Design, fabrication and testing a portable brown rice

This process embraces two basic operations. One operation is the removal of the husk to produce brown rice. This operation is called dusking (or deluging). The other operation is the removal of the bran layer from brown rice to produce polished (or white) rice. This operation is called polishing or whitening. Milling also removes the germ and a portion of the endosperm as broken kernels and powdery materials. Before the advent of mechanical milling, hand-pounding traditional method of rice milling was In practice.

This method produces more nutritive value as compared to machine milled rice. But with the Introduction of mechanized mills, and-pounding method has steadily decreased because it could not compete with machine mills capacity. Brown rice or planar In Toga was popular among Filipinos until the early 1 sass. Brown rice then was in form of partially polished rice produced by hand pounding using mortar and pestle or stone grinder. With the introduction of milling machines that produce the polished rice, consumers' tastes and preferences started to shift In favor of white rice.

Only a few consumers, such as health-conscious people and balalaika's who occasionally eat brown rice in the US as health food, continue to demand brown rice from the market. Brown rice and white rice have similar amounts of calories, carbohydrates, and protein. The main differences between the two forms of rice Ill In processing and nutritional content. Only the outermost layer, the hull, Is removed to produce what we call brown rice. This process Is the least damaging to the nutritional value of the rice and avoids the unnecessary loss of nutrients that occurs with further processing.

If brown rice is further milled to remove the bran and most of the germ layer, the result Is a whiter rice, but also a rice that has lost many more nutrients. At this point, however, the rice Is still unpolished, ND it takes polishing to produce the white rice we are used to seeing. Polishing essential fats. Because these fats, once exposed to air by the refining process, are highly susceptible to oxidation, this layer is removed to extend the shelf life of the product. The resulting white rice is simply a refined starch that is largely bereft of its original nutrients.

The process that produces brown rice removes only the outermost layer, the hull, of the rice kernel and is the least damaging to its nutritional value. The complete milling and polishing that converts brown rice into white rice destroys 67% f the vitamin 83, 80% of the vitamin 81, 90% of the vitamin 86, half of the manganese, half of the phosphorus, 60% of the iron, and all of the dietary fiber and essential fatty acids. Fully milled and polished white rice is required to be “ enriched” with vitamins 81, 83 and iron. Interrelationship, 2010) Aside from being more nutritive, brown rice is a concentrated source of fiber needed to minimize the amount of time cancer-causing substances spend in contact with colon cells. Brown rice is also a very good source of selenium, a trace mineral that has been shown to substantially reduce the risk of colon cancer. But selenium does not only play a critical role in cancer prevention, it also works with vitamin E, a powerful antioxidant that helps the selenium to prevent heart diseases, to decrease the symptoms of asthma and the pain and inflammation of rheumatoid arthritis.

In this period of rice shortages, it is a great irony to spend more money on well- polished rice even if it is less nutritious and healthy than its cheaper variety. Indeed we use up more electricity to polish rice and get rid of the nourishing parts of the grains. So, it is really wiser to eat brown rice. Brown rice costs PH. 50. 00 to 60. 0 per kilo while ordinary white rice costs PH. 25 to 30. 00 per kilo, which is truly ironic because producing brown rice is actually cheaper. It requires 65% less energy to mill brown rice. At the same time, the milling recovery is 10% more.

The reason for the high price could be that there is no steady supply of brown rice so this study will aim to supply sufficient amount of brown rice in the community. Moreover, beyond the “ dirty’ look of brown rice, this lost health food is now being revived and taken back into regular diet of consumers, but this time without reintroducing the back breaking hand pounding and stone grinding teeth instead this is an introduction of a portable milling machine for brown rice. Related Literature Payday grain basically consists of a husk (or hull) and a grain of brown rice.

Brown rice consists of a bran layer (including pericardia, seed coat, and ailerons layer), a germ and scuttle’s connected on the ventral side of the grain, and an edible portion or endosperm. Basically, payday grain is not suitable for eating. It becomes edible only if the husk and the bran are removed. Rice milling involves the removal of the husk and the bran layer to produce the edible portion for consumption. Http:// www. Pub. Rug. L/Eldon/disk/CEO/l. Kong. Nine/co. PDF Brown rice may be cooked and eaten as is or milled into regular-milled white rice.

