Food and Agriculture Organization of the United Nations

Background document for the E-conference

'Utilization of Food Loss and Waste *as well as* Non-Food Parts as Livestock Feed '

Introduction

Approximately 1.3-1.6 Gtonnes of food get wasted globally every year, which is estimated to have enormous environmental (*ca* 3.3 Gtonnes of CO_2 eq. greenhouse gas emission/year, 305 km^3 water/year, 1.5 billion ha land to grow food that is wasted), social (936 billion US$) and economic (1055 billion US$) costs. Also the food loss and waste has an impact on food security and on local and national economies. A part of these losses can be converted to animal feed, without compromising animal product safety and animal and human welfare. Similarly a large amount of non-food parts such as crop residues and agro-industrial by-products originate from the food supply chain. These also require natural resources to produce and have economic and environmental costs associated with them. Wasting and burning of non-food parts of crops release greenhouse gases and can cause animal and human health concerns. The food loss and waste and non-food parts are valuable animal feed resources and can be brought back to food chain by using them as a part of animal feed.

There are projections that between 60 to 70% more animal products would be consumed in 2050 than consumed currently, resulting in increased requirement of animal feed. Meeting the future feed requirement is a big challenge given the scenarios of increase in land degradation, food-fuel-feed competition, water deprivation and on-going climate change. Currently 33-35% (approx. 790 million tonnes) and 5-6% (approx. 143 million tonnes) of grains are used annually for animal feeding and biofuel production respectively. The better use of food lost and wasted and non-food parts as feed resources, would also decrease food-feed-fuel competition and enlarge the feed resource base, contributing to feed and food security.

Against the above backdrop, a framework and an action plan on 'Food Loss and Waste *plus* Non-Food Part to Livestock Feed' is presented with *the objective to enhance animal feed availability without compromising animal health and welfare and animal product safety and quality, and meeting legislative requirements.*

Initially terminologies used in the framework have been defined, which is followed by development of the framework, scope and system boundaries that are planned to be covered through the framework, possible programme content, and linkages with other related initiatives. It is expected that implementation of the framework will lead to: *a) harmonized methodologies for quantification of food loss and waste and of non-food parts in the food supply chain, b) data on food loss and wastes and of non-food parts in the food supply chain*

that could potentially be used for animal feed, c) better understanding of the reasons for losses and wastes and origin of non-food parts enabling efficient conversion of these resources to safe feed, d) impact evaluation (e.g. decrease in food-feed competition; decrease in use of resources such as land, water, energy and other resources; decrease in environmental pollution; employment generation etc.) of the improved use of the above materials as animal feed, e) formulation of strategies and policy options of using food wastes and losses and non-food parts as animal feed, and f) provision of technical support to small scale industries to utilize food wastes and losses and non-food parts as animal feed.

Definitions and terms used in the framework

The definition of 'food', 'food supply chain', 'food waste and losses' and other terms mentioned below are the same as stated in the FAO's Food Waste and Loss framework (FAO, 2014)

1. **Food.** Any substance, whether processed, semi-processed or raw, which is intended for human consumption, and includes drink, chewing gum and any substance which has been used in the manufacture, preparation or treatment of "food" but does not include cosmetics or tobacco or sub-stances used only as drugs. (Codex Alimentarius Commission, Procedural Manual, 2013)
2. **Food loss** in the production and distribution segments of the food supply chain is mainly caused by the functioning of the food production and supply system or its institutional and legal framework.
3. An important part of food loss is called **food waste**, which refers to the removal from the food supply chain of food which is fit for consumption, or which has spoiled or expired, mainly caused by economic behaviour, poor stock management or neglect.
4. **Food waste** is not sharply defined. However it is still recognized as a distinct part of **food loss**, because the underlying reasons, economic framework and motivation of the food supply chain actors for wasting food are very different from the unintended food loss, and subsequently the strategies on how to reduce food waste are conceived in a different, targeted manner.
5. Quantitative food loss can also be referred to as physical food loss. It does not include the reduction of mass resulting from food processing operations such as drying, heating, ripening and fermentation. It does however include the removal of food for cosmetic or other market reasons by food processing operations such as grading and sorting.
6. **Food supply chain.** It is connected series of activities to produce, process, distribute and consume food.
7. **'Intended'** refers to the original purpose for the product in the food supply chain, even if certain actors in the food supply chain may intentionally discard a wholesome part of the product or divert it to a non-food supply chain. Examples being the whole potato is food, even if a French-fry manufacturer disposes of a fraction when slicing the product in to uniform size; or potatoes, other vegetables and fruits that do not meet the size requirements or are deformed.
8. **Feed.** Any single or multiple materials, whether processed, semi-processed or raw, which is intended to be fed directly to food producing animals. (FAO/WHO, Codex Alimentarius CAC/RC 54-2004, amended in 2008).

