

Participatory on-farm appraisal of improved pearl millet varieties in Eritrea

A study conducted by MOA NARI and SLM

Paul Roden (SLM)

Negusse Abraha (NARI)

Eskinder Tesfay (NARI)

Thomas Kohler (CDE)

2006



Participatory on-farm appraisal of improved pearl millet varieties in Eritrea

A study conducted by MOA NARI and SLM

The authors would like to acknowledge the contribution of the National Agricultural Research Institute, the Gash Barka and Anseba Zobas' Ministry of Agriculture, and the women and men in the villages in which the appraisal took place.

Furthermore, we would like to extend our thanks to the Sustainable Land Management Programme (SLM) Eritrea – the Syngenta Foundation for Sustainable Agriculture (SFSA) Basel, and the Centre for Development and Environment (CDE), University of Berne for their financial and technical support.

Participatory on–farm appraisal of improved pearl millet varieties in Eritrea

A study conducted by MOA NARI and SLM

Paul Roden (SLM)
Negusse Abraha (NARI)
Eskinder Tesfay (NARI)
Thomas Kohler (CDE)

2006

Citation:

Roden, Paul, Negusse Abraha , Eskinder Tesfay, Thomas Kohler: Participatory on-farm appraisal of improved pearl millet varieties in Eritrea. Berne, Geographica Bernensia, 36 pp. SLM Eritrea; National Agricultural Research Institute (NARI), and Ministry of Agriculture, Eritrea; Syngenta Foundation for Sustainable Agriculture (SFSA), and Centre for Development and Environment (CDE), University of Bern.

Publisher:

Geographica Bernensia, Bern 2006

Printed by:

Varicolor AG, Bern.

Copyright:

Sustainable Land Management Programme (SLM) Eritrea, and NARI.

English language editing:

Paul Roden, Thomas Kohler

Layout:

Simone Kummer, CDE

Photos including front cover:

Paul Roden (SLM)

Copies of this report can be obtained from:

National Agricultural Research Institute (NARI)

P.O.Box 4627

Asmara, Eritrea

Syngenta Foundation for Sustainable Agriculture (SFSA)

WRO 1002.11.52

CH-4002 Basel, Switzerland

www.syngentafoundation.org

syngenta.foundation@syngenta.com

Sustainable Land Management Programme (SLM) Eritrea

Centre for Development and Environment (CDE)

University of Bern

Steigerhubelstrasse 3

CH-3008 Bern, Switzerland

www.cde.unibe.ch

info@cde.unibe.ch

ISBN:

978-3-906151-89-1

Contents

Summary	7
Introduction	9
Methodology	11
Analysis and Discussion	13
Libana Village	13
Shebek Village	17
Angulet Village	21
Conclusions	25
References	27
ANNEX 1	29
Selected key information on the newly released pearl millet varieties	
Annex 2	31
Impact diagrams, Libana and Shebek villages	

Photos

Photo 1	Ploughing operations in Shebek	17
Photo 2	A woman's look at millet	20

Figures

Figure 1	Pearl millet growing areas in Eritrea	8
Figure 2	Libana: men's ranking	14
Figure 3	Libana: women's ranking	15
Figure 4	Shebek: men's ranking	18
Figure 5	Shebek: women's ranking	19
Figure 6	Angulet: men's ranking	22
Figure 7	Angulet: women's ranking	23
Figure 8	Farmers' priority attributes for pearl millet	25

Tables

Table 1	Study sites	12
---------	-------------	----

Summary

Pearl millet – general characteristics

Pearl millet (*Pennisetum glaucum* (L.) R. Br.) is grown mainly for grain in the tropical and sub-tropical areas of Africa and the Indian sub-continent. It is an indispensable food for millions inhabiting the semi-arid and arid tropics and is more important in the diet of the poor. Pearl millet grain is among the most nutritious of the major cereals. Its protein content is not only high, but of exceptionally good quality, being seriously deficient only in lysine. It also has good levels of phosphorus and iron, and reasonable quantities of thiamine, riboflavin, and nicotinic acid. The major types of foods produced from pearl millet grain are (a) porridges, either thick or thin, which are common in west Africa and (b) flat bread, either unfermented (mostly Asia) or fermented (Eritrea and Sudan). Downy mildew caused by *Sclerospora graminicola* (Sacc.) J. Schröt is the most widespread and destructive disease of pearl millet causing severe economic losses. Other major diseases affecting pearl millet are smut (*Moeszimyces penicillariae* (Bref.) Vanky), ergot (*Claviceps fusiformis* Loveless) and rust (*Puccinia substriata* Ellis & Brath.).

