Pulses: Harvesting, Processing and Value Addition

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Abstract **- Cereals and food legumes are essential components of Indian diets, especially for low-income individuals. Food self-sufficiency remains an unattainable goal for these classes. Despite the fact that India is now self-sufficient in cereal production, it still needs to improve pulses to fulfil its domestic needs. This is not necessarily or just due to in efficiency in local production system; it may also be due to post harvest losses. In the case of pulses, post-harvest losses are estimated to be in the range of 25-30 percent. This is due to the fact that pulses must pass through a number of unit operations before being converted to dal. Every stage of processing result in certain losses, which must be minimised. Reduced post-production losses will help India achieve nutritional protection. Indeed, improvements in productivity must be accompanied by improvements in post-harvest operations and the avoidance of post-harvest losses. Traditional approaches, appropriate technology, and mechanised processes are all explored in depth, as are the experiences or solutions that arise from their use. It also recommends strategies for using by-products in the production of value-added products, thereby increasing farmer profits. It also makes recommendations for future research directions in this area.**

Index Terms **- Pulses, Harvesting, Processing, Technology**

INTRODUCTION

The Indian diet contains a strong balance of all essential amino acids. The proteins found in cereals and pulses complement each other. Idali-Sambhar, Dal-Roti, Dal-Chawal, Dal-Roti, Dal-Chawal, Dal-Roti, Dal-Roti, Dal-Roti, Dal-Roti, Dal-Roti Pulses are ingested in the form of dal after dehusking and splitting, a process known as pulse milling. This age-old activity was upscaled into large capacity commercial mills as the agro processing industries became urbanised. Prior to milling, pre-milling treatments are used to loosen the binding of the seed coat to the cotyledons. Pre milling treatments include water soaking, oil soaking and grain heating. Dehusking and splitting is usually done in successive passes with the assistance of abrasive rollers. This results in scouring losses and dal recovery. The chain of pulse processors, wholesalers, processors, and retailers benefits more than the manufacturer, who has to sell raw grain at lower prices and buy finished products at higher prices. The concept of village or farm-level pulse processing will not only provide rural entrepreneurs with the additional income and job opportunities, but it will also boost the rural economy. To meet the demand, various research organisations have built low capacity (75-125 kg/ha) dal mills. Dal mills are small mills that are used to grind dal. IIPR, Kanpur, CIAE, Bhopal, PKV, Akola and CFTRI< Mysore have all produced programs that are widely used across the world. Items with added value, the income produced from pulses and pulse milling by-products can be used to supplement rural income.

PULSES MILLING

After wheat and rice, pulse milling is the India's third largest food industry. Pulses are consumed after limited processing, just like every other seed, Pulses are commonly eaten as dehusked splits or dal. In India, about 80% of total pulse output is consumed in the form of dal or powder. The remaining 20% is either used as whole grain or saved for seed. Milling method and machineries used. Pulses are milled in about 1400 dal mills strewn across the region, yielding 65-70% dal recovery against an 88-89% potential recovery. Dehusking pulses in an age-old tradition that began at the household level and has progressed to large scale modern mills. The major step in dehusking is the same whether you are doing it at home or in a commercial environment.

1. Pre-milling loosens the seed coat,
2. Dehusking or husk removal adds culinary properties, and
3. Splitting converts dehusked whole (gota) into dal.

In the milling units, the dehusking and splitting processes are carried out simultaneously. Pigeon peas require dehusking, while other pulses can be eaten whole, splits with husk, or splits without husk. The powder type of dehusked grains is used in the majority of secondary and tertiary processed goods. The husk is removed, which increases the colour, texture, cooking consistency, palatability, and digestibility of the food. If the external infestation is avoided, dehusked splits provide better resistance to insect activities than whole grain without any chemical application. During milling, husk removal is difficult due to the presence of gummy substances between the seed coat and the cotyledons. Pulses are classified as easy to mill or difficult mill depending on the quality and quantity of gums present. Cleaning, grading, pitting, treatment, milling and polishing operations are all part of the milling process.

COMMERCIAL PULSE MILLING PROCESS UNIT OPERATIONS

Each unit process necessitates the use of specialised machinery to complete the job. The following are the main phases in pulse milling:

- Cleaning and grading
- Pitting
- Pre-milling treatment
- Cottage scale pulse milling(Wet Milling)
- Large scale milling (Dry Milling)
- Thermal treatment
- Tempering
- Drying
- Dehusking and splitting
- Polishing

Cleaning and grading:

The pre cleaning and grading of raw materials is an essential part of the milling process. It entails the removal of dust, soil and foreign material, as well as the grading of off sized, young and damaged grains. The raw material is the first passed through a cleaner-cum-grader. The quality of the raw material used in milling influences the quality of the finished product, dal, impurities, foreign matter and damaged or shriveled grains are all removed with cleaner. Raw material is graded based on scale, shape and gravity to ensure a consistent standard of raw grain. Commercial mills also use reel machines for size grading. Stones and pebbles are removed with a destoner. Aspirator, fans, and pneumatic separators are used to eliminate lighter impurities.