Note: Although the term 'food loss' encompasses "food waste", the term 'food loss and waste' is used in this document, to emphasize the importance and uniqueness of the waste part of food loss.

About the framework

The Food Loss and Waste *plus* Non-Food Part to Livestock Feed Framework builds on the Food loss and waste framework of FAO (FAO, 2014a) and Definitional framework of food loss (FAO, 2014b) and includes both edible food loss and waste, as well as non-food parts from the stage when a crop is in the field ready for harvest for human consumption (in the livestock sector when animals/birds are ready for slaughter; milk has been drawn from the udder; eggs are laid by the bird). The framework is prepared as a key step towards improving our understanding of the food loss and waste 'hotspots' (the points at which the losses and waste are substantial) as well as non-food parts in the food supply chain that could possibly be channeled to animal feed; thereby, furthering resource use efficiency and food security. In a recently conducted survey by FAO, to rank elements of sustainable animal diets, all stakeholders in the livestock sector desired that in future efforts must be made to reuse food losses and waste as animal feed, without compromising safety of the animal products as well as animal health and welfare. It was one of the top ranked elements (Makkar and Ankers, 2014).

This framework acknowledges that a) among the hierarchy of choices, the first priority is the prevention of food losses and waste including recovery of food by charities for redistribution to under-privileged masses, and the efforts that emerge from the framework must not contribute to enhancing food losses and waste; b) a food losses and waste as well as non-food part prevailing in a situation and in a context can best be utilized as animal feed if this does not compromise animal health and welfare and animal product safety and quality; c) food losses and waste and non-food part used for feed preparation has to meet quality and safety standards as prescribed by Codex and/or local regulations and the regulatory and legislative requirements; and d) in future, increased efforts to decrease food losses and waste will start yielding results, and over time the food losses and waste as well as non-food parts would decrease as percent of the food produced (the decrease in non-food losses is expected to be due to introduction of improved processing tools and technologies). On the other hand, total amount of food production will increase in the future; and the balance of these two phenomena will determine increase or decrease in feed availability; but nevertheless efficient use of food losses and waste and non-food parts will result in overall enhanced food security.

The impact intended to be generated through implementation of the current framework is consistent with the food losses and waste use hierarchy of the HLPE/CFS (2014) in which the use of food wastes and losses as well as of non-food parts for feed is higher in hierarchy compared with its uses for generation of bio-based materials, composting, biogas production, incineration or landfill. The framework is also in consonance with the trophic pyramid of food web, which for sustaining life in nature mandates that a biological material first be used for food production, and other uses such as bio-energy generation, bio-based material production, energy generation through combustion, landfill, incineration, etc. are lower down the hierarchy of competitive uses of biomass. The use as animal feed is the best utilization of food losses and waste as well as non-food parts since it indirectly goes back to human food chain. Also producing bioenergy directly is more efficient than producing food and then energy.

