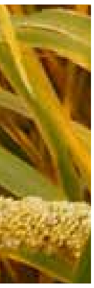


FEEDING THE FUTURE

MILLET

by Andrew Wilkinson

Recent studies have shown that at the current rate of growth, by 2050 the human population will have swelled to 9.5 billion. Recent FAO statistics have also shown that we do currently not have enough land set aside for cultivating crops to cope with this population surge.

So to meet this increase in demand, we will need to find new ways of getting food to those who need it most. One of the most effective ways of meeting this deficit would be to grow the food at source – even in some of the world's most hostile climates.

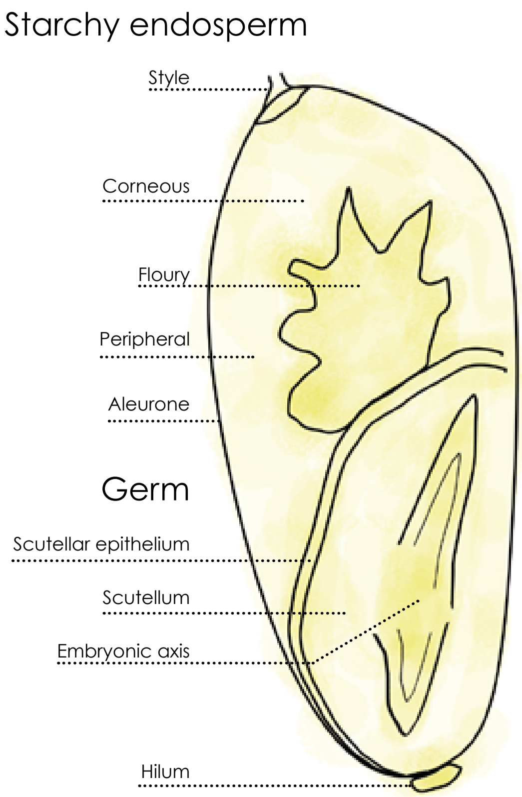
Why millet?

Millets are a group of versatile, small seeded, resilient, cereal crops that are used widely around the globe for both food and animal feed.

One of the key factors in the spread of millet is that the crop has proven itself throughout history to be particularly drought resistant. Millet also boasts an impressive wealth of health benefits, as well as being gluten free.

However, among cereals, millet ranks sixth in the world in terms of area production behind wheat, maize, rice, barley and sorghum according to FAO statistics. Annual world production of millet grains is currently 762712 tonnes - with India the top producer at 334 500 tonnes.

In sub-Saharan Africa millet is the third most widely grown crop, with the world's top millet producers being India followed by Nigeria; with Nigeria and Mali producing the third and fourth highest yields respectively. Presently, the African continent produces 56 percent of the world's output, of which 99.9 percent is produced in sub-Saharan Africa.



Schema of Pearl Millet Seed Structure.
(Source: Rooney and McDonough, 1987

Harvesting

Once the grasses and seed heads have turned golden brown, millet can be harvested either by hand or with the use of a mechanical thresher. The plant can quickly come to head, so it must be managed accordingly because as the plant matures the value and palatability of feed reduces.

Pearl millet should be harvested as early as possible to minimize losses due to birds, and bad weather. Mature grain pearl millet in the field usually contains about 30 percent moisture. At moisture levels higher than 25 percent, the seeds are too soft to withstand the threshing action. The ideal moisture content for harvesting grain pearl millet is about 20 percent. However, it is worth noting that thin stems, heavy panicles, and profuse tilling may result in lodging of the plants.

The seeds in the panicles of lodged plants germinate in the moist field and thus affect grain yield and quality. Hence, the plants are tied together to prevent lodging of plants.

Storage

Storage of crops is an essential component of the whole production system, and millet is no exception. This stage in the process facilitates several of each farmer's key objectives, such as ensuring that excess food is made available for the future; whilst also presenting an opportunity to prevent against food shortages. The storage stage can also provide seed during the next growing season, allowing the farmer to keep the grain aside for a time when they will be able to sell at a much more favourable price.

However, in previous years, not so much attention has been paid by scientists to establishing the most favourable conditions for storing millet, and according to McFarlane, et al. (1995), this attention, "has been considerably less than that for other cereals." The main reason for this, according to the FAO, is that sorghum and millets are regarded as, "minor grain crops despite their relative importance as food staple in many growing countries."

The other notable reason given by the FAO is that farmers in the arid and semi-arid countries where millets are grown achieve "quite impressive" storage performance with regards to millet by employing relatively simple traditional methods.

Most millets have excellent storage properties and can be kept

for up to 4-5 years in simple storage facilities such as traditional granaries. This is because the seeds are protected from being eaten by insects by the hard hull covering the endosperm, and because grain is usually harvested and stored in dry weather conditions (FAO and ICRISAT, 1996). So , although there may be large year-to-year variations in production, stockpiles can easily build up over a number of years.

Following drying and threshing, millets can be stored as loose grain in bags or or in loose containers (McFarlane et al, 1995). The most common method then involves leaving the grains on the field, prior to threshing, in stacks or piles of harvested plants. That said, the detached heads may also be stored away from the field, in exposed stack or in traditional storage containers. However, the essential pre-requisites for storage of millets are the same as those for other grains.