The light brown color is due to the presence of the bran layers and the embryo or germ. Brown rice requires longer cooking time than either parboiled or regular- nut-like flavor. (USA Rice Federation, 2005) Most people consider eating white rice, because of its softness and fluffier effect after cooking. On the other hand brown rice is an overwhelming treat in terms of cooking and can be stored for six months under normal conditions. Brown rice also contains magnesium, manganese, and zinc which re essential for our daily diet.

Since brown rice has the bran intact, it has more fiber than any other type of rice. (Bassist, 2009) A cup of brown rice provides 88. 0% of the daily value for manganese. This trace mineral helps produce energy from protein and carbohydrates and is involved in the synthesis of fatty acids, which are important for a healthy nervous system, and in the production of cholesterol, which is used by the body to produce sex hormones. Manganese is also a critical component of a very important antioxidant enzyme called superposed diastase.

Superposed diastase SOD) is found inside the body’s mitochondria (the oxygen-based energy factories inside most of our cells) where it provides protection against damage from the free radicals produced during energy production. Willet and Manson (2007) published a study about the importance of choosing whole grains such as brown rice rather than refined grain, example, white rice, to maintain a healthy body weight. A study conducted on over 74, 000 female nurses aged 38-63 years over a 12 year period found that weight gain was inversely associated with the intake of high-fiber, whole- grain foods.

Not only did women who consumed more whole grains consistently weighed less than those who ate less of these fiber-rich foods, but those consuming the most dietary fiber from whole grains were 49% less likely to gain weight compared to those eating foods made from refined grains. In addition to supplying 14. 0% of the daily value for fiber, a cup of cooked brown rice provides 27. 3% of the DVD for selenium, a trace mineral important to human health. Selenium is an essential component of several major metabolic pathways, including thyroid hormone metabolism, antioxidant defense systems, and immune function.

Accumulated evidence from prospective studies, intervention trials and studies on animal models of cancer has suggested a strong inverse correlation between selenium intake and cancer incidence. Several mechanisms have been suggested to explain the cancer- preventive activities of selenium. Selenium has been shown to induce DNA repair and synthesis in damaged cells, to inhibit the proliferation of cancer cells, and to induce their potatoes, the self-destruct sequence the body uses to eliminate worn out or abnormal cells. Most et.

AY (2005) evaluated the effects of rice bran and rice ran oil on cholesterol levels in volunteers with moderately elevated cholesterol levels, they found that rice bran oil lowered their OLD (bad) cholesterol. The researchers concluded that the reduction in cholesterol seen in those receiving rice bran oil must have been due to other constituents such as the unclassifiable compounds found in rice bran oil. The scientists suggest that the unclassifiable present in rice bran oil could become important functional foods for cardiovascular health. Cadre, Burley, et al. 2007) conducted a

study to determine how much fiber 35, 972 participants in the I-J Women's Cohort Study ate. They found a diet rich in fiber from whole grains, such as brown rice, and fruit offered significant protection against breast cancer for pre-menopausal women. Monte (2010) said that the Philippines do not have to import rice if we shift our preference from white to brown yield as compared to white rice. Chance (December, 2010) concluded that aside from being more nutritious, it also has a lower glycerin index so the energy release is slower. In terms of digestion, the brown rice takes a longer time in the pit of the stomach to be absorbed. It means that in the metabolism of carbohydrate in the suggestive system, it doesn't force the release of insulin onto the pancreas, thereby not putting any burdens to the normal function of the pancreas. " Alongside this report studies that have shown eating brown rice instead of white could significantly reduce the risk of developing type 2 diabetes. It was further explained that because brown rice is slowly digested, the increase in glucose or sugar level in the bloodstream is gradual compared with white rice.

In white rice, carbohydrate is more rapidly absorbed and this causes a sharp rise of the blood sugar level. In other words, the rowan rice maintains the normal function of the pancreas while the white rice abuses it. This makes a crucial difference in whether a certain person really develops the diabetes or not, the website warns. Brown rice is unpolished whole grain rice that is produced by removing only the hull or husk. The remaining bran gives the brown color to the grain. It becomes white or polished when the bran layer is stripped off in milling, the whitening process.