Furthermore, in no case, in this framework economic gains will override resource use efficiency and long-term sustainable food production in making decisions for not using food wastes and losses as well as non-food parts as animal feed. However, there might be situations where conversion of food waste and loss and of non-food parts to animal feed is high-resource demanding and in such situations other uses such as compost making or bio-energy generation may be considered. Life cycle analysis approach could be useful in making such decisions.

Scope of work and system boundaries

Scope of the work includes 'Use of **food wastes and losses** and of **non-food parts** as animal feed' (Figure 1)

Note: in many cases 'what is a non-food part' would be determined culturally and by the specific food supply chain.

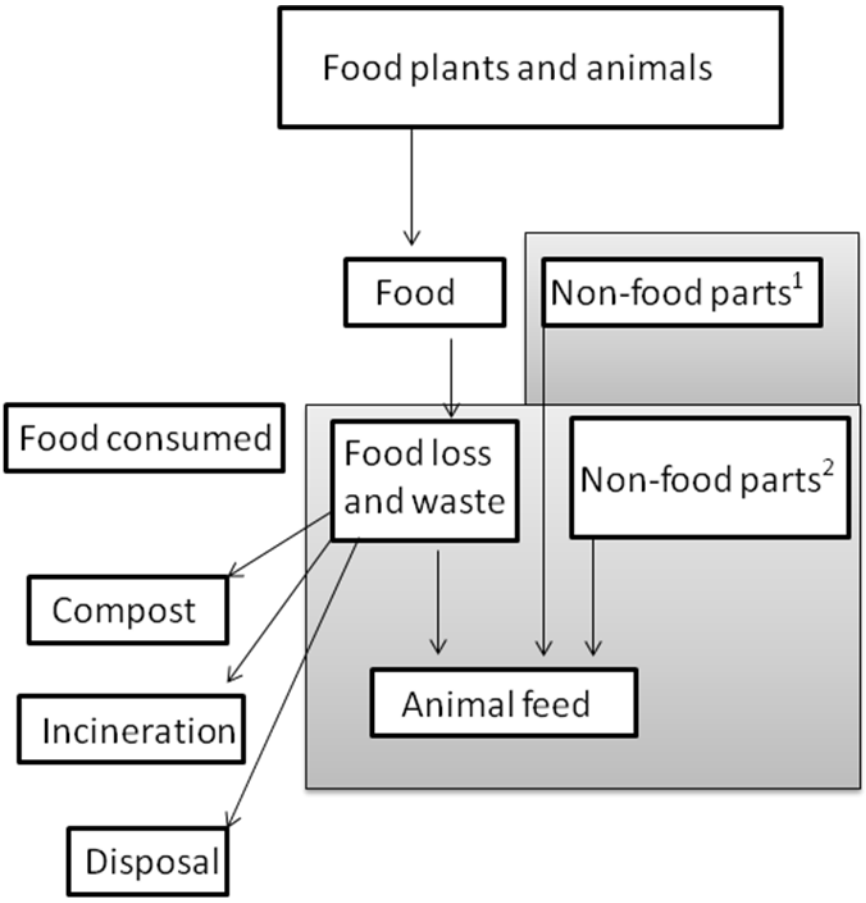

Figure 1. Flow of foods in the food consumption and disposal chain (the box in shaded area shows domain of the current framework); [1] obtained during upstream process such as wheat or rice straw obtained during grain (wheat or rice) harvesting, [2] obtained during downstream process such as wheat bran or rice bran obtained during grain processing

The system boundaries of this framework are presented below.

