ECONOMICS OF PRODUCING AND USING SPROUT FODDERS AS UNTRADITIANAL ANIMAL FEEDS

By

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B.Sc. Agric. Co-operative Sc., High Institute for Agricultural Co-operation, 1996

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ABSTRACT

Hayam EL- Sayed Mohamed Deraz: Economics of Producing and Using Sprout Fodders as Untraditianal Animal Feeds. Unpublished M.Sc. Thesis, Arid Land Agricultural Graduate Studies and Research Institute, Faculty of Agriculture, Ain Shams University, 2015.

Sprouting has been used to improve the nutritional value of the barley (*Hordeum vulagre*) and faba bean (*Visa faba*) seeds. Raw rice and wheat straw were used as media to sprouts of barley and faba bean with four seeding densities. Growing conditions of the system can produce between 6.3to 12.8 kg of fresh fodder and 2.1 to 5.9 kg of dry fodder in 7 days from one kilogram of dry barley grains compared to 3.7 to 6.5 kg of fresh faba bean fodder and 1.2 to 2.9 kg of dry faba bean fodder in 7 days from one kilogram of dry faba bean seeds. The dry fodder per unit seed volume (kg / kg seed) increased with decreasing seed density, since rice and wheat straw increased per (m^2), but the nutrient content of the fodder especially protein will decreased. Daily sampling of the barley sprouts was done to assess dry weight (DW) on day 7 in comparison to the unshrouded grain. Results showed about 15% loss in DW from the original seeds after sprouting for a period of 7 days. Barley and faba bean sprouts improved quality of fodder from wheat and rice straw. Protein, carbohydrate and lipid content increased with increasing seeding density while crude fiber decreased compared with rice and wheat raw straw. Fiber fraction (Neutral detergent fiber NDF, Acid detergent fiber ADF, Acid detergent lignin ADL) percentage decreased with increasing barley and faba bean seeding density. Relative feed value (RFV) increased with increasing seed density for both barley and faba bean either grown on rice straw or on wheat straw media. It's economic and low cost estimated per ton Dry matter (DM) and total digestible nutrient (TDN) of sprouts especially barley sprouts grown on rice straw. Its coast approximately equal to alfalfa in L.E. per ton and cost less than hydroponic barley except for protein cost in alfalfa. On the other hand faba bean sprout was not economic with higher cost per ton than all other feedstuff as corn silage, alfalfa and hydroponic barley. It was concluded that, the fresh green feed barley sprout technique grown on rice straw medium obtained a good quality fresh forage in small area all year around and can be recommend as sheep source of energy (TDN) compared with hydroponic barley and alfalfa. Also the technique saving agricultural lands for strategy crop production as wheat and corn since could be produced and grown on roofs in smaller area. In conclusion, the idea of producing barley sprouts is accepted from the technical point of view. Due to absence of natural forage. Recently, it is not economically viable to feed animals with sprouted grains under Egyptian circumstances. This conclusion can be supported by the fact that there is no demand now on such sprouted fodder in Egypt.

Key wards: barley, faba bean, rice straw, sprout, wheat straw, sprout cost, return.

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I. INTRODUCTION

The shortage in local feed stuff production is considered as the main constrains for improving and developing animal production in Egypt. Record high grain prices and the drought of 2012 are driving up interest in alternative feeds. Recently that interest focuses on sprouting barley for fodder production. The gap between the available feeds and animals requirements was about 6 million tons in term of concentrate feeds and as a shortage of 4.8 million tons of TDN per year **(El-Ashry2007).** The high cost of concentrate feed mixture and clover hays, and unavailability of fresh Egyptian berssem (*Irifolium alexandrinum*) during summer seasons are the major problems confront the development of livestock. Therefore it is believed that inclusion of some agricultural by-products to replace a part of diet for animals become an obligation **(El-Tahan *et al.*, 2003)**.

In Egypt about 12 million tons of agricultural wastes were left without any use in which year. This hay amount of agricultural waste is affecting the environment, especially if it is burned, which cause air pollution and agricultural land pollution **(Shafie *et al.*, 2012 and Sadek, 2013).**

Rice straw reaches about 3.6 million tons annually while wheat straw reaches about 8.5 million tons **(Agric. Statistics, 2009).** Few attempts were tried to improve quality of wheat and rice straw to be used as an animal feed, these include addition of ammonia **(Mason and Owen,1985)** and growing grain with straw **(Ibrahim *et al.*, 2001, and Abdallh *et al.*,2014).** These attempts lead to getting rid of crop surplus by-products and providing feed with better quality without need to grow any crops that will use a cropping area. Using seed sprouts to improve nutritional value of these straw wastes will lead to increase the rote of utilization in future **(Sneath and McIntosh, 2003; Mohammadi and Abdallah 2007 and Abdallah *et al.*, 2014).**