The added steps to turn brown rice to white also remove the nutrients. Bran contains several items of major importance such as fiber ND essential oils. Fiber is not only filling, but is recommended in the prevention of major diseases such as certain gastrointestinal diseases and heart disease. The oils that are present in the bran help to lower the risks of heart disease by decreasing the levels of serum cholesterol in our bodies. Due to the higher demand for white rice, it is produced at a larger economic scale compared to brown rice. This makes brown rice seemed as a premium product and hence making it more costly.

Brown rice, due to its small amount of oil in the bran layer, has a shorter shelf life compared to white rice. This makes brown rice more costly as more resources are needed to preserve the quality of brown rice during transportation and storage. (altogether Promotion Board) Chic (April, 2011) said that today's markets, brown rice remains a much costlier product than white rice because despite white rice requiring the extra step of dusking, brown rice goes rancid more easily due to the presence of mineral oils in its nutrition rich bran.

Higher rates of spoilage and wastage, combined with its lower demand as compared to white rice, makes brown rice a less economically viable, and hence a more expensive, good. The overall consensus is that brown rice wins in some ways and loses out in others. As with most things, versatility is the key to cooking brown rice. For instance, the different textures and tastes of brown and white rice mean that they will compliment different dishes. " White rice is more fragrant, while brown rice has a " rougher" taste. White rice seems to go with Chinese, Japanese or Thai flavors better.

Brown rice works with more robustly flavored cuisines such as Indian or Western cuisines," Rice Chemistry and Food Science Division (ARCS) of Philippic, said that brown rice is a good source of dietary fiber, agencies, lysine, and protein. It is more nutritious than white rice. When rice is polished, a significant amount (68 to 90%) of calcium, phosphorous, thiamine, riboflavin, and thiamine are removed. Protein content of rice is also lessened by 15% when the bran layers are removed. Any rice variety can become brown rice, although the public.

The Asia Rice Foundation (ARE) though dubs it as a " whole rice grain. " In the milling of brown rice, only 28 percent of the husk is removed. For white rice, an additional 10 percent of the husk is removed during the milling process. Traditionally, brown rice is produced using the mortar and pestle. Nowadays, conventional milling machines are used. In this machine the separation of unhealed payday (play) for the hulled brown rice comprises roughly 14% of the cost of brown rice in the market. Because these machines are intended to produce white rice, the machine needs necessary adjustments to mill brown rice.

In many cases, rice mill operations are unwilling to do so. Andantes, et al (2008) Therefore designed and fabricated a rice mill for brown rice by assembling together a deluging unit, an aspirator, and a play separator. This type was subsequently improved to come up with a third and trial prototype. Brown rice has had only its husk removed during milling. With the bran intact, it retains more fiber, flacon, iron, riboflavin, potassium, phosphorus, zinc, and trace minerals such as copper and manganese, than other types of

rice. Moreover, brown rice is the only form of the grain that contains vitamin E.

Although it is known that brown rice has a higher nutritional value when compared to the milled and polished rice (white rice) before consumption, researchers still investigate the nutritional value to humans after consumption of these two forms of rice. Scientific research has taken its investigation into many different areas of the nutritional value of brown compared to “ white” rice. These include, 1) Glycerin index, 2) nutrient value, 3) disease prevention, 4) Vitamin 812 levels, 5) digestibility of proteins, and 6) effect of rice fiber in the intestinal tract.

The reader is invited to review each of the following areas of research and references to further understand the impact and nutritional value that the natural unprocessed rice compared to recessed rice has on the human body. ARP. Ophthalmologist’s. Com D. Suttee (Texas A & M) says that the variables in the performance of rice mills are quality of payday, maintenance of the machines, and operators skills and that mixing varieties with different sizes does not allow for proper machine settings. He further observed that many mill owners do not supervise and train their operators.

