserve moisture, regulate soil temperature, reduce

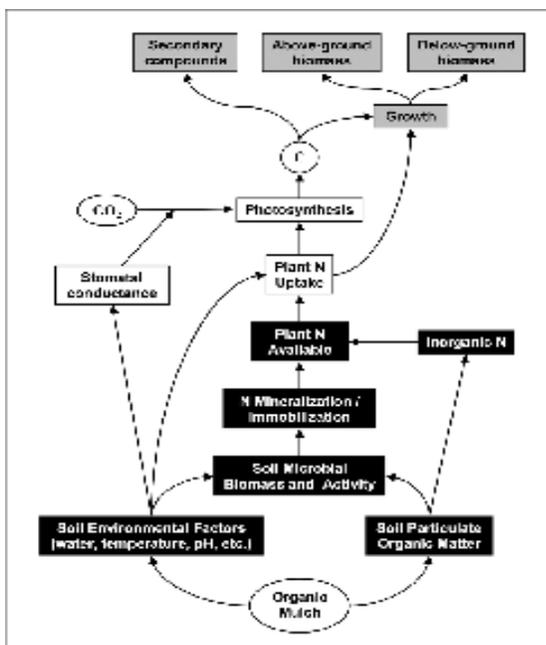


Figure 1 The processes of Nitrogen in mulch

weed growth, and decrease erosion (Home Depot, 2014). Mulch can also prevent soil crusting, damage from heavy rainfalls, and freezing (Kelly et al, 2011). It will also help to increase the nitrogen in the soil depending on the carbon ratio to nitrogen already (Perez and Lloyd, 2009). It actually prevents nitrogen contamination and this is because nitrogen is released slowly out of the mulch as it decomposes, also

preventing any chance of runoff (Perez and Lloyd, 2009). Mulch was actually used in the past in certain crop production until chemical fertilizer became readily available and easier to apply (Perez and Lloyd, 2009). Mulch reduces weed growth by not

allowing germination. It conserves water by blocking out the ability for evaporation as well as increasing the soils ability to hold on to water (Perez and Lloyd, 2009). In some crops like avocado, mulch can actually prevent root rot (Faber et al, 2008). When mulch regulates soil temperature, it can conserve heat in the soil and act as an insulator to prevent plant death at either the beginning or end of a season (Kelly et al, 2011).

### Synthetically made Biodegradable and Polypropylene Mulch

Mulch can either be permanent or temporary. Usually organic mulches are made out of materials like bark, sawdust, manure, and many other materials (Perez and Lloyd, 2009). Mulch can also be made out of plastics and rubber these would be an example of permanent mulch (Corbin, 20113). Polypropylene and biodegradable mulch is a newer technology of mulch filming, which has come out to help crops grow efficiently and protect them yet is still friendly to the environment depending on the material the mulch is made of (Schonbeck, 2012). Biodegradable mulches that are made out of polypropylene have an extra chemical added to the polymer chain are broken down by sunlight and heat (Brown, 2004). The mulch then breaks down into smaller plastic pieces, and then should be removed (Brown, 2004). Other biodegradable mulches are made out of plant starches or sugars, and polyester fibres. These mulches break down by temperature, humidity, and microorganism that live in the soil (Penn State College of Agriculture, 2014).

The polypropylene and other biodegradable mulches still posses some of the key qualities that organic mulch does. They prevent soil erosion, reduce weeding, reduce water consumption in extreme weather, increase temperature of the soil especially if it is dark mulch, and conserve nutrients in the soil (Corbin, 2013). Plastic polypropylene mulches are much more restrictive with water and can actually require drip irrigation (Schonbeck, 2012). It is best to have permeable sheets for best results. With heavy rainfalls these mulches can help prevent further soil erosion and damage

to the plants (Corbin, 2013). These mulches can increase germination and growth of the plants by increasing soil temperature (Schonbeck, 2012). These synthetically made mulches do not provide the same nutritional value to the soil as organic mulches do, but certain biodegradable mulches leave no toxic residues and break down into organic matter (Penn State College of Agriculture, 2014).

Depending the material these mulches are made of will determine if the mulch will break down into toxic or non-toxic pieces (Corbin, 2013). Normal polypropylene plastics will break down into smaller pieces of plastic, and eventually completely dissolve (Schonbeck, 2012). These mulches are not environmentally friendly choice since it leaves behind ketones and aldehydes in the soil (Corbin, 2013). Other biodegradable mulches made with plant material break down into carbon and water which is much more sustainable for the environment (Penn State College of Agriculture, 2014).

