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MILLET: THE FORGOTTEN GRAIN AND ITS POSSIBLE REVIVAL AS AN ANSWER TO FOOD SHORTAGE IN THE PHILIPPINES

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Abstract

Millet was one of the grains produced in the Philippines during the pre-colonial era. Though it is described in ancient Egyptian and Babylonian texts, millet's origin and introduction in the Philippines remain shrouded in history. Its cultivation and use, however, were described by early Spanish missionaries. Along with rice, millet was one of the festal foods of the Philippines which were consumed only during times of feasts and merry-making. In the course of centuries, the Filipinos were drawn towards a wider utilization of rice and the farming and consumption of millet has become more of a rarity as it became confined to a few remote areas in the islands. Meanwhile millet is still being grown in various countries of Southeast Asia like Malaysia and Indonesia. Beyond the region, millet is a major grain in India and China which are its biggest producers as well as various countries in Africa. This paper examines the reasons for the decline of the cultivation of millet and discusses the possibilities and benefits of its revival and popularization. Compared to rice millet requires less water and fertilizer and it is more tolerant of hot and dry climates and increased soil salinity. The article also compares the nutritive value of millet compared to other grains and its popular cultivation could become a solution for the food shortage and malnutrition in the Philippines.

Keywords: millet, cultivation, consumption, nutritive value, food security, revivial

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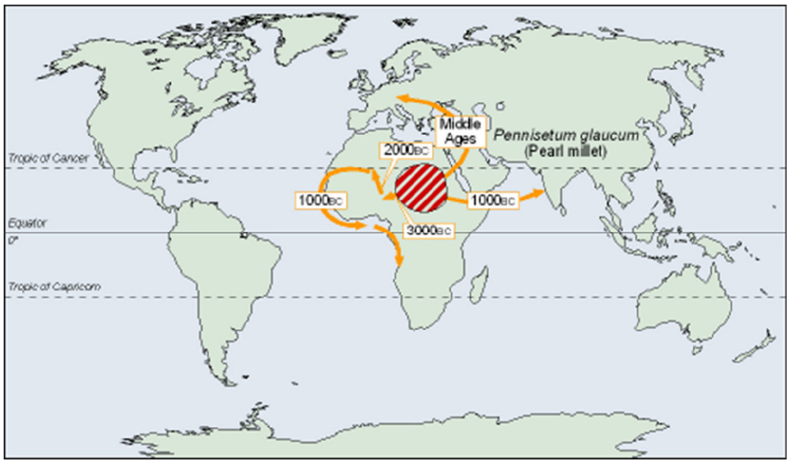
Millet in World History and the Philippines

Millet *(urochloa ramosa)* is one of the food grains of the Philippines. It is an ancient grain and its true origin is shrouded in mystery. Scientists originally believed it came from Africa and it was also cultivated in the Fertile Crescent. Millet was recorded as one of the grains grown in Sumeria in present-day Iraq. The cultivation of millet predated the cultivation of wheat and it was known as the ingredient to produce beer which was one of the rations of the builders of the pyramids of Egypt. Millet beer was part of the payment for laborers in Mesopotamia during ancient times.[1] Aside from Egypt and the Fertile Crescent, millet was also cultivated in Western Europe and in ancient China. Millet is also grown in Southeast Asia. In areas like Sarawak in Borneo, millet is grown in the upland areas and still consumed as food. A popular delicacy there is called *pulug wajik* which a sweet delicacy that is cooked in the same fashion as rice cakes except its main ingredient is millet.[2]

Wajik from Bali, Indonesia
https://en.wikipedia.org/wiki/Wajik#/media/File:Wajik_Side_View.jpg

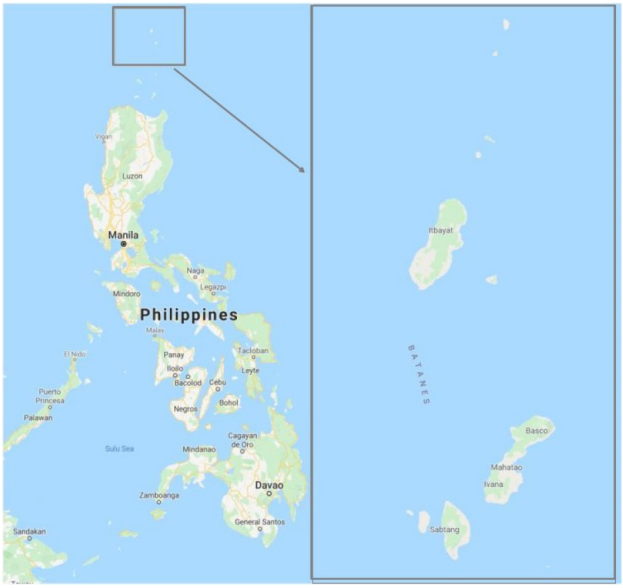
[1] 5,000-year-old pay stub shows that ancient workers were paid in beer in: https://arstechnica.com/science/2016/06/5000-year-old-pay-stub-shows-that-ancient-workers-were-paid-in-beer/ [Accessed November 19, 2019].

