LEADING QUESTIONS SECOND WEEK

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety aspects? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste' only. Do not include non-food parts -- the Moderator]

Q10. In your opinion, how can 'non-food parts' be secured and used as animal feed, without compromising feed safety aspects? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste may please also be kept in mind.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Q12. What role do you see for the food industry in making use of 'non-food parts' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Second week, message 117: Opinion on questions 8

Dr Perfecto Buyamba KABANSHI, State Veterinarian, Zambia.

[Welcome Dr. KABANSHI for opening the second week discussions. Moderators]

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

Response:

a) There must be adequate technological expertise to render the food which is unsuitable for human consumption fit as feed for animal consumption. The food [related to Q8, food is a crop… Moderators) must undergo nutritional laboratory tests to certain suitability as ingredients for animal feed and then used to produce appropriate feeds.

b) Institutionally, I feel there are possibilities of coming up with FOODTRANSFORMATION industries that can transform food into feed.

c) There must be policies in place that can help guide the transformation of food unsuitable for human consumption to suitable feed for animal consumption as a way of public good disposal. For example, human food about to expire can be transformed into ingredients for animal feed.

Second week, message 118: Opinion on questions

Rogerio M. Mauricio

Animal Science Bioengineering Department, Federal University of Sao Joao del-Rei, Brazil

Dear moderators, thanks for the opportunity to be part of this important contribution for the world!

Q8*. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?*

In Brazil, if this occurs, the decision for the use of the "residue" is done by the farmers and no policy is already implemented for this act. If farmers have agriculture and livestock business, they normally will leave the area for grazing or according to the grain quality, and if it is economically viable, they can harvest and send for animal feeding.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts –Moderators]

Harvest- It is an important question but without answer at the moment as we do not have any legislation for it. Therefore, in Brazil, the decision on the use will depend only by the farmer criteria.

Post harvesting-their use varies according to quality (ex. broken grains could go to milling industry if not contaminated etc.) or even direct to animal feeding industry, but varies according to the economy value.

Processing- The same approach as described for Post harvesting.

Distribution and consumption stages: The decision varies according to the company, no legislation at all.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

It will depend on the legislation! From my point of view we need to take the decision of "how to use no-food parts" from people and transfer them according to rules defined by polices. However, other questions come out: how the control will be done in an enormous country like Brazil or even in several others in Africa? Or Asia? Do we have labs to do feed analysis? It is a complex problem!

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

When I start to think about this question a second time, something more important, comes out to my mind: Have you got the same food waste every harvesting, post harvesting, processing distribution? Of course not! As it will depend on several aspects (climate conditions, type of processing etc.) that can change the co-product. Therefore we need a broad legislation that will cover several aspects of feed quality and also laboratories to do the work. So after solving the legislation and lab test the food industry (in general) can safely use the material.

The future for the use of food loss will be directly linked to legislation/policy that will testify quality (sanitary, nutritional etc) and control from the State, from my view.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Extremely important as we can give economical value and quality (sanitary, nutritional etc) according to the legislation that will not only cover the food industry but also the farm level.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Extremely important as we can give economical value and quality (sanitary, nutritional etc.) according to the legislation that will cover not only food industry but also to farm level and feed manufacturing.

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Extremely important as we can give economical value and quality (sanitary, nutritional etc.) according to the legislation that will cover not only food industry, feed manufacturing but also to farm level.

Second week, message 119: Opinion on question 9

Dr Mahesh CHANDER, from Indian Veterinary Research Institute.

Responding to Question#9:

Food loss is also a matter of human perception!!!!!

In many developing countries including India more food is lost due to poor post harvest management and lack of food storage infrastructure. If such food waste is avoided or minimized, there would be substantial quantity available for human consumption & surplus can be used for animal feed (which can be converted into animal protein consumed by human population suffering nutritional hunger!) making it sustainable food & feed management. Food waste, is thus more a management issue !!!

Whole sale & retail grain, fruit & vegetable markets ("Mandis") as well as households every day waste thousands of tons of grains, vegetables and fruits, most of which could be eaten but for poor management practices turns into waste due to quality loss. Many different types of vegetables, cabbage, potatoes, tomatoes, apples and bananas etc constitute this avoidable waste because they are not used in time. Some enterprising people in India have attempted to use this waste including kitchen waste from hotels to feed cattle & pigs. There is need to assess the quantum of such waste including its proper handling for its safe use in livestock feeding. Sugarcane tops are used as cattle feeding (though it is limiting in Ca & P, so requiring supplementation) in India, which otherwise could have been lost. Crop residues are also burnt in many parts but they are valuable feeding material in some parts where cattle depend to great extent on crop residues. We should believe there is no waste but everything can be made use of through creative thinking!

Dr Mahesh Chander
Principal Scientist & Head Div of Extension Education
Indian Veterinary Research Institute, Izatnagar-(243122 (UP) India

Second week, message 120: Opinion on question 8
Hello Manju WADHWA from INDIA

In response to Q8

I would like to share an excellent example on one of the crops grown by *Field Fresh* (Bharti ent.) i.e. Snow peas *(Pisum sativum var. saccharatum)*-a variety of pea for export. Unlike sweet peas, these are valued for their pods rather than just the beans inside and are eaten whole with pod as a salad. Snow peas are delicate and sweet in flavor. Frost affected snow peas are considered unfit for human consumption, fail the quality control test and are not exported. This bulk can't be sold to the local people, so our team with Dr M P S Bakshi (Former Head Department of Animal Nutrition, GADVASU, Ludhiana) evaluated this as animal feed. Cull snow peas contain 23–25 percent CP, 1.0 percent EE and 35.8 percent total sugars on DM basis. These are an excellent source of vitamin A, B complex, C and vitamin K. Also, they are rich in pigments like lutein and zeaxanthin which help promote vision.

In vivo trial on male buffaloes (424 kg body weight) was conducted; the animals in the control group were offered 2 kg concentrate mixture with 7 kg wheat straw and 2 kg green fodder (C). While in the experimental group the animals were offered either 25 kg fresh snow peas and 6 kg wheat straw (SP1); or fresh snow peas were fed *ad libitum* exclusively (SP2). In the SP2 group the animals consumed 50–55 kg fresh snow peas/animal/day, indicating very high palatability. In another experiment, sun dried snow peas replaced 50 and 100 percent of iso-nitrogenous and iso-caloric concentrate mixture in the diet of male buffalo calves (168 kg body weight). The fresh or sun dried cull snow peas were highly palatable and can be effectively utilized in the diet of livestock, without effecting nutrient utilization or the health of the animals (Bakshi and Wadhwa, 2012b).

Ref: *Bakshi, M.P.S. & Wadhwa, M. 2012b. Utilization of residual biomass from fruit and vegetables. In H. S. Oberoi, ed. Proceedings National Training on Fermentation technology for production of value-added products from agricultural residues. Central Institute of Post Harvest Engineering and Technology (CIPHET), Ludhiana from 03-12-2012 to 16-12-2012.*

Technological, institutional and policy options can be taken to salvage it for feeding to animals:

This crop should be used fresh (by farmers in the close vicinity), sundried (to be transported) or ensiled at the site. If this is not possible these farms should have liaison with the local institutes, universities for evaluation and alternate use of these kinds of crops as animal feed. Policy options for integrated farming should be advocated, whenever such a situation occurs; the crops can be used as livestock feed, which would economise the dairy farming even for short period. We must remember that small changes can lead to a BIG CHANGE.

Regards

Second week, message 121: Opinion on question 8

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

Reply: Fermentation may be a good method to treat the crop to adapt it to animal feeding. However, some hazard factors should be monitored during the processing. Furthermore, effective microbial may need to be found.

Chong Wang
Zhejiang A&F University

Second week, message 122: Opinion on questions

I am Dr NWORGU Friday Chima from Nigeria, Chief lecturer at Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan, Nigeria.

My answers to the questions are as follow.

Q8. The first thing to do is to control the flood institutionally, secondly the crop should be salvaged, and thirdly the crops/produce/products should be initially sun dried/oven dried, air-dried, fermentation can also be done, alkaline treatment can be done, then the quality of the nutrient status determined whether it is fit for animal consumption or not.

Q9. It can be secured by determining the nutrient status and the quality of the food loss and wastes and that will give an idea if they meet the minimum requirement for animal nutrition. If they do not meet due to low protein or mineral status, it can be fortified with amino acids, mineral premix and oil.

Q11. The feed industries in Nigeria sometimes buy deformed grains, tubers during the harvest at price lower than the farm-gate price after harvesting when the farmer has stored his seeds. If the germination of seeds or tubers is lower than the standard, farmers sell the seed to the feed millers at cheaper price. Some of the processors during their processing of the grains, tubers and fruits will have some leftovers such as groundnut cake, soybean meal, and cowpea waste among others which they now sell to feed millers for feed formulation.

Q12. Most non-food parts fall short of the quality required in the food [feed?] industries, so their utilization in food [feed industry? .moderator].industry is limited by this.

Q13. In Nigeria, this is a very big business for feed millers who buy such items, process them into feed or sell them to small scale farmers.

Q14. Utilization of non food parts is mostly useful for ruminant animals, for example, after the harvest of maize, sorghum, sugarcane, the non food parts can be processed and preserved to be used during the dry season in Nigeria. However due to the bulky nature of such items and their low nutritive value and probably anti-nutritional factors, their utilization in developed countries is limited unlike in developing countries.

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Second week, message 123: Opinion on questions

I am Budi from Indonesia,

Response to Q8: It should be either made into hay in case of rice crop or could be fermented or ensilage, then stored and used for animal feed during the time of lack of feed. In case of my country farmers' groups can do the works and the technologies can be adapted from research institutions or universities.

Answer to Q9: Food loss during harvesting in the case of vegetables can be collected and used directly for animal feeding or being dried but usually due to the problem of lack of sun light make it is difficult to do so. When it is already in the market then the loss or wasted parts can also be collected and used to feed animal. A lot of vegetables are marketed and maybe 10-20% is left unsold. When they are in homes there are still some parts being discarded before cooking

Response to Q10: Non food parts from by-products of food crops such as straw of rice and maize or even sugarcane tops can be fermented for 21 days (the technique is available) and then used for animal feeding. The farmer groups possibly can be the institution to do this. Government institutions only play a guiding role and especially can support with technologies.

Answer to Q11: The food industry can help in collecting raw materials of unacceptable food quality to use it as feedstuff rather discarded it. Examples are the fruit canning industries and bakeries.

Response to Q12: There is a role of the food industry in relation to loss and waste of non food parts in the soy sauce or tofu production. It can sell the soy sauce waste and tofu waste for feeding animals. In the sugarcane industry it can sell the molasses and/or bagasse for animal feeds. The palm oil industry can provide palm kernel cake or solid decanter waste as animal feed.

Response to Q13: The feed manufacturing industry can make selection on the possible raw materials from food loss and waste or non food loss and waste and do chemical analysis to make sure that the materials are acceptable for feed formulation.

Answer to Q14: Similar to Q13:

Best regards,

Budi HARYANTO
Senior researcher in ruminant nutrition, Indonesian Research Institute for Animal Production
P.O.Box 221 Bogor 16002, West Java. Indonesia

Second week, message 124: Opinion on question 8

Dr. Tanveer Ahmad, Associate Professor, Faculty of Veterinary and Animal Sciences, PMAS-Arid Agriculture University, Murree Road, 46300, RAWALPINDI, PAKISTAN

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

Usually, under our local conditions such crops are used as such for animal feeding. From a technological point of view it must go into labs for analyses, particularly mycotoxin analyses. Then it should be properly preserved either dried or ensiled, even some treatment is required to be applied before preservation.

Policy is required to ensure animal health safety while feeding of affected crops. Such policies will be difficult to formulate and to implement when a major proportions of the farmers are either landless or having small land holdings.

Second week, message 125: Opinion on question 8

Greetings

I am Dr Pavan, working as Assistant Meat Technologist, Department of Livestock Products Technology, GADVASU, Ludhiana, India

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

When crop is ready for harvest and become unsuitable for human consumption due to nature's fury, it must be utilized for feed. There should be popularization and adoption of various technological processes that converts such crops in feed such as silage making, hay making and testing safety of these feed. Institutions such as agricultural universities should be promoted to train farmers in these methods. Various governments should support the conversion of such food into feed by various promotional activities, providing protocols for the transformation, subsidy etc.

Second week, message 126: Opinion on question 8

I am Dr. A. B. Mandal from India

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

It depends upon the extent ant type of damage, as well as the type of plant. The crop-residual part, leafy vegetables, fruits etc. may be utilized for making strawlage or silage (considering conditions of strawlage/silage making like moisture content, type and maturation of plant, etc.) for feeding of livestock. If necessary, good quality straw or least damaged crops can also be mixed to have better quality of silage/strawlage or better quality silage/strawlage can be mixed with silage/strawlage prepared from affected crop for feeding. If sufficient sunshine is available, the crop may also be dried and stored as dry weather and bright sunshine after such calamities, may prevent growth of fungi. Monitoring should be done for mould growth and mycotoxins; the longer the duration of wet exposure the more is chance of mould growth. The options vary depending upon harvesting capacity, silage storage facilities, drying capacity and moisture content of the raw material.

