Indian Journal of Traditional Knowledge
Vol 22(1), January 2023, pp 50-56
DOI: 10.56042/ijtk.v22i1.33003

'Rantak': Perishing indigenous wisdom of cold arid region of Ladakh

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Received 25 March 2020; revised 12 May 2022; accepted 07 July 2022

The present study done in four purposively selected villages of district *Leh* in the union territory of *Ladakh* documents the perishing indigenous technology of cold arid *Ladakh*, a water mill used to grind grains. The traditional water mill of this region, locally known as the *'Rantak'* or *'Churak'* is used for grinding grains of different crops and vegetables. Driven by fast moving water usually coming or made to come from a height, the *Rantak* serves the people in grinding cereals like *barley, wheat, buckwheat* and vegetables *like pea, broad bean* etc. The mill is made by the villagers having expertise in this by using locally available materials. Unfortunately with the passage of time, a few of them are left in the region and among those left many are non functional. The present generation does not know much about these. The indigenous wisdom of the people of the region is now perishing and the technology is on the verge of extinction.

Keywords: Extinction, Grains, Grinding, Indigenous Technology, Rantak

IPC Code: Int Cl.[23]: B02B 1/00, B02B 5/00, B23G 1/36

At an elevation of 2900 m to 5900 m above mean sea level, the Union Territory of Ladakh is one of the highest and coldest regions in the world[1]. This Union Territory has two districts of Leh and Kargil and in the country is also the principal cold desert. The maximum and minimum temperature here varies from +35°C in summer to -35°C in winter. Barley constitutes the major crop of this cold arid region[2] followed by wheat as the next main crop of this cold arid region[3]. The summer season here is shorter and mild with a long and cold winter. Due to long harsh winter season, the region remains cut off from rest of the country. This isolation of the region necessitated and has led to a number of indigenous tools and technologies. These technologies developed with the traditional wisdom of local people still play a great role in sustenance of the economy of this region and socio-economic development of this region.

According to National Academy of Agriculture Research Management (NAARM) Hyderabad, Indigenous Technical Knowledge (ITK), the thinking of the local people in various operations of agriculture and allied areas is actually applied. This knowledge is unique and traditional existing within the societies and that has been developed around the specific conditions of both the sexes indigenous to a particular geographic area[4].

Such type of knowledge encompasses the technical know-how, the traditional skills and practices that have been developed, sustained and passed on from generation to generation within various communities that often form a part of its cultural or spiritual identity[5]. In contrast to the Indigenous Knowledge is the International Knowledge system generated by various universities, research institutions, various private players and all other stakeholders engaged in generation of knowledge. The traditional knowledge forms the basis for making various micro level decisions at the grass root level in various sectors that also include crop production, processing, value addition, sustainable management of natural and a host of many other activities in which rural communities are involved (NAARM). Indigenous knowledge is not only limited to identification, but it also has a proactive role in the system of management of natural resources[6].

One such example of the indigenous technology is the '*Rantak',* the traditional water mill of Ladakh. A look into the world history reveals the water mills

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existed back as long as 4000 BC in Egypt and some other countries[7]. It is believed that an engineer Vitruvius used the vertical wheel which was used for irrigating crops, grinding of different grains and were used to ensure supply of drinking water to different villages. The use of fast flowing water from rivers and snow fed mountain streams to power the flour mills is also done in villages of Union Territory of Ladakh[8]. This traditional mill is also known as '*churak'* in local language The '*Rantak'* is used for the grinding of grains like wheat, buck wheat, barley, maize and peas; the machine is now fastly being replaced by electric mills. Although maize is not among the crops grown all over in this entire region, yet *'Rantak'* can be used for grinding maize grains also. It does not require any investment as it is made by locally available materials like stone and wood. It has now been time immorial since the water driven mill is being used in this region.