Processing on an industrial scale

At present, industrial methods of processing millet are not as well developed

as the methods used for say, processing wheat and rice; which in most places are considered to be much more useful than millet.

Attempts have been made to develop improved industrial techniques for milling millet. One such attempt was made by Ngoddy in a study carried out in 1989. It was found that custom milling "has had a significant impact" in several African countries where it had recently been introduced.

In Nigeria alone, the study found that where about 80 percent of millet was custom milled into whole flour, just over 2.5 million tonnes of millet had been processed in this way.

Urban markets

One of the key issues facing global the spread of millet grains is that they are still mainly limited to populations in rural areas and are often milled manually within a household. This, according to the Comprehensive Reviews in Food Science and Food Safety is due to the lack of "innovative millet processing technology" which would enable "easy-to-handle, ready-to-cook, ready-to-eat and safe products and meals at a commercial scale that can be used to feed large populations in urban areas."

For millet to be used more globally, developments would have

to be made in industrial milling techniques to ensure that the grain is more widely available and at lower cost. A cost effective milling process would need to be employed to ensure that the versatile grain was reaching those who needed it most; those in poorer, urban areas. Does milling millet have any effect on its composition?

Effects of milling on millet

The effects of milling on nutritional contents of millet grains and their milling fractions have been studied by a number of researchers. One such study, carried out by Haryana Agricultural University in India, found that the milling of pearl millet changed its gross chemical composition. However, baking it did not cause a significant change in nutrient content of raw pearl millet flour. It was also found that milling and heat treatment during chapatti making lowered polyphenols and phytic acid but increased both the protein and starch amino acids.

In a second study that was conducted by India's University of Mysore, two pearl millet varieties were milled into whole flour, semi-refined flour, and a bran-rich fraction and were evaluated for nutrients, anti-nutrients, and mineral bio-accessibility. The results of the study indicated that nutrient content of the semi-refined flour was comparable to whole flour, with the exception of its fat content, which was at 1.3 percent. Why would people choose to consume millet flour over its more widely consumed counterparts such as wheat or rice?

Nutrient profile comparison of millet with other food staples

Synopsis composition:	Cassava	Wheat	Rice	Sweetcorn	Sorghum Millet	Proso Millet
Component (per 100g portion, raw grain)	Amount	Amount	Amount	Amount	Amount	Amount
Water (G)	60	13.1	12	76	9.2	8.7
Energy (Kj)	667	1368	1527	360	1418	1582
Protein (G)	1.4	12.6	7	3	11.3	11
Fat (G)	0.3	1.5	1	1	3.3	4.2
Carbohydrates (G)	38	71.2	79	19	75	73
Fiber (G)	1.8	1.2	1	3	6.3	8.5
Sugars (G)	1.7	0.4	>0.1	3	1.9	-
Iron (Mg)	0.27	3.2	0.8	0.5	4.4	3
Manganese (Mg)	0.4	3.9	1.1	0.2	<0.1	1.6
Calcium (Mg)	16	29	28	2	28	8
Magnesium (Mg)	21	126	25	37	<120	114
Phosphorus (Mg)	27	288	115	89	287	285
Potassium (Mg)	271	363	115	270	350	195
Zinc (Mg)	0.3	2.6	1.1	0.5	<1	1.7
Pantothenic Acid (Mg)	0.1	0.9	1.0	0.7	<0.9	0.8
Vitb6 (Mg)	0.1	0.3	0.2	0.1	<0.3	0.4
Folate (Mg)	27	38	8	42	<25	85
Thiamin (Mg)	0.1	0.38	0.1	0.2	0.2	0.4
Riboflavin (Mg)	<0.1	0.1	>0.1	0.1	0.1	0.3
Niacin (Mg)	0.9	5.5	1.6	1.8	2.9	4.7

Potential health benefits

Millet boasts a wealth of health benefits, as well as being gluten-free. Millet is also an alkali, which makes it easy to digest and is widely considered to be one of the least allergenic and most digestible grains available. Millet protein is also high in fibre, B vitamins and magnesium.

According to a study carried out by researchers from China's Agricultural University in Beijing and Assiut University in Egypt, the potential health benefits of eating millet includes "preventing cancer and cardiovascular diseases; reducing tumor incidence; lowering, risk of heart disease, cholesterol and rate of fat absorption." Many of these health benefits owe much to millet's relatively high antioxidant levels. The study also found that millet grains have the potential to be "useful in preventing diabetes and for treatment of diabetics" due to its high poly-unsaturated fat content.

However, millet does come with a slight health warning. The grain is said to contain small amounts of goiter genic substances that can limit uptake of iodine to the thyroid. These so-called "thyroid function inhibitors" can cause goiter when consumed in large quantities; this may explain the correlation between millet consumption and goiter incidence in developing countries where millet constitutes a significant part of the diet.

Global warming and the increased demand for millet

Millet's versatility and its reputation for drought resistance, could prove key to preventing a possible impending global feed crisis. With cultivation areas soon to be under higher demand than ever, hardier crops such as millet, which are able to be stored for longer periods of time, could soon be key to ensuring those that live in the most arid of climates are fed well into the future.

With the threat of global warming also looming, much more of our planet could soon be classed as arid, so with the changing climate will come the need to adapt and diversify – which could see crops such as millet become much more commonplace in both our diets and our fields.