The grains or seeds from the affected plants may be undersized, broken or cracked or may be infested with moulds resulting in production of mycotoxins. The microbiology (presence of bacteria, moulds & yeast) and safety of cereal grains and cereal products is also very important. The bacterial pathogens contaminating (surface contamination) cereal grains are *Escherichia coli, Salmonella*, *Staphylococcus aureus Bacillus cereus, Clostridium botulinum, Clostridium perfringens,* etc. Moisture favours the growth of such organisms and also mould. *The* cereal grains/seeds must be dried to reduce moisture content below 13% (most safe at moisture level below 12%) for storage. Thereafter, those can be used depending upon amount and type of mycotoxins. Several methods have been suggested for treatment of cereal grains or seeds for preventing mould production. However, dilution technique (dilution depending upon mycotoxins concentration so that at feeding point the concentration should be much below of tolerance level) has been the best and user-friendly. The wet grains can also be

preserved under anaerobic condition (reconstitution) supplemented with suitable organic acids (acetic, propionic, fumaric, benzoic acids, etc.) or their salts.

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Second week, message 127: Opinion on questions

By way of introduction my name is Tim Juzefowicz and I am from Australia.

I am Technical Manager at CSF Proteins Melbourne, Technical Director for the Australian Renderers Association and President of the World Renderers Organisation. The industry would be classified as Food Industry.

The industry I am representing is called Rendering – this being the collection and processing of Animal Products for conversion into Animal Protein Meal and Animal fats and Oils. The industry is also involved in the collection and processing of used cooking oils from the food industry. The finished products derived from the rendering of animal products are extensively used in the intensive livestock industries.

My responses to the questions are in reference to material derived from the meat processing industry and it is about the products that are not suitable for human consumption.

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

In the context of animal production and livestock adverse conditions (drought, heat wave, severe cold) can occur where the animals may die, be injured or be deemed unfit for human consumption.

The animals can be salvaged through collection and then be rendered. The technical processes are well defined and rendering plants are in many countries. Rendering plants generally operate under license by a governing authority and the systems required to ensure food safety are defined in manufacturing standards and include HACCP plans. In general the manufacturing facility will be audited by a third party at a frequency defined by the country.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts -- Moderators]

The security [safety? Moderator] of materials suitable for animal feed should be managed by using the risk management approach. One such system of analysis and control is through the use of the risk based program of HACCP. Rendering plants are designed to process animal products and use the risk based management throughout the supply chain. The risk analysis process should cover the entire food supply chain. The basis for control should be licensing, standards of operation, auditing and management of controls.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

Securing the safety of animal feed can include licensing, accepted standards and code of conduct.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Animal products not suitable for human consumption must be recognised as a raw material for further processing by the generator. If the food loss and waste is regarded using this terminology the generator may not, or does not treat the material appropriately (added physical contaminants, added water, exposed to harsh conditions, etc) causing deterioration and degrading the finished product quality after processing. Food materials deemed not suitable for human consumption must be handled with end use in consideration.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The food industry should be educated to understand the value of non-food parts as animal feed. The education should include an explanation of where the material will be used, methods of preserving the quality of the material, regular inspection or management.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The feed manufacturing industry generally accepts that animal proteins meals and animal fats and oils are an important part of the feed ingredient mix. Supplier and manufacture relationships should be gained to improve compliance to specifications and/or standards where defined.

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

In general the feed manufacturing industry is well prepared to handle animal products derived from rendering. Specifications and standards are necessary. However, the acceptance criteria maybe unacceptable or unnecessarily harsh. Quality demands maybe too high and therefore a more reasonable standard accepted.

TIM JUZEFOWICZ
Food industry
Technical Manager
CSF Proteins Melbourne
Technical Director, Australian Renderers Association
President, World Renderers Association

Second week, message 129: Opinion on questions

JAFAROU SANDA ALTINE from the Ministry of Livestock of Niger

Q8: I think fermentation should be used to salvage it for feeding to animals.

Also the crops may be converted into silage and given to animals.

Q9:.Food loss and waste should be analysed in order to determine its safety before giving to animals.

Q10:.The same approach as described in Q9.

Q11:.Governments should be involved by establishing legislations on food and feed safety.

Q12: The role of industry should be very important because it is adding value and quality to feed.

Second week, message 130: Opinion on questions

Hi, I am Dr. A.K. Nagpal, Principal Scientist (Animal Nutrition) From National Research Centre on Camel, Bikaner, Rajasthan, India

QUESTIONS FOR WEEK 2

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

Reply: When natural disaster strikes and renders the food crops (cereals, pulses, oils etc.) ready for harvest, unfit for human consumption, possibilities of use can be explored if the crop is not fully damaged due to microbial spoilage. If the food crop becomes black and toxic due to microbial fermentation spoilage, it has to be totally discarded and if partially damaged, the cereal grains, pulses, oilseeds and crop residues (pods, stem, leaves, straws) can be partially recovered for livestock consumption

According to a report published by *Dainik Bhaskar* a daily newspaper dated 09.10.2015, about 56% Kharif crops failed in Rajasthan state due to drought conditions on account of poor rainfall this year. Out of 15.4 million hectares, crops sown in 8.6 million hectares were destroyed. Cereal crops in 2.5 million hectares and pulse crops in 1.0 million hectares are in the grip of drought. Rabi crops also bore the brunt of heavy rainfall and hailstorms and farmers suffered a lot. Crops in 1.689 million hectares of 21000 (twenty one thousand) villages suffered losses and the government distributed financial compensation to the tune of Rs.3600 crores (1 crore = 10 million),

Technological options: The recovered food and non-food parts can be used by the feed processing industries for making feed pellets or feed blocks for livestock.

Institutional and policy options: The agriculture sector is worst affected by the natural calamities. The Indian Government has launched several insurance schemes and give compensation to the farmers to mitigate their financial losses but the noticeable impact is seen on food, feed and nutritional security of human and livestock and consequent impact on inflation and loss of government revenue and less government funds available for development activities. The government can also buy the damaged food for its own feed factories. Besides government should constitute a "Feed Corporation of India" on the lines of Food Corporation of India for feed and nutritional security of livestock and focus on construction of feed and feed block go downs for use during natural calamities.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts -- Moderators]

Reply: Food loss and waste can be secured and used by the animal feed industry.

Harvesting: Agricultural implements for crop harvesting should be such that there are minimum losses of food.

Post harvesting: Proper Infrastructure development. There is a lack of enough godowns for storing agricultural food items (cereals, pluses, oil seeds etc.) which are subjected to spoilage. Cereals are often packed in gunny bags and stored in open and covered by big polythene sheets. Efficient storage godowns with optimum storage conditions are the need of the hour so that valuable food is not lost.

Processing Food industries: Both private and government food industries (flour, rice and oil mill etc.) and fast food industries (maggies, bread, biscuit etc.) should install efficient machinery for food processing so that losses are nil.

Distribution: While transportation and distribution of food grains, bags made of suitable fabric should be used to avoid losses.

Consumption: Waste from consumption need to be minimum to avoid losses.

Institutional policy: Government should develop standards / guidelines to be followed for harvesting, post-harvesting, processing, distribution of food crops to minimize the food losses.

Social: Public awareness programmes by the public /private agencies and NGOs among the public should be encouraged through radio, TV and newspapers to avoid food losses and enhance food and nutritional security.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

Reply:

Feed supply chain. Non-food parts become available at the time of harvesting food crops (straws/stovers) and processing (cereal brans, pulse chunnies, oil cakes etc.).

Harvesting: The agricultural machinery should be developed to allow collection of a maximum of the non-food parts.

Post harvesting: Proper and efficient food storage infrastructure development is the answer.

Processing: The feed industries can use agricultural by-products and straws for making feed pellets and feed blocks of different composition, nutritional value suitable for different categories of livestock for optimum animal production. Several types of complete feed blocks and feed pellets have been prepared from crop residues viz., gaur straw, gram straw, wheat straw, groundnut haulms, tree leaves namely khejri, ardu, neem and guar churi, bajra grains, mineral mixture, common salt, molasses etc. at NRCC, Bikaner. Feed blocks are easy to handle, store, distribute and animal feeding. Non-food parts like straw can be given ammonia treatment to make them more nutritious and digestible and incorporation in feed blocks.

(*Can we please hear to what extent these technologies of block making are used in practice and on a commercial basis – the moderators?*)

Distribution: Leak and weather proof bags for an efficient transportation system within permissible load limits are desired to avoid food loss and waste.

Consumption: The livestock should be fed as per feeding standards developed by the nutrition scientists to avoid under and over -feeding for optimum animal production.

Institutional policy: Where feeding standards have been developed the Government should enforce such feeding standards. Awareness among farmers/livestock owners through radio, TV and newspapers should be created to follow the feeding standards.

Social: Public and farmers should be made aware to understand the importance of livestock feeding standards.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Reply: Role of food industry (Cereal industry, Pulse industry, Oil industry) in making use of food loss and waste as animal feed:

The food industry should be aware of the fact that food and its by-products generated by them can be utilized by the animal feed industry for making animal feed and see to it that the excess food and by-products reach them at proper price instead of throwing them as waste.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Reply: Food industry may develop synergy with feed pellet and feed block industry for utilization of non food parts.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Reply: The feed manufacturing industry has a very important role in making use of food loss and waste as animal feed.

Harvesting and post harvesting: Food loss and waste such as damaged, broken wheat /rice grains etc. can be effectively utilized by the feed manufacturing industry for making feed pellets/feed blocks.

Processing: Tomato waste, apple waste can be utilized for making animal feed.

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Reply: The feed industry has a major role to play in making use of non-food parts as animal feed in the food supply chain. In our country, both government as well private companies are engaged in feed manufacturing. Compound livestock feed manufacturers association (CLFMA) is one of major associations of feed manufacturers in India.

Harvesting: Feed industry has the capability to utilize both food byproducts (cereal brans, pulse chunnies, oil cakes and non food parts (straws / stovers / pods/ dry leaves of crops and trees) for making feed pellets and feed blocks and should use that machinery which produces maximum output with minimum losses.

With best regards
Dr. A.K. Nagpal, India
Email: scientist.com_aknagpal@mail.com

Second week, message 131: Opinion on questions

This is Dr. Ime UMOH from Nigeria

Wish to corroborate the earlier submission

Q8. The first thing to do is to control the flood institutionally, secondly the crop should be salvaged, and thirdly the crops/produce/products should be initially sun dried/oven dried, air-dried, fermentation can also be done, alkaline treatment can be done, then the quality of the nutrient status determined whether it is fit for animal consumption or not.

Q9. It can be secured by determining the nutrient status and the quality of the food loss and wastes and that will give an idea if they meet the minimum requirement for animal nutrition. If they do not meet due to low protein or mineral status, it can be fortified with amino acids, mineral premix and oil.

Q11. The feed industries in Nigeria sometimes buy deformed grains, tubers during the harvest at price lower than the farm-gate price after harvesting when the farmer has stored his seeds. If the germination of seeds or tubers is lower than the standard, farmers sell the seed to the feed millers at cheaper price. Some of the processors during their processing of the grains, tubers and fruits will have some leftovers such as groundnut cake, soybean meal, and cowpea waste among others which they now sell to feed millers for feed formulation.

Q14. Utilization of non food parts is mostly useful for ruminant animals, for example, after the harvest of maize, sorghum, sugarcane, the non food parts can be processed and preserved to be used during the dry season in Nigeria. However, due to the bulky nature of such items and their low nutritive value and probably anti-nutritional factors this is not done.

Dr Ime Umoh
Federal Ministry of Agriculture and Rural Dev
Abuja, Nigeria

Second week, message 132: Opinion on questions

I am Dr James Higenyi and I wish to comment on the raised questions as follows:

Q8: In Uganda, there is no emergency response system to help develop feed from the crop in case it is flooded or hit by the hailstorm. It is upon the farmers to make best use of it for animal feed. However, aid to the affected farmers depending on severely can be organized by the government through the ministry of disaster and preparedness.

Q9: Securing food loss and waste for use as animal feed is not uncommon. More often losses occur along maize value chain, particularly at post-handling and storage nodes. This is attributed to aflatoxins and the crop ends up in animal food chain through feed. However, as an institution we train farmers on good post harvest handling and storage using the new tech developed by research institutions. Similarly, awareness creation of stakeholders on standards and regulations in feed industry as well as reviewing the industrial standards too. Also vegetables like cabbage and sukuma which often float and become waste are increasingly used as animal feed but farmers are encouraged to process to take account of for anti-nutritional factors.

Q10: Use of non-food parts of agricultural products is strongly encouraged. For instance use of potato vines is currently being promoted for production of potato vine silage. Similarly, maize stovers are being used especially by commercial farmers under and a technology of cereal-legume-feed is widely promoted under sustainable agriculture. Other by-products like cotton seedcake and sunflower are often used in animal feeds by the feed manufacturing industry but with caution due to hazards. We encourage manufacturers to have a documented quality control system.

Q11: The food industries are increasingly involved in production of animal feed through their waste. However, the challenge is that the waste is exposed to hazards which often lead to animal health problems. For instance use of spoiled bread in pig production.

Q12: The food industry in urban areas plays a vital role in animal feed production through provision of non-food parts like banana peels, cassava peels-for zero grazing units. The only challenge is exposure to anti-nutritional factors and hazards. On another aspect, the use of non-food parts as animal feed reduces the garbage load and thus cleans the town.