[2] http://library.binus.ac.id/eColls/eThesisdoc/Bab2/bab%202-is1-sn-ad-2020-0110.pdf [Accessed June 14, 2024]



The apparent introduction of millet from Africa to Asia and Europe.
https://www.nhm.ac.uk/discover.html?section=crops&page=spread&ref=millet

In the Philippines, millet has been grown from time immemorial. No one knows whether it was introduced by primitive men or it was brought by animals. It is considered as one of the native plants of the Philippines unlike corn and sweet potato which were brought to the Philippines from the Americas by the Spaniards. The grain is known by Filipinos in various languages. In Batanes which is the northernmost province of the Philippines, it is called *raut*.



Map of the Philippines showing Batanes Province.
https://meanttogo.com/batanes-travel-guide-north-batan-south-batan-and-sabtang/#google_vignette

In the islands of Samar and Leyte in the Eastern Visayas region millet is called *daba* or *dawa*. In the island of Cebu in the Central Visayas, millet is called *budbud* because of its very small grains. West of Cebu in the province of Negros Oriental, millet is called *budbud kabog*.

Map of the Visayan region showing the islands of Samar, Leyte, Cebu and Negros.
https://www.thepinoyexplorer.com/lander?showComment=1347921191395

The cultivation of millet was recorded by recorded by Spanish missionaries notably by Fr. Ignacio Alcina, S.J who was assigned to the island of Samar in the 17th century. According to Alcina's work describing people and culture of the Eastern Visayan region, the *Historia de las Islas e Indios Visayas* (1688) (The History of the Islands and the Visayan Natives 1688), millet was known as *daba* in Leyte.[1]

In the Tagalog region in the island of Luzon, millet was known as *kulasan* or tigbi. The term refers to foxtail millet.[2]

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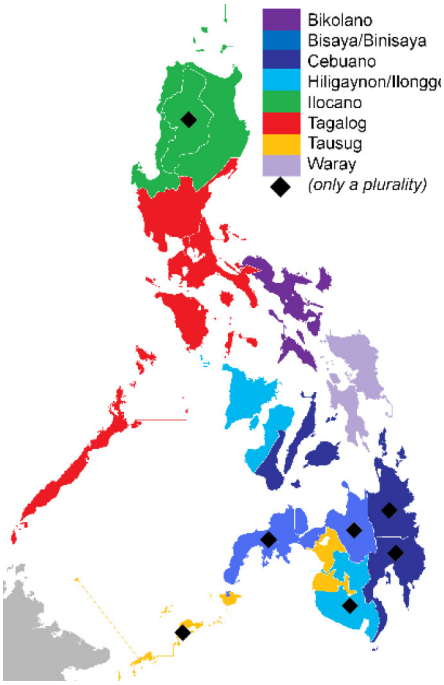
[1] Ignacio Alcina, S.J. Trans and Edited by Cantius J. Kobak and Lucio Gutierrez, O.P. History of the Bisayan People of the Philippine Islands. Vol. 3. (Manila: University of Santo Tomas Publishing House, 2002), pp. 106-108.

[2] Foxtail Millet in Tagalog in: https://glosbe.com/en/tl/foxtail%20millet [Accessed November 21, 2019.

Foxtail millet

https://images.search.yahoo.com/search/images;_ylt=AwrOoaZacGxmBaYBmpBXNyoA;_ylu=Y29s-bwNncTEEcG9zAzEEdnRpZAMEc2VjA3BpdnM-?p=Foxtail+millet&fr2=piv-web&type=E211US0G0&fr=mcafee#id=7&iurl=https%3A%2F%2Fcdn.shopify.com%2Fs%2Ffiles%2F1%2F1751%2F6601%2Fproducts%2FFoxtail_Millet__DSC5324_800x.jpg%3Fv%3D1606373490&action=click



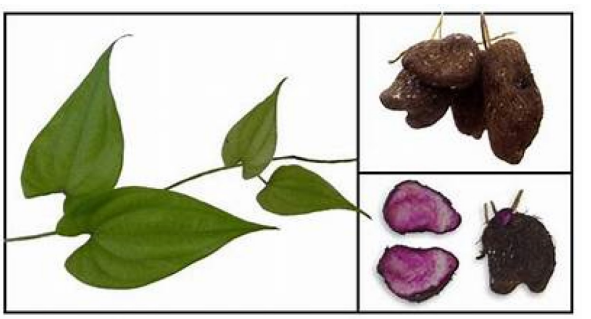
Map showing the major ethnolinguistic groups of the Philippines. The region colored in red indicates the Tagalog-speaking region.

https://langfocus.com/language-geography/filipino-tagalog-the-lingua-franca-of-a-hugely-diverse-country/