#### Canadian Companies and Product Cost and Inputs

When choosing a company it must be taken in to consideration the type of mulch that is desired and which one will be most beneficial as well as economically affordable. The company Dubois Agrinovation has two locations in Canada, one in Simcoe Ontario, and the other one is in Quebec (Secretary of Dubois Agrinovation, Personal Communication, November 20<sup>th</sup> 2014). This company produces a biodegradable black mulch film. This product is produced at their Quebec location and is produced mainly of non-GMO corn (Secretary of Dubois Agrinovation, Personal Communication, November 20<sup>th</sup> 2014). This product leaves behind no toxic residues and breaks down into water. They're currently in the process of being certified organic by USDA (Secretary of Dubois Agrinovation, Personal Communication, November 20<sup>th</sup> 2014). Pricing of their mulch would decrease with the amount purchased for example 48inch x 6000ft of biodegradable mulch would cost around \$355 Canadian (Secretary of Dubois Agrinovation, Personal Communication, November 20<sup>th</sup> 2014). No official quotes were given on bulk prices since these mulch films depend on the soil. These

mulches are also measured in thickness (Dubois Agrinovation, 2014). For more sandy soils a thinner biodegradable mulch would be used, where as for rich and healthier soils a thicker mulch would need to be used since it would break down faster due to the microorganism in the soil (Secretary of Dubois Agrinovation, Personal Communication, November 20<sup>th</sup> 2014). This company does not provide shipping across seas (Dubois Agrinovation, 2014).

Another company considered was Northern Greenhouse, which is a small company, located in Manitoba (Northern Greenhouse, 2014). Their main mulch product is the original polypropylene mulch. This mulch lasts for a few years and can withstand more since it also woven (Northern Greenhouse, 2014). With a similar price to Dubois Agrinovation for \$333 Canadian a sheet of 10ft x 90ft can be purchased and for 10ft x 450ft the price is about \$1,575 Canadian (Northern Greenhouse, 2014). This is not necessarily affordable for most farmers in Nepal. Many companies in Canada sell the biodegradable more environmentally friendly sources of mulch filming. Organic mulches made out of natural materials cost anywhere in between \$25-\$60 Canadian per cubic yard (Home Depot, 2014).

With synthetically made mulches there is a piece of machinery which places the mulch as a layer on the soil. Some mulch can also be placed by hand. Many people also use pegs to help the layer stay firmly down. These other pieces of machinery may need to be taken into consideration depending on the mulch used.

### Opportunities for Canadian Companies

If Canada was able to export a product to Nepal it could create many great opportunities. It would allow for a new relationship and lead to the possibility to become trading partner (Government of Canada, 2014). If Canada was to ship one product it could allow the opportunity for more products creating a growing market and larger global market share (Government of Canada, 2014). It would

help Canada's economy since there was a large decline in exports out of Canada after 2008 as seen in figure 2 and since then its been slowly increasing. With a new trading partner it would allow this trend shown in

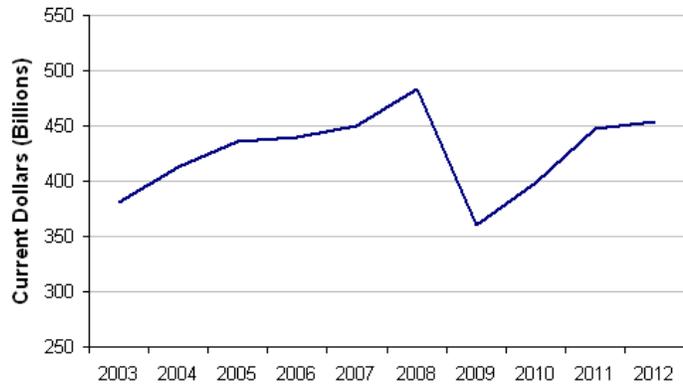


figure 2 to increase and would also allow other foreign companies to invest in Canada (Government of Canada, 2014). For Canadian companies it would allow them to grow larger ultimately increasing sales. The company would receive more recognition as it would be shipped over seas and would possibly open other opportunities for the company (Government of Canada, 2014). This would ultimately create new jobs with a growing company and over seas in Nepal as well.