Q13: The feed manufactures should put in place quality and safety control measure and ensure the removal anti-nutritional factors and hazards in feedstuffs.

Q14: As in Q13

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Second week, message 133: Opinion on questions

This is Khan Shahidul HUQUE from the Bangladesh Livestock Research Institute;

Let me share my opinions on the questions for WEEK 2 (8 to 14) in the context of Bangladesh.

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

Opinion to Q8:

i) Differences in seasons (dry season may affect e.g. winter maize, wheat; monsoon may affect e.g. flood, pouring e.g. paddy), livestock holding pattern (landholders may not have livestock, they will not be interested to spent money for crop salvation for feed production, livestock holders may not be allowed to salvage the crop for feeding their animals) and financial support (farmers may not afford financial support to salvage biomass at the time of needs) must be taken into consideration to salvage food crop for feed uses.

ii) Feed entrepreneurs may be interested to invest for further value addition to salvaged food for feed production, they may preserve it either through sun drying or ensiling for further use.

iii) However, it is a matter of adverse condition, feed entrepreneur should be in the existing system and policy support must be in place for salvaging the crop for feeding animals, and the country must have capacity for feed processing (drying, ensiling, mixing, blocking/pelleting) and marketing. This requires capacity building of the private sector.

iv) Public policy support (credit support, mechanical support, strong bi -or multilateral regional or international technological and awareness support) must be there.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use

as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts -Moderators]

Opinion to Q9:

The food safety authority of a country may play a pioneering role here; they have the authoritative power to monitor any food loss and waste, and their safe uses. In Bangladesh, it sometimes happen when low quality food grains are imported and declared unfit for human consumption (post harvesting), vegetables not marketed (harvesting) due to fall of market price, bulk stored grains deteriorated and declared unfit for human consumption.

Food safety authority may use its lab network, even FAO lab network may be effective to respond to expert opinions for the safe use as animal feeds; the bulk food loss and waste, if declared fit for animal feeding, may be sold to feed entrepreneurs for further value additions and marketing.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

Opinion to Q10:

Production and supply mismatch due to seasonal and regional differences, distant relations between producers and consumers, absence of policy supports; social unawareness often affect availability of non-food parts as feed for animals. Drying is the only conventionally and socially adopted and accepted system that has been helping preservation of non-food parts for feeding animals, and this is true only for paddy straw, pulse offals, wheat straw in Bangladesh. Maize stover is not used effectively; market sources of vegetable/fruit wastes have seldom uses.

Policy for technological development and credit support, awareness creation, integration of feed processing with animal production system, feed analytical support at farm level are important.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Opinion to Q11:

Food & Feed industry must have strong collaboration; biomass loss (food loss and waste) during harvesting, post harvesting, processing and distribution are valuable raw materials to feed industry; brans, rejected grains, crushing wastes, non-compliant processed feeds may be stored and transferred to feed industry.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Opinion to Q12:

Food industries that use a contract growing system may support the supply of non-food parts to the feed industry during harvesting, post-harvesting, processing, they may follow contractual distribution to feed industry for its value additions.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Opinion to Q13:

I. Development of feed manufacturing industry is a must for increasing the feed availability to farmers.

II. Recent transformation of livestock holding pattern in Bangladesh has been resulting in more input supported animal rearing replacing conventional mixed farming due to various socioeconomic and agro-ecological changes, irrespective of landholding patterns.

III. Growing market demands of animal products, spiraling of prices of safe animal foods in the market, gradual shifting of producers to consumers of similar food products due to urbanization, rise in literacy, transboundary human movement etc have been creating opportunity for value added animal product development e.g., cattle fattening, value added product demand of meat, milk etc;

IV. Conventional wet marketing, hot spots of disease transmission especially of zoonoses, must be limited. Value added animal product market demand will gradually rise with the awakening of safe food demand; this needs policy and technological supports both for feed industry and value added animal product market development.

V. Thus, feed manufacturing industry development and its role is important for processing food loss and waste as animal feed.

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Opinion to Q14:

Food and Feed industry must grow on mutually trusted basis, and they must have policy support; similar to the answer of Q 13, they may have programme for collection and value addition to non-food parts. In a country like Bangladesh this is the major source of biomass for feed production.

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Second week, message 134: Opinion on questions

Hello Manju WADHWA from INDIA

Will be talking about securing of *Food loss* and waste as animal feed, role of food and feed industry in making use of 'food loss and waste' as animal feed. My comments relate to fruit and vegetable losses.

Effective ways of securing *food loss and waste* as animal feed are drying (solar- would be fine in tropical countries), ensiling with any dry roughage available in that particular area (wheat or rice straw in ratio of 70:30 or 80:20) or feeding fresh to the animals (in nearby villages).

Regarding *compromise with feed safety and animal health and welfare, if we are concerned about pesticides,* the safety can be ensured to some extent by simple washing of the produce with water before use, depending on constitution of the fruit, chemical nature of the pesticide and environmental conditions. This is the most common practice used by processing industries. There are Maximum Residual Limits for different pesticides & insecticides used for food and feeds, which if adhered to should ensure food and feed safety of food loss and wastes to be used as animal feed.

Here I would like to add that these pesticides, insecticides are in practice to increase the production, *at the cost of health* of both human and animals. Need to decide on use of judicious use of pesticide or to go for organic production.

Just because of injudicious use of pesticides and insecticides we will be ***increasing the food loss and waste***; peel and the layer immediately beneath it of many fruits and vegetables are a veritable mine of highly essential nutrients and health-promoting phytochemicals, besides being an excellent source of natural fibre. More important is the fact that the peel, in many cases, is richer in nutrients compared to the sweet and juicy fruit pulp. Apple peel is an outstanding source of fiber with cancer-fighting properties and contains abundant quantity of the antioxidant polyphenols. Apple skin contains quercetin, a flavonoid, banana peel is rich in fiber aiding in digestion and bowel movement and helps to reduce cholesterol in the blood. Banana peel has an antioxidant called lutein, which helps to protect and improve the health of our eyes and a mood-stimulating substance called tryptophan. Similarly vegetable peels like potato are richer in mineral nutrients and antioxidant phytochemicals which protect us from various illnesses. Potato peel contain double the quantities of seven nutrients, seven times more calcium, five times more riboflavin and 17 times more iron than the same weight of pulp. The same applies to many other fruits and vegetables also. It is now well established that the peel surpasses the pulp or flesh in its nutritive value (Wadhwa et al., 2013, FAO Publication: http://www.fao.org/docrep/018/i3273e/i3273e.pdf). Therefore, it is prudent to use fruits and vegetables wastes and the best way is to use it as animal feed.

Food industry can play an important role in ***preventing/decreasing food loss and wastes by using*** (in other food products to increase the functionality of the existing products e.g. use of peels to increase fiber content, antioxidants etc.) or by distributing the unused products to the nearby research institute through advertisements or by contacting them personally for the evaluation of unused products so that the scientist can advise the farmers or feed industry people for levels of incorporation in feed for different categories of animals.

Dr. Manju Wadhwa Sr. Nutritionist -cum- Head Dept. of Animal Nutrition GADVASU, Ludhiana.

Second week, message 136: Opinion on questions
From Dr. T. K. Walli, India

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

To Q8: When the weather conditions improve, the crop needs to be harvested immediately. The grains could be subjected to sun drying or mechanical drying, followed by storage. Because storing wet grains means inviting fungal spoilage. Then, depending up on the final quality, its usage has to be decided. If it is free from fungal spoilage, it can go for human/ poultry/pig consumption, very mild spoilage, could still be used for ruminant feeding, but substantial spoilage means not even fit for ruminants.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts --Moderators]

To Q9:If we really want that wet grains should be saved, even for its consumption by animals, then these have to be subjected to drying treatment before storage. Grains having mild fungal spoilage, may still be considered for the feeding of ruminants, provided, anti fungal agents and anti toxins are added to the compound feed. There is no way that such spoiled food is fed to poultry or pigs.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

To Q10: Non food parts of the plant may be harvested and immediately converted into hay. Hay could then be stored and used directly for the feeding of ruminants or may be used as the roughage part of the densified TMR feed, made either into blocks or into pellets. As a policy matter, modern technologies need to be introduced into the system, for the harvesting and immediate for hay making of the residues/biomass, especially in case of maize, sorghum and millets, in order to harvest maximum nutrients for supplying to animals.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

To Q11: In the first place it has to be ensured by the policy makers that for the expected quantity of food produced, as food grains, fruits and vegetable, there are matching storage facilities available in the country. Since, the governments in these countries have failed to visualize the root cause of the food spoilage and its loss, which is mainly due to the lack of proper storage facilities, the setting up of storage facilities as silos should be the priority for such governments. Our resource poor farmers put in an enormous effort to produce food for the vast human population in these regions, thus, it is really criminal that part of their effort gets wasted when the food gets spoiled.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

To Q12: After the grain harvest in the case of maize, sorghum and millets, the farmer doesn't bother about the residues, which may be allowed to be left in the field for a longer period, by which time, it becomes highly lignified and thus, the quality gets further deteriorated. It has to be ensured that the residues are immediately harvested and made into hay, using modern farm equipment. Then hay may be used as such or made into densified TMR feed, either as blocks or as pellets, which has a variety of benefits, being a balanced feed with better digestibility, apart from being easy to handle, feed, store and transport. In India lot of crop residues are burnt in the field itself, thus wasting the feed resource as well as polluting the environment. It is better to convert this crop residue into TMR feed blocks and feed it to ruminants.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

To Q13: It depends up on the extent of damage caused to food items through rain soaking followed by poor storage conditions prevailing in these countries. No question of using the food made unfit for human consumption as poultry or pig feed. Well, if there is a very mild spoilage, it may be considered as a feed for ruminants and that too at a minimum proportion, not beyond 10 per cent. Also, in such a compound feed, anti toxin has to be added for the purpose of safety of the final product with respect to the consumption of meat and milk by humans.

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

To Q14: Non-food parts of the food crops mostly refer to crop residues. As such in the tropical world, these constitute the major roughage portion of the ruminant diet. Farmers need to be educated about the simple practice of chopping of the straws and stovers in areas where they have no concept of this technology even today. I have seen it happening in Southern parts of India and recently I saw it in Bangladesh also. So, the first thing is that choppers should be made available in these areas. The feed industry can also consider going for the manufacture of crop residue based on densified TMR feed as blocks or pellets. Their operation can start right from the field itself, harvesting the stover, converting it to hay, chopping it and storing it before making blocks or pellets along with the concentrate component. This technology is now available in India and FAO is making efforts for the transfer this technology to other parts of the region as well. Bangladesh has already taken a lead in this direction.

Dr. T. K. Walli
Former Head, Dairy Cattle Nutrition Division
National Dairy Research Institute, Karnal India

Second week, message 137: Opinion on questions

This is Khan Shahidul HUQUE from Bangladesh again.

I like to add some more comments in response to WEEK 2 questions.

Vegetable and fruit wastes of market sources are excellent biomass available in a single place like in the whole sale and also in retail markets. We find, through one of our studies that almost 0.8 to 1.0% of the vegetable and fruits marketed in a place is lost and this incurs cost of disposing to market authorities. Moreover, it is used as landfills and pollutes air emitting GHGs continuously.

Recycling of vegetable and fruit wastes into feed may reduce disposal cost and increase feed supply without competition for land, the most limiting resource to farmers, in a country like Bangladesh. The crude protein, total digestible nutrients and the extent of rumen degradability of vegetable wastes were 16.9 %, 63.3 % and 80.0 %, respectively; suggesting them to be excellent feed resources. Heavy metals were below the maximum tolerable level, total aflatoxins or organochlorine, organophosphorus or carbofuran pesticides were below detectable level. So, it could be excellent source of biomass, value additions to it as feed may i) increase feed supply ii) reduce environment pollution, iii) create employment and, iv) other secondary industries.

This needs support of i) processing technologies ii) coordinated efforts of concerned authorities (Research/development organization and market authority) and iii) investment of the private sector. Different collectors may be employed for collection of the wastes and then it may be processed, dried and packed for marketing. Plastic recycling is the best example for it.

Awareness of the market authority, and vegetable and fruit sellers may make the job easier. A demonstration plant equipped with good machineries may be established by the concerned authorities. Having successful demonstrations, public sector may extend soft loans to entrepreneurs in addition to committed financial benefits for clean air production for further expansion of market sources vegetable and fruit waste based feed productions. International organization deals with livestock production and environment may extend their technical assistance for breaking the ice and developing waste based safe feed production, at least, in land hungry countries.

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Second week, message 138: Response to messages 131 and 136

Gbemenou Joselin Benoit Gnonlonfin, international consultant from Benin Republic, based in Nairobi, Kenya.

I would like to contribute to the ongoing discussion. This is to add some practical input to the responses from message 131 and 136 that were well elaborated and comprehensive. Actually, drying could be done for example on a raised platform and with respect of hygiene. During drying grain moisture content could be monitored to achieving safe moisture content (≤13%). Hygiene aspect is not followed or given less attention especially in the context of small scale farmers in the developing world. Hygiene and good manufacturing practices should be followed during feed processing as well. This will ensure the safety and high nutritious feed. Mycotoxins (aflatoxins) are among other contaminants that are very persistent and negatively affect the safety and ultimately deteriorate the nutrients in the feed. In this respect, many developing countries lack regulations and policy. Therefore, there is urgent need to have in place such regulations and policy.