Millet is one of the grains carried by sea-going Badjaos and the Sama Balanguiguis in the southern part of the Philippines during their long voyages. There is a rather apocryphal story about the Badjaos who cook their cereals, especially sorghum. When the sorghum passes through their digestive tract the grain is partially digested and they gather the grain to be eaten again. This caused some of their fellow Moros especially the Sama to deride them as feces eaters.[1]

Along with rice, millet is mentioned by historian William Henry Scott as a festal food and it was consumed only during special occasions. Another food grain that was also grown in the precolonial Philippines was sorghum. Because of the difficulty of cultivating individual plants, the main sources of carbohydrates in the Philippines were root crops such as gabi or taro, ube or yams (white and purple varieties), sago palm and *rimas* or bread fruit.[2]

A taro or gabi plant and edible root http://www.stuartxchange.org/Gabi.html



Ube or yam pant with edible roots http://stuartxchange.com/Ubi.html

[1] Margarita de los Reyes Cojuangco, History of Mindanao. Unpublished Ph.D. Dissertation, University of Santo Tomas Graduate School, 2004. p. 34.

[2] William Henry Scott, Barangay. 16th Century Culture and Society (Quezon City: Ateneo University Press, 1994), p. 111.

A sago palm with seeds

https://images.search.yahoo.com/search/images;_ylt=AwrOoaboc2xmYQQASkpXNyoA;_ylu=Y29sbwNncTEEcG9zAzEEdnRpZAMEc2VjA3BpdnM-?p=sago+plant+and+sago+fruit&fr2=piv-web&type=E211US0G0&fr=mcafee#id=44&iurl=https%3A%2F%2Fplantcaretoday.com%2Fwp-content%2Fuploads%2FLHF-52908-sago-palm-seeds-t1-min.jpeg&action=click

A breadfruit or *rimas*

https://images.search.yahoo.com/search/images;_ylt=Awr.1Tfsc2xmyrcMB0aJzbkF;_ylu=c2VjA3NIYXJjaARzbGsDYnV0dG9u;_ylc=X1MDOTYwNjI4NTcEX3IDMgRmcgNtY2Fm-ZWUEZnIyA3A6cyx2OmksbTpzYi10b3AEZ3ByaWQDbzBWeEdfeDBSMEN2UEhGUDduWGdUQQRuX-3JzbHQDMARuX3N1Z2cDMARvcmlnaW4DaW1hZ2VzLnNIYXJjaC55YWhvby5jb20EcG9zAzAEcHFz-dHIDBHBxc3RybAMwBHFzdHJsAzIyBHF1ZXJ5A3JpbWFzJTIwcGxhbnQlMjB3aXRoJTIwZn-J1aXQEdF9zdG1wAzE3MTgzODM3ODY-?p=rimas+plant+with+fruit&fr=mcafee&fr2=p%3As%2Cv%3Ai%2Cm%3Asb-top&ei=UTF-8&x=wrt&type=E211US0G0#id=0&iurl=https%3A%2F%2Ffilipinoeyes.com%2Fwp-content%2Fuploads%2F2023%2F02%2Ffruit-g00e641eb5_1920-1024x683.jpg&action=click

Millet plants in Basco, Batanes
(Photo courtesy of Dr. Forentino H. Hornedo)

The Method of Planting Millet

Cultivating millet was done through the *kaingin* or slash and burn farming. Alcina described the method of planting:

> *"Prior to sowing, they soak the seed from two or three days in these regions (the Eastern Visayas); in others, they do not soak them.*
>
> *The method of sowing is not to scatter the seed abundantly but to scatter it on the land like the daba, that is we have already stated, a kind of millet which they sow by scattering the seed called sabuag"*[1]

Alcina said that that in some regions millet and corn can be planted with the main rice crop. Millet matures more quickly and is harvested one or two months before the rice. The grain can be grown in any season as long there is proper irrigation. This is different from what is done in China when millet is grown during the summer months. The natives of the Philippines sow both rice and corn at the edges of the land sown for rice which they call *daplin*.[2] The plants are

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[1] Ignacio Alcina, S.J. Trans and Edited by Cantius J. Kobak and Lucio Gutierrez, O.P. History of the Bisayan People of the Philippine Islands. Vol. 3, p. 109.

According to *Alcina, sabuag* refers to sowing seeds or by scattering them on soil prepared for planting.

[2] *Daplin* according to Alcina refers to the edge of the cultivated area or a shore of a river or sea. But in cultivated areas where wet rice cultivation is practiced like the rice paddy daplin refers to the edges of edges of the rice paddy.

enclosed in the rice paddy which is necessary to prevent the plants from being blown down by the wind or washed away by the rain.[1]

After about 60 to 70 days the plants begin to flower and pods resembling cat tails or earheads depending on the type of millet begin to form.[2] The type of millet that is more common is the pearl millet though fox tail millet is also found in the Visayan area. Tiny grains begin to form in the pods and these will be ready for harvesting when they turn yellowish. In other species of millet like fox tail millet, the pods droop indicating that the grains inside them are already mature. Millet is harvested by hand. Harvesting is done by cutting the ear heads first and the stalks later. The straw from the stalks are cut after a week.

