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Post-Harvest Loss and How It Can Be Reduced

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ARTICLE INFO

Article history:

Received 16 January 2016

Accepted 21 May 2016

Keywords: Post-harvest loss, food insecurity, education, international conference

ABSTRACT

Post Harvest Loss (PHL) is a worldwide problem that hurts both producers and consumers. Although PHL solutions are simple, they are not easy to implement. Because the causes of PHL are so varied and diverse, the solutions themselves must also be varied and diverse. A blanket solution will not work, and real changes will only happen when scientists, policy makers and community leaders come together. Educating producers and consumers alike will make a huge difference in reducing PHL. When PHL is reduced, less food will be wasted and the overall quality of life can be improved for people around the world.

INTRODUCTION

Post-Harvest Loss (PHL) is a problem that affects the world's supply of grains, vegetables, fruits and other agricultural commodities. Because any loss after food has matured is considered post-harvest, we are left with a very broad definition of PHL that is necessary to encompass all the ways that food is lost. PHL includes losses because of loss of weight of product and loss of quality (Lucia & Assennato 1994). While food is lost all over the world, the causes and potential solutions for these losses are very different depending on where and in what stage the post-harvest system the losses occur.

Before individual problems related to PHL can be identified, it is important to understand why PHL is a problem. A major effect of PHL is increased food insecurity. According to the United States Department of Agriculture (USDA), food insecurity

is the "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable food in socially acceptable ways" (Coleman-Jensen et al. 2015). PHL is a greater concern in areas of the world other than the United States. However, in 2013 it was estimated that 50 million people in the U.S. resided in households that the USDA described as food insecure. It is shown that food insecurity has a negative effect on the health of someone who lacks proper nutrition. Although food insecurity and PHL are not the same things, food insecurity in the United States and around the world could be reduced if PHL itself was reduced. Food insecurity could be lessened if there was more food to go around. By reducing PHL, more food would be available at cheaper rates. This has opened the eyes of many policy makers as they seek to make sure their constituents go to sleep each night with

adequate amounts of food (Gundersen & Waxman 2015).

Another negative effect of PHL is the amount of agricultural resources wasted because of losses. Around the world, 30-50% of food grown goes unconsumed. This means that 30-50% more food could be eaten with the same resources allotted today if PHL was eliminated. This statistic is huge when the stresses placed on energy and water supplies are considered. If PHL was eliminated, these same resources that are wasted today could be used for other purposes. Each day the world population continues to grow, and with it also grows the need to have food to feed the extra mouths (Aulakh & Regmi 2015).

PHL is extremely devastating to Sub-Saharan Africa. Twenty-four percent of the people in this region are undernourished, and the population is expected to double over the next 35 years. Yearly losses here are equal to about \$4 billion USD, 13.5 % of total grains produced, or enough food to adequately feed 48 million persons for one year (Stathers et al. 2015).

The post-harvest system is a complex, multi-faceted route that food takes as it goes from the producer to the consumer. The stages of this system are harvest, drying/storage, transportation, processing, and retail. Some stages have more loss than others, but in every stage, improvements in procedure, policy and technology can help reduce PHL.

This paper looks at the different causes of postharvest loss and what can be done to reduce the loss in each particular situation. While a blanket solution would be very simple to solve the problem of PHL, the range of problems occurring is too large around the world to fall under one simple, concise solution. Because of this, the solution to fixing PHL must be a worldwide effort.

Countries all over the world must come together to make changes in procedure and governmental policy to solve the problem of PHL.

Harvest

The first stage in the post-harvest value chain is harvest itself. Losses in this stage are generally caused by poor handling practices by the harvesters. Consider, for instance, the strawberry. A major cause of losses to the strawberry is bruising. Studies have shown that bruising is caused by force enacted upon the fruit. This force may result from compression due to inadequate storage techniques in the harvesting process, because of carelessness of the harvester (i.e., being rough with fruits), or from temperature increase. Studies have also shown that harvesting food at times other than its peak harvest time can negatively affect quality (Abayomi et al. 2015). PHL could be reduced in this situation with greater vigilance on the part of the harvester, and also a better understanding of proper harvesting times.

Another case of PHL in the harvest stage occurs with olive trees in Morocco. The current method of harvesting olives involves beating braches with a stick to cause the olives to fall to the ground. While this makes it easier to obtain ripe olives, this also can have extreme negative effects on olive quality and quantity in the future. During the beating process, the flowering parts of the olive tree may be knocked off which causes a loss of up to 100 % for the given tree. In extreme cases, it is not unheard of for olive trees to only produce every other year. Beating the olives also can raise acidity in the subsequently made olive oil, reducing the quality and the likelihood of consumer consumption. These losses could be reduced if cost effective equipment such as machines was made available to individual farmers. An olive picking machine

generally has a long arm with a basket on the end. This basket is extended to the olives and a slight vibration is applied allowing for the olives to fall without flowering parts. These machines are more efficient at harvesting olives and would prevent the loss of flowering parts, substantially reducing PHL for Moroccan olives (Bonfour 2015).