Pearl millet in Eritrea

Pearl millet is the second most important cereal crop in Eritrea, grown mainly by small farmers in low lands and mid lands. It is predominantly grown in less favorable environments where rainfall is variable and low (250–300 mm). Landraces currently grown contain the traits that farmers have selected for over centuries, and thus represent a very valuable resource. However, because of the cross-pollinated nature of the crop, desirable traits may not exist in a high frequency in landrace populations and may be accompanied by various undesirable traits, such as susceptibility to downy mildew.

The pearl millet breeding programme was begun in 2000 by NARI (National Agricultural Research Institute) based upon the improvement of local landraces by crossing these with introduced varieties/ populations with disease resistance, early maturity, and improved plant or panicle type. The process has resulted in the introduction of an ICRISAT variety (ICMV 221) (*Kona*), and the release of new cross-bred variety (*Hagaz*), which is a cross between *Kona* and a local landrace (*Tokrora*), and by a range of other new varieties in on-station and on-farm trials, involving a number of different Eritrean landraces. All of these are superior in disease (downy mildew) resistance and grain yield to the parent landraces, yet retain many of the desirable characteristics of those landraces. Most importantly, the approach has produced a range of improved experimental varieties in a very short time, allowing Eritrean farmers access to new varieties within a few years of the beginning of the breeding programme. The two newly released varieties – *Kona* and *Hagaz* – have shown increased demand by farmers due to their higher yields, early maturity, and resistance to the primary pearl millet disease; downy mildew. They represent an important part of the governments' food security efforts, addressing the immediate needs of the farmers with relatively quick impact.

