

## Apron Technology for Nepal

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### **Pesticides and apron technology in Nepal**

The technology of the personal protective apron is an extremely useful technology that can be implemented in Nepal. Aprons that are on the Canadian market range in price and type of material. For the agricultural communities in Nepal, the best apron would be an apron made from polyethylene which is one of the cheapest materials for making aprons. The use of pesticides on vegetable crops in Nepal has dramatically increased in recent years (Maharjan et al.,2004). Pesticides are used heavily in cotton and mustard production in the Terai region (Kumar Jha and Prasad Regmi, 2009). The average pesticide use in Nepal is 142 g/ha which is very low in comparison to India (500 gm/ha) (Gupta,2004). The most common fungicides that are used in vegetable production are Carbendazim, Copperoxychloride, Mancozeb, Metalaxy 8 percent plus Mancozeb 64 percent (Kumar Jha and Prasad Regmi, 2009). It is also likely that the amount of pesticide used in Nepal is lower than in other countries (Atreya, 2008).

Women make up the majority of the total farming labor force in agriculture (Atreya, 2007). There are very few studies that have been done on the knowledge and practices of pesticide applicators in Nepal (Atreya, 2007). A study performed on the Kavreplanchowk district, mid-hills of Nepal which is located 40km east of the capital, Kathmandu discovered that 93% of males and females accepted that pesticides are harmful to human health and livestock (Atreya, 2007). Even though the Nepalese people know that pesticides are dangerous a total of 31% of females and 22% of males wore the same clothing continuously even after a spray operation was performed can be seen from table one (Atreya, 2007). A protective apron would be useful for when the people are not changing their clothing after a spray operation. The main route of entry of pesticides into the human body is by the skin during application of sprays (Wolfe, 1973). Individuals who wear protective clothing such as an apron protect themselves to dermal exposure when using concentrated formulations of the pesticides. Annual household expenditures on healthcare due to the use of pesticides ranged from 0 to 63.59 US dollars, with an average of 16.8 US dollars (Atreya, 2006). The annual health cost for the country from the use of pesticides was estimated to be \$2.14 million US dollars (Atreya, 2006). Protective aprons

can give the agriculture communities another low-cost equipment option for the usage of pesticides, fungicides, and insecticides. Table two indicates that protective equipment is currently used and put into practice. 14.8% of pesticide applications are still not using any sort of protective gear. Although the applications without gear are low, it should be zero to help eradicate the health care costs.

**Table One: Awareness and practices of pesticide use by gender**

	Females	Males
Decides for the use of pesticide in the household.	No 66% Yes 33%	No 20% Yes 80%
Care of wind direction while spraying pesticides.	No 45% Yes 55%	No 33% Yes 67%
Previous knowledge on pesticide safety.	No 76% Yes 24%	No 63% Yes 37%
Read and understand toxic label present in the pesticide containers.	No 75% Yes 25%	No 47% Yes 53%
Awareness of toxic label present in the pesticide containers.	No 64% Yes 36%	No 38% Yes 62%

**Table Two: Percentage of application in which protective equipment is used**

Protective equipment's	% of Application

Long-sleeved	67.7
Full pants	58.3
Cap	5.3
Handkerchief	14.2
Shoes	11.2
Mask	9.8
Gloves	1.5
Spectacle	<1
Boots	<1
Other (plastic, shawl)	4.1
Without any protective equipments	14.8

Total percentage is >100 since individual may use more than one protective gear in a spray. (Atreya, 2008)

It is very important that the material for the protective equipment is tested for its ability to resist a dilute and concentrated version of the pesticides and fungicides (Staiff, 1982). From a study done on protective clothing for pesticide workers it was concluded that light-coloured and lightweight protective garments such as an apron are generally accepted by workers for use, even in very hot weather (Staiff,1982). Along with the colour of the garment, the amount of pesticide that penetrated the garment was dependent on the concentration, application regimen and the formulation (Staiff, 1982). Polyethylene- coated spunbonded olefin and rubberized cotton provide adequate protection against concentrated pesticide formulations (Staiff,1982). Moreover, a polyethylene apron is the best option for pesticide protection in Nepal agriculture. Not only is polyethylene a good preventative option for prevent entry of pesticides into the skin, Polyethylene is a very cost effective option.

