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# Pack #111, Item 6

# Type: Backgrounder

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**Backgrounder: Production and postharvest activities for fonio**

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**Introduction**

* Fonio, (*Digitaria exilis*), is considered the oldest cereal in West Africa. The Digitaria family includes more than 300 species. These are sometimes cultivated as forage plants, but only three or four are grown as cereals, including:
* *Digitaria exilis* or white fonio,
* *Digitaria iburua* or black fonio;
* *Digitaria sanguinalis* or crabgrass/Polish millet, grown in Eastern Europe; and
* *Digitaria cruciata* or *raishan*, grown in India.
* Fonio is produced between the 8th parallel north and the 14th parallel north, from Senegal to Lake Chad.
* Mali is the third largest producer of fonio.
* Unlike other cereals, there has not been a big expansion of crop acreage, as fonio has been considered a secondary crop in most countries where it is grown.

***Why is this subject important to listeners?***

Because fonio farmers, traders, and processors should know:

* How to manage fonio on the farm.
* How to select the right planting material for cultivation.
* The right time to harvest fonio.
* How to properly harvest fonio.
* How to handle fonio after harvest.
* How to add value to fonio.
* The types of strategies that farmers and the public services should develop together, for example, methods and mechanisms to process and market fonio.

***What are some key facts?***

* Fonio is well adapted to soil and climatic conditions and grows in sandy to stony, poor, degraded soils. It performs better than other cereals in drought and low soil fertility and it reduces the impact of erosion by establishing ground cover. Fonio is also less sensitive to pest damage and less vulnerable to pests.
* In rainy seasons, fonio will survive if soils are well-drained.
* Fonio seeds germinate one week after planting. Fonio can be grouped into several different types of varieties:
	+ very early varieties with a 70-90-day life cycle;
	+ early varieties with a 90-110-day life cycle;
	+ intermediary varieties with a 110-130-day life cycle; and
	+ late varieties with a lifecycle of more than 130 days.
* Mature fonio is harvested with a knife or sickle, then tied in sheaves, dried, and stored covered until it’s dry enough for threshing.
* Fonio can be used to feed livestock as well as humans. Farmers can use fonio straw to feed cattle, sheep, and goats in dry areas where feed sources are scarce at some time of the year.
* Fonio can be grown for hay, and fonio straw can be used to build houses, burned to provide heat for cooking, or burned and used as an ingredient in potash.
* If fonio is well managed, the yield per hectare ranges from 600-800 kilograms and as high as 1,000 kilograms per hectare if given sufficient organic manure and good weeding.
* Fonio can be planted by broadcasting and lightly covering the seeds with soil at the onset of the first rains or during the rains. It can also be sowed in rows.
* Mature fonio plants are 50-80 centimetres in height with an inflorescence (flower head) which usually has two or three heads.

***What are the big challenges in fonio production?***

* During land preparation, farmers burn vegetation and crop residues. This reduces the amount of soil organic matter and hence the fertility of the soil, and reduces the amount of moisture that the soil can hold.
* Farmers plant fonio seeds from previous harvests which have lost viability. This results in low yields.
* Using planting materials that are not adapted to local weather conditions may cause damage during the ripening stage, drastically reducing the yield.
* Since fonio doesn’t establish quickly, farmers neglect weeding. Weeds then suppress fonio growth, reducing yields.
* Traditional shattering of fonio grains when they mature results in seed loss and reduced yield.
* De-husking and milling are complicated and labour-intensive. When farmers de-husk fonio manually by beating or trampling on sheaves, the grains are often contaminated with sand. This makes milling and removing grit more difficult, especially because fonio grains are very small.
* All these constraints often result in farmers abandoning fonio production in many parts of Africa.

***Gender aspects of reducing postharvest loss in fonio***

* In Togo, women take an active and primary role in fonio production.
* In West Africa, women dehull or dehusk and clean fonio.
* In West Africa, women grow and cook fonio as a special food for weddings, baptisms, and other ceremonies.
* In the Plateau and Bauchi States of Nigeria, fonio is grown by women with low education and financial standing.
* In southern Mali, fonio is largely grown by women on their own plots and women are responsible for most fonio activities (manual weeding, threshing, winnowing, and processing).