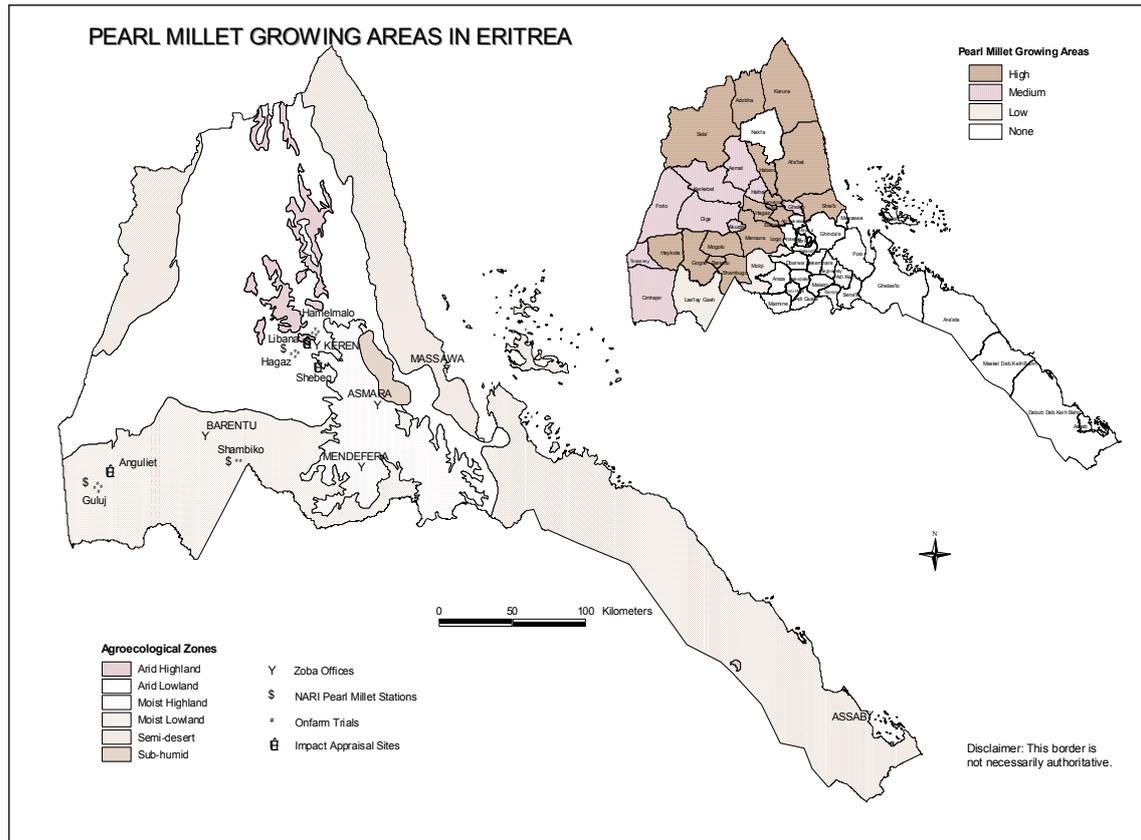


Figure 1 Pearl millet growing areas in Eritrea

The map on the left hand side above shows the location of the three villages selected for the present study.

Introduction

Pearl millet in Eritrea

Pearl millet is the second most important cereal crop in Eritrea. It is predominantly grown in less favorable environments where rainfall is variable and low (250–300 mm); and the grain is for human food whilst the straw is used as feed for livestock. The Pearl Millet Improvement Program at the National Agricultural Research Institute (NARI), through conventional plant breeding, has identified, in collaboration with ICRISAT, two higher yielding pearl millet varieties, *Kona and Hagaz*, which are adapted to Eritrea's marginal environments. On-station trials showed that the yield of these varieties was up to 30% higher than those of traditional landraces. These positive results encouraged the Program to start on-farm trials in selected areas, and to assess the farmers' response to the new varieties, as a feedback on past breeding activities, and a guideline for future efforts in millet breeding.

Aims of this study

This study assesses farmers' perception, both men and women, of new pearl millet varieties (*Kona and Hagaz*¹) developed and released by the Ministry of Agriculture through the National Agricultural Research Institute (NARI). The study attempts to determine what effects these new varieties may have on farmers' livelihoods, and whether they are interested in planting them again. To this end, it compares the new varieties with local landraces, by using farmers' criteria, both those of women and of men. A team comprising a socio-economist, a pearl millet breeder, an animal scientist, and Zoba extension workers were responsible for the appraisal. The study was carried out at three different sites, of which two are located in Zoba Anseba (Libana, Shebek) and one in Zoba Gash Barka (Angulet). These sites represent three different agro-ecological zones (Table 1) as well as different ethnic groups. Their location is indicated on the map on page 8 in this report.

The *Kona* variety was first released in 2000, and the *Hagaz* variety in 2004. When this study was conducted in 2004, farmers had thus little experience as yet with these varieties, especially compared to their traditional landraces. This must be kept in mind when reading the results presented by this study. However, as it is planned to repeat appraisals in the same locations in future, the results presented here will be an important baseline reference.

¹ Descriptions available in the Annex

Methodology

Participatory methods were used throughout this survey with the aim to share our knowledge, to obtain information from the local land users on indigenous knowledge, their total costs and benefits, and to help plan for the future relating to breeding and release of new millet varieties. Moreover, it was our intention that participation would engender ownership of the research findings and so increase the likelihood that this impact appraisal will itself have an impact.

Specifically, the survey was conducted using group discussions and Participatory Impact Assessment (PIA) methods. In each of the three study sites separate groups of approximately 10 to 20 men and 5 to 10 women participated.

Pair-wise ranking matrix

The purpose here was to gather information and to make comparisons between men and women's priority attributes of pearl millet *in general*, i.e. without making any specific reference to any particular variety.

Matrix ranking

After the participants had identified the priority attributes of pearl millet, we compared them firstly to the specific pearl millet varieties that have been developed and released by the NARI – Ministry of Agriculture, and secondly to the local landraces. Matrix ranking in this case was useful in providing a comparative understanding of various pearl millet varieties according to the list of attributes that were already identified in the pair-wise ranking. The results are presented for each village separately in the analysis and discussion chapter of the present report.

Impact diagram

An impact diagram was used to identify and depict the impact of the released varieties *as perceived by the farmers*. The impact can be positive or negative. In this case the participants mapped out the impact of the newly developed pearl millet varieties (*Kona and Hagaz*) on their livelihoods. The diagrams for the villages of Libana and Shebek are shown in the Annex of this report. For Angulet, no impact diagram was prepared.