Harvesting at the proper time is critical to the prevention of PHL. If an agricultural product is harvested too late, then it may rot in the field, or become more susceptible to the losses from animal damage. These types of losses could be qualitative or quantitative, negatively affecting the ability to nourish consumers and reducing the economic value for producers (Lucia 1994).

Drying and Storage

The next stages of the post-harvest value chain are drying and storage. Drying and storage go hand in hand, but are not the same stage. The drying of crops, particularly grains, happens before the storage process. Many believe these stages are the cause of the majority of the losses. Losses during this these stages are due to inadequate drying, which lead to increased mold and or insects in the agricultural product (Lucia & Assennato 1994). Different parts of the world have different insects that affect their crops, but most PHL from this stage could be reduced with the use of hermetic storage solutions.

This storage method requires storing the grain in airtight containers. While in storage, grain respire using up the available oxygen and producing more carbon dioxide. With no oxygen, the likelihood of mold and insect growth are substantially lowered. High temperatures, common in areas where this technology would be used, would also add to the suffocating effect of the bags. As temperatures are increased, the rate of respiration for all insects increases. This causes

the available oxygen to be consumed more rapidly inside the hermetic storage containers and increasing the death rate of insects. These bags create a lethal dose of carbon dioxide that is proven even in elevated levels of oxygen (Somavat et al. 2015). Hermetic storage solutions are also beneficial for the environment because they need no chemicals to eliminate pests (Abalone et al 2011; Villers et al. 2010). By keeping pests out, PHL in this stage can be significantly reduced.

Transportation

Transportation is the next stage of the post-harvest system. Many transportation losses are caused by substantial lengths of travel time and by poor handling practices during the transportation process. It comes as no shock that when perishable foods are left unrefrigerated for long periods of time, losses occur. Transportation losses can also occur because of poor handling by workers. Bumping of pallets, improper loading of products, and overloading of vehicles could all be eliminated through the knowledge of a trained professional. Ventilation is also highly important to reducing PHL in the transportation phase. As many transportation vehicles are unrefrigerated, it is important that all vehicles allow for proper air circulation during transportation. Poor air circulation causes food to go bad faster and can negatively impact the quality of food delivered to consumers. A cause of loss that has no current solution is poor driving on the part of the transporter. Even though a vehicle may be loaded and ventilated properly, losses can occur due to negligent practice of the driver. Good hiring practices are the best available method to combat these losses. Most of the losses could be eliminated by adjusting current transportation

and handling practices (Agarwal & Dhingra 2015).

Processing

If produce is sold, but not eaten fresh, it is transported to a processing center. Poor levels of quality can cause the losses in this stage of the value chain. For example, some pineapple from Uganda are dried and then exported around the world. The other markets around the world often expect extremely high levels of quality. But, due to poor climate conditions in Uganda, the quantity of produce rejected by the overseas markets can be substantial. If the crops are rejected, then they will go to waste as there is no local market for them in Uganda (Troeger et al. 2015). PHL could be reduced if there was a local market for these dried pineapples, or a better standard of quality so that they may be exported.

Retail

The final step of the post harvest value chain is the retail stage. Although this stage is at the end of the production series, it is the most crucial in terms of economic gain. Damaged crops in this stage do not mean a reduction of weight, but a loss in profit. In

CONCLUSIONS

In conclusion, PHL contributes to the growing scarcities of energy and water, while also leaving people hungry at night and causing economic loss. If these losses could be reduced, then it would benefit much of the population. As the world population continues to grow, it is important that PHL are reduced and solutions found to improve food security and eliminate food scarcity. These solutions could include technological advances, more education for producers and handlers, or better marketing strategies to find ways to use damaged food. Education seems like the most basic solution as it can be implemented with

a study done by Compton et al (1998) on the value of maize damaged by insects, a price decrease between 0.5 and 1 % usually resulted for every 1% of damage in excess of 7%. A similar study done by Jones (2012) showed that for every 1% of damage in the 10-30% range caused a price discount of about 3% (Lowenber-DeBoer 2015).

Not all effects of PHL are harmful however. Although these damages equate to a loss for a seller, often times the consumer can get a good price for the damaged fruit. Consumers with small budgets often times look for damaged goods because they know they can get a lower price with minimal loss of quality. They work around the damaged parts and serve the food to their families (Troeger et al. 2015).

The main problem in the retail stage is that produce sellers are left with whatever they can get, damaged or not. This causes a price loss for sellers, who have no alternatives. This has huge consequences for small dealers who are trying to provide for their families and make a living.

current equipment to discontinue bad practices when handling produce. When these practices are eliminated, PHL can be lowered in all phases of the post-harvest system. Cost-effective mechanical advances that aid in harvesting could reduce grain loss in the field. Another big reducer of PHL is new technology. Any technological advances must be either created for or adaptable to small farms. In order to ensure a more sustainable system of growing, processing, and selling food, PHL must be eliminated.

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