The millet seeds are removed from their ear heads or pods simply by rubbing them against each other and the seeds fall to a flat rattan or bamboo tray which serves as a winnower. Then seeds are then left to dry. Care is taken because once the seeds were dried, they can be easily blown by the wind. After being dried the millet seeds are gently pounded. To separate the chaff from the seed air is blown allowing the chaff and the hulls to fly off leaving only the bare grain. Natives simply blow air into the pounded millet and only the grain is left in the container. Broken grains may be retrieved by sieving. The millet can now be used for cooking.

Unhusked millet grains

[1] Ignacio Alcina, S.J. Trans and Edited by Cantius J. Kobak and Lucio Gutierrez, O.P. History of the Bisayan People of the Philippine Islands. Vol. 3, p, p. 111.

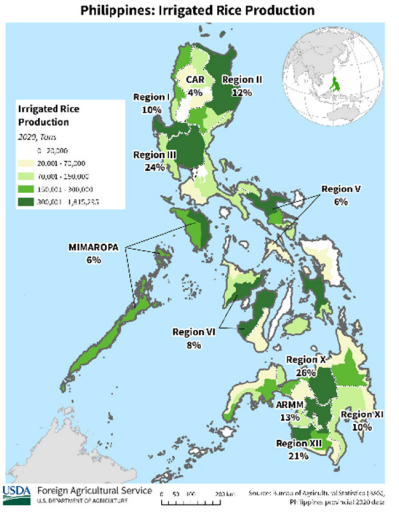
[2] Actually the pods look like *talahib* or saw grass flowers.

Rice Eclipses Millet as a Popular Grain

of the Filipinos

Millet can be served as a porridge or as a rice cake. The grains are capable of expanding and makes it possible to have many servings per kilo. It could have been a major grain for the Philippines. However, rice began to eclipse millet and other grains. In many areas of the Philippines, its cultivation has largely disappeared. The Philippines has become to have a rice-eating culture and millet has been largely forgotten. Large tracks of land have been devoted to rice cultivation and even mountains have been carved out for rice propagation.

A rice field in Nueva Ecija province in Central Luzon known as the rice granary of the Philippines.
https://www.camella.com.ph/exploring-nueva-ecija-life-at-the-heart-of-central-luzon/



Map showing irrigated rice-growing areas of the Philippines
https://ipad.fas.usda.gov/countrysummary/default.aspx?id=RP

Rice terraces in Banaue, Ifugao province: If there were terraces for rice cultivation how come there were no terraces for millet? https://ph.pinterest.com/pin/270708627574824322/

The bias towards rice is reflected on the nation's culture. Songs have been written about rice like the popular *Magtanim ay Hindi Biro (Planting Rice is Never Fun),* which is a rice-planting song. The rice-growing culture is also reflected in art. Countless of paintings depict bucolic scenes of rice planting, harvesting and winnowing.

A painting by Philippine national artist Fernando Amorsolo showing rice planting with the Mayon Volcano in the background. https://artistxyz.blogspot.com/2022/05/paintings-of-fernando-amorsolo-planting.html

In Philippine society, having a large stock of grain like rice in the household is a measure of affluence, so was eating well-polished white rice. A person who was depended on, especially on for financial needs was sarcastically called a *palabigasan*, a rice granary because his friends or relatives draw their money from him. On the other hand, Filipinos on the edge of starvation would look for two things, rice and salt- the latter was desired to flavor the cereal. The bias towards rice is also reflected in the meals of the Filipinos who eat steamed or fried rice along with their usual viands of fish and vegetables. They hardly use other cereals like corn or sweet potato.

Rice was also used to inspire moral values among Filipinos. For example, children were told by their elders not to waste or throw away rice that `was not eaten. They were told that discarded rice even a single grain weeps because it just goes to the garbage. The lesson teaches the Filipinos to conserve rice. Another popular lesson is to eat the proper amount of food, particularly rice because there are so many people who go hungry while they are wasting this life-giving substance. Socialist-minded Filipinos such as Luis Taruc,[1] he reminded his listeners that the President and the Cardinal who live in palatial residences both eat rice and that the rice they consume comes from the labor of the poor peasant farmer. He reminds the people of the importance of the role of the lowly cultivators of the land and the need to uplift their social and economic conditions.

As rice has taken over the minds of the Filipinos, millet has faded away. Even the meals like suman (native cakes) which originally used millet, has been taken over by rice and are now known as rice cakes.

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[1] Luis Mangalus Taruc (B. June 21, 1913 – D. May 4, 2005) was a peasant and rebel leader. He was the Supremo (supreme leader) of the Hukbalahap (Hukbong Bayan Laban sa Hapon or People's Anti-Japanese Army), a guerilla organization which fought the Japanese invaders during the Japanese occupation of the Philippines. The group later became the *Hukbong Mapagpalaya ng Bayan* (People's Liberation Army) which fought the Philippine government after the war. This author was privileged to have interviewed Taruc several times when he was head of the HukVets, an organization representing the Hukbahahap veterans.