Methodology

The Leh district of the Union Territory of Ladakh constituted the area selected for this study. From this district four villages were selected purposively based on the presence of functional '*Rantaks'* in these villages. The villages selected were Stok, Matho, Stakna and Saspol. The data was collected from the '*Rantak'* owners with the help of an interview schedule in a face to face situation. The interview schedule had both open as well as closed ended questions. The visit to these '*Rantaks'* was also made at a time when these structures were running to see how different components of them works. In order to overcome language barrier, a local person who could speak as well as understand both Ladakhi and Hindi was also arranged and accompanied the authors during their visits. All this was done with the objective of getting information related to all the aspects of these structures, validating through cross checking from different sources and then documenting all this information.

Result and Discussion

Principle

The *'Rantak'* (Fig. 1) works on the simple principle of conversion of kinetic energy into mechanical energy. Moving objects carry with them kinetic energy and what happens is that the mechanical energy is generated from the kinetic energy of the falling water. As the region of Ladakh is rich in water resources, this traditional mill gets rotated by the water that is diverted from various water bodies. This energy of fast moving water forces underground turbines to rotate. On the surface are two circular stones of which one is fixed and the other is rotating. The lower one is fixed and the upper one is rotating.

Operation

The threshed, cleaned and dried grains are fed in the basket like structure locally called as 'Khortsel' (Fig. 1) that is fitted on the top of the two circular stones. An underground wooden structure called as *'Skuru'* (Fig. 2) is fitted just below the water fall. An

Fig. 1 — Rantak

Fig. 2 — Skuru

indigenous type of meter to adjust the flow of grains from '*Khortsel*' to the central hole '*Mik*' (Fig. 3) and called as '*Melong'* is also fitted at the rear end of '*Khortsel*'. The grinding stones are circular and are made up of granite. The granite stone is given a circular shape by experts from the villages with the help of iron hammer and rod. Each stone weighs up to one quintal. The round shaped chiseled stone wheels. The lower one is called as '*Yokdo*' (Fig. 4) is fixed and having a pivot in the center. The upper round rotating stone called as '*Kongdo'* also shown in Fig. 4 has a central hole called as *'Mik'* from where the grains come down on the fixed lower stone wheel. The upper stone wheel rotates with the flow of water and grinds the grains. When the water falls on the blades of water wheel, they in turn use it to turn the wheel. The rotation of the upper wheel grinds the grains. Dust and other impurities are removed with the help of a sweeping fur which is made up of sheep/goat skin and called as *'Phebyak'* (Fig. 5). Another spade like wooden structure with a long handle called as '*Panka'* (Fig. 6) is used to collect the flour at one place in the '*Tsekyi'*. The indigenous type of meter to adjust the flow of grains from '*Khortsel*' to the '*Mik*' is called as '*Melong'* (Fig. 7). The outlet through which water comes out of the '*Rantak'* is called as '*Wamjuk'* (Fig. 8). The '*Skuru'* is fitted with wooden wings caked as '*Shokpa*' (Fig. 9) on its lower portion. When the water from a height falls on the *'Shokpa'* (Fig. 9) of the *'Skuru';* the *'Skuru'* rotates and causes the stone wheel to rotate which is connected to it with the help of a another structure called as shaft. The rotational force caused by the water falling from a height gets transferred to the upper rotating stone and makes it to grind against the lower fixed stone.

Fig. 3 — 'Mik'

Fig. 4 — Kongdo and Yokdo

Fig. 5 — Phebyak

Fig. 6 — Panka

Fitted with the *'Khortsel'* is a wooden flat rectangular structure usually 10 to 15 cm in length called as '*Taktaldak',* (Fig. 10). The '*Taktaldak'* touches the upper rotating stone and shakes the hopper thus discharging the grains from it. The flow of the grains is different for different crops based on their size and texture. For barley, the flow is maintained more than wheat because of its brittle nature and its ability to get grind easily. The resultant flour falls into a trough called as *'Tsekyi'* and that encircles the stones. About 2 to 3 quintals of flour can be grinded from this traditional water mill in one day.