An impact assessment at this early stage of the project is considered as premature. Appraisal is thus a more appropriate term in the case of this study. There are several reasons for this:

- a Firstly; in some locations the new varieties were first **distributed in 2004**, and in order to find more concrete results, a longer distribution period of three to four years would have been more appropriate, especially considering the vagaries of the climate (low and variable rainfall) in the study areas.

- b Secondly, the study was conducted **soon after the harvest**. In some instances the beneficiary community did not have the necessary time to make an overall evaluation of the crop and its uses.
- c Thirdly, ideally this study should be seen in light of the whole **farming system**. However, as **time was extremely limited** the study focused as much as possible on the preferences, adaptability and adoption and reasons for the adoption of the new pearl millet varieties.
- d As there was no **baseline survey** conducted prior to the introduction of the new varieties, a benchmark is lacking. It is therefore difficult to make any real comparisons with the ex-ante situation, especially with regards to socio-economy.

Table 1 Study sites

Study site, village	Libana	Shebek	Angulet
Sub Zoba/Zoba	Hamelmallo/Anseba	Hagaz/Anseba	Gulij/Gash Barka
Ethnic group	Bilen	Tigrigna	Nara
Location	N15 51 43 E38 23 01	N15 36 57 E38 27 49	N14 45 09 E36 47 54
Distance from main town	40 min drive from Keren	120 min drive from Keren	90 min drive from Tesseney
Altitude (m.a.s.l)	1,391m	956m	approx 800m
Agro-ecological zone	arid highlands zone	arid lowlands zone	moist lowlands zone
Rainfall (mm) per year	200-500	200-500	500-800
Temperature (°C)	15-21	21-29	21-28
PET (mm) per year	1,600-1,800	1,800-2,000	1,800-2,000
DLGP (days)	0-30	0-30	50-90
MLGP (days)	30-60	30-60	60-120

Source: FAO 1997. Agro ecological zones map of Eritrea. Department of Environment, Ministry of land Water and Environment. Project FAO/TCP/ERI/4554 (A) field document 2, 67 pp.

Explanations:

PET – Potential Evapotranspiration

DLGP – Dependable Length of Growing Period

MLGP – Median Length of Growing Period

Analysis and Discussion

Libana Village

Crop production in Libana is dominated by pearl millet and groundnut. A minor crop is sorghum. Local millet landraces used for comparison with the introduced new varieties were *Tokroray* and *Zibedi*.

Men's ranking

Figure 2 shows the overall priorities that the men identified for pearl millet. The question asked was: '*What are the attributes that you look for in pearl millet?*' The figure also shows the rankings that male participants gave for each pearl millet variety grown in Libana village. Comparisons are then made between the different pearl millet varieties grown in the area. *Tokroray* and *Zibedi* varieties are local landraces, while *Kona* and *Hagaz* are varieties newly released by NARI.

The results show that the men were primarily concerned about the damage caused by the chaffer beetle. Farmers reported that damage of local landraces sometimes resulted in a total loss of harvest. They had no control against this pest attack. The newly released NARI varieties, *Kona* and *Hagaz*, however, scored as very good, due primarily to their early maturity which allows them to escape the stage of the chaffer beetles life cycle where most of the damage normally occurs. Farmers explained that they believed that the released varieties were chaffer-resistant.

Farmers also said that pearl millet is suited to the low rainfall and marginal soils present in their area, and that thanks to its suitability pearl millet is their main crop. They further expressed that they prefer to have varieties that were early maturing, drought resistant² and capable of growing in poor soils. Drought resistance and early maturing were thus came second in farmers' priority list. *Kona* scored highest, followed by *Hagaz* and followed by the local landraces, *Tokroray*, and lastly, *Zibedi*.

² Early maturity allows the plant to escape drought. Drought resistance allows the plant to withstand moisture stress.