Millet Production and Consumption in the 21th-Century Philippines

There are only a few areas in the Philippines where it is still cultivated but only in small scattered areas such as the mountainous areas of the Visayas and in the Batanes province. According to respondents, only a few people eat millet for food because it is very expensive.[1]

The farm gate price of millet in 2017 is about P200 a kilo. In the Eastern Visayas millet is not very common in the market place. It is available seasonally and the cost of a kilo of millet in Biliran is more than P200 or about US$3.41.[2] Millet from Dumaguete can be purchased at P250 (or about US$4.26) a kilo. The local rice cake or *suman* made with millet is also expensive. As of this writing (2024) five pieces of *budbod kabog* cake are being sold online for P270 (US$4.60). It is being billed as "gourmet suman."[3]

The ordinary *suman* or rice cake made with glutinous rice
https://grottepastenaecollepardo.org/#google_vignette

[1] Personal remarks. Rosita Diadole, resident of Biliran, Province, August 15, 2015.
[2] Personal remarks, Florentino H. Hornedo, resident of Basco, Batanes. April 3 , 2014.
[3] https://www.budbudgourmetsuman.com/products/budbud-kabog?variant=43185535680672

A budbud kabog (millet) cake being sold online https://www.budbudgourmetsuman.com/products/budbud- kabog?variant=43185535680672

There are areas in Manila where millet can be obtained. However, most of these are imported and they can be bought from Indian stores which sell the grain for P180 or US$3.54. Because of its nutritive qualities, it is also available at health food stores for a higher price at P365 or US$ 7.17 a kilo.

On scattered farms across the Philippines, millet is cultivated in the same way that Alcina described it in the 17th century. According to Hornedo, millet in his native Batanes matures in three or four months and it could grow three to five feet. It is harvested along with rice.[1]

The millet seed is separated from the cut stalks in the same manner as rice and the grain is obtained through pounding with a mortar and pestle method. The unhusked grain and grain shells are separated by gently blowing over the pounded shells and exposed grain. The lighter grain husks, stalks, chaff and dirt are blown away. Another method to separate the grain from the shells is to shake these materials in a special bamboo tray called *bilao* which has tiny holes that will allow the unhusked grain to fall through while sifting.

Millet is consumed as native cake or *suman.* It can be eaten pure or mixed with sticky rice. In making *suman* millet is mixed with coconut milk and sugar and wrapped in banana leaves. Millet can also be consumed as a If cooked this way, a cup of millet (about 200 grams) with at about five cups of water would be needed. The porridge is cooked in a metal pot and when the millet and water mixture starts to boil, it is necessary to keep stirring until the said mixture has become viscous. The porridge is served hot and sweetened with sugar and milk is added. Upon cooking the millet will expand and one cup of millet will be able to serve at least five persons.

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[1] Florentino H. Hornedo Personal conversation with the author, April 3, 2014.

There are different types of millet grown in the Philippines. One type is the "pearl millet" *(Pennisetum glaucum)* which is characterized by very small grains. This is the type of millet used by the people of the Batanes.

Pearl millet grains still on its pod.
https://foodofy.com/pearl-millet.html

Pearl millet on close-up
https://spsuperstores.blogspot.com/2010/12/pearl-millet.html

Other millet varieties which are present in the Philippines are the "finger millet" *(eleusine coracana),* the "proso millet" *(panicum miliaceu)* and the foxtail millet *(setaria italica)*.[1]

[1] Ryan Joseph Abrigo, Researcher Department of Agriculture, Bureau of Agricultural Research, Personal remarks. August 2, 2016.

Finger millet on stalks (left) and as loose grains (right).
https://www.africaresearchinstitute.org/newsite/wp-content/uploads/2014/10/1.3-Finger-millet-from-above-DSC_0667.jpg and https://www.asiafarming.com/finger-millet-cultivation

Proso millet on stalks and as loose grains.
https://www.riverrefugeseed.com/wildlife/white-proso-millet and
https://www.tridge.com/stories/tridge-market-update-high-quality-white-proso-millet-from-the-united-states

Foxtail millet in stalks and as loose grains
https://www.chilternseeds.co.uk/item_1173e_setaria_italica_hylander_seeds
and https://syncwithnature.in/know-your-food/foxtail-millet-korralu/

Because of the decline of millet production in the Philippines, there is practically no data on how much millet is being produced on the farms according to the Philippine Department of Agriculture.[1] This means millet has been reduced to some kind of a curiosity plant and it is being cultivated in remote areas and since many farmers have shifted to rice cultivation, the millet plant and its cultivation as well as its connection to local culture may vanish altogether.