Pitting:

Using an emery-coated roller, this is a popular practice in commercial dal mills. Abrasive action is provided by the emery coating. The seeds are scratched by passing the whole pulses through an abrasive roller system. The entry of oil/water added to the grain during pre-milling treatment is facilitated by the cracked seed coat. While cracks should not be visible to the naked eye, some dehusking and splitting occurs during the pitting process.

Pre milling treatment:

- Wet pre-milling treatment
- Dry pre-milling treatment

In domestic or cottage scale milling, Wet pre milling treatment is used.

Commercially in large scale, Dry pre milling treatment is used.

Cottage scale pulse milling (Wet milling):

Whole grain is soaked overnight or for a set period of time, then sun dried and tempered for 2-3 days to reach a moisture level of 10-12% before dehusking and splitting in hand –operated wooden or stone chakkies. A manual winnowing procedure is used to extract the husk. Several other pretreatments are used in different parts of the world, such as red earth application, irion pan roasting with or without sand, oil smearing, boiling and so on. Pulse milling on a small scale is a time consuming, weather dependent and labour-intensive operation. Despite pretreatment, it is difficult to achieve 100% dehusking in traditional chakkies, lowering the appearance of the dal and lowering its market value. However, a segment of the affluent market is developing a preference for unpolished cottage scale dals.

Large Scale Milling (Dry milling):

Pulse milling on a commercial scale has attempted to solve the limitations of conventional cottage scale

mills. Commercial pulse mills tackled issues such as drudgery, time consumption, weather dependence and inappropriate dehusking. Oil and water application, also known as dry treatment, is widely used in the northern zone to reduce soaking and drying time. Linseed oil is added to pitted grains at a rate of 0.7%. for 3-4 days, alternate daytime heating under the sun with nighttime heating and cooling loosens the seed coat. Dehusking is accomplished by milling treated grains in emery roller mills. However, the sun drying process is also dependent on the weather and solar system.

Thermal Treatment:
Pulse milling pretreatments, whether done at home or on a large scale, are a time consuming, weather dependent operation. CFTRI, Mysore, has been developed a weather independent thermal method. The method also prevents the use of oil entirely. For optimal conditioning, the procedure is repeated twice. This is weather independent method that is not being implemented due to higher equipment costs and maintenance costs.

Tempering:
After soaking in watr or applying oil, the grains are heaped and covered with gunny bags for 12 to 18 hours to condition the whole grain mass uniformly. This method allows oil/water to penetrate under the seed coat and aids in the loosening of gummy substances.

Drying:
In commercial mills across the Indian subcontinent, sun drying of treated and tempered grains is very popular. On a small scale, electricity-based mechanicals dryers are used for years-round operation and to minimise weather dependence. For 2-3 days, alternate sun drying in thin layer during the day (heating) and heaping at night (cooling) results in seed coat loosening. The method of sun drying takes a long time and needs a lot of effort. Mechanical dryers take 2-3 hours to dry, so they save both time and energy.

Dehusking and splitting:
After full pre-treatment, grains are subjected to abrasive surface for husk removal in commercial mills. In emery roller mills, the dehusking and splitting process is carried out. Silicon carbide (carbon + crystalline alumina) is used to make the emery coating, also known as carborundum. The dehusking performance of carborundum is affected by its grit scale. For different types of pulses, different grit sizes are used. The majority of dehusking and splitting, the mills use emery rolls. Some millers use a disc sheller to break dehusked grain, while dehusking is done exclusively with emery rollers. To achieve a high-quality product, milled fractions such as unhusked whole, dehusked whole, unhusked dal, dehusked dal and broken are separated. Cattle are usually fed by product from the milling industries.

Polishing:
Polishing is necessary to give milled products a uniform appreance and to increase consumer appeal. Dal with husk cover is part of a milled commodity fraction. Polisher aid in the removal of the husk from this kind of dal. Different types of polishers are used on various types of dal, such as nylon polish, oil/water polish, leather and makhmal polish. In industrial mills, oil and edible colour polish are widely used. Consumers are developing a preference for unpolished dal as they become more cocious of adulteration and the use of non-edible compounds.

DAL MILLS IN MINIATURE SIZE

High–capacity pulse processing plants, like the majority of the food processing industry, are concentrated in cites. Whole grains are purchased at a lower cost by middlemen and the value-added product, dal is sold back to villagers at a cost. The cost of the finished product can often be double that of the raw material. Procurement companies, wholesalers and supplier networks all the benefits from forward and backward linkages. The actual grower and rural population suffer as a result of having to pay more for processed dal and the profit margin shifts to urban areas. It was discovered that pulse processing can be used by rural entrepreneurs to help them develop their businesses. Several research organisations conceptualised the idea of limited capacity mini dal mills. In different parts of the country, mini dal mills built by CFTRI, Mysore, CIAE, Bhopal, PKV, Akola and IIPR, Kanpur are common. Mini dal mills in rural areas would minimise transportation costs and make cheaper dal accessible to the rural population. Milling losses are easier to manage on a small scale, so such units yield higher dal recovery. The establishment of

processing units in rural catchments has the potential to encourage rural entrepreneurship, create jobs, increase rural income and eventually prevent migration to cities.

