

# ANIMAL RENDERING: A TOOL FOR ENHANCING THE FUNCTIONALITY OF VOCATIONAL AGRICULTURE FOR A SUSTAINABLE DEVELOPMENT

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## **Abstract**

Animal rendering, a tool for enhancing Agricultural education for a sustainable future, examines the focus of vocational agricultural education, which is to equip its recipients with functional skills that can enhance student's ability to be self employed gainfully. The ability of the Educational system to keep upgrading available opportunities for students to acquire relevant skills, will ultimately determine the effectiveness of vocational programs. Rendering, the process of converting waste animal tissues into stable value added commercial materials which are organic in origin which includes high protein ingredients for poultry feeds, pet food, and fertilizer, yellow grease for biodiesel production used to power vehicles, tallow a valuable ingredient in the production of soap, paint, toothpaste, mouth wash, dyes, nail polish, crayons, glue, shoe polish, antifreeze, ornaments, pharmaceutical products, and wax paper. The trend the world over is transformation of waste products into a source of income generation. Skill acquisition in animal rendering would not only be a potentially promising income generating source, but also help in sustaining a healthier environment, given the massive problems of waste both in the agricultural sector and in the nation at large. The paper therefore examines what animal rendering is, the raw material for rendering, what rendering yields, types of rendering, uses to which rendered materials are put, disadvantage of using rendered materials in cattle feeding. Recommendations were made to help in establishing an animal rendering industry around which the various sectors can operate among which is that The government should look into the possibilities

of including instructions on practical animal rendering in vocational agricultural programs.

Vocational agriculture is defined as the teaching of agriculture, natural resources and land management through hands-on experience and guidance to prepare students for entry level jobs, to further their education and to prepare them for advance agricultural jobs (Phipps Osborne, Dyer Ball, Lloyd Edwards, James Anna. 2008). It is the training for a specific vocation in industry of agriculture or trade. The emphasis of vocational agriculture is to train people in such areas as production marketing and conservation (Phipps et-al, 2008). There is therefore an urgent need to continually upgrade the skills in offer in vocational and technical education to be more functional and meaningful by adopting various teaching and learning strategies that can take advantage of factors of production that are readily and cheaply accessible (Dike V.E, 2005). Vocational agriculture will effect the needed development, since it is designed to offer training to improve an individual's proficiency (Ademola EA, Olakunle O.B, Badmus A.S 2012). Continual updating and upgrading of occupational skills that can be taught in vocational agriculture is therefore of great importance (Knoblock N, Ball A, Allen C. 2007).

Recycling can be an economic as well as an environmentally friendly process, which can offer direct development opportunities for a country's economy which may include local revenue, agricultural job creation, business expansion, and local economic base.

In make vocational agriculture to be more functional than what it presently is, there is a need to explore and exploit the vast potentials inherent in transforming the massive and mounting problems of agricultural waste materials into profitable products. Animal rendering operations offer great opportunities in this direction, and if incorporated into agricultural vocational programs can further enhance effectiveness of the program. Animal rendering may be a dormant unexplored area of massive income generation in agriculture, as the focus the world over is on conversion of waste into avenues of wealth generation.

#### **What Is Rendering?**

Rendering is a process that converts waste animal tissues into stable value added materials, by processing of animal products into more useful materials (Meeker, 2006). Rendering can be carried out on an industrial, farm or kitchen scale.

#### **Raw Materials for Rendering**

According to NRA, (2013), waste animal tissues processed comes from slaughter houses, butcher shop trimmings, expired meat from meat shops, carcasses of euthanized animals and dead animals from animal shelters, zoos, veterinarians, and on transit. They also include restaurant waste grease. Specific materials used include fatty tissues, bones, offal, feathers, blood, brains, eyeballs, entire carcasses of animals condemned at slaughter houses and those that have died on farms, in transit etc. Types of animals rendered may include beef, sheep, pork and poultry (Mohammed, 2003). Integrated rendering plants normally process only one type of raw material, whereas independent rendering plants often handle several raw materials that require either multiple rendering systems or significant modification in the operating conditions for a single system.

#### **Why Rendering?**

1. Rendering is recycling in the best sense of the word as everything is used.
2. Finished products of rendering are organic.
3. The industry provides long term employment and it sustains the environment.
4. Rendering reduces the raw material volume by approximately 50%.
5. Rendering in part is part of the human food chain.
6. Rendering is also a part of animal feed chain.
7. Rendering is proven and safe disposal of waste.
8. Rendering decrease waste and converts waste (valueless) into economic valuables.
9. Rendering help reduce the rate of clandestine killing of sick animals sold into the market without going through meat inspection procedures (NRA, 2013).

#### **Products of Rendering**

Whole animal fatty tissues are processed into purified fat such as lard and tallow. Remains of animals abandoned and their viscera, blood, skin, bones, hooves are processed into fertilizers, leather, glue, and oil/grease for industrial purpose (Energy solution Centre, 2007).