The Philippines has become so dependent upon rice that consumption of this cereal has outstripped production beginning in the 1970s and imports have become necessary. Recently the country became the world's largest importer of rice. It became the world's biggest importer in 2016 and again reached this unenviable honor this year when it outstripped China at 2.8 million metric tons. It is expected t uphold its unenviable position in 2024.[2]

Aside from rice, farmers have shifted to other sources of carbohydrates such as corn and root crops such as taro *(gabi)*, potatoes *(patatas)*, sweet potatoes *(kamote)*, cassava *(kamoteng kahoy)* and white yam *(ube)*. The last root crop is a staple in the province of Batanes.

The end of millet cultivation may also signal the end of a tradition since millet is one of the traditional crops of the Ivatans who are the natives of Batanes

The Ivatan people (left) and the province of Batanes in the Philippine map. https://www.yodisphere.com/2022/09/Ivatan-Batanes-History-Culture-Traditions.html and https://www.discoverthephilippines.com/batanes-province-philippines/

[1] Technology Commercialization Division, Statistics on Philippine Agriculture, Department of Agriculture, Bureau of Agricultural Research, Philippines.

[2] C. Balita, "Rice Market in the Philippines- Statistics and Facts. Statista Agriculture and Farming https://www.statista.com/topics/11682/rice-in-the-philippines/#topicOverview .

To avoid the total extinction of millet production, cultural historians like Dr. Hornedo remarked that he had to pay some farmers to continue planting the crop. According to him there were four species of millet in his province of Batanes, one specie, a subspecies of the pearl millet has disappeared. Another problem is what beset Philippine agriculture today, many farmers would opt to go to the cities to do other work such as serving in the transportation industry where they can earn the same amount of income in significantly less time compared to farming. Working as drivers or in the construction industry to them would earn them more money instead of waiting for their crops to mature. Also, many children of farmers would not like to do their parents' work especially if they have become professionals. This also led to the neglect of farms and the decline of the agricultural industry in general. Except for a few areas in the Philippines only a few Filipinos know about millet. In the cities, they are known only as "bird seed," and thus considered only good for pet birds.

where, the cultivation and consumption of millet continues. Millet remains a major grain in countries like China and India. In China and Japan millet is used for the making of noodles. India remains the biggest producer of millet and the other major producers are in Africa.

The top ten producers of millet in the world are:

Rank	Country	Amount (Metric Tons)
1	India	11,000,000
2	Nigeria	5,800,000
3	Niger	3,200,000
4	China	1,800,000
5	Mali	1,600,000
6	Burkina Faso	1,100,000
8	Ethiopia	700,000
9	Chad	700,000
10	Senegal	560,000

Source: International Crops Research Institute for Semi-Arid Tropics (ICRISAT), Hyderabad India, 2022)

Today, 90 million people depend pearl millet production for food and income and 31 million hectares have been devoted to pearl millet production. Because of its hardy nature 50% of all millet harvested today belong are pearl millet. Since 1980 pearl millet production in Central and West Africa has increased 130%

A bag of Indian millet. This one originated from India (from the author)

What Caused the Decline of Millet Production in the Philippines?

The decline and virtual disappearance of millet in the Philippines were caused by the antiquated method of separating the millet grain from its husk. According to Hornedo, this process which has not changed since the Spanish era (1565-1898) is very laborious. One has to pound the grain through a mortar and pestle method after which the husk and grain had to be separated by repeatedly tossing the pounded grain to the air using the *bilao* method. This also causes a lot of grains to fall to the ground and since the grains are very small, these are considered losses.

The *bilao* method of separating the grain from the husk
https://images.search.yahoo.com/search/images;_ylt=AwrgzZgonW9mRkgRSkpXNyoA;_ylu=Y29sbwNncTEEcG9zAzEEdnRpZAMEc2VjA3BpdnM-?p=winowing+the+rice&fr2=piv-web&type=E211US0G0&fr=mcafee#id=3&iurl=https%3A%2F%2Fi.pinimg.com%2F736x%2F12%2F67%2F9c%2F12679caa5e28e5a47888756cfbc77e2d--the-grain-the-force.jpg&action=click

Compared to rice, millet is more difficult to separate from its husk because the grains are smaller. Rice that has fallen to the ground can be easily picked up compared to millet. Recently the process of separating unhusked rice grain or *palay* has been mechanized and this eliminated the need for the mortar and pestle and the *bilao* method. Rice mills also significantly reduced losses as little or no grain gets wasted.

A simple mechanized rice mill
From https://www.youtube.com/watch?v=km3vc6WCRYg

Aside from separating the grain from the husk, the planting and harvesting of rice especially in countries like Malaysia and Thailand have become fully mechanized. Millet cultivation and harvesting on the other hand, remained largely a manual task. However, in areas like Sarawak in Borneo, animal power has replaced manpower in separating. The farmers there used a water buffalo which is made to walk around in circles to turn a large stone mill to separate the millet grains from its hulls.