1. The portions of food waste and loss from the food supply chain, from primary production ready for harvest, post-harvest, processing and manufacturing, whole sale retail and marketing, and food preparation and consumption are included in the framework. For example the vegetables and fruits that do not meet the size requirements to market them or that are deformed or produced in surplus in the peak season and therefore could not be marketed are included in the framework. The motivation is to increase feed availability through conversion of these materials into animal feed.
2. The framework includes non-food crop parts (non-food parts; the parts not intended to be consumed by humans) such as wheat or rice straw and maize stovers as well as plant parts of vegetable or legume crops (e.g. peels, leftovers in vegetable and fruit markets). The reason being that some of these products are important components of ruminants diet in many countries while others have the potential for use as ruminant feeds. Besides having uses such as mulch, fuel, bedding, roof and cottage thatching, etc. crop residues form a major part of ruminant diets in developing countries. However. crop residues are also lost as well as wasted (intentional for example burning or unintentional), which must be accounted for and solutions put in place to decrease theses losses, by making their efficient use as ruminant feed. Non-food portions of animals, aquaculture and fisheries obtained during processing are also within the boundaries of this framework. It is expected that inclusion of non-food parts in the framework will further efforts for their inventorisation and efficient use.
3. If crop products (for example grains, root crops and pulses, among others) that are commonly produced for human consumption, are exclusively cultivated for use as animal feed then this is not considered as food loss and waste according to the FAO's Definitional framework of food loss (FAO, 2014b). Therefore, any losses and waste in these products will be accounted under feed loss and waste, with the motivation to identify both causes for such losses and waste as well as solutions for their reduction, which will result in increased feed availability.
4. However, in many situations agricultural products (for example grains, root crops and pulses, milk, among others; in raw, semi-processed or processed forms) are cultivated and produced not exclusively for animal consumption but for potentially different uses including for human consumption and animal feeding. In such cases, from the time it is known (or decided) that a part of food, which was originally intended for human consumption, is to be used for animal feed (not for reasons of low quality), *that part* **will not be considered as food waste**. Any losses in food before taking the decision to use a part as animal feed will be accounted as food loss and waste, and thereafter the losses and wastes will be accounted as feed loss.
5. Pre-harvest losses, both for crops and farm animals, due to adverse weather conditions, other suboptimal production and management conditions or diseases that lead to below-optimal production (efficiency gaps) are not within the scope of the framework.

6. However, 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. In some situations, the crops could possibly be salvaged for feeding to animals, and such situations therefore have been included in the scope/boundary of the current framework. The intension behind this is to promote: a) efforts to salvage this crop, and b) R&D efforts that enable to use this now inedible crop (earlier meant for human consumption) as livestock feed. This will not only enhance resource use efficiency but also provide some financial compensation (for the lost crop) to farmers

Possible programme content

1. Quantify food losses and waste, for possible use as animal feed
2. Quantify non-food parts, for possible use as animal feed
3. Quantify losses and waste in non-food parts, so as to develop strategies for reduction of the losses and waste
4. Develop, identify and upscale strategies for efficient and safe use of food losses and waste and of non-food parts as animal feed.
5. Evaluate impact of using the above materials as animal feed. Some of impact parameters could be: decrease in food-feed competition; decrease in use of resources such as land, water, energy and other resources; decrease in environmental pollution; employment generation among others.
6. Strategy and policy formulation on using food wastes and losses and non-food parts as animal feed
7. Provide technical support to small scale industries to utilize food wastes and losses and non-food parts as animal feed
8. Raise awareness and develop partnerships

Linkages with other initiatives

The FAO's Food Waste and Loss framework aims to develop standard approach on quantification of food waste including inedible portions. We see synergies between these two frameworks because information on the type and quantifications of food wastes and losses and of non-food parts at different stages of the food chain, by using the standard and harmonized protocols will assist in developing the approaches for using the food wastes and losses and non-food parts as animal feed. It is expected that the information on resource flows leaving the food chain would also promote strategic research and innovations for enhancing the use of the food wastes and losses and non-food parts as animal feed, increase investment in indirectly channelizing these components back into human food chain, decrease food-feed competition, enlarge feed resource base and assist feed industries to identify opportunities for using new feed resources, promote linkages between food processing and feed industries, and help develop appropriate policies in context to food wastages.

Note: EU's FUSION framework (EU, 2014) also aims to develop standard approach on quantification of food waste including non-food parts.

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