### Exporting out of Canada

Exporting out of Canada requires a process of steps. First a business number must be obtained and then the export product must be described (Government of Canada, 2014). It must also be determined whether other services will be used to help the progress like custom brokers (Government of Canada, 2014). Then either an individual or general export permit must be obtained and if exports need to be declared then an export declaration must be filled out (Government of Canada, 2014). This process may take a while to process especially depending on restrictions in both countries (Government of Canada, 2014). If the mulch that is shipped out of Canada were to be wood then this would be monitored (Chief Plant Health, 2011). Canada monitors all imports and exports of all non-processed wood materials to make sure no invasive wood species are being spread around (Chief Plant Health, 2011)

### Environmental Stability

Depending on what materials the mulch is made of will ultimately decide what is best for the environment. The original polyethylene or polypropylene mulches are made of recycled plastics (Corbin, 2013). When these mulches eventually break down they break into small little pieces of plastic which can pollute the soil (Corbin, 2013). Once the plastic has broken down in to little pieces it is very hard to remove it all before it's in the soil (Corbin, 2013). This source of mulch is not the most environmentally friendly material that can be used on fields. These mulches usually last up to one growing season yet some can last up to about three years before being replaced (Northern Greenhouse, 2014). If the mulch is removed before it's completely broken down into the soil it goes on to be burned or dumped in a landfill (Corbin, 2013). This will leave behind ketones and aldehydes in the landfills (Brown, 2004). The most sustainable method of mulch for the environment is probably organic matter but next would be the biodegradable ones. Biodegradable mulches are made out of materials that will break down in the environment and will not pollute the soil (Corbin, 2013). These are made out of things like plant fibres, and starches such as corn and polyester fibres (Penn State College of Agriculture, 2014). These mulches will break down in the soil into water and carbon no residue of the mulch behind (Penn State College of Agriculture, 2014). This benefits the soil instead of causing harm to it like plastics may. These sheets will need to be replaced about every growing season for best results (Corbin, 2013).

## **Part Two**

### **Nepal**

Nepal is a country located in South Asia (Khanal, 2014). It is landlocked between China and India, and is home to about 27.8 million people (Khanal, 2014). The country is 147,181 square km and has a capital named Kathmandu (World Fact Book, 2014). Nepal's land can be divided into three main geographical areas, which are: terai also known as the flat lands, central hilly region, and the

Himalayas (World Fact Book, 2014). There are different opportunities and constraints for each region when it comes to agriculture and crop production. This may include weather, soil quality and type, land formations, and many other natural occurrences.

80% of the people in Nepal reside in rural areas (Khanal, 2014). This means that's agriculture is a large part of many peoples lives, and actually makes up about 30% of the annual income (Khanal, 2014). The average annual income in Nepal is only around \$300 USD (Khanal, 2014). The currency in Nepal is Nepalese rupees. 1 rupee is equal to about 0.011 of a Canadian dollar.

Farmers in Nepal usually own smaller areas of farmland. On average a farmer will only 1 hectare of land, which is equal to about 1 and ½ football fields (Khanal, 2014).

### Major Issues in Nepal

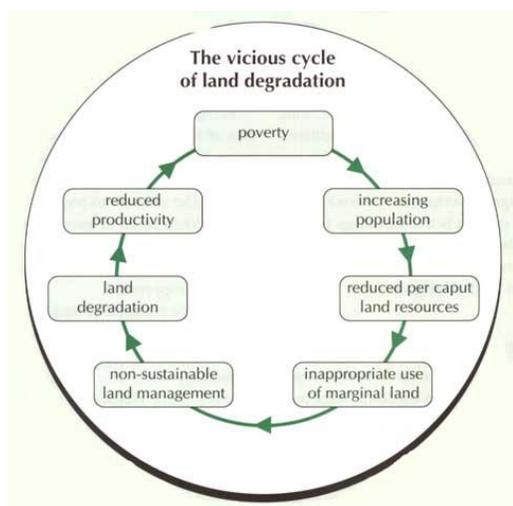


Figure 3 this figure represents land degradation and how it affects poverty

Nepal is a developing country and tends to face different issue than somewhere like Canada. Nepal struggles with issues like poverty, land degradation, water pollution, and extreme weather depending on the season (FAO, 2014). In Nepal poverty is an ongoing cycle and can be directly related to education, politics, and even agriculture. Agriculture is not the

most stable business and this is because many unpredictable things can happen in unstable climates especially when farmers cannot afford newer technology to solve issues (FAO, 2014). As mentioned earlier land degradation is a large issue, which directly correlates to agriculture and poverty. As seen in figure 3 starting with poverty there is usually an increase of population, this results in less useable land. When over use of farming land happens it leads to unsustainable management of land and causes land

degradation. When the land is so degraded it causes productivity to decrease ultimately leading to less sales and right back to poverty.