Products of rendering would include:

1. Biogas production- This is a non toxic biodegradable diesel fuel produced from yellow grease, used in vehicles.
2. Yellow grease is produced from the recycling of used cooking oil.
3. Protein meal- meat / bone meal used as protein in Livestock feeding.
4. Tallow – Fat produced from the rendering of animal by-products which find use in the manufacture of paints, soap, pharmaceuticals and cosmetics.
5. Rendering yields a fat commodity (yellow grease, choice white grease, bleachable fancy tallow).
6. Production of lard or edible tallow for use in food products.

### **Methods of Rendering**

The methods used in the rendering process varies in many ways depending on the following:

1. Whether the end products are to be used for human consumption, which is based on the type of raw materials and processing method used.
2. Whether the end products are to be used as animal or pet food.
3. If the materials are to be processed wet or dry. In wet processing either boiling water or steam is added to the material causing fat to rise to the surface. Wet rendering is one of the processes that produce the purest form of tallow, while in dry processing, fat is released by dehydrating the raw material (Becker, 2004).
4. The temperature range used, whether high or low.
5. The processing plant may be operated by an independent company that collects the materials on the open market, or by the packing plants that produce the material.

### **Rendering Process for Edible Products**

Rendering for the production of edible products are basically meat processing operations which leads to the production of lard or edible tallow used in food products. Edible rendering is generally carried out in a continuous process at low temperatures. The process involves finely chopping the fat trimmings from meat cuts, heating them with or without steam and then carrying out two or more stages of centrifugal separation. The final stage separates the liquid water and fat mixture from the solids. The solids may be used in food products or pet food, depending on the original materials. The separated fat may be used in food products, or if in surplus it may be diverted to soap making operations (Animal Rendering Fact Sheet, 2004).

### **Rendering Process for Inedible Products**

Materials that are not suitable for human consumption because of sanitary reasons are the feedstock for inedible rendering processes. Much of the inedible materials are rendered using dry method. This may be a dry or a continuous processing in which the material is heated in a steam-jacketed vessel to drive off the moisture and simultaneously release the fat from the fat cells. The material is first ground, and then heated to release the fat and drive off the moisture, percolated to drain off the free fat, and then, more fat is pressed out of the residue, which at this stage is called cracklings or dry rendered tankage. The cracklings are further ground to make meat and bone meal (Shah, 2011).

### **Kitchen Rendering**

Rendering of fats is also carried out on a kitchen scale, where butter is transformed into clarified butter, and suet into tallow, chicken fat into schmaltz and pork into lard.

Clarified fat is produced by melting butter and allowing the different component to separate by density. The water evaporates, some solids float to the surface and is skimmed off and the remainder of the milk solids sinks to the bottom and is left behind when the butter fat (which will then be on top) is poured off. (Energy Solutions Centre, 2007). It has a longer shelf life and higher smoke point than regular butter.

### **Meat Rendering Plants**

Meat rendering plants process animal by-product materials for the production of tallow, grease, high protein meat and bone meal. Plants that operate in conjunction with animal slaughter houses or poultry processing plants are called Integrated Rendering Plants. Plants that collect their raw materials from a variety of off-site sources are referred to as Independent Rendering Plants. Independent plants obtain animal by product materials including grease, blood,

feathers, offal and entire animal carcasses from butcher shops, fast food chains, supermarkets, restaurants poultry processors, slaughter houses, farms, ranches, feedlot, and animal shelters (Prokop,1992).

### **Importance of Animal Rendering**

The rendering industry makes possible the development of a large food industry.

The industry takes what would otherwise be waste materials and makes useful products such as fuel, soap, rubber, plastics out of them. Rendering stops what would otherwise be a major disposal problem, were large slaughter house and animal operations are concerned (Animal Rendering Factsheet, 2004).

Materials in rendering process are susceptible to spoilage but, after rendering the materials are much more resistant to spoiling. The fat obtained can be used as low cost materials for making greases, animal feed, soap, candle, biodiesel and as feedstock for the chemical industry.

### **Uses of Rendered Materials**

Tallow derived from beef waste is an important raw material in the steel rolling industry, providing the required lubrication when compressing steel sheets. The meat and bone which are in dry ground state are used as meat and bone meal in livestock feed.

1. Industrial chemical and synthetic oils originating from tallow, particularly fatty acids are used to make various products which include; abrasives, shaving cream, asphalt tiles, candles, caulking compounds, cement additives, cleaners, cosmetics, deodorants, paints, polishes, perfumes, detergents, plastics, printing ink, synthetic rubber, water repellent compounds (3).
2. Inedible tallow reduces dust, improves color and texture, enhances palatability, increases

peleting efficiency, and reduce machinery wear in feed production.