Regards

Second week, message 139: Opinion on questions

Dear all, I am Erasmus zu Ermgassen, University of Cambridge, UK.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

I consider food safety, animal health, and welfare concerns to be focused on the control of infectious diseases, such as foot-and-mouth and BSE, and potential feed contaminants, such as aflatoxins or heavy metals.

To prevent the spread of transmissible spongiform encephalopathies (TSEs), ruminants should not be fed food wastes containing animal products; the safe feeding of food wastes to ruminants therefore requires the separation of wastes with and without animal products. This separation may require legislation, monitoring, and enforcement.

Pigs, poultry, and fish do not develop TSEs and can be fed wastes containing animal products, though this practice is currently illegal in many parts of the world, including the EU. Nations like South Korea do however safely recycle food wastes as pig feed; there, feed safety is maintained by regulation of food waste collection, transport, storage, heat treatment, and feed manufacture. Food waste is heat-treated to sterilise the feed and deactivate viruses (such as foot-and-mouth or African and classical swine fever). The shelf-life of food waste feed can be prolonged by dehydration or fermentation.

In South Korea, the level of contaminants is also regulated and monitored. The government has set legal limits on the presence of aflatoxins, heavy metals, and dioxins, for example. The contamination of food waste can of course be limited by appropriate sorting, storage, and transport.

Countries such as South Korea and Japan, which both recycle ca. 40% of their food waste as animal feed, show that it is possible to safely feed food waste to livestock. In many parts of the world, the main barrier is instead the law: the EU bans the use of all household and catering wastes and only recycles ca. 3% of food waste as animal feed (not including agricultural co-products/losses/waste).

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The food industry should consider food wastes and losses as a value added product, not a "waste" per se. According to the food waste hierarchy (http://www.vision2020.info/ban-food-waste/the-food-waste-hierarchy/), the food businesses should prioritise recycling food wastes and losses as animal feed over alternatives such as composting, anaerobic digestion, or land filling, which all have an environmental burden. The onus does not, however, fall only on the food industry; government may need to subsidise the recycling of food wastes as animal feed – for example by supporting businesses recycling food waste as feed, or creating incentives for food businesses to link with farms which can use their food waste.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

In many parts of the world, the feed industry can do more to create value from food waste. In Japan, for example, food waste pig feed is certified as "Ecofeed" (because of the environmental benefits of recycling food waste as animal feed) and animal products that are reared on Ecofeed are eligible for a price premium. The industry can also create added value through education: in Japan those most knowledgeable about the pig industry show the greatest support for the use of food waste as animal feed. Finally, to achieve the full potential for food waste may require legislative change – in regions where the use of food waste in animal feed is illegal, the animal feed industry may lobby governments to introduce safe, regulated systems of recycling food waste as animal feed.

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Second week, message 140: opinion on questions 9, 11 and 13

My name is Filipe PACHECO and I'm living in Portugal. I have been working in research and development related to sheep and goat production systems.

Congratulations to the organizers and moderators of this E-conference!

My contribution concerns the question 9, 11 and 13.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts -- Moderators]

Processing, distribution and consumption stages

In my opinion, a regulation on inspection of animal feed must be created, stating the requirements to fulfill by the food industry. Industry and government must share responsibility with respect to safety and efficacy of animal feed and, ultimately, of our food. The safety evaluation should include an assessment of the livestock behavior (health and performances). Advice on animal nutrition should be given. In order to inform the food and feed industry about the requirements to accomplish, awareness campaigns should be developed.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Processing, distribution and consumption stages

There must be cooperation and the creation of synergies between the industry, aiming at the search for collective and innovating solutions for a better access and capacity to intervene in the markets. The interconnection between the farmers and the industry is also essential for the strengthening of the bonds.

I'll present an example concerning spent grain.

Brewing by-products are "spent grain". Brewer's spent grain consists of the residue of malt and grain. It consists primarily of grain husks, pericarp, and fragments of endosperm. As it mainly consists of carbohydrates and proteins, spent grains can also be used as fertilizer, whole grains in bread, as well as in the production of biogas.

The spent grain has high nutritional value. However, it has received little attention as a raw material. From an economic and ecological point of view, the use as animal feed can be considered as a good solution.

The conversion of spent grain has been exploited by the bakery industry in the manufacture of various products such as bread and biscuits. However, some limitations may arise when used for food purposes, as they cause a change in flavor, color and texture of the food when used large amounts of flour.

The spent grain is a source of value-added products in industrial processes. It has been developed by the company Heineken a simple process and flexible, which separates the spent grain into two different categories of products: proteins and the fibers. The protein extract comprising protein and fat and low content in fiber makes it suitable for feeding to animals other than ruminants (for example, pigs and poultry). The product rich in fiber and low in protein can be used in sustainable thermal energy production.

Best Regards and keep up the good work!

Filipe PACHECO

Second week, message 141: general comment on questions

For us in developing countries like Nigeria, food losses and wastage cannot be properly understood without adequately addressing the infrastructural deficiencies we have.

Dr Danlami Moses Ogah
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Second week, message 142: Opinion on questions

Hi, this is Agha Waqar Yunus from National Agricultural Research Center, Islamabad, Pakistan.

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hailstorm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

The answer to this question will be largely influenced by the type and severity of disaster and previous experiences in a specific country.

Floods: Cereal crops affected by flood are not usable anymore, and I don't think there is any technology to make them reusable. It is however possible to promote such crops which either survive the floods, or are sown immediately after the floods. Sugarcane for example is known to survive the standing flood waters (height of the crop along with the ability to re-grow). The affected sugarcane in Pakistan is either sold at a lower price due to low sugar content or its tops are used in animal feeding.

Rain/Hail: When a crop is affected by rain or storm, the owner (farmer) is in the best position to decide on its use. Some participants of this conference have suggested making hay out of such crops. It may be possible to make hay in case of crops affected by unexpected rains though, it is not a practical option in the rainy season. Although preservation in the form of silage could be one option, it should be remembered that facilities to preserve all the affected crop is not usually in place and it is mostly economical to let the grain mature. In Pakistan, farmers mostly decide to allow the crop to mature even with the disadvantage of lower production.

Consumer law and welfare: This year we had heavy rains near the harvesting time of wheat which severely affected the grain quality. Despite this, wheat is being used for humans due to the big population and lack of awareness on effects of contaminated grains. Even if we had laws in place, I believe government should relax the rules to save population from hunger (of course depending upon the type of contamination).

Contaminated crops can be fed to different animals depending upon their sensitivity to the specific contamination. One example is the case of grains contaminated with deoxynivalenol. In EU, a contamination level of up to 5 ppm is allowed in chickens compared to less than 0.75 ppm for humans and swine; so companies always have the choice to shift such grains to chicken feeding.

Last but not the least, farmers all around the world are able to judge which crops can be fed to animals. At the institutional level, we need to educate them on crop preservation and devise disaster management strategies for specific areas. For regular floods or other disasters, following could be options:

1. Identifying the areas which are affected at regular intervals.

2. Identifying the crops in that specific season.

3. Change the crop and cropping pattern or plan intervention during the disaster.

In case of unexpected disasters, the strategy will be affected by its scale and the type of crops affected.

Although everyone would like to use the affected crops for animals, we need to first establish the regulations in developing countries.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts -- Moderators]

The answer to this question will depend on the type of food involved. Most of the time it is not economical to collect the grains lost during harvesting. However, the amount of grain lost during harvesting can be reduced using better harvesting technology in developing countries. The byproducts of grain milling are already being utilized by farmers (I believe around the world). Intervention is mostly required in case of processing of commodities other than grains. For instance, the fruit not fit for human consumption in our Himalayan region (spoilage in remote areas) is now converted to cakes for animal feeding (e.g. peach cake). The fruits high in sugar contents are used to make products like urea-mulberry-blocks after recent intervention of government and NGOs. So there are always areas where governments can intervene for reducing food

losses. In our case, women empowerment was an additional benefit of reducing food losses.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

The non-food part having low nutritional content arising from harvesting (straws and stovers) and processing (rice husk) in populated and developing countries is being used in livestock feeding. The important question is the environmental impact of such uses as straw in ruminant feeding results in significantly higher fermentation gases per kg of animal product produced. I believe we should try to improve the fodder production and rangelands as there are already huge gaps in developing countries (at least this is true in case of Pakistan). Until then, the farmers are already using these items.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The food industry can increase profit by selling the non-food part as feed. However, they need help from research institutions and academia to find ways of utilization. For example, when sugar mills were established for sugar extraction using sugar beet, they did not know what to do with the pulp. Initially it was gifted to cattle farmers for use as a straight feeding stuff. Nowadays they sell it for making silage (mixed silage of sugar beet pulp and cereal crops) after academia showed them the efficacy of such silages.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

As already explained under question 9, there are non-traditional ways of preserving the waste fruit as dried cakes and urea blocks. For a sustainable utilization, involvement of industry is a must (e.g. making and then selling in other remote areas).

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

I think there will be little interest of the industry in marketing of such products due to the bulkiness of the non-food parts. However, they can develop supplements for the farmers using such products.

Kindest regards

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Second week, message 143: Opinion on questions

I am Dr. Raja Kishore Konka, Animal Nutritionist, INDIA

Q8.

Disaster is a crisis situation that far exceeds the capabilities.

During the times of natural disasters the crops that were damaged should be checked for their nutritional quality. They should be subjected to suitable processing methods viz. drying, baling, urea treatment if necessary etc for feeding to livestock. This situation mostly occurs on emergency basis for which continuous institutional policies should be drafted for counter acting the event. In this the educational institutions will play an important role. The personnel involved in these activities should be well trained, equipped with the knowledge of recent advance and techniques of handling the damaged produce.

The crops that were damaged should be selected on the basis of extent of damage, plant material to be handled etc. The grains that were damaged can be better utilized by dilution technique i.e. addition with good quality grains and can be fed to livestock. Always the damaged plant material which is with moisture should be checked for fungal or mould growth before offering to animals. The microbiological tests for organisms and toxin analysis will give a good indication of quality of the material. For these, rapid methods of detection should be designed at the place of the availability. This also ensures the utilization of the damaged material at the place of its own availability.

Q9. Secured usage of Food loss and waste

The food loss can be better classified at different stages as given in the question.

a. Harvest stage:

At the time of harvest of food crops there will be a lot of damaged produce (grains etc.) which is not fit for human consumption, but can be fed to livestock. While attempting this, minimum quality of the grain should be checked and subjected to grinding and mixing with other feeds can be done to improve its nutritional quality.

b. Post harvest stage:

This is the stage where we are in a position to get huge quantities of food loss after harvesting the main produce for human consumption. They can be categorized as the straws, stovers, hays, green leafy material with stem portion etc. which can form the major portion of bulk top the ruminants. Particularly, in India we are bestowed with huge quantities of crop residues. They can be better utilized with the concept of Total Mixed Rations which is gaining importance in the recent days as the land for growing forage crops is decreasing tremendously.

c. Processing, distribution and consumption stage:

This is the time where we will be getting different types of byproducts during the processing of grains, pulses and other agricultural products. The material thus obtained upon processing is considered as food waste and can be better utilized for animal feeding.

Ex: Sugarcane industry-Sugarcane Bagasse, Sugarcane press mud, Molasses etc

Palm oil industry: Palm press fibre, palm press mud, Palm oil meal effluent (POME) etc.

Corn industry:-Corn flour, Corn spent liquor etc

Sea nut cake, Sunflower cake, Soy bean meal, neem seed cake, linseed cake etc.

Further during the time of distribution and consumption stage i.e. during storage situation also there will be certain loss to the prepared material. The quality of the material should be checked before feeding to livestock as the shelf life the material may not be too long. This situation arises particularly with the food and vegetable industry.

The fruit and vegetable waste obtained should be dried or subjected to certain techniques by addition of preservatives and can be fed to live stock.

Best Regards
Dr. K. Raja Kishore, PhD
Assistant Professor Department of Animal Nutrition NTR College of Veterinary ScienceGannavaram-521102Andhra Pradesh, INDIA

Second week, message 144: Opinion on questions

Gregory Ndwandwa Sikumba, Nairobi Kenya

QUESTIONS FOR WEEK 2

Q8.

Answer: In terms of cereals one of the technological options is to make silage. Institutional and policy options to be put in place include establishment of effective early warning systems to prepare farmers with equipment for ensiling to insure losses are minimize as well as training of farmers on how to salvage the remains such as making silage or haymaking.

Q9.

Answer: This can only be done through capacity development of all actors (producers, transporters, processors etc.) across the value chain. When all actors understand the importance of food safety, it will be easy to enforce mandatory tests, use of proper transportation equipment as well as proper storage of feed. Standard operation procedures (SOPs) should be develop on how to handle food wasted for livestock feed.

Q10.

Answer: Research Institutions should develop SOP on processing and utilization of non-food parts for livestock feeding and enforce them

Q11.

Answer: They play an important role in developing feed processing technologies that will be able to process the feed wasted into livestock feed that is safe.

Q12.

Answer: They play an important role in developing feed processing technologies that will be able to process the non-food parts into livestock feed that is safe.

Q13.

Answer: They play an important role in developing feed processing technologies that will be able to process the non-food parts into livestock feed that is safe.

Q14.

Same as in Q11.