Transportation

Some companies for mulch provide transportation in Canada but this is usually from companies who produce organic mulch. Most companies who supply synthetic mulch do not provide shipping (Dubois Agrinovation, 2014). If these products were to be shipped to Nepal they would first need to be transported by transportation truck or train to the most reasonable shipping site in Canada. The mulch would then most likely be shipped over seas by boat to either Africa or India. The mulch would then be transported straight to Kathmandu, which is the capital of Nepal, by train or transportation truck. If the mulch were to be transported by plane it would take approximately 22 hours (Khanal, 2014). If the mulch was to be transported by boat and shipped to India it would be in-between a 15 – 20 hour drive to Kathmandu (Google Maps, 2014).

Importing into Nepal

Importing and exporting into any country come with regulations. When moving stuff into

Nepal there must be a bill of entry to import goods into the country or even through India (Government of Nepal, 2014). Also a

<b>Mode of Transport</b>	<b>Insured Value</b>
1. Rail	Customs Duty.
2. Road-trucks belonging to NTWCL/NTC	Customs duty plus an Undertaking by NTWCL to pay the difference of MV- (GIF + Customs Duty).
3. Goods moving by road other than 2) above	MV- CIF

commercial invoice must be present to ensure ownership and payment (Government of Nepal, 2014).

On top of those documents there must be insurance and an import license, and if the product is shipped by sea or flown it will also need a bill of lading or an airway bill (Government of Nepal,

2014). As seen in table 1 the customs will also differ when travelling by land. When traveling by train it only needs to travel through customs. When it's being transported by truck it still must go through customs as well as an undertaking.

### Who Will Purchase this Product and how will it benefit them

In Nepal mulch would mostly benefit farmers and distributors. If the product was first shipped

No. treatment	Total marketable fruit (mt/ha)	Mean fruit size (g/fruit)
1. No mulch	32.7	174
2. No mulch, sods on sides and top of ridge	24.5	181
3. Strip of plastic	33.1	174
4. Strip of plastic, sod on sides	37.7	173
5. Full polyethylene cover + fumigation	39.1	188
6. Full polyethylene cover	38.0	180
7. 112 mt/ha compost	31.1	170
8. 112 mt/ha compost and sod sides	32.9	175
9. 224 mt/ha compost and sod sides	34.4	167
10. 224 mt/ha compost and sod sides	34.3	166
Orthogonal contrasts		
1&2 vs 3,4 & 7-10	**	*
1 vs 2	**	NS
3&4 vs 7-10	NS	*
3 vs 4	NS	NS
5&6 vs 1-4&7-10	**	**
5 vs 6	NS	NS
7&8 vs 9&10	NS	NS
7 vs 8	NS	NS
9 vs 10	NS	NS

NS, \*\*, \*: Nonsignificant, significant at 1 (\*\*) or 5% (\*) levels, respectively

to Nepal it seems that the most suitable thing to do is have distributor or store that would distribute the mulch. From here the farmers or would be able to purchase their mulch for use. Purchasing a product like mulch could be helpful and even critical for more success with

**Figure 4 Comparing yields with and without mulch**

crop production. First these mulches would reduce

the amount of work and weeding farmers would have to do (Corbin, 2013). It does not allow germination of the weed seed and blocks the sunlight from reaching these weeds and provides it to the more desired plants (Schonbeck, 2012). This would help farmers reduce their total amount of manual labour allowing for other important jobs around the farm to be done. Cost efficiency and helping the environment is another main thing mulch is useful for. Mulch would reduce the amount of chemicals and herbicides farmers would need to use on their crops. This means farmers would not have to spray nearly as much if at all on weeds saving money on herbicides. These mulches will also help farmers protect their crops against unpredictable weather. Mulch can be purchased for many types of soil but will differ by thickness (Dubois Agrinovation, 2014). The thickness of the mulch is important for the location whether it is in the mountains or on the Terai land the weather will differ. Nepal is seen sometimes to have torrential rainfall and this could prevent plants from dying and most

importantly prevent soil erosion (Corbin, 2013). Since soil and land degradation is such a large issue in Nepal, one step to help this developing country is making sure they have a sustainable future and land to use. As seen in Figure 4 mulch also increases yields, which is very important and allows farmers to also have healthier crops.