They do not recognize that the higher yields could be obtained if the rice mill was properly operated. Mutters (1985) said that broken grains are usually valued less Han whole grains; therefore varieties with less broken grains will accrue more profit from sale than their counterparts with higher broken grains. After the husk is removed the remaining product is called brown rice. Brown rice is more nutritious than white rice, but very elite rice is consumed

in the brown form. Brown rice contains a bran layer that is about 12% of the brown kernel by weight.

The protein in white rice is much more nutritious than most cereal grains but has a low level of the essential amino acid, lysine. The protein level in bran layer of brown rice is higher ND has more lysine. The protein in brown rice has one of the most complete essential amino acid profiles of any vegetable crop. The rice bran layer of brown rice also contains digestible fiber as well as minerals and vitamins not found in milled rice. It was learned that incidences of beriberi were dramatically reduced when diets where switched from white milled rice to brown rice or even parboiled rice which contained more thiamin.

The oil content of the rice bran contains vitamin E bran is removed, years ago many states passed laws requiring white rice to be fortified with vitamin and minerals. Despite it nutritional value, consumption of brown rice is low because it takes almost one hour to cook and many people do not care for the taste and texture. Unfortunately, once the husk is removed from the rice, the bran layers starts going rancid and this contributes to the bitter taste of brown rice (FAA, 2012).

According to United States Standards for Milled Rice (2009), the whole grain yield is the primary parameter used to quantify rice milling quality. Most rice varieties are composed of roughly 20% rice hull, bran layers, and 69 % starchy endosperm, also referred to as the total milled rice. Total milled rice contains whole grains and broken. The by products in rice milling are rice hull, rice germ and bran layers, and fine broken. Conceptual Framework of

the Study Figure 1 shows the paradigm of the conceptual framework of the study.

The first box presents the independent variables that serve as cause or stimuli that can be manipulated. The independent variable includes the common rice varieties in Baby area, different shutter distance and different number of passes. These variables will be utilized to determine the dependent variables, which include the performance of he portable milling machine based on machine's throughput capacity, percent milling recovery, percent husk, and percent loss, the characteristics of brown rice in terms of percent whole grains, percent broken grains, percent dosage and 1000 grain weight.

Independent Variables Dependent Variables Statement of the Problem This study will be conducted to design, fabricate, and test a portable brown rice milling machine. Specifically it sought to answer the following questions: 1. What is the capacity of the portable brown rice milling machine using different rice varieties n Baby area, different shutter distance and different number of passes? 2.

Is there significant difference on milling performance as affected by different rice varieties in Baby area, different shutter distance and different number of passes in terms of percent milling recovery, percent loss, fuel consumption, and percent husk? 3. Is there significant difference on brown rice quality as affected by different rice varieties in Baby area, different shutter distance and different number of passes in terms of percent dosage, weight of 1000 grains, percent whole grains, and percent Rosen grains? 4. What is the cost

of fabrication and operation of portable brown rice milling machine? . What is the cost and return analysis in operation of the portable brown rice milling machine? Hypothesis The study will test the null hypothesis that there is no significant difference in the capacity and efficiency of the machine using different rice varieties. The study will also test the null hypothesis that there is no significant difference in terms of percent milling recovery, percent loss, and percent husk as affected by different rice varieties n Baby area, different shutter distance and different number of passes.

And lastly it will also test the null hypothesis that there is no significant difference on brown rice quality passes in terms of percent dosage, 1000 grain weight, percent whole grains, and percent broken grains as affected by different rice varieties in Baby area, different shutter distance and different number of passes. Significance of the Study The main purpose of the study is to design, fabricate, and test a portable brown rice milling machine. The study will give a great opportunity to the following: (1) to the small scale entrepreneur whose line of business is on rice dealing. 2) to the community to meet private institutions to serve as a reference in designing and formulating portable brown rice milling machine in conducting further research. Scope and Limitation The scope of the study is to design, fabricate and test a portable brown rice milling machine using different rice variety. The study will be conducted during the Second Semester of Academic Year 2012-2013 at the Department of Agricultural Engineering, College of Agricultural Sciences and Technology, Laguna State Polytechnic University, Occasional Campus, Occasional, Laguna.