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Second week, message 145: Opinion on questions

Oko Oluwatosin Kennedy from Nigeria

I do agree with most submissions made on these questions.

Let me add some points.

Q8. Flood prevention and early signal warnings should be effectively utilized to minimize flood occurrences. Where possible at any stage of production, crops salvaged should be sun dried/boiled/oven dried/air-dried or fermented. Thereafter they can be bagged and packaged for future use for animal feeding.

Q9 Food waste can be secured and used as animal feeding by proper processing and fortification in terms of amino acid, vitamins, mineral or enzyme supplementations.

Q12. Most non-food parts such as peels, roots, leaves, and stalks are currently exploited as cheaper feed resources for animals.

Q13. In Nigeria, small, medium and large scale feed millers source for such items to produce least cost feeds.

Q14. Utilization of non food parts is useful not only for ruminant feeding even for monogastrics.

The issues associated with non-food part include, presence of antinutrients, low nutrients and low digestibility.

With proper processing and preservation of these products the animal feed industry will develop faster as feed cost is the major challenge to increased animal production in AFRICA.

Regards
Oko Oluwatosin Kennedy
Nigeria

Second week, message 146: Opinion on questions

I am P L SHERASIA from INDIA.

I would like to share my views on questions for week 2:

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

Reply: Harvest the crops immediately, dry it and ensure the qualitative damage to the crops is minimized. Depending upon the quality of the damaged crops, we can decide their uses, whether as animal feed, fuel or fertilizer. Moderately damaged crops may be used for animal feeding by incorporating other feed ingredients in a phased manner. For example, a significant quantity of food crops was damaged due to flood in Northern Gujarat. We collected samples of feeds and fodder from different regions and analyzed for aflatoxins. The samples with no contamination were recommended for animal feed, whereas for the samples with low aflatoxins contaminations adding of toxin binders was recommended as per the prescribed level before their use as animal feed. In such a way, we may use the damaged crops with proper treatment.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts - Moderators]

Reply: Low-cost technological intervention need to be placed in developing countries. One of the most efficient technologies to secure food loss and waste in India is sun drying and/ silage making with other dry roughages. To secure the biomass, local institutes/government bodies may intervene and educate the farmers for using this enriched biomass as animal feed. Local vegetable and fruit markets can be contacted by

nearby small-medium dairy farmers and secure these waste for efficient use as animal feed after proper drying and processing.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

Reply: Regional and seasonal variation in availability of fodder exists in different parts of India. Some areas are deficit, while other areas are surplus in fodder. In this situation, private entrepreneurs can play an important role for securing non-food parts of agricultural products. The private entrepreneurs from fodder surplus area may get in touch with some agencies from fodder deficit areas. As per these win-win situations, private entrepreneurs collect non-food parts of agricultural products from surplus areas, process them for making blocks/briquettes/bale by enrichment and densification, and supply them in deficit areas. Cost efficient technologies for securing the biomass can be used. Policy makers may involve in developing this model.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Reply: In India, region/state wise food loss and waste should be quantified. To secure the biomass, storage facilities for these biomasses need to be created by Public Private Partnership (PPP) model in different states.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Reply: By technological interventions, the food industry may utilize non-food parts of agricultural products as animal feed.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Reply: Feed industries may involve in collection and processing of food loss and waste.

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Reply: In India, economical viable technological interventions would be needed for collecting; processing and distribution of non-food parts of agricultural products.

Regards,
Pankaj L Sherasia
National Dairy Development Board, Anand, INDIA

Second week, message 147: Opinion on question 8

Hello, this is Dr Nitin Mehta, Dept. of LPT, GADVASU, Ludhiana, Punjab

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

Answer: The nature fury has always been a reason for rampant loss of production particularly cereal crops in India. The best technological option is conversion of crop into silage for consumption of animals. Institutes can impart training to farmers for best utilization of these crops for silage making through on the farm training. Policy makers should ensure that a warning and alert system should be devised which can effectively communicate the farmers about the adverse condition well in advance.

Also, the government can think of mechanisms like Minimum Support Price for crops residues and silages made from these in the affected area. The purchase should be done preferentially from the affected area by government agencies which in turn indirectly support the farmers who have lost their produce.

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Second week, message 148: General comment on questions

Dear all, I am Netra Osti from National Animal Science Research Institute (NASRI) Nepal working in animal nutrition

My interest is sugarcane especially its industrial by-product utilization. Industries are located far from ruminant animal production areas, huge amount of byproducts like sugarcane bagasse, sugarcane tops, tomato byproducts and other are wasted and pollute water. When I was traveling from Kanpur India there was smelling sugarcane byproducts molasses wastage (even in running train), let's make research and development strategies to control pollution and better use these in animal feed.

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Second week, message 149: Opinion on questions

My name is Ricardo Luis SAGER, from Argentina; I work as Manager of Scientific and Technological Development of the National Institute of Agriculture Technology, and as Animal Nutrition Professor at the University of San Luis, (Argentina).

Q8. Depending on the type of crop and damage it could be harvested by the animals, by allowing them to forage in an organized way, that Is, in small plots or offering some hours of the day to forage.

In the case of small plots it could handpicked and processed for hay or silage for future us. For serious and extended damage, the state may provide tax exemptions. Local institutions should develop contingency plans that include weather forecasting and warning of meteorological events.

Q9. Every stage of the food supply chain should have specific measures to reduce food loss and waste and as a general consideration there should be improved harvesting, processing and distribution technologies.

In the case of inevitable losses at harvest time several measures could be taken depending on the type of food, sun dry and preserve, grind and store, sell it fresh to local stakeholders.

At processing is it possible to have more waste than loss, due to the nature of the food. In the case of root crops selection could be made by size (carrots, external damage, poor quality) and all the waste could be packaged and clearly identify to be sold at a lower value for animal consumption.

Q10. Non-food parts are really difficult to manage since they have no commercial value until they are recognized as animal feed. At harvest of corn for example, corn stalks could be recovered and bales or rolls prepared that could be use in feedlot diets.

After processing of foods like tomatoes, potatoes, carrots these produce a large amount of waste for compost of aerial parts, seeds, weeds, peels and so on, that could be ensiled, air/sun dried and sold as animal feed.

Wine industry produces a lot of grape waste (grape pomace) that could be ensiled and used throughout the year. The same procedure could be used with waste of citrus from juice industries and preserves.

Q11 and Q12. Each link of the food chain should play a critical role and all of them should be involved with good producing and processing practices, including waste disposal focusing on diverting most of the food loss into feed for animals.

Q13. Nowadays the feed manufacturing industry is not considering the use of feed loss and waste as animal feed, because it is difficult to manage, and usually has low dry matter, fast decay, is hard to preserve, variable in quality and so on. If there is some improvement on food loss and waste disposal procedures at harvesting and processing the feed industry may be interesting in using it.

Q14. Non food parts coming from post harvesting and processing are very much in use in the feed industry, because the use residues like gluten feed, brewers grains residues, peanut shells, sugarcane bagasse. Because some nutrients are concentrated (proteins) during the industrial process, residues are stabilized and uniformed, which increases dry matter and makes it easier to store and have them available throughout the year.

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Second week, message 150: Opinion on questions

Dear All, my name is Reza Lotfi from Iran and I am a PhD candidate at Ferdowsi University of Mashhad.

I am pursuing my PhD program in the field of ruminant nutrition. Also, I am grateful to participants for their valuable information presented in this E-conference and the moderators of this E-conference. The responses are my own personal observations and remarks.

First of all, as you know, humans cannot consume directly wheat grain or soybean seeds or corn grain and so on. As a result, processing for each food is applied and many by products are produced which are potentially foods or non-food-parts (For example, wheat flour and Wheat bran or Soybean oil and Soybean meal). However, we can use foods, for example corn grain, directly as feed in animal feeding as well as its byproducts in its processing plant. Therefore, based on this explanation and this topic "ACCOUNTING of food losses", clarifying the food type would be important for the estimation or Food Loss accounting as well as the following questions (Q8 up to Q14). Considering my example, as you know, wheat bran is not a food and considering wheat grain as food, this would

result in an overestimation of Food Loss. Also, in my opinion, this topic (the food type) would make our topic partially complex.

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

I have not experienced this situation. But, as mentioned in a previous message, these situations (adverse condition strikes) also affect livestock in the same way. In my opinion, how to separate the soil and other non useful debris from a crop for example? Whole crop wheat is an obstacle to produce an edible feed and depend on the kind of adverse condition that strike. How many energy is needed for producing an edible feed from a damaged crop? However, in my opinion, in some case, we can use a damaged crop as humus or as a substrate for Biogas or Ethanol production.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts -- Moderators].

In my opinion and as I mentioned before, having a defined system in food production (the food type is not defined) would be important.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

In my opinion, having a comprehensive and extensive processing plant would be useful for production of safety non-food parts. For example, a corn processing plant is used as an example. Also, economical aspects as well as supply and demand find and present the best practice for production of safety non-food parts.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

In my opinion, using a person who has a view on animal nutrition in a processing plant would be useful for use of 'food loss and waste' as animal feed. Also, having a scientific communication between line managers and animal nutritionists in food supply chain would be useful. Also, economical aspects as well as supply and demand affect this question.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

In my opinion, using a person who has a view on animal nutrition in a processing plant would be useful. Also, having a scientific communication between line managers and animal nutritionists in food supply chain would be useful. Also, economical aspects as well as supply and demand affect this question for producing safety non-food parts.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The feed manufacturing industries make use of 'food loss and waste' as animal feed now and there is no doubt on this topic. The role suggested for the feed manufacturing industry is considering the rules for producing and formulating a safe, well balanced and an efficient as well as a hygiene diet. For example, hygiene storage of food is useful. Also, processing of cereal grains (Steam flecked corn) for better utilization is an important topic. In other words, keeping up with scientific findings is suggested.

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The feed manufacturing industries make use of 'non-food parts' as animal feed now and there is no doubt on this topic. But, considering anti nutritional factors in non-food parts, for example pistachio by products, is important. Also, using scientific application for increasing [ingestibility as well as ... correct? Moderators] digestibility of non-food parts as well as a whole diet consisting of non-food parts is suggested. Importantly, having a scientific communication between feed manufacturing industries and animal nutritionists in this topic would be useful.

Best Regards,

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Second week, message 151: Opinion on question 10

My name is Jianxin Liu, Zhejiang University, China

In my opinion, the "non-food parts" of agricultural products have great potential for use as animal feed when adequate technologies and feeding strategies are employed. During recent years, we conducted several experiments in which corn stover or rice straw were used to replace alfalfa and other "good" quality forage in lactation dairy cows. When 30% of the TMR was replaced by corn stover or rice straw, milk yield reduced by 10-15%, but the cost reduced more. When appropriate supplements were used to the cows fed a TMR with 20% of crop by-products, lactation performance remained almost similar to the good-quality forage-fed cows.

At the moment, we have not any measure to ensure the quality of the crop by-products. Sometimes, moulds will occur on the surface of them. It is necessary for the policy-maker to understand and realize the importance of those agricultural by-products. We should also be careful to use correct expression of these resources to avoid misunderstanding. For example, the "non-food parts" of agricultural products are usually called as crop residues. I strong suggest calling them as agricultural "by-products".

Jianxin Liu
Professor and Director, Institute of Dairy Science
Zhejiang University, China

Second week, message 152: Opinion on questions 9 and 10

My name is Dr. Mandal

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question

you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts -- Moderators]

Comments: The fruits and vegetables wastes can be dried or ensiled for feeding of animals depending upon the quantity available and facilities available for drying/ensiling. Almost all the by-products available during processing of food grains and seeds are generally used in livestock and poultry feed depending upon their safe/effective levels of inclusion in diets. Certain rejected lots of foods are available in market (biscuits, noodles, soybean chunks, breads, etc.) and are generally used in cattle feed.

The food loss and waste can be converted to livestock and poultry feed depending upon its quantity available (commercial feed mill requires consistent supply of raw materials with constant quality), and type and extent of damage, if any. Large amount of cereal grains are damaged during storage, which are unfit for human consumption. Those can be used in livestock and poultry feed after analysis of uric acid and mycotoxins content. Certain experiments have also been conducted on feeding of damaged grain but nutritionist should take its own decision depending upon the condition of grains. However, there is risk of using grains or seeds kept for seed.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

Comments: Non food parts of agricultural products are being secured and are used in animal feed. The roughage residues are being harvested for feeding of animals without or with processing. Generally dried cereal and pulse residues (straw and stovers) are stored and fed. There is scope of processing for improved utilization. Several experiments have been conducted and several methods have been suggested but could not be implemented at small scale, except for chaffing, soaking, shani (total mixed ration), and supplementation of green. The dried residual roughage parts of oilseeds have not received due attention.

The byproducts available during processing of cereals, pulses and oilseeds, undersized and/or broken seeds are generally utilized.

The fruit and vegetable wastes, obtained during processing, are also dried and fed to animals.

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Second week, message 153: Opinion on questions

Olawale F. Olaniyan from The Gambia again; in response to questions 8-14 of week 2.

In addition to hail and storms, natural events such as drought and crop disease outbreak have tendencies to reduce quality of farm produce and also, the amount of harvest. For most of the developing countries, food loss or waste in terms of quality and quantity are

noticeable during production, harvesting, transportation, processing, storage, and even during final utilization by the end users.