With a product like mulch it may not be the most affordable technology for farmers to purchase every year for about a hectare of land. This can easily be solved though. The best way for these farmers to use polyethylene mulch or biodegradable mulch would be to use it on the most important parts of the land. This could either be their own food supply, or the food they plan on selling.

### Potential for Nepal

Canada exporting a product that is new to Nepal could create many new opportunities for Nepal. Just like Canada, Nepal would be in a growing relationship with a country like Canada. This would allow the potential of Nepal trading and exporting their goods to Canada (Government of Canada, 2014). In Nepal it would help the business of the distributor or supplier that would be supplying the mulch to farmers. This ultimately would open doors for the company and even farmers. Farmers may need assistance placing the mulch layer, which could allow the supplier to hire people who are able to help with this process. In Nepal it could also allow educational experiences for people learning about soil and lead to new studies done by students in Nepal.

### Competition with Other Countries

Since Nepal is landlocked it means that it is surrounded by other countries and is not bordering on any coastlines (Khanal, 2014). To the south of Nepal is China and to the North is India. Both China and India are very large producing

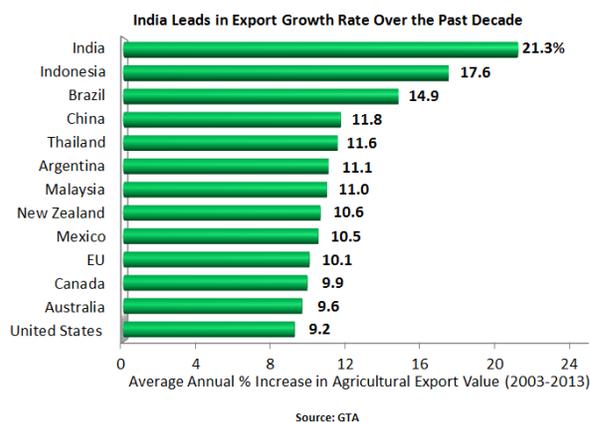


Figure 5 comparing exports from various countries.

companies and are both ranked in the top four countries for exporting over the past years according to Figure 5. These countries produce plastics largely so they have potential to be competition for exporting something like propylene or biodegradable mulch. India and China both have a wide array of rubber mulches for sale (alibaba, 2014). These mulches are more similar to the organic mulches because of the way they're cut. They don't come in the style like the plastic sheeting. These places do sell mulch filming anywhere in between \$1500 -\$2500 US for a ton, or \$12-\$14 US for a roll (alibaba, 2014). Besides these two countries there is other competition, and it actually is from Nepal. Nepal also has company which produces the biodegradable mulch film. This mulch is \$10 USD per roll, no measurements of a roll was given (TOBOC, 2014).

### Conclusion

In conclusion, there are many things to take into consideration when choosing proper mulch to export to Nepal. This opportunity for a relationship between Nepal and Canada would improve both economies and create a larger global market. It would open more doors for more trading and create jobs in both countries. This creates work for people making the product, shipping the product, and then distributors in Nepal. Also very importantly it would help farmers in Nepal. This would allow farmer to reduce the amount of labour like weeding that they must do. It would also allow the soil to improve through water conservation, and increased temperature allowing faster growth and higher yields. Mulch also prevents soil erosion, which is an ongoing issue and can happen anywhere. Soil erosion lowers yields and degrades soil and can cause run off of important nutrients.

When determining what mulch to use farmers must determine the thickness and the material they need. Biodegradable mulch is the most environmentally friendly and is the least labour intensive. Polypropylene mulch is useful but is more labour intensive, less sustainable for the environment, and can cost more than the biodegradable versions. Ultimately the best choice would be

the biodegradable mulch and it could be used on smaller and more important parts of the garden instead of covering the whole farmland with mulch sheeting.

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