Fresh green barley grass produced is of such high quality that it is suitable even for all livestock and has been found on a worldwide basis to be more practical because of its price and availability **(Sneath and McIntosh, 2003)**. There are some arguments about the sprouting grains for convenience of green forage production in hydroponics system to compensate the feed resources for animals **(Rajendra *et al.*, 1998 and Tudor *et al.*, 2003)**.The hydroponics green fodder is produced from forage grains, having high germination rate and grown for a short period of time in a special chamber that provides the appropriate growing conditions **(Sneath and McInosh, 2003)**. It is a well-Known technique for higher fodder yield, year round production and least water consumption **(Cuddeford, 1989; Tudor *et al.*, 2003; Al- Karaki, 2011and Al-Hashimi, 2008)**. This technology may be especially important in the regions where forage production is limited **(Mukhopad, 1994 and Buston *et al.*, 2002)**.

However fodder produced hydroponically is of a short growth period 7-10 days and does not require high – quality arable land , but only a small piece of land for production to take place **(Cuddeford, 1989; Al-karaki, 2011and Mooney, 2005)**. It is of high feed quality, rich with protein, fiber, vitamins, and minerals **(Bhise *et al.*, 1988; Chung *et at.*, 1989 and Lorenz, 1980)** and it's conation a grass juice factor that gives an improved performance to livestock **(Finney 1982)**.

Limited research has been contented to determine the value of sprouted grains however **Thomas and Reddy, (1962) and Peer and Lesson,(1985)** noticed that the dry matter intake of green fodder by feed lot cattle and dairy cattle were low due to its high moisture content. Also during soaking and germination for producing sprouts, grains loss dry matter and **Chung *et al.*, (1989)** measured 9.4% decreased in dry matter of sprouted barely seeds over 5 days ,while **Flynn *et al*.(1986)** found 24%loss for 7 days.

Sneath and McInosh (2003) analyzed the value of fodder on a dry matter, energy and protein basis, in their comprehensive review of hydroponic fodder production for beef cattle. Their analysis found that hydroponic sprouts shows increment about 3.4 times more expensive per kilogram of dry matter (DM) than the original barley grain, the energy in the hydroponic barley sprouts is 3.7 times more expensive and the protein is 2.2 times more expensive. In economic efficiency effects with using rice straw. **Zewil(2005)** found that the economic cost expressed as feed cost one kg weight gain for lambs fed biological treated rice straw was better (4.86L.E/kg weight gain) than control group (10.65L.E/kg weight gain).

Light, moisture and consistent heat are critical for sprouted fodder to work. Experiments with fully automated hydroponic systems using artificial light were more stable and production more reliable. However, this method is very expensive due to generated excess heat that makes the system not economically viable.

On the other hand, sprouted barley grains on rice straw revealed significant improvement in OM, CP, EE, CF, NFE, NDF, ADF, hemicellulos and TDN g /kg body weight **(Helal, 2012 and Fazaeli *et al.*, 2012)** Hence, this research was conducted to compare the economic; production and nutritional value of sprouted barley and fabe bean grown on wheat and rice straw media compared with commercial feedstuff in Egypt (corn silage and alfalfa) in addition to hydroponic barely sprouts.

For any economic evaluation, a sprouting facility must be sized according to the total pounds of sprouted fodder needed per day.

Daily input costs: gas heating, groin, lab bone, depreciation and interest of capital. These were the items included is estimating the cost of sprout production.

II. REVIEW OF LITERATURE

2.1. Agriculture wastes (rice and wheat straw)

Rice (***Oryza sativa L.***) is the world's second largest cereal crop after wheat it's important in Egypt; however, it produces large amounts of crop residues. Only about 20% of rice straw was used for purposes such as ethanol, paper, fertilizers and fodders and the remaining amount is either removed from the field, in situ burned, piled or spread in the field, incorporated in the soil, or used as mulch for the following crop. Burning cause's air pollution called the "Black Cloud" and loss of nutrients depending on the method used to burn the straw. Rice straw is unique relative to other cereal straws in being high in silica and lignin with low digestibility and protein content. Rice straw in developing countries is used as a main feed for ruminants. **(Emtenan *et al.*, 2012)**.

The world statistic of the wheat and rice straw indicates that about 710 million metric ton of wheat straw and about 670 million tons of rice straw are produced each year as the agriculture waste. Only one percent of this amount is produced in Egypt, and nevertheless, causes a huge environmental problem each year **(El Messsry and El-Deeb, 2013)**.