Fig. 7 — Melong

Fig. 8 — Wamjuk and Shoqkat

In *'Tsekyi',* dust and other impurities are removed with the help of a sweeping fur which is made up of sheep/goat skin and called as *'Phebyak'.* Table 1 carries information about different parts of a '*Rantak'* along with their vernacular names and functions.

'SKURU':* The back bone of '*Rantak'

It is a cylindrical wooden turbine. It occupies a vertical position. '*Sroq'* at the top of *Skuru* is a 'T' shaped iron shaft. *'Tia'* refers to the upper horizontal part of the 'T' shaped Sroq. It remains fixed into the runner stone in a central position. The wooden blades/wings (*shokpa*) are fitted at the lower portion of the turbine. Their number varies from 8 to 10. '*Phang'* is the spindle on which the base of the turbine rests. *'Phang'* has a rounded base that rotates upon a shallow bowl shaped white stone. This white

Fig. 9 — Skuru with Shokpa

Fig. 10 — Taktaldak

Table 1 — Different parts of a '*Rantak'* their vernacular names and functions

S. No	Part	Vernacular/local name	Function
1	Basket	*Khortsel*	Grains are put in this structure
2	Rotating stone(upper)	*Kongdo*	It rotates by the action of falling water through a wooden turbine like structure
3	Lower stone (fixed)	*Yokdo*	Grains fall on it and are ground by the rotation of upper stone
4	Wings of turbine	*Shokpa*	These rotate when water falls on them and in turn rotate the upper stone
5	Hole in upper rotating stone	*Mik*	The hole at the center of the upper stone
6	Poking wood	*Taktaldak*	Touches the upper rotating stone, shakes the *Khortsel* thus discharging the grain from it
7	Wooden frame	*'Shoqkhat*	Wooden frame inserted a little away from the outlet of water to catch the wings of '*Skuru'*
8	Sieve	*Phechaqs*	Used for sieving the flour
9	Water outlet	*Wamjuk*	Water comes out of this outlet
10	Collecting ring	*Tsekyi*	Flour falls into this ring
11	Sweeping fur	*Phebyak*	Gathering floor in the collecting ring
12	Adjuster raw /fine	*Dakshinj*	Used to adjust the quality of grinding
13	Meter	*Melong*	to adjust the flow of grains from '*Khortsel*' to the '*Mik*

stone is locally called as '*Pagor'*. '*Maqdan',* a wooden plank like structure acts as a link between the '*Skuru'* and the *Phapstaq'*. The *'Phapstaq'* is also another 'T' shaped structure made up of wood or iron whose upper horizontal portion remains above the ground. The lower vertical portion of *'Phapstaq'* is attached with *Maqdan* through another attachment called as '*Khoqzer'*. The outlet through which water comes out of the '*Rantak'* is called as '*Wamjuk'*. To ensure that the blades remain in their position and they do not come out off the '*Skuru'*, a structure in the form of a wooden frame called as *'Shoqkhat*' is placed a little behind the outlet. It is made up of locally available willow sticks.

Similar to the 'Rantaks' are the 'Gharats' of the Jammu and its various adjoining districts. These Gharats have also been reported in the ancient times on the banks of various water bodies in Jammu region. There are still Gharats in many places of Jammu division like Chenani, Udhampur, Rajouri, and Poonch and at many other places. George Forster an employee of East India Company visited Jammu in 1783. In his travelogue he said that Jumbo is situated on the side of a hill. The bottom of the hill is washed by the river and many water- mills stand on its banks for grinding corn. These water mills are constructed in a neater manner than any he had seen in any other place in India[9].

Economics

Unlike with mechanized grinding mills which generally charge in rupees for grinding grains, the *Rantak* owners in this cold arid region besides cash also take it in kind. When it is in cash it is at the rate of rupees three per kg of the product grinded; when in kind it is in the form of manual help in the fields that the *Rantak* owner takes from his/her customers. On a single day if the flow of water is good about 1.5 quintals of grains can be grinded and going by the rate of rupees 3 per kg, the daily earnings stand at rupees 450-500. The annual income for only eight months in which *Rantak* remains functional in a year income comes out in between 1.0 to 1.10 lakh rupees.