***Predicted impact of climate change on fonio production***

* Fonio is suited to hot and dry weather and can contribute to long-term food security in such climates. It is regarded as a staple in the dry West African Sahel.
* Fonio is a fast-maturing crop, so it can produce well even when the rains are short.
* Fonio is tolerant of seasonal droughts.
* In Sierra Leone, farmers turn to fonio to protect them from total crop failure when low rainfall cannot support rice farming.
* In West Africa, farmers regard fonio as a back-up crop that can be harvested and consumed when other crops fail.
* Climate variabilities such as an early end to the rains could affect late varieties in some areas, causing low yield and leading some producers to abandon these varieties.
* Environmental factors such as lack of soil fertility, temperatures that are too high or too low, insufficient sunlight, and lack of rainfall can contribute to a decrease in yield.

For further information, please see documents 2, 4, 5, 6, 7, 8, 10, 11, and 12.

***Key information about production and postharvest management of fonio***

**1. Cultivation**

To increase yields and reduce postharvest losses in fonio, farmers should use the following cultivation practices:

* To protect fonio from wind, plant taller crops such as maize, leguminous agroforestry trees like *Faidherbia albida, Leuceana lecocephala,* and *Gliciridia* species, or hedges around fonio fields.
* Weed in a timely fashion to stop weeds from using the nutrients required by the growing fonio crop.
* Monitor fonio regularly for pests and diseases and manage when they appear.
* Rotate fonio with legume crops.
* Test soils and replenish missing nutrients with chemical fertilizers and/or organic inputs.
* Use certified fonio seeds for better yields.
* Mulch fonio soils to conserve soil moisture.
* Keep soil cultivation to a minimum in fonio plantings.
* Plant fonio varieties that are quick-maturing and tolerant of drought and other constraints linked to climate variability.
* Plant fonio early in the season, ideally at the onset of the rainy season, to maximize the availability and use of rainwater.
* Use methods that retain water in the field, including bunds around the perimeter of the field and *zaï\**.
* Plant in rows to facilitate weeding, thinning, and, whenever possible, use mechanical harvesting.

**2. Soil fertility**

Though fonio can grow in poor soils, yields can increase if farmers maintain or enhance soil fertility.

* Fonio should be rotated with legumes such as beans, cowpeas, and groundnuts that fix nitrogen in the soil. Rotating to legumes also reduces damage from soil-borne pests and diseases that affect grass family crops like fonio or maize.
* Increasing fertilizer (NPK + urea) in the soil suppresses the growth of striga, which interferes with fonio growth.
* To minimize loss of nutrients from the soil, keep crop residues on the field as mulch after harvest and allow them to decompose, improving soil fertility.
* Apply mineral fertilizers that contain phosphorus and potassium if the soil lacks these minerals.
* Fonio yield can increase by 35% by applying mineral-rich fertilizers. The following: doses are recommended:
* 30 kilograms of cotton complex (NPK + urea) per hectare on rich soils during land preparation;
* 50 kilograms of cotton complex (NPK + urea) per hectare on poor soils during land preparation.
* A good alternative to synthetic fertilizers is the application of organic materials such as manure, plant by-products, and green manures, which have a less harmful long-term effect on the soil and which are easy for farmers to make.

**3. Pest and disease management**

Though fonio is relatively pest- and disease-resistant, it’s vulnerable to fungal diseases.

* Fonio can be attacked by termites, armyworms, and other sucking insects.
* Fonio is vulnerable to the following diseases: melting out and cercosporiosis.
* Before planting, treat seeds with ash and neem or castor leaves. These substances hinder the growth of fungal diseases.
* Rotating fonio with legumes and planting seeds that are resistant or tolerant to diseases can help prevent other fungal diseases.
* Spraying pesticides and fungicides and using mechanical tillage to bury fungal spores may reduce the impact of pests and diseases.
* To stop birds from feeding on mature grains, farmers should scare them.

**4. Varietal selection**

Planting materials (varieties and seeds) should:

* Be adapted to local climatic conditions.
* Be tolerant of local pests and diseases.
* Be capable of high yield.
* Be improved or better varieties, including being resistant to shattering or bending because of fragile stems.
* Possess farmers’ preferred characteristics and be readily available.

**5. Sowing**

Fonio can be broadcast or sown in rows.