Value Added Products of Pulses

Pulses are consumed in India in a variety of ways and shapes, including whole, dehusked splits, milled, mixed with cereals, roasted, puffed, salted and sweetened varieties. Green, roasted, boiled, fried, crushed and cooked types of immature pulse grains are used. The same pulse can be eaten as a dried grain, soaked, sprouted, boiled, steamed, fried or cooked as dal after maturation. Every household in southern Indian makes dal or sambar from dehusked cotyledons on a daily basis. Dehusked splits are often ground into flour and used in a variety of dishes across the world. Soaked, frying/roasting, puffing, extrusion, germination, fermentation etc, are important processes involved in preparation of different recipes from pulses. Due to abrasive dehusking in commercial mills, only 70% of the dal is recovered during pulse milling, compared to a capacity of 85%. Cattle feed is made from the by-product of pulse milling. This low-protein, high fiber by product can be used to make food for humans. At the IIPR in Kanpur, attempts were made to use this nutrient-dense, protein-rich by-product for human consumption. Around 30% of the cotyledon powder is separated by sieving the milling by-product, which can be used as pulse powder in various pulse-based recipes or instant dal. Sieved fractions include phenol and fiber-rich husk, which can be used for medicinal purposes. In order to make biscuits, 10%, 20% and 30% milling by-product were mixed into dough. The economic potential of milling by-products can be exploited by making fibre and protein-rich biscuits. These biscuits made from pulse by-product are equivalent to wheat fibre-based biscuits sold commercially. The product's organoleptic assessment among subjects of various ages demonstrated its acceptability. People of a certain age displayed a strong preference for high-fibre biscuits, while younger people preferred lower milling byproduct. Improved varieties, varieties must be produced with millets needs in mind.

FUTURE RESEARCH THRUST AREAS

- Dehusking varieties with low gum and husk content is simple and results in limited losses.
- Pre-treatments that are effective: newer methods and processes for loosening the seed coat prior to milling are required.
- Independence from the weather: the method of pulse milling is weather-dependent.
- It is essential to establish processes and machinery that can dehusk grains regardless of whether condition.
- Improved dehusking unit: to achieve optimum dehusking with the least amount of breakage and powdering, system parameters such as emery grit size, roller-sieve clearance, diameter length ratio and so on must improve.
- Usage of milling by-product: pulse milling by-product are commonly used as cattle feed. This low protein, high fibre milling by-product, on the other hand, has the ability to be used as an edible value-added product.

REFERENCES

[1] Prasoon Verma, (2018), Processing and Value Addition of Pulses, ANUSANDHAN- AISECT University Journal Vol. 06, Issue No. 13, P-ISSN 2278-4187.

[2] Lal, R.R.; Verma, P. (2007). Post-Harvest Management of Pulses. Technical Bulletin. Indian Institute of Pulses Research, Kanpur.

[3] Mangaraj, S., Agrawal, S., Kulkarni, S. D., & Kapur, T. (2005). Studies on physical properties and effect of pre-milling treatment on cooking quality of pulses. Journal of Food Science and Technology, 42(3), pp. 258–262.

[4] Exim Bank., 2015. Indian Pulses Industry. In: Agri Export Advantage: May 2015. Vol XIX. Issue III, 4-5.

[5] Deshpande, S. S., and Nielsen, S. S., 1987. In Vitro Enzymatic Hydrolysis of Phaseolin, the Major Storage Protein of Phaseolus Vulgaris L. Volume 52, Issue 5, Pages 1326–1329.

[6] Frias, J. E., Penas, C., and Villaluenga, M., 2016. Fermented Pulses in Nutrition and Health Promotion. In: Fermented Foods in Health and Disease Prevention. Chapter 16, 385-416.

[7] Gopalan, C., Rama Sastri, B.V., and Balasubramanian, S.C., 2004. Nutritive Value of

Indian Foods, National Institute of Nutrition, ICMR, Hyderabad.

[8] India Pulses and Grains Association (IPGA), 2014. Handbook on minor and imported pulses of India. Foretell Business Solutions Pvt. Ltd. (www.CommodityIndia.com), South Africa. ISBN 9788175110502

[9] Jukanti, A. K., Gaur, P. M., Gowda, C. L. L., and Chibbar., 2012. Nutritional quality and health benefits of chickpea (Cicer arietinum L.): A review. British Journal of Nutrition, 108, S11 S26.