Technological interventions therefore need to systematically target each stage of crop production right from field preparation and not only at the harvest alone. The required technology will vary according to type of crops and agroclimatic conditions.

Quite a lot is presently done concerning technologies that can improve productivity of crops but such efforts would be marred if they are not backed up with appropriate policy tools (awareness, training, incentives) and institution (network of farmers and farmers' groups with both food and feed industries) that can reduce wastage associated with harvesting, processing, and storage.

National research institutions need to be backed up with adequate policies and funding in order to enhance studies on reducing harvest and post-harvest losses. The concept of field to feed whereby food loss/waste is harvested in the field and directly converted to feed can be explored for those agricultural commodities which are not good for human consumption. Institutionally, this will require motivation and good operational environment for feed industries to buy lost/wasted food and thereafter add values to such commodities through processing. In addition, the food industry can research into how they can convert non-food and lost/wasted food to feed just as some big supermarkets are beginning to use non-marketable food items in their warehouses for biogas production.

Also, the role of food industry in making use of 'food loss and waste' as animal feed may involve transfer of such materials to specialized feed industry for further processing. This could be on contractual terms resulting in mutual benefits for the two (food and feed) industries. The non-food parts (usually referred to as agro-byproducts) are much easier to utilize as feed because of existing demand for such materials. Crop farmers may however need to put extra efforts into proper processing and storage.

Best regards,
Olawale F. Olaniyan

Second week, message 154: Response to message 151

Dear all, I am Netra Osti from NASRI Nepal.

We are also doing research on TMR [total mixed ration ….. Moderators] based on rice and wheat straw with molasses, urea, mineral and vitamin mixture in dairy cattle and found normal milk production, I agree with Jianxin Liu (opinion 151), let's do more research and utilize low quality feed staff in ruminant livestock.

Netra Prasad Osti
Senior Scientist (Animal Nutrition and Feeding)
National Animal Science Research Institute (NASRI), Khumaltar
Lalitpur, Nepal

Second week, message 155: Response to previous messages

Hello all, and thank you for your comments.

I am Ericka MCTHENIA from the United States, currently living in Peru. I fall under the category of academia (I am a graduate student).

I would like to comment on some previous responses:

I agree with Tim Juzefowicz on Question 12 (Message 127).

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to

divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

"The food industry should be educated to understand the value of non-food parts as animal feed. The education should include an explanation of where the material will be used, methods of preserving the quality of the material, regular inspection or management."

MY RESPONSE: Absolutely, the food (and food service) industry needs to be more educated about ways to reduce and recycle food parts as animal feed. In regards to the food service industry, as the farm-to-table movement is popular, we should work on closing the loop to also be table-to-farm and send food waste back as animal feed if fit for animal consumption and/or used as compost.

Response to Message 139 (Erasmus ZU ERMGASSEN, Q11).

What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

"The food industry should consider food wastes and losses as a value added product, not a "waste" per se. According to the food waste hierarchy (http://www.vision2020.info/ban-food-waste/the-food-waste-hierarchy/), the food businesses should prioritise recycling food wastes and losses as animal feed over alternatives such as composting, anaerobic digestion, or land filling, which all have an environmental burden. The onus does not, however, fall only on the food industry; government may need to subsidise the recycling of food wastes as animal feed – for example by supporting businesses recycling food waste as feed, or creating incentives for food businesses to link with farms which can use their food waste."

MY RESPONSE: I think you make a very good point about encouraging the government to subsidize the recycling of food waste, at least to get started until this becomes a routine act or we have decreased our food waste by a significant amount. As for compost, it does not have an environmental burden, but rather returns nutrients to the earth and acts as a soil amendment where over fertilization and heavy pesticide/insecticide/herbicide use has been present. Recycling the food waste to feed animals is the preferred option. But composting is an underutilized tool that has great benefits to the environment. Regarding this question, I also think that there is a great opportunity for the food industry to make use of food loss and waste as animal feed. I think if there was a policy in place, it would help enact this thinking more. However, as for harvesting and post-harvesting, whatever food is unfit to go on to the next stage should be returned to the animals as feed. Processing and distribution are a little trickier and perhaps need more policy or guidelines. Depending on the distance of the animals to the processing plant, it may be quite difficult for the food recycling to be realized. In this case, I think food should be composted. And the trickiest stage still is the consumption stage as we have strict guidelines in the US about recycling food at this level. Here, I think there needs to be more education and advocacy campaigns (such as the Love Food Hate - Waste campaign in Europe). With the United States being one of the biggest producers of food waste, I think our first step is education and information.

Message 140 from Filipe PACHECO, Q11.

What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. "Processing, distribution and consumption stages: There must be cooperation and the creation of synergies between the industry, aiming at the search for collective and innovating solutions for a better access and capacity to intervene in the

markets. The interconnection between the farmers and the industry is also essential for the strengthening of the bonds. I'll present an example concerning spent grain. Brewing by-products are "spent grain". Brewer's spent grain consists of the residue of malt and grain. It consists primarily of grain husks, pericarp, and fragments of endosperm. As it mainly consists of carbohydrates and proteins, spent grains can also be used as fertilizer, whole grains in bread, as well as in the production of biogas. The spent grain has high nutritional value. However, it has received little attention as a raw material. From an economic and ecological point of view, the use as animal feed can be considered as a good solution."

MY RESPONSE: There are some breweries in the US that also send their spent grains from breweries to local farms or zoos as animal feed. This is a great example and, in my opinion, something that needs to happen more often. If it is happening more often, I don't hear or read about it happening, and it might be a good way to encourage others to follow suit.

Message 144 from Gregory Ndwandwa Sikumba

In regards to the answer for Question 9: I absolutely agree with the point that standard operation procedures (SOPs) should be develop on how to handle food wasted for livestock feed. Of course, it will be different for each type of industry, but even a loose guideline to start off with can render big results.

Second week, message 156: Opinion on questions

I am Maureen LARTEY from Ghana

Q.8

One of the Technological Options available in salvaging the crops for animal feed is laboratory analysis. This will ensure that the safety parameters are within acceptable limits for animal feed, to guarantee animal safety.

Institutional Option will entail collaboration among various stakeholders (private and state institutions) to ensure that only wholesome Crops (raw materials) are used.

Q.9

Food Loss/Waste can be secured through effective legislation and ensuring that all the state institutions have well defined roles aiming at animal health, welfare and animal product safety.

With Harvesting, Post-Harvesting and Processing, adequate infrastructure should be put in place to ensure that products are wholesome and not susceptible to contamination along the value chain.

Q.11

Food industry plays a very vital and critical role. A lot of by-products from food processing and waste accrue from the activities of food industries. There should be a constant communication between the Food and Feed Industries to ensure that the waste is proactively made accessible to the feed producers.

Examples are fruit waste from fruit juice companies, fish waste/offals, restaurants waste, non-conforming and expired products.

Q.14

Non-food parts include maize cobs, stalk, leaves, wheat bran, rice bran, peels of cassava, yam and cocoyam. The Feed Industry can process some of these materials and use them as ingredients for animal feed.

Second week, message 157: Opinion on questions

I am Danilo PEZO, from Costa Rica, and in following paragraphs you will find comments to the proposed questions for Week 2.

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

I wouldn´t like to repeat what other participants have mentioned responding this question, particularly in connection to technological interventions in response to adverse conditions. I would rather refer to institutional and policy options, although from a very general perspective.

Due to climate change, it is expected that in following years/decades we will face more frequently extreme weather events (such as floods, droughts), higher temperatures and reduced rainfall, that will lead to heat and water stresses, with consequent impacts on crop and livestock production. Although we believe that livestock is more resilient than crop production when facing such events, if mitigation measures are not taken, poor rural communities will lose assets that can push livestock dependent households into chronic poverty. In spite of it, Disaster Risk Management Plans very seldom include measures for preventing/mitigating impacts on livestock production. Therefore, one of the priorities for animal scientists and veterinarians should be to assure that mitigation measures for the livestock sector are considered in those plans, including the training of farmers on well-known technology options for effective use of affected crops as animal feed.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts -- Moderators]

The way "food loss and waste" is used for animal feeding will depend on the moisture content, weather conditions and facilities available. In general terms, those with high moisture content should be used almost directly (shortly after collection to prevent spoilage) or conserved as silage; whereas others could be sun-dried or using drying devices (e.g., solar dryers) that do not require fossil energy. Some of these activities could be implemented in each farm, but to do it at a larger scale frequently, collective action is required given the monetary and/or labor investment needed for collection, transport and processing of the food waste to be used as feed. At institutional level, there is a need for sharing information with farmers on the nutritive value of those feeds, how to improve their utilization, and potential risks while using those feedstuffs non-properly preserved/stored. Also, some adjustments need to be made in the courses offered at professional level, because frequently we have found that in Feeds and Feeding courses emphasis is given mostly to the "concentrate-type" feeds (i.e., grains, protein-rich meals, etc.), and very little to local feed resources.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

Proper handling of "non-food parts" at all stages of the food supply chain is needed to assure that feed safety and animal health is not compromised. It even goes before harvesting, because some of the chemicals used to control pests and diseases in the crops could be harmful for the animals, and even for humans consuming the livestock

products. There is not much control on the use of pesticides in crops in most developing countries, and frequently recommendations for their use come from agro-vet stores, instead of extension staff, and not all those stores have professional staff.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

There are many by-products of the food industry with good value for animal feeding that could add value to the whole processing; however, in some cases those are thrown to water bodies or garbage fills without any control, creating pollution problems, because of costs or lack of infrastructure needed for the manipulation/disposal of residues, or the lack of agreements with other actors for their processing and/or commercialization. The problem is greater when the residues have high moisture content.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The answer for Q11, also applies to Q12.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

I agree with the answer provided by Ricardo Sager (Argentina), that most feed manufacturers are not interested on and/or prepared for using feed loss and waste.

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Many of the non-food parts of agricultural products resulting from processing are used as ingredients in the preparation of concentrates by all feed manufacturers; whereas the non-food parts that come from harvesting and post-harvesting stages are more frequently used by feed manufacturers that produce less sophisticated feeds, such as multi-nutrient blocks. The residues from distribution and consumption are very seldom used by feed manufacturers.

Danilo Pezo, PhD, Freelance Consultant, San José, Costa Rica.

Second week, message 158: Response to messages 151 and 154

I am Abiola Olusoji from Nigeria,

I want to lend my support and credence to opinion 151 and 154, that we need more research on these food products, by-products and others. The results will enhance their utilisation for farm animals. This is where Government policy has a serious role in supporting agricultural research especially in developing countries like my own. If this is done wastage will be minimized and there will be a great development in agricultural sector. Anti-nutritional factor, contamination and spoilage can equally be researched into seriously and come with a positive solution on all these.

Thanks.

dayspring_dnk12.

Second week, message 159: Opinion on questions 11-13

I am Dr. A.B. Mandal from India

Comments on question nos. 11-13

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Food grain processing, distillery and meat processing industries have sufficient scope for making loss into quality feeds at processing site. A large number of raw materials of good quality from the food grain (especially cereals and pulses) industries are available for feeding of animals. DDGS is also being produced by the distilleries. Fish meal/manure is also available from fish processing industries. Similarly meat-cum bone meal, blood meal, liver mill, trims from major cuts, poultry slaughter house byproduct meals of high quality protein are being produced from meat processing industries. However, there is further scope in standardizing for processing techniques (low temperature rendering) for production of DDGS and meat industry byproducts for improving protein digestibility. Moreover, meat–cum-bone may contain certain toxic amines that cause injury to gut health. Again, un-organized small scale slaughtering of animals and birds, and processing of fish makes it difficult to collect for further processing. Fruit and vegetable industries have scope for processing of loss or waste into quality feed at processing sites.

At consumption stages, the table garbage, fruit and vegetable wastes are collected and used for feeding of swine. However, wet meat and fish products loss due to breakdown of cold-chain system could not be used as animal feed due to microbial load, rancidity of fat and production of toxic amines.

The post-harvesting loss during storage and transport has already been discussed.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The Food industry is providing non-food parts of agricultural products as animal feed like rice bran/polish, broken rice, rice gluten meal, wheat bran, maize germ meal, maize germ cake, maize bran, maize grit, maize gluten meal, malt sprout, yeast, DDGS, oil cakes, cluster bean meal, high protein roasted cluster bean meal, pulse husks, broken pulses with husk, meat-cum bone meal, meat meal, blood meal, animal fat, soya lecithin, and likewise many other ingredients. Moreover, with the advancement in processing technology, so many newer byproducts may be available in future. Now it is the task of animal nutritionists to identify such by-products and to assess their feeding value in different livestock and poultry feeding systems as well as for pet animals.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The feed manufacturing industry is using almost all the food losses and wastes in different feed formulations to prepare low cost feed. Moreover, those by-products also act as buffer to gap the shortage of conventional feed ingredients like maize and soybean meal. Again many of the by-products are rich in one or more nutrients, and thus those are being used as strategic supplement. As for example, maize gluten meal, sesame cake, etc. are very rich in methionine. However, the major constraint is non-availability of many of the low-cost by-products for longer duration with consistent quality.

Feed industry is also using roughage part in compounding complete feed.