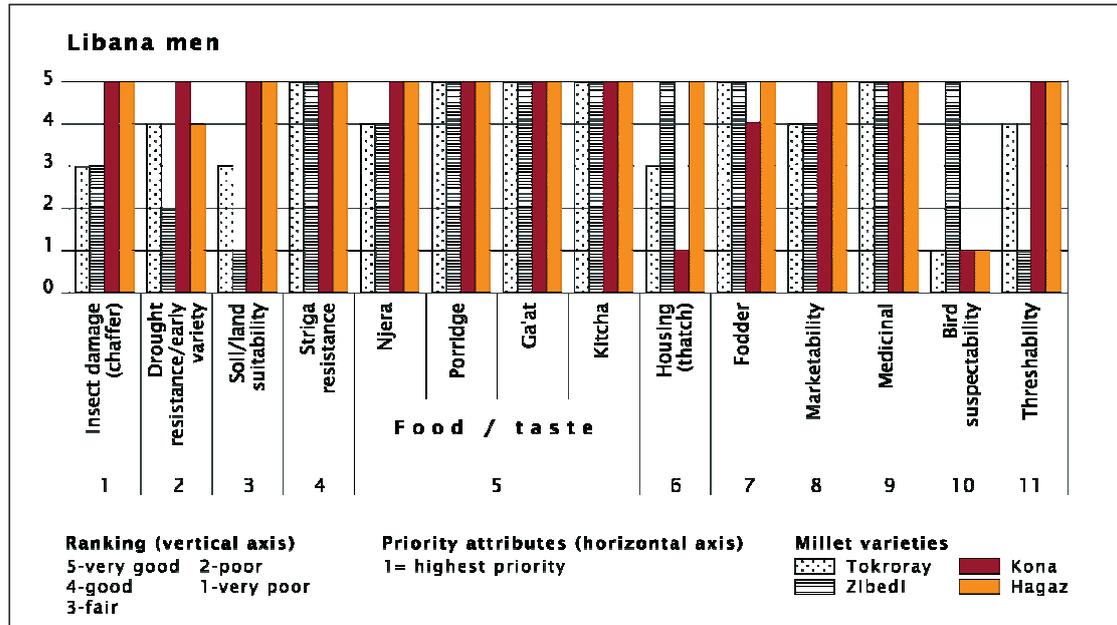


Figure 2 Libana: men's ranking

Participants identified both *Kona* and *Hagaz* as capable of growing across a wide range of soil types. *Tokroray* was identified as fair and *Zibedi* as very poor in this respect; these two landrace varieties prefer soils with higher water holding capacity, and higher soil fertility. The newly released varieties are more forgiving in this respect.

The participants emphasized that pearl millet is also grown because of its resistance to striga (*Striga hermonthica*). Crop rotation with pearl millet and sorghum is practiced in order to reduce striga infestation. Pearl millet is often grown in a striga-infested field for two to three years, after which farmers will then plant sorghum again.

The food value of pearl millet³ was ranked as equally important as that of its *striga* resistance. Typically, the male participants made no real distinctions between the different varieties in terms of food suitability for the variety of local dishes.

³ In all villages women identified food as the primary reason for growing pearl millet, men also identified it as an attribute. Though this is true, it is also true all crops are grown primarily for food, and therefore the logic of including this attribute as part of the ranking can be brought into question. The team feels that this attribute should be included in the analysis and discussion because the participants raised it. In future this attribute should be compared to other primary crops grown in the area. Comparisons can be based on energy provision, for example. However, the comparisons made between the different varieties provide some valuable insights for the research team.