In Egypt there is a large amount of agriculture wastes produced annually, after harvesting processes. One of these wastes is rice straw which produced in average of 3.6 million ton while wheat straw reaches about 8.5 million ton on year **(Agrc. S., 2009 and Khattab *et al*., 2009)**.

Anti-nutritional factors are defined as naturally occurring substances that interfere with nutrient intake and/or availability in the animal **(Saini, 1989)**. Their biological effects can range from a mild reduction in animal performance to death.

Of the 10 groups of anti-nutritional factors identified and reported by **Enneking and Wink (2000)**, non-starch polysaccharides (NSP) are considered more relevant in the wheat and rice straw. NSP are classified into cellulose and non-cellulosic polysaccharides, the latter containing hemicelluloses, β-glucans, pectin substances in addition to the storage polysaccharides such as inulin, gums and mucilage's **(Englyst and Hudson, 1996)**. Hemicellulose, pectin, β-glucans and galactomannan gums are the examples of soluble dietary fibers **(Cho *et al.*, 1997)**. Hemicellulose is the fiber fraction which is insoluble in cold and hot water and dilute acid, but soluble in dilute alkali. The insoluble fiber fraction refers to the fiber components that do not dissolve in various solvents such as water, alkali and acid solutions. The insoluble fractions include cellulose, lignin, and some hemicelluloses.

The soluble fraction of (NSP) increase the gut viscosity by directly binding water molecules, and the (NSP) molecules themselves interact and become entangled in the network **(Smits and Annison, 1996)**. This increase in gut viscosity reduced the mixing of digestive enzymes and substrates in the intestinal lumen **(Choct, 1997).** Combined with increased mucus production, NSP can also increase the resistance of the unstirred water layer at the intestinal surface **(De Lange, 2000)**. Furthermore, NSP in cell walls physically inhibit the access of digestive enzymes to nutrients that are encapsulated within cell walls. Soluble NSPs, in particular, may stimulate microbial growth and increase the amounts of microbial protein and fat at the terminal ileum. Certain NSP may also stimulate the growth of toxin producing microbes, which may affect gut health and digestive function **(De Lange, 2000)**. In addition, endogenous secretions, such as bile acids, may be bound by the viscous NSP and consequently reduces the extent of recycling. All of the above could eventually lead to a reduction in nutrient digestion and utilization.

Legume NSPs are more complex in structure than those in cereals, containing a mixture of colloidal polysaccharides called pectin substances **(Choct, 2006)**. Pectin substances are mainly found in the cotyledon of legume seeds, whilst cellulose and xylenes, which are the major NSP in cereal grains, are only found in the hulls or husks of most legume seeds.

REVIEW OF LITERATURE

Periago *et al.*, (1997) reported that the major constituents of the total NSP of chickpeas were cellulose, arabinose, and uranic acids.

In Egypt using agricultural by products such as olive tree pruning **(Helal and Hassan, 2013)** and rice straw **(Fayed ,2011 and Mohammadi and Abdallah2007)** as a growing media for sprout production increased dry fodder yield from one kilogram of seeds compared with hydroponically sprouted seed yield. Such agricultural by –product are available around the year but are not efficiently used **(Abd-Elfatah, 2009)**.

Since there is a wide gap between the available feeds and animals requirements in Egypt which estimated by about 6 million tons in term of concentrate feeds and as a shortage of 4.79 million tons of TND per year **(EL-Ashry, 2007)**. Therefore using agricultural by-products for sprouted grain production can minimize this gap and decreasing grain sprout production cost than hydroponically sprouted grains. Using rice straw is an environment friendly since rice straw burning threatens public health **(Shafie *et al.*, 2012).**

Agricultural activity produce about 3.6 million tons of rice straw and 8.5 million tons of wheat straw annually **(Agric. Statistics, 2009)**. Rice straw and wheat straw are a ligno cellulosic biomass. Relative to other agricultural by-products, it contains a high amount of inorganic components and ash. Straw is seen as a major feedstock for the bio based economy. Currently, combustion of straw is the most common application. However rice straw is a low cost biomass **(Bakker *et al.*, 2013)**.

Various mechanical treatments of lingo cellulosic straws could be used to upgrade their feeding value. Chopping hay to one inch is a simple and effective method. Grinding, or fine chopping, decreases particle size, increases surface area and bulk density of both leaf and stem fractions, and hence raises rumen microbial accessibility and feed intake **(Xiong, 1989 and Fu *et al.*, 1991)**. The increase in intake due to grinding is generally higher with low quality than with high quality residues, and with small and