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Second week, message 160: Opinion on questions

I am Steve Bartle, Beef Cattle Nutritionist, Kansas State University, US

As Dr. KABANSHI stated in Comment 52 (and more clearly than I have):

". . . where there is excess agricultural production, the issue of food loss and waste takes a different angle. That is, the question of food loss becomes more evident at storage and consumption levels rather than whether the food is used by humans or animals. However, when food is in low supplies like is the case often in some regions, there is always a nutritional conflict of interest between humans and animals."

Second week questions:

Q8.

This is not my area, but my understanding is that most farmers of the major crops take a voluntary insurance policy on their yields. If adverse conditions reduce the yields, an inspector scores the field for a percentage loss of yield. Often if the loss is less than 100%, the field is harvested, and the insurance pays on the lost production, which is based on the history of the field. If the judgment is that the field does not merit harvest, the farmer can harvest the field for forage (either dry or ensiled) or they can bring animals to the field and allow them to graze. Often grazing is done with the use of temporary electric fences. As several others have mentioned, mycotoxins can be a concern.

Q9.

In the US, the location of the food loss and waste is often separated from the areas of animal production by 100s of kilometers. In theory, it may be possible through policy changes and government support to encourage livestock production in areas closer to the food waste production.

Q13.

Food waste is a current topic in the US, and there are companies in the US that collected food waste and transfer it to livestock operations, and do it for profit. Usually, they collect food waste from large distribution centers. They can transport food waste in the range of 100 to 150 km but often there is a shortage of livestock within this distance. No processing of the food waste is done in this scenario. Traditional feed companies work with 90% dry ingredient; drying most food wastes to this level is not economical.

Q14.

The non-food parts are often low energy, and require processing to fit into the traditional feed industry. Therefore, such products are not often part of feed manufacturing product lines.

Best,

Steve

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Second week, message 161: Response to messages 148

This is T.K. Walli from Karnal, India and I am responding to the message No. 148 sent by Netra Osti from Nepal.

Since the sugarcane tops/ bagasse are available at a place which is far away from where the ruminant production system is followed, it may be worthwhile to convert these sugarcane tops into hay and then make the dried and chopped roughage as part of the complete densified balanced feed as blocks or pellets, along with other concentrate ingredients. It is easier to transport the densified feed to the place where it is required than as loose and bulky roughage. Even the sugarcane bagasse to the tune of 10 % can form part of the roughage in the densified TMR [total mixed ration …. Moderators] feed.

India has developed this technology and now FAO is helping in transferring this technology in the region. On FAO's initiative and expertise, a densified TMR feed plant is in the process of being installed in Bangladesh right now.

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Second week, message 162, opinion on questions

This was already distributed as Message 137

Second week, message 163: Response to messages 162 (137)

This is T.K.Walli again from India and supporting the post sent by Khan Shahidul Haque of Bangladesh, message No.162 (137)

Dr. Khan's suggestion that the recycling of vegetable and fruit waste into feed, rather than using it as landfills and polluting the air by the GHG emitted from these, is very pertinent, and needs serious attention by the Governments of the developing countries.

Japan is a good example: It produces a substantial part of animal feed from food wastes. Time has come when the technology may be injected into this area, so as to avoid food wastage, reduce pollution and increase feed availability for livestock, In India, creation of food parks in different states is on the cards, wherein different types of food items are going to be processed. In my opinion alongside the food processing plants, these parks may contain feed processing plants as well, as the food waste and by-products obtained during food processing may serve as the raw material for the feed processing plants. In this way, the feed manufactures shall be able to save on labor as well as the transportation cost and ultimately produce cheaper feed.

T.K.Walli Ph.D.
Former Head, Dairy Cattle Nutrition Division
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Karnal, Haryana, India.

Second week, message 164: Comment on message 161

Dear all, I am Netra Osti from NASRI Nepal

This message is related to Prof Walli’s suggestion (message 161). We have developed sugarcane top silage and are now trying to make silage from sugarcane bagasse. Yes TMR (total mixed ration) is easy to transport from one place to another, besides tops soft part of sugarcane byproduct bagasse can be utilize in ruminant feeding.

With best regards

Netra Prasad Osti
Senior Scientist (Animal Nutrition and Feeding)
National Animal Science Research Institute (NASRI), Khumaltar
Lalitpur, Nepal

Second week, message 165: Comment on messages

My name is Togtokhbayar Norovsambuugiin, from Mongolia;

I work as Animal Nutrition Professor at the Mongolian State University of Life Sciences.

Q8. Crops could be harvested and prepared as a feed for livestock, depending on the type of crop and damage. In spring this year farmers of Mongolia planted crops on time, but rain was late. Therefore many farmers have lost their crops as a human food. But the Government of Mongolia bought their harvest as forage for livestock. I really agree with Professor Ricardo Luis Sager on provision of tax exemptions by state, development of contingency plans that include weather forecasting and warning of meteorological events.

Q9. There is more waste than loss, due to the nature of the food in the kitchen of households. Therefore food waste management and propaganda is necessary among citizens.

Togtokhbayar N, Mongolian State University of Agriculture, School of Animal Sciences and Biotechnology

Second week, message 166: Opinion on questions

From Muhi El-Dine Hilali, ICARDA

Q8

If farmers in the NAWA [North Africa & West Asia …. Moderators] region cannot harvest, they may leave their fields after drying to be grazed by small ruminants for certain period on a daily basis together with grazing on stubbles or offering straw.

Q9

Storage condition is very important, e.g. ventilation and humidity. Molds may produce aflatoxins that can limit the use of food losses as feed. Regulation and awareness is very important.

Q11 and Q12

The food processing industry may have strategies to get an extra benefit from processing by-products into feed e.g. processing of tomato, sugar beet and starch industry. To prevent losses and pollution, policies should be developed on a country level to implement certain economic rules even at small-scale processing units. Government support may play a role in encouraging closing the gap.

Q13

In NAWA, Feed industry could make use of almost all the losses and wastes of grains and legumes that are not suitable for human consumption to produce low cost feed. However, different balanced rations should be developed.

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Second week, message 167: Opinion on questions

I am Dr Bakshi from Ludhiana, India

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

Opinion on Q8

Technology, policy options

Sometimes due to unforeseen weather, the standing crops like wheat and paddy are badly damaged and cannot be kept in the field till maturity; the only option is to harvest, chaff and feed to dairy animals or if possible it can be ensiled after wilting. Another example of natural calamity is due to excessive and extended frost by which snow peas are damaged intensively and are declared unfit for human consumption. Such frost affected fresh snow peas are relished by animals and have high palatability. Or the damaged snow peas can be dried in forced air oven specifically meant for drying forages or sundried and can be used in the concentrate mixture. In order to avoid financial losses to the farmers, crop insurance should be made mandatory for the farmers of all the socio-economic categories.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts -- Moderators]

Opinion on Q9

Post harvesting

In India, fruits and vegetables during their peak production season are available at throwaway prices. Potatoes and onion are stored in temperature controlled stores, while apples and pears are kept in controlled atmosphere stores also called CA stores. In-spite of keeping in such stores there are food losses for example on an average 6% loss in normal potatoes, 10-12% loss in CIPC (Chlorpropham or isopropyl-N-(3-chlorophenyl) carbamate; used to suppress sprouting) treated potatoes and about 1.5-2.0% in case of stored apples. These food losses vary depending on the quality of product received at the time of storage. Such 'food loss and wastes' can be secured by intervention of feed industry e.g. by blowing hot air or by keeping such wastes in specially designed hot air ovens, which not only reduce the moisture content, but temperature higher than 42°C will also eliminate pathogens if any.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

Opinion on Q10

Post harvesting; processing

The conventional and non-conventional straws and stovers of cereal and millet crops, straws of some of the pulses and groundnut are secured throughout the developing countries and their (non-leguminous) nutritional worth can be improved considerably by natural fermentation with urea. However, the technology is yet to be mechanized.

In the northern states of India some of the progressive farmers store the wheat straw as such or after above treatment in the month of April/May. The farmers feed treated straw to their animals, without disturbing the stack/kup/shed in which untreated straw was stored. By the time the paddy crop is harvested, paddy straw is available almost free of cost in the month of October/November and farmers start feeding paddy straw to their animals. The untreated wheat straw kept in a separate shed is then sold in the market at hefty price.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Opinion on Q12

Post harvesting; processing

In Punjab state of India, after extracting the pulp from tomatoes, the tomato pomace (peels, seeds and residual pulp) was earlier dumped in landfills as a waste material. But now due to spreading of awareness amongst the farmers and feed manufacturers, the situation is totally different, as some of the food processing industries, sundry the tomato pomace at their premises and sell to the feed manufacturers. During the summer season when the tomato crop comes, the ambient temperature is around 40-45°C, and it takes hardly 3-4 days to sundry tomato pomace.

After shelling peas for human consumption, the left over empty pea pods, similarly, carrot pomace, waste potato chips etc. can be used in livestock feeding.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Opinion on Q13

At distribution and consumption stage

In India huge quantities of fruit and vegetable wastes are daily dumped out of whole sale fruit and vegetable markets on the road side or landfills. These include culled or spoiled fruit and vegetables. Such FVWs are consumed to certain extent by stray and cull animals especially crossbred males and sterile cows; the left over ferments there itself. Such sites are cause of accidents, besides causing environment pollution.

Some NGOs should come forward to procure such wastes and feed fresh to their productive animals. The best example is a common practice of small and marginal pig farmers, who collect hostel kitchen, hotel or mess waste on daily basis and feed fresh to their pigs. Or some young entrepreneurs should be given interest free loan with tax holiday to set up small scale feed processing industry for drying or processing such wastes.

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Second week, message 168: Opinion on questions

My name is Paul FEATHERSTONE, United Kingdom. I am President of EFFPA, the European Former Foodstuff Processors Association, and President of UKFFPA, the UK Former Foodstuff Processors Association and Procurement Director at SugaRich Ltd.

QUESTIONS FOR WEEK 2

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts-- Moderators]

Processing: At food manufacturer level there are always unintentional/unavoidable production errors. In a bread factory for example, the loaves of bread can be too small, too big, stuck together in the baking process or have small burn marks. Nutritionally speaking the product is fine, but for commercial reasons human consumption is no longer an option. Production errors can also be imagined for foodstuffs such as biscuits, chocolates and breakfast cereals (damage, incorrect flavouring). When a food manufacturer can secure the safety and integrity of the former foodstuffs, former foodstuff processors can process them into animal feed.

From a policy perspective, governments need to stimulate the safe feed use of former foodstuffs. Most crucial in their approach is to consider the feed use of former foodstuffs as a means to reduce food waste accumulation in the supply chain. This will help with securing food losses for animal feed, as the sustainability of the practice will be inherently recognized.

Distribution: Food manufacturers have to produce large quantities of food items for seasonal activities, such as festive celebrations (Easter, Christmas, Halloween) and sports events (World Cup Football). The surpluses that result are eligible for feed use, after donation to food banks is taken into account.

Consumption: In the EU, food losses at consumption stage may not be used in feed for food producing animals. Former foodstuff processors do not use this as a source.

At any stage in the food lifecycle that a 'loss' may occur and in order to assure feed safety, the continuation of full assessment and minimization of risk (HACCP) **MUST** be applied. The **FULL** requirements of food + feed law must be maintained at all times and through the application of HACCP, feed safety can be assured.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The food industry plays a **key** role in ensuring the application of the best circular economy solution to its food loss/waste. As originators or holders of the loss/waste they are likely to have the full legal ownership of the challenge (product(s)) and hence are instrumental in the solution. If they choose to do the right thing and minimize waste/loss by finding the best solution, which is likely to include animal feed, then they have met their moral and in some instances legal requirements. If they fail to do the right thing then waste in its true sense of the word is the result.

Examples of positive intervention:

Processing: When a food manufacturer sells former foodstuffs as feed for food producing animals, the food manufacturers needs to take its responsibility as regards the rules for feed safety and traceability. In the UK (for instance), the UKFFPA developed a module *together* with BRC 'Food Standards to facilitate the implementation of feed hygiene requirements (BRC Voluntary Module No. 9)'. Former foodstuff processors, in the EU at least, pay food manufacturers for the nutritional value of the former foodstuffs. It should therefore be part of their business strategy to take animal feed into account for their food by-products, as they can recover some of the costs they lose for not being able to bring the foodstuff to the human consumption market. By no means should feed ever be considered as one of the disposal routes, belonging in the waste management area.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the

food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

EFFPA has an excellent relationship with the European compound feed manufacturing association FEFAC, and so do EFFPA members with FEFAC members at national level. FEFAC helped with bringing former foodstuff processors together, thereby playing a crucial role in the establishment of EFFPA, and with providing professional guidance. EFFPA will develop its own sector feed safety management guidelines in the coming year, with the consulted help of the feed industry.

Processing: The EU feed industry, who use the processed former foodstuffs as an ingredient, engaged with the food industry and policy makers to establish the risk profile of the of former foodstuffs destined to feed and has made efforts to harmonize the terminologies used. Most notably in the Feed Catalogue, Regulation (EU) No 68/2013), with a clear definition for "former foodstuffs" and the listing of the various identified food products that are recognized as feed materials.

In addition, it is the role of the (global) feed industry to establish a harmonized LCA methodology that will allow feed manufacturers to calculate the environmental footprint when former foodstuffs are included in feed.

Second week, message 169: Opinion on message 161

I am Dr.Thirumalesh, Professor and Head, Dept. of Animal Nutrition, Veterinary College, Bidar, Karnataka, India.