A stone grain mill. A larger one is powered by a water buffalo
rushpixel.com/stock-photo/ancient-quern-stone-hand-mill-953433.html

Revival of Millet Production as a Solution to Rice Importation and Malnutrition In the Philippines

If millet production were revived and popularized in the Philippines, it would surely solve the problem of its over-dependence on rice imports. Compared to rice, millet is not a picky crop. According to the International Crop Research Institute for Semi-Arid Tropics (ICRISAT), millet is one of the hardiest warm season cereal crop. It can survive even in the on the least fertile soils in the driest regions, on highly acidic and saline soils, and in the hottest climates.[1]

Since the flowers of the plants are so light, they can easily cross-pollinate with each other. Of the millet varieties pearl millet *(Pennisetum glaucum)* appears

[1] Nutritious Pearl Millet (Pennisetum glaucum) Varieties Enable West-Central Africa to Fight Fe (iron) induced anemia in: https://www.icrisat.org/crops/pearl-millet/overview. [Accessed March 18, 2024].

to be the hardiest. According to ICRISAT millet grows well in soils with high salinity or high acidity (low PH level). It grows well where other crops like corn and wheat cannot survive such as the edge of the Sahara Desert in Mali. Even with saltwater intrusion into the farms caused by rising sea levels, millet plants can grow in places with high salinity.[1]

Another advantage of millet cultivation is that it can grow in areas where there is rainfall. Unlike in wet rice or paddy rice agriculture, farmers do not need to flood their fields to grow millet. In the Philippines some farms are rain-fed or in upland areas far from sources of water. Millet can easily grow in those areas. Millet therefore suits well in areas adversely affected by global warming and climate change. Aside from less need for water, millet does not require much fertilizer compared to rice.

Millet can thrive even in the most difficult areas. Data obtained by the United Nations World Food Programme (WFP) showed that even impoverished countries like Bangladesh countries like Bangladesh produced 12, 402.82 of millet in 2022.[2] War-torn countries like Iraq and Afghanistan produced 3,441 and 2,616 tons respectively in 2021.[3] Because of its hardy nature, otherwise idle land can be utilized and unemployed people can now become productive farmers. Millet can be intercropped with other crops like corn and cowpeas. Millet plants can also reduce and prevent soil erosion caused by wind and rain.

The greatest value of millet aside from its hardy nature is that it can solve problems of malnutrition. Millet has more protein, fiber, iron and calcium than rice and wheat. The following chart shows the nutritional content of millet species such as foxtail, little, kodo, proso, barnyard, pearl and sorghum millet compared to wheat and paddy rice (see table below).

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[1] https://www.icrisat.org/crops/pearl-millet/overview

[2] Bangladesh - Crops » Items » Millet – Production, Knoema https://knoema.com/FAOPRDSC2020/production-statistics-crops-crops-processed?tsId=1023820 [Accessed March 16, 2024].

[3] https://worldpopulationreview.com/country-rankings/millet-production-by-country [Accessed March 16, 2024].

Comparison of Millet with Other Millet Varieties with Rice and Wheat[1]

(One Cup or 174 grams food value in grams)

Crop	Protein	Fiber	Minerals	Iron	Calcium
Pearl Millet	10.06	1.3	2.3	16.9	38
Finger Millet	7.3	3.6	2.7	3.9	34.4
Foxtail Millet	12.3	8	3.3	2.8	31
Proso Millet	12.5	2.2	1.9	0.8	14
Kodo Millet	8.3	9	2.6	0.5	27
Little Millet	7.7	7.6	1.5	0.3	17
Barnyard Millet	11.2	10.1	4.4	15.2	11
Rice	6.8	0.2	0.6	0.7	10
Wheat	11.8	1.2	1.5	5.3	41

Source:http://www.indexmundi.com/agriculture/?commodity=millet&graph=production [Accessed March 17, 2016].

Compared to paddy rice and wheat, varieties of millet have more protein, calcium, phosphorus, niacin and fiber. Millet as whole grain can prevent heart disease according to Anderson[2]

[1] Source: Millet Network of India, http://www.milletindia.org (Accessed. February 2, 2016)

[2] JW Anderson, Hanna TJ, Peng X, Kryscio RJ. Whole grain foods and heart disease risk. JAm Coll Nutria 2000 Jun;19(3 Suppl):291S-9S. 2000. PMID:17670.