*Row planting*

* Sow in rows by hand or with an animal-drawn sower.
* Sowing in rows limits seed wastage.
* Sowing in rows makes it easier to mechanically weed (with hoes or other tools).
* Row planting results in more plants and more evenly-spaced plants in the field.

*Broadcasting*

* Is easier than sowing in rows. Sow six kilograms of fonio mixed with 25 kilograms of sand per hectare. This rate ensures that fonio plants are well-spaced. Alternatively, some researchers recommend 30-40 kilograms per hectare and 70 kilograms per hectare for farmers who want to limit excessive weed growth. This rate will considerably increase yield.
* Requires more seed than sowing in rows.
* Can only be weeded by hand.
* Often results in uneven patches of fonio.

**6. Weed management**

The best way to manage weeds in fonio fields is to:

* Sow immediately after land is prepared.
* Weed four to seven weeks after planting. Do a second weeding when fonio flowers.
* Prevent dispersal of weed seeds to other parts of the field during harvesting.
* Remove striga before planting, as striga stifles fonio growth. Farmers can gradually eliminate striga through crop rotation, weeding before the striga plant flowers, using herbicides, and increasing nitrogen levels in the soil.

For further information, please see documents 1, 2, 4, 5, and 12.

**7. Harvesting**

Harvest fonio as soon as grains are ripe to protect them from shattering in the field. Depending on the varieties grown, the grains turn yellow, red, or brown when mature.

* Harvest with a sickle, knife, or mechanized technology.
* Tie cut stems in sheaves weighing 1-3 kilograms and pile in cylindrical heaps 1.5-2 metres high, and cover.

**8. Postharvest activities**

* Leave heaps in the field or place on top of wooden structures to improve aeration.
* Dry heaps for one to two weeks before threshing. If there is heat between the sheaves, disassemble them immediately to protect fonio grains from spoilage.
* Thresh by rubbing sheaves by hand, with flails or sticks, or by placing on a plastic or canvas sheet and trampling.
* Traditionally, threshing is done on bare ground covered with cow dung mixed with clay.
* Winnow threshed grains, then sift and wash.
* Dry fonio in the sun on canvas or plastic sheets for 4-5 days. The fonio is then ready for storage.
* The recommended moisture content for stored fonio is 10-11%.
* Make sure that storage facilities such as granaries are dry and pest-free.
* Well-dried fonio can be stored for months or years without spoiling.

For further information, please see documents 1, 4, 5, 6, and 8.

**9. Processing**

To increase the market value of fonio, farmers can process fonio at home by:

* *Hulling/dehusking*: Remove the outer coating of fonio grains (“raw” or “paddy” fonio) with specialized machines or a pestle and mortar.
* *Whitening*: Remove the fonio germ and fruit-wall\* (or pericarp – see illustrations below) from the grains.







* *Washing*: Wash whitened fonio to remove impurities such as sand.
* *Pre-cooking*: After washing, precook by steaming.
* *Drying*: Dry moist, precooked fonio.
* *Packaging*: Package precooked and dried fonio for sale.

For further information, please see documents 1, 3, 5, 8, and 11.

**Definitions**

*Fruit wall*: The inner part of the seed that is fused to the seed coat in grain crops in the grass family.

*Zaï: Zaï* pits are holes that are typically 20-30 cm long and deep and 90 cm apart, and dug in the soil before the farming season to catch water and concentrate compostable vegetation. The technique is traditionally used in the western Sahel to restore degraded drylands and increase soil fertility.

***Where can I find other resources on this topic?***

*Documents*

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11. West Africa Agricultural Productivity Program, undated. *Senegal-The fonio husking machine.* <http://www.waapp-ppaao.org/sites/default/files/fonio_husking_machine.pdf> (13.1 MB)
12. Worldwatch Institute, 2011. *Africa’s indigenous crops.* <http://www.worldwatch.org/system/files/NtP-Africa%27s-Indigenous-Crops.pdf> (1.66 MB)

## Acknowledgements

Contributed by: James Karuga, Agricultural journalist, Kenya

Reviewer: Dr. Ibrahima Zan Doumbia, Scientist, Plant Breeder, Cinzana Agronomic Research Station, Rural Economy Institute (IER), Mali

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