1. As a supplement to Dr.Walli's message 161, the farmers of the northern part of Karnataka use sugar cane tops as a source of roughage immediately after harvest but the trash (around the cane almost dry leaves) is burnt on the sugar cane field due to high labour cost for collection. However, it is not palatable but 4% urea treatment can improve its palatability and sheep can consume around 2.5 to 2.8% of the body weight.

2. Similarly, the banana plant wastes like leaves and stems grown in this region were collected and ensiled with sugar cane bagasse as moisture absorbent to reduce the moisture level to 65% and the sorghum powder as a source of soluble carbohydrate. The silage prepared thus becomes almost complete feed and no need of feeding of CFM and roughage separately above maintenance level. This way the agricultural crop and fruit plant wastes which otherwise would have been wasted as manure can be efficiently used animal feed.

Second week, message 170: Opinion on questions

My name is Alexander Döring and I work for the European feed manufacturers federation, FEFAC. The answers below reflect only my personal opinion and shall not be attributed to my organization.

QUESTIONS FOR WEEK 2

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety aspects? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste may please also be kept in mind. . [Note: please restrict your answer to 'food loss and waste' only. Do not include non-food parts -- the Moderators]

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during:

harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

The key responsibility and liability for safe use of food losses in feed production lies with feed businesses. They need to conduct appropriate risk assessments by applying HACCP-based to ensure that such products do no present an animal health or food safety risk. Processing technology may indeed be an effective risk management option to remove and control certain contaminants from such food losses (e.g. physical treatment (heat & pressure, chemical treatment, acidification, decontamination by active carbon, unpacking of former foodstuffs etc)

As stated in the first round of questions, food waste cannot be legally used in feed for food-producing animals in the EU (except for use in pet food and fur animal feed). One of the key reasons for this ban, are the extremely damaging experiences made with untreated food waste use in feed in the last decade which have been identified as a key source for the spreading of Food and Mouth Disease (UK, 2004) and Swine fever in Germany (2002 & 2006) leading to major food and feed recall (including destruction of 4 Mio sheep in the UK alone). Catering food waste of old people homes and hospitals have also been shown containing drug residues and other chemical residues which cannot be removed through heat treatment. The presence of animal proteins present in catering waste, falling under the EU feed ban for processed animal proteins is another key reason why food waste (e.g. catering waste) remains banned for the feeding of food producing animals.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The food industry holds an important responsibility to maintain safety and integrity of former foodstuffs destined for animal feed use, by storing such products in good condition (temperature control, confined storage to prevent rodent infestation etc) separately from actual food waste. Food business operators also should apply HACCP-based risk assessment to ensure that effective risk-based control and management procedures are put in place.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

As stated under Q11, food business and non-food business operators which are delivering co-products from their industrial processes for food and non-food production (biofuels, chemical industry etc) to the feed chain, must have robust , risk-based own-control systems in place to ensure safety and integrity of these co-products (e.g. oilseed meals, wheat bran, Distillers dried grain solubles, fatty acid derivates etc) and "fit for purpose" status, e.g. no risk for animals, humans and the environment. The CODEX manual on good animal feeding provides practical guidance to food and feed business operators to set up such robust own-control systems for feed products.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Feed manufactures as key users of food losses should implement risk-based auditing programmes for suppliers of such products. Audits should ascertain that such suppliers have identified critical control points and respective control and risk management measures to eliminate e.g. minimize any feed safety risks from such products (e.g. removal of packaging residues from former foodstuffs)

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Same answer as under Q13: In our general experience with feed safety incidents over the past decade in the EU, the vast majority of feed safety risks have its origin in raw materials. Since there are very limited control and risk management options available at the level of the feed mill and even less at the level of on-farm mixer to minimize such risks, the main focus to remove animal health and food safety risks from the feed chain is directed towards the "entry" point of feed ingredients in the feed chain. Suppliers of such products have to intensify their efforts to carry out risk assessments and increase testing of their products and share any risk-related information with their customers allowing them to apply risk-appropriate risk management measures which effectively avoid any spreading of such risks to food products of animal origin.

Second week, message 171: Opinion on questions

I am Dr Anyizi Bertha Nkemnyi From Cameroon.

I fall under the group of academia (a graduate student)

I want to sincerely thank the organizers and all the participants so far for their relentless effort.

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

Opinion on Q8

These crops can be harvested and fed directly to the animals or dried and used as feed ingredients. In Cameroon, due to the difficult terrain and lack of farm to market roads the farmer can only make use of it if he or she has animals and if the animal farm is close to that crop farm without which it would not be economical to bother about it. There are many farms just being abandoned in this type of situation. Government policy is really needed here.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts -- Moderators]

Opinion on Q9

In Cameroon most food is grown in those interior parts of the country which are inaccessible especially during the rainy season. So before the food reaches the market most of it is in bad shape. Fruits such as tomatoes, pawpaw, pineapples, pepper etc; not to count vegetables and foodstuffs such as potatoes, plantains, bananas and coco-yams are lost. In these areas food and fruits are very cheap but by the time they reach the market they become very expensive because just a hand full arrives in good condition. If the government can go into these areas and construct post harvesting preservative units, it will go a long way to help, Some farmers cooperative have tried but their efforts are not enough, It is not spoiled food that we give to the animals, but the surplus, to avoid wastage.

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare?

While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

Opinion on Q10

These are really mind opening and awareness questions. We begin to see here that the problems we have in Cameroon is not lack of food but lack of preservation and transformation of the food. It is not even easy to transport the food properly, talk less of non-food parts. Locally ovens can be constructed in the farms to dry the pulp, leaves and stems of rice, maize, sugar cane etc before storage or before transporting them to areas of need.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages."

Opinion to Q11 and Q13

Sharing the same view with Filipe Pacheco, (message 140) I would agree that the food and feed industries should collaborate. Using the same example as he did, the breweries industry in Cameroon is very active and so produces a lot of spent grains. Unfortunately these are dumped along the highways. Although some people package it locally and sell to some farmers, if these were to be sent directly to local farms or feed industry it would avoid contamination and wastage. If these grains were to be handled properly it would be a big relief for the feed industries in the country.

Second week, message 175: Response to message 167

This is T.K. Walli again

I support the views expressed by Dr. M. P. S. Bakshi, who has given some valuable suggestions on the recycling of fruit and vegetable waste like apple and tomato pomace and pea pods as animal feed. He has also given his ideas about the disposal and processing of huge quantities of fruit and vegetable wastes which are daily dumped out of whole sale fruit and vegetable markets on the road side or used in landfills, which ultimately causes environment pollution. It is a good idea that some NGOs should come forward to procure such wastes and deliver it to young entrepreneurs, who should be given interest free loan with tax holiday to set up small scale feed processing industry for drying or processing such wastes.

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Second week, message 188: Opinion on question

Almudena Rodriguez EUROPEAN COMMISSION COMMENTS

QUESTIONS FOR WEEK 2

Q8. When a crop is ready for harvest, and an adverse condition strikes (e.g. hail storm, and floods), the crop meant for human consumption may not be suitable for that purpose

anymore. What technological, institutional and policy options can be taken to salvage it for feeding to animals?

Institutional and Policy options

When a natural disaster renders a crop unfit for human consumption the farmer may decide to use it for animal feeding if complies with feed legislation requirements.

Depending on the quality and hygienic conditions of the crop, the farmer is in the position to salvage such crops for feeding animals or for other uses such us biofuel.

Farmers in the EU are subject to certain legal hygiene requirements. Operators are responsible for primary production of feed shall ensure that operations are managed and carried out in such a way as to prevent, eliminate or minimise hazards with the potential to compromise feed safety.

There are also requirements for the use of those crops as feed. Operators can only use those crops if they are safe and do not have a direct adverse effect on the environment or animal welfare. There are certain quality requirements and specification for some feed materials

Legislation on pesticides, contaminants or presence of undesirable substances shall also apply in order to ensure that only feed fit for animal consumption is used.

The Common Agricultural Policy provides also that EU Member States may support for harvest insurance that shall contribute to safeguarding producers' incomes where there are losses as a consequence of natural disasters, adverse climatic events, diseases or pest infestations. When the crops are highly spoiled, damaged some farmers may have recourse to this option.

Technological alternatives

There are technological alternatives to use these crops as feed, for example heat and pressure processes or fermentation.

Q9. How can 'food loss and waste' be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind. [Note: please restrict your answer to 'food loss and waste'. Do not include non-food parts-- Moderators]

Without prejudice of the different interpretations of food loss and waste for which we can differ, the EU has different legal requirements applicable to the whole chain from harvest/ animal production to the final consumer. Any product intended for feed must comply with the relevant feed legislation.

The EU feed hygiene regulation is one of the key elements to ensure that feed is produced , harvested, processed and placed on the market without compromising feed safety.

This Regulation laid down hygienic and traceability requirements for primary production including the feeding of animals. Also the processing industry must comply with provisions regarding facilities and equipment, personnel, production process, quality control, dioxin monitoring, storage and trans port, record keeping and complains and product recall. Transport and storage are also regulated to prevent spoilage, deterioration etc.

The feed business operator processing feed must perform HACCP (Hazard Analysis and Critical Control Points) to ensure that feeds do not pose a risk for human or animal health.

The feed marketing legislation establishes conditions for placing a feed on the market. Those provisions must ensure traceability, information to the user for the proper use of

the feed and information that ensures an adequate management during transport and storage, e.g. indication of storage life, storage conditions etc.

The EU encourages the adoption of national and Community guides on good practices for the control of hazards in primary production of feed. Also for the feed industry, the EU promotes Good Manufacturing Practices where the feed business operators agree on voluntary basis.

As regard animal products we should stress that there are many risks associated to these products and many restrictions are imposed in the EU by different pieces of legislation.

At international level, the CODE OF PRACTICE ON GOOD ANIMAL FEEDING CAC/RCP 54-2004 and the GUIDANCE FOR GOVERNMENTS ON PRIORITIZING HAZARDS IN FEED CAC/GL 81-2013 are two important references to prevent the use of unsafe feeds

Q10. In your opinion, how can 'non-food parts' of agricultural products be secured and used as animal feed, without compromising feed safety and animal health and welfare? While answering this question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages. Not only technological but also other dimensions (institutional, policy, social) of securing food losses and waste and their use as animal feed may please also be kept in mind.

Non- food parts must be treated in the same way as other feeds. Food operators that divert non-food parts to feed must be aware of the feed legislation requirements and must be regarded as feed business operators.

The use of non-food parts in animal feed is very important in the EU and many technologies have been developed to process those products and make them suitable for animal nutrition. This use largely contributes to the optimisation of the resources and reduces the environmental impact; therefore, the benefits for the society are evident.

Many of the non-food parts uses come from the food industry and are co-products obtained during the processing of food. There are some other non-food parts coming from different industrial sources such as the pharmaceutical industry (mycelium silage from the production of penicillin) or the biodiesel industry (yeasts from biodiesel process) that can be also used as feed. These are in many occasions fermentation products using substrates from crop origin.

Q11. What role do you see for the food industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

The optimisation of resources and the prioritisation for animal feed should be an important element to consider by the food industry but any use of those products should bear in mind the risks associated. As we indicated in Q 10, food operators must be regarded as feed business operators and should be aware of feed requirements.

We consider that many products of food industry diverted to feed uses are not food loses or waste. The food industry plays a major role in the prioritisation process so, whenever possible, those products should be intended for feed. The implication of the food industry is important to ensure that those products are fit for animal consumption and are not diverted to other uses if they are adequate for feed. The food industry must be aware that an appropriate management of these products contributes to reduce the environmental impact and to optimise resources.

Q12. What role do you see for the food industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

For the EU this is very important for the arguments expressed in question Q10 and Q11.

Q13. What role do you see for the feed manufacturing industry in making use of 'food loss and waste' as animal feed? While answering the question you may wish to divide the

food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

Animal feed is accounts for more than 50% of the turnover in livestock production and the EU is lack of protein sources, therefore, the optimisation of resources is an important factor for the feed industry to ensure its economic viability and the economic viability of the livestock sector.

The feed industry plays an important role in promoting the best utilisation of products from the food industry and from harvested crops and has developed high level technologies to cope with this objective.

For wastes or losses in the distribution and consumption steps, the risk associated should be carefully considered. Packaging materials may pose a serious danger to animal and human health. The use, for example, of catering waste is forbidden in the EU for the risks associated with its use.

Q14. What role do you see for the feed manufacturing industry in making use of 'non-food parts' of agricultural products as animal feed? While answering the question you may wish to divide the food supply chain as during: harvesting, post-harvesting, processing, distribution and consumption stages.

For the same reasons stated above the feed manufacturing industry plays a very important role in making use of non-food parts.

In the European Union a high performance and innovative technology has been developed to utilise products from harvest or co-products from the food industry for the production of feeds. Many of these products are regarded as feed materials and perfectly described in the catalogue of feed materials. Some examples are citrus pulp, grape pips, apricot kernel expeller etc.

REGULATION (EC) No 183/2005 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 January 2005 laying down requirements for feed hygiene

REGULATION (EC) No 767/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 on the placing on the market and use of feed,

REGULATION (EU) No 1308/2013

COMMISSION REGULATION (EU) No 68/2013 of 16 January 2013 on the Catalogue of feed materials