Nutritional content in 100 gms of dry Grain	Protein (in gms)	Carbohydrates (in gms)	Fat (in gms)	Minerals (in gms)	Fiber (in gms)	Calcium (in mgs)	Phosphorous (in mgs)	Iron (in mgs)	Energy (in kCals)	Thaimin (in mgs)	Niacin (in mgs)
Foxtail	12.3	60.2	4.3	4	6.7	31	290	2.8	351	0.59	3.2
Little	7.7	67	4.7	1.7	7.6	17	220	9.3	329	0.3	3.2
Kodo	8.3	65.9	1.4	2.6	5.2	35	188	1.7	353	0.15	2
Proso	12.5	70.4	1.1	1.9	5.2	8	206	2.9	354	0.41	4.5
Barnyard	6.2	65.5	4.8	3.7	13.6	22	280	18.6	300	0.33	4.2
Sorghum	10.4	70.7	3.1	1.2	2	25	222	5.4	329	0.38	4.3
Pearl	11.8	67	4.8	2.2	2.3	42	240	11	363	0.38	2.8
Finger	7.3	72	1.3	2.7	3.6	344	283	3.9	336	0.42	1.1
Paddy Rice	6.8	78.2	0.5	0.6	1	33	160	1.8	362	0.41	4.3
Wheat	11.8	71.2	1.5	1.5	2	30	306	3.5	348	0.41	5.1
Quinoa	14	64	6	*	7	36	457	4.6	368	0.36	*

Compiled from a study published by the National Institute for Nutrition, Hyderabad and other sources for Quinoa.

Like other crops, millet especially pearl millet has threats. These include bacterial diseases

Such as bacterial spot *(Pseudomonas syringae)* and bacterial leaf streak *(Xanthomonas campestris* pv. *pennamericanum);* fungal and pseudo-fungal diseases especially downy mildew (caused by *Sclerospora graminicola* and *Plasmopara penniseti),* blast (caused by *Pyricularia grisea*), smut (caused by *Moesziomyces penicillariae*), ergot (caused by *Claviceps fusiformis*) and rust (caused by *Puccinia substriata* var. *penicillariae*).[1]

There are also pests from the insect world such as the millet head miner and stem borers and parasitic nematodes. Environmental stresses such as droughts, soil acidity, salinity and high temperature may affect the growth of seedlings or when the plants start flowering.

[1] 7 Major Diseases of Finger Millet (With their Management) | Plant Diseases in http://www.biologydiscussion.com/plants/plant-diseases/7-major-diseases-of-finger-millet-with-their-management-plant-diseases/43160 [Accessed November 21, 2019}

A millet field in Basco, Batanes
(Photo courtesy of F.H. Hornedo)

A farmer tending his millet plants in Batanes, Northern Philippines
(Photo courtesy of F.H. Hornedo)

Mr. Severino Baldove, a millet farmer of Basco, Batanes
(Photo courtesy of Dr. Florentino H. Hornedo)

Dr. Hornedo with the other millet farmers in Basco.
(Photo courtesy of Dr. Florentino H. Hornedo)

Concluding Remarks

Summing up, despite having been one of the traditional crops of the Philippines, the behavioral inclination towards rice consumption has pushed millet to oblivion. The Filipinos sadly, are addicted to rice, and the Philippines, despite being an agricultural country has become the world's biggest importer of rice.[1] The shift to a rice-based culture also threatened local culture and the traditional way of life. To keep traditions like millet cultivation and foods using millet from disappearing some persons, out of love of their own culture were willing to pay more for millet-based food or to pay farmers to continue planting the crop. In one of the author's lectures about millet, he was asked what people would feel if the food they were eating was the same as the one consumed by their pet birds. This raises the issue of adaption to the rediscovery of a traditional food source.

Yet, reviving traditional crops like millet may be the answer to the food shortage and malnutrition in the Philippines. Reviving millet cultivation can be a way to cope with climate change, rising sea levels and salinity in farms that would

[1] "Philippines Beats China as World's Biggest Rice Importer," in: www.philstar.com headlines. [Accessed November 21, 2019]

make other crops like rice very hard to grow. Furthermore, millet is not a delicate plant and it can grow with less water and less fertilizer compared to rice. With its high nutritional content, it is an answer to malnutrition and stunted growth among children.

Already millet has proven itself in as a food source in the most inhospitable and arid regions of the world. Millet cultivation may revive idle lands which have been abandoned because it is no longer fertile or has become saline. Thus, by having people work the lands, the problem of unemployment can be reduced.

Products from millet (courtesy of F.H. Hornedo)

As to addressing issues why millet cultivation and consumption fell, innovations can be done to make production easier. The main cause of the abandonment of millet was that separating the grain from the husk is labor intensive and that the grains are too small to be milled. Instead of using the mortar and pestle method, the millet grains can be milled. There are special devices or mills that can grind tiny grains. These are readily available commercially and can be attached to electric motors which can speed up the separation of grains from the husks.

Also instead of manually blowing into the milled grains, motorized or electric fans running at a very slow speeds can shorten the task. Finally government and private research centers may find innovations to produce new products out of millet. Already the United Nations World Food Programme found a way of making high-calorie bars using millet grains. These were given to undernourished children in Africa. Applying the same solutions in the Philippines and other countries may alleviate malnutrition especially among children.

Mill purchased by the author to mill small millet grains

Dr. Hornedo operating the hand mill to separate the millet grain from the hulls

Blowing air into the ground millet to separate the hulls from the grain

Unmilled millet seeds

Finished product

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