Limitations

The Union Territory of Ladakh is constrained by the water that gets frozen in winters and this renders the '*Rantak'* functionless during winter months. The villagers thus cope up with this by grinding the grains in summer months. They then store the flour for winter use. The flour, so stored does not spoil because of low temperature. This also happens in case of other perishables like fruits and vegetables which are sundried and processed into various products for subsequent use in the winter months.

Advantages

Grain grinding by this technology has a lot of beneficial effects too and these have been proven scientifically. The grinding by stones is a comparatively slow process when compared to the grinding that is done by the electric mills. The slow grinding ensures that the wheat germ does not gets exposed to high temperatures and thus prevents rancidity which otherwise had caused the fat from the germ portion to oxidize and become rancid. The flour thus gets a longer life without any risk of getting spoiled on storage. Also as the grain is being ground

in small amounts, the fat of the germ gets well distributed which also minimize spoilage[10]. The loss of Vitamins also gets minimized due to exposure to low temperature. Studies also reveal that the endosperm, bran and germ remain in their natural proportions[11]. Another important aspect is that because the ground flour is usually coarser, the nutritive losses due to oxygen exposure are also limited[12]. In addition, the taste, texture, flavors and standard of the flour of the watermill is far superior to flour of modern mills[13]. Baking quality is of the flour obtained through *'Rantak'* is also better as compared to the flour of modern mill. Yield of the flour thus obtained by grinding is also more as there is less of wastage as compared to present day flourmills.

Conclusion

The '*Rantak*' of Ladakh and the '*Gharat*' of Jammu region are vital and indigenous technologies since ages. These traditional water mills are still being widely used in the Himalayan region. Studies reveal that about 2.5 lakh traditional wooden water mills are still in use in Himalayan and Sub Himalayan region[14]. Although, they are time consuming, these are eco friendly having very low maintenance cost that do not require electricity or any fuel which cause pollution. In the present era, climate change has hit hard almost every sector of the economy. Agriculture is a sector which contributes to climate change as well as is affected by it. The sector is more vulnerable to extremes of climate change and such indigenous technologies which do not need any fuel and do not cause any pollution can make a lot of difference in controlling the increasing temperature.

Recommendations

With the advent of electric mills, these ancient symbols of culture are fast disappearing. What is more pathetic is that the younger generation is not aware of this traditional technology and wisdom associated with it. A few of these are now found in few villages of this region. Given their importance in bringing sustainability, tackling climate change and maintaining the quality of final product, it is recommended that:

a. Urgent corrective measures for improving their efficiency and thus restoring this ancient traditional wisdom and environment friendly technology should be taken. This will also improve the livelihood security of the inhabitants furthering the judicious use of the natural resources in the Himalayan region which are under threat due to various anthropogenic activities. The concerned agencies like the Ministry of water resources, the Panchayati Raj Institutions, different institutes working in cold arid Ladakh like Defence Institute of High Altitude Research (DIHAR), Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, GB Pant institute and various NGOs should come forward and take the necessary steps to safeguard this indigenous structures and the technology.

b. Suitable modifications of these traditional structures making them compatible with the local climate have already been done in various states of Jammu and Kashmir, Uttrakhand and Sikkim. In the cold arid Ladakh region where in the harsh winters water freezes and '*Rantaks'* are rendered functionless, there is a need to work out some other mechanism by which they can be put into use throughout the year.

Acknowledgement

The authors acknowledge all the owners of this traditional mill in the villages of Stok, Matho, Stakna, Saspol, who were so kind and keen to provide all the necessary and relevant information regarding these traditional structures. Special thanks are due for Agang Angchuk, Sonam Norboo and Stanzin Gonbo; the local residents of the area for providing information regarding the villages where *Rantaks* are functional and also about their owners

Funding

No financial help was taken from any agency.

Conflict of Interest

The authors declare that there is no conflict of interest in the publication of this paper.

Author's Contributions

PK: Data collection original writing, review and editing; KL: collecting information and data; DN: Conceptualization

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