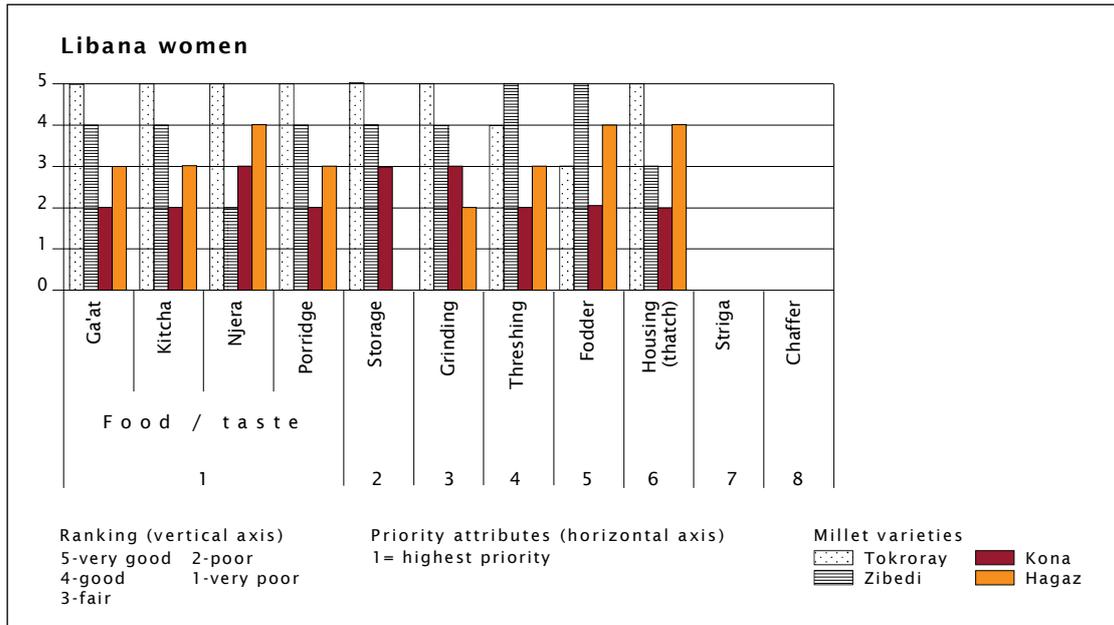


Figure 3 Libana: women's ranking

Other important attributes from the point of view of the men included stover for thatch, stover for fodder, grain market value, and medicinal value. Bird pests were listed as a minor problem by the farmers. *Kona* ranked as very poor for thatching (low biomass/short plant height) and *Hagaz* as very good for exactly the opposite reasons. *Zibedi* scored as very good for its resistance to bird damage, which was due to high bristle presence, whilst all the other varieties scored as very poor as to bird damage. Both *Kona* and *Hagaz* are especially susceptible due to their early maturity, which exposes them to concentrated bird attack. All the varieties, except *Kona*, were rated as very good for fodder. However, *Kona* was recognized as being more palatable as fodder.

Marketing: Participants ranked this criterion according to income generated at the markets. As both *Kona* and *Hagaz* give higher yields, they generate a higher overall return. Farmers recognized that in the early days of the introduction of *Kona* (around 2000), its market price was low in comparison to local varieties. However, at the time of this study (2004), the price of *Kona* has risen to almost the same levels as that of local landraces.

Ease of threshing: Participants agreed that *Zibedi* was more difficult to thresh than all the other varieties due to smaller seed size and the presence of bristles on some panicles.

The farmers identified pearl millet in general as a valuable animal feed during periods of drought. When faced with a lack of pasture, they supplement pearl millet stover with pearl millet flour, mixed with water, which is fed to their livestock as a high energy feed. Farmers informed the team that this mix is able to sustain the animals.

During the pair-wise ranking farmers did not mention the effects of *downy mildew* (*Sclerospora graminicola*). However, during final discussions farmers identified *downy mildew* as a major problem since 1998. They call the disease *AIDS*.

The participants were not asked which pearl millet variety they preferred overall, instead, based on a generalized overview of the results it is possible to conclude that the newly released varieties scored the highest for most attributes chosen by the men. Across the first four priority attributes – chaffer beetle (*Pachnoda interrupta*) avoidance, drought resistance/early maturity, soil/land suitability, and culinary (cooking) properties, *Kona* scored highest, followed closely by *Hagaz*, then *Tokroray*, and finally *Zibedi*.

Women's ranking

Figure 3 presents the women's ranking. The women identified eight different priority factors. They ranked food as the main reason for growing pearl millet in their area. In terms of taste and dish suitability, the local land races came first. *Tokroray* scored the highest for all types of dishes, followed by *Zibedi*, and followed by the newly released varieties with *Hagaz* first, and finally *Kona*. The women agreed that they preferred the bitter taste of the landraces which *Kona* lacks, whilst *Hagaz* is a combination of *Kona* and *Zibedi* – hence the more positive rating.

They went on to say that pearl millet in general had good storage attributes when compared to other crops, in particular to sorghum. Amongst all the varieties *Tokroray* scores first relating to storage, followed by *Zibedi*, and finally *Kona*. They have not yet had any experience with the *Hagaz* variety.

Other factors identified in order of importance are ease of grinding, threshing, fodder, thatch, and *striga* resistance. They identified the chaffer beetle as affecting pearl millet, but did not rank it as having much importance.

An overall picture on women's varietal preferences indicates that *Tokroray* is the most valued. It scored highest in the first three priority attributes of food, storage, and ease of grinding. *Zibedi* scored second overall