## **Regulations and protocol for Pesticide, Fungicides, and Insecticides in Nepal**

During the green revolution, mid-1960s and 1970s the Nepalese farmers started to use improved seeds, chemical fertilizers and pesticides to grow more food (Shrestha & Neupane, 2002). Pesticide use began in Nepal as early as the 1950s (Shrestha & Neupane, 2002). DDT was common among the Terai and Inner Terai regions. Even though many of the chlorinated hydrocarbons were banned, methyl parathion is one of the most popular insecticides (DOPP,2001). Use of chemicals on the fields in Nepal has become a common occurrence and most of the time these chemicals are spread by the technique of spraying. There are no consumer safety regulations and much of the time expiry dates are unlabelled (Shrestha & Neupane, 2002). A major concern is the Nepalese farmers are not following the recommended waiting period between each time the field is sprayed. This causes much of the crops to contain concentrated levels of chemicals that are dangerous if consumed by humans (Shrestha & Neupane, 2002). Farming communities still have the misconception that pesticides are “medicine” for the field which is the wrong way to look at pesticides (Palikhe, 2002)

## **Manufacturing and Pricing**

Currently, there are multiple manufacturers of aprons and other personal protective equipment. For instance, a Canadian company that goes by the name Ronco is a world class manufacturer of personal protective equipment that is specifically designed for durability, comfort, and value in workplace operations that require protecting the body (Ronco, 2016). This company has also been part of Canada’s 500 Fastest Growing companies for a third consecutive year (Ronco, 2016). Although Ronco is a manufacturer they do not handle their distribution first hand. In order to purchase the aprons, a third party distributor has to be used. An example of a company that distributes polyethylene aprons is Staples. Staples currently sells aprons for \$83.29 for a 500 pack. The currency rate is 81.30 Nepalese Rupees per one Canadian dollar as of Monday, November 21, 2016. Taking the currency into consideration the pack of 500 aprons would cost 6771.13 Nepalese Rupees. Having a farmer buy a 500 pack of aprons would not be logical because of the cost (6771.13 Nepalese Rupee’s). It would be more advantageous for a farmer to purchase the aprons either individually or in smaller quantities. It is necessary for the farming communities to purchase smaller quantities of aprons because on average, a person in

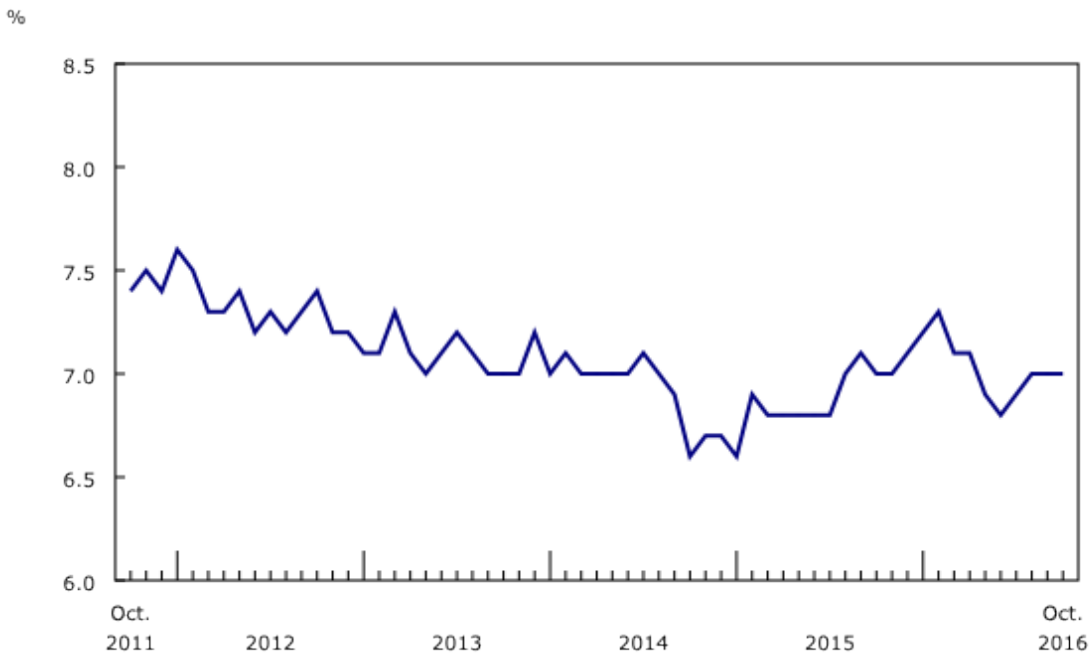
Nepal makes 95% less money than a Canadian (Chapagain, 2016).