3. Meat and bone meal serve as high energy additive to livestock and poultry feed, high in protein (55 to 60%), calcium, phosphorus and fat, usually stabilized with an anti-oxidant to prevent rancidity. It is also sold for use as fertilizer, or as a valuable product for animal pet foods.
4. Edible tallow is used in margarine, shortening, and cooking fats, gives better flavor to fried food than vegetable oils. There are however claims that tallow causes heart disease reducing its use for human consumption. (Mohammed, 2003).
5. Mutton tallow can also be used in skin ointment and natural skin care remedies, it penetrates layers of dead skin, softening the hard areas on the face.
6. Tallow has an existing market in conventional oleo chemicals with a unique feedstock with properties that are hard to reproduce from plant oil (Becker, 2004).
7. Beef tallow is protective against breast tumors, and its use will help make bones strong, because of its high vitamin D content (Booth, 2007).

### **Saleable Meat Meal Quality Requirements**

1. Must contain no odor of putrefaction.
2. Storage temperature must not be above 10<sup>o</sup>c above ambient.
3. No detectable pathogenic organism.
4. Must be free from insects and rodents and their residues.
5. Digestibility and availability of the protein, not more than 13% of the crude protein should be undigested by pepsin (Franco, 2013).

### **Blood Processing and Drying**

Whole blood from animal slaughter houses, containing 16 to 18 percent total protein solids, is processed and dried to recover protein as blood meal. The blood meal is a valuable ingredient in animal feed because it has a high lysine content and is used at minimal inclusion level in livestock feed. It is unpalatable as feed ingredient and has low digestibility but especially high in lysine.

### **Poultry Feathers and Hog Hair Processing**

The raw material is introduced into a batch cooker and is processed for 30 to 45 minutes at temperatures ranging from 138<sup>o</sup>c to 149<sup>o</sup>c, and pressures ranging from 40 to 50 psig. This process converts keratin, the principal component of feathers and hog hair, into amino acids. The moist meal product containing the amino acids is passed either through a hot air, ring type dryer or over steam-heated tubes to remove the moisture from the meal. The dried meal is transferred to storage. Feather meal is composed of feathers, wet rendered and dried to form a high protein meal (80% protein). The protein lacks certain amino acids (Shah, 2011).

### **Grease Processing**

Grease from restaurant is recycled as another raw feed material processed by rendering plants. During processing, the melted grease is first screened to remove coarse solids, and then heated to about 93<sup>o</sup>c in vertical processing tanks. The material is then stored in the processing tank for 36 to 48 hours to allow for gravity separation of the grease, water and fine solids. Separation normally results in four phases: Solids, Water, Emulsion layer, and Grease product. The solids settle to the bottom and are separated from the water layer above. The emulsion is then processed through a centrifuge to remove solids and another centrifuge to remove water, the grease product is skimmed off the top.

### **Bovine Spongiform Encephalopathy (BSE)**

The practice of feeding meat and bone meal to cattle is prohibited in developed countries because it is believed to be the main route for the spread of bovine spongiform encephalopathy BSE (mad cow disease), which is also fatal to human beings. Meat and bone meal from cattle is however fed to non ruminant animals and meat and bone meal from non ruminant animals is fed to cattle in the United States. Due to the resistant nature of the infectious agent of BSE, a misfolded protein (prion), feeding cattle meal to non ruminant and vice versa will not prevent the occurrence of BSE. The underlying cause is that the prion survives in the system of the animal that has been fed with meat and bone meal from different animals including cattle. These animals are eventually rendered and fed to cattle, which also results in the development of the disease (FDA, 2010).

### **Summary**

The key to sustainable development in vocational agriculture is to ensure the system is continually dynamic. A continuous updating and upgrading of the syllabus is mandatory if relevance and impact is desired. Conversion of waste materials into an avenue of sustainable income generation is the order of the world over. Taking advantage of the agricultural waste that has become a nuisance in many urban and rural areas of the nation as a dependable source of income generation would not only create more jobs for our teeming youths, but also assist in handling the problem of the disposal of waste generated. Development of rendering would ultimately lead to the profitable utilization of the meat industry by-products. Animal rendering should therefore be considered for inclusion in Agricultural curricula to make it more relevant to both present and future needs of youths.

### Conclusion

The development of rendering would lead to profitable utilization of meat industry by-products which in turn, would lead to the development of a massive industrial-scale meat industry that would make food more economical for the consumer, because it will allow the economic disposal of by-products which will otherwise be dumped in the environment. Animal rendering could therefore re-engineer vocational agriculture and make it more relevant.

### Recommendations

In order to ensure that a vibrant rendering industry is developed, one that is accessible to all interested participants, the following suggestions are proffered;

1. The government should look into the possibilities of including instructions on practical animal rendering in vocational agricultural programs.
2. Create the enabling environment for the take off of a flourishing rendering industry in the country.
3. Create adequate awareness in all major animal producing areas, on proper disposal methods of animal by-products and dead stock.
4. Encourage the breaking up of the operations into smaller sections that would make it easier for the small holder businesses to participate.
5. Make access to capital easy for those interested in investing in the industry.
6. Make careless disposal of dead stock and large trimmings of animal tissues in refuse sites illegal.
7. Draft legislative acts that would serve to maintain standards in the operations of the industry.

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