### Exporting and Benefits for Canada

Exporting the personal protective apron has significant benefits for Canada. For instance, the manufacturing of the apron in Canada through the company Ronco will increase the number of jobs available for Canadians. The creation of jobs will help lower the unemployment rate. Stats Canada released information on employment for the month of October 2016 and the results showed that employment rose by 44,000 because of the availability of part-time work. Manufacturing sales also rose for the fourth consecutive month (Stats Canada,2016).

Graph One: Unemployment rate for the month of October 2011- 2016



Source: CANSIM table 282-0087, Stats Canada website.

With manufacturing sales on the rise, over the past couple of months and employment on the rise it would be extremely useful for Ronco to sell the aprons to Nepal, doing so will help keep manufacturing sales and employment rate on an incline. Canada is less trade-dependent - using value-added trade measures, Canada's share of global trade falls to 2.9 percent (from 3.1 percent using conventional statistics.) (Canada NewsWire, 2012). Becoming trade partners with Nepal could allow greater access to new technologies and ideas that have been developed in Canada and vice-versa. Canada becoming more integrated with Nepal would allow Canada to be a global figure and strengthen relations.

### **Overview of Nepal**

Nepal is a landlocked region that borders India and China. The capital of Nepal is Kathmandu. The lowest part of Nepal with respect to sea level is Kacanakalana, Jhapa and the highest is Mount Everest which is 8848 meters above sea level (Government of Nepal, 2016). There are over 113 languages spoken but the official language is Nepali. The Majority of the population is located in the eastern region and the total population of the entire country is 26.5 million people as of 2013 (MOE Nepal, 2013). While rich in cultural, heritage and natural beauty, Nepal still remains one the poorest countries in the world (Prennushi,1999). A study in 1995 determined that the per capita income was approximate \$200 which would place Nepal as the 9<sup>th</sup> poorest country in the entire world (Prennushi,1999). Average life expectancy is 64.1 years and the infant mortality rate is 4.6 per 1000 live birth (MOE Nepal, 201).

### **Apron purchasing and franchising**

The personal protective apron can be purchased in large quantity as previously mention in section Manufacturing and Pricing. The most effective form of distribution would be in a wholesale store similar to the Canadian company named Costco. Aprons could also be sold in small stores located in the most remote regions of the Nepal. For instance, aprons could be distributed to a store similar to a hardware store. The most cost effective way for the distributor to purchase this technology would be in mass quantities such as 500 aprons per box. With the majority of the shopping centers located in Kathmandu, it would be profitable to have the aprons sold in the capital. The aprons could be sold individually or in packs of 10. Although the aprons are disposable they can be used a couple of times before a new one would need to be purchased.

Aprons could be sold in Bhat- Bhateni Supermarket and departmental stores. This company has locations across Kathmandu and Pokhara. Bhat- Bhateni also has a full range of 3,00,000 products from 10,000 local and international suppliers (Bhat-Bhateni Supermarket and Departmental Store, 2016). Shipping the aprons from Canada to Nepal would be made through UPS and there is no surcharge for the pickup of the shipment (UPS, 2016). For a 10lbs package of aprons, it would cost approximately 370.54 Canadian dollars to ship the aprons directly from Canada to Kathmandu using UPS Worldwide Express Saver (UPS, 2016). The average polyethylene apron weighs about 0.025 lbs. Therefore, shipping 400 aprons would equal a weight of 10 lbs. In conclusion, shipping and manufacturing of the product would be about 434 Canadian dollars (price of aprons without shipping from Staples website). The price per unit in Nepalese Rupees would be 88.7.

### **Competitor Country**

One of the main countries that is a competitor for apron technology is China. China sells disposable aprons that are on a roll for \$0.0208-0.0236 US dollars per apron. They are a very popular company that is located on the mainland in china and are a gold supplier (Alibaba, 2016). Even though the aprons are technically cheaper they would be more expensive to ship because they are on a roll. The roll would weigh more than having every apron packaged in a plastic wrapping. Ronco aprons are much stronger and would last a lot longer due to the thickness (1.5 mm) of the polyethylene that is used. The main reason why aprons are cheaper from china is because the Chinese do not make the same wage as a Canadian would who is doing the same job. Health and safety costs are much lower than in the United States and Canada.

### **Recommendations**

To sum it up, personal protective aprons made from polyethylene would be extremely useful and effective in stopping pesticides, fungicides, and insecticides used in the agricultural communities from getting on the skin. The skin is the main entry point for pesticides to enter the bloodstream and affect the human body (Wolfe, 1973). An apron would be a simple form a protective that does not require a lot of knowledge on how to put it on. Studies have shown that Nepalese do know that pesticides are harmful to the human health but they do not have the resources to take

the proper precautions (Atreya, 2007). Not only would aprons benefit Canada it would also have a significant impact on Nepal. With this technology being implemented, it would be beneficial for Canada to connect with Nepal and help the government enforce tighter regulations on pesticides. The most important aspect of the apron would be the ability for it to protect from the pesticide. Keeping the cost low would be key to implementing the product into Nepal. Adding information or an infographic of the effects of pesticides in the apron packaging would also be a useful method of teaching the people and providing some kind of education on the dangers of chemicals that are spread on the fields. Cracking down on the companies that are supplying expired pesticides to poorer nations would also play a role in the protection of human health. Knowledge about application, types of chemicals, and precautionary measure to take is the only way that things will begin to change in Nepal. The price per unit is still high when shipping is included in the price. It would be recommended to look into options of travelling less distance to get the product into Nepal, such as using the distribution location in China.



**Reference:**

Atreya, K. (2007). Pesticide use knowledge and practices: A gender differences in Nepal. *Environmental Research*, 104(2), 305-311.

Staiff, D. C., Davis, J. E., & Stevens, E. R. (1982). Evaluation of various clothing materials for protection and worker acceptability during application of pesticides. *Archives of environmental contamination and toxicology*, 11(4), 391-398.

Palikhe, B. R. (2002). Challenges and options of pesticide use: in the context of Nepal. *Landschaftsökologie und Umweltforschung*, 38, 130-141.

Manandhar, G. B. (2005, November). Agricultural Engineering Research and Development in Nepal. In *1st United Nations Asian and Pacific Centre for Agricultural Engineering and Machinery (APCAEM) GC/TC Meeting, New Delhi, India, November* (pp. 21-24).

Palikhe, B. R. (2016). Pesticide Management in Nepal: IN the view of Code of Conduct. Food and Agriculture Organization of the United Nations.

Cockburn, J. (2002). *Trade liberalisation and poverty in Nepal: A computable general equilibrium micro simulation analysis*. University of Oxford, Centre for the Study of African Economies.

Kathmandu, N. (2009). Productivity of pesticides in vegetable farming in Nepal.

Jayaraman, T. K., & Shrestha, O. L. (1976). Some trade problems of landlocked Nepal. *Asian Survey*, 16(12), 1113-1123.

Atreya, K. (2008). Health costs from short-term exposure to pesticides in Nepal. *Social Science & Medicine*, 67(4), 511-519.

Prennushi, G. (1999). Nepal: Poverty at the turn of the Twenty-first century. *The World Bank South Asia Region Internal Discussion Paper, Report no. IDP, 174*.

Monitor, Evaluation, and supervision Division, (2013). Retrieved November 28, 2016

DOPP (2001) Jibanashak Bisadi Ain, 2048, Jibanashak Bisadi Niyamawali, 2050 Ra Panjikrit Bisadiharuko Adhyawadhik Suchi (Pesticide Act 1991, Pesticide Regulations 1993 and Updated List of Registered Pesticides). Plant Protection Directorate (PPD), Department of Agriculture, HMG, Nepal

Shrestha, P. L., & Neupane, F. P. (2002). Socio-economic contexts on pesticide use in Nepal. In *Proceedings of the International Workshop on Environmental Risk Assessment of Pesticides and Integrated Pest Management in Developing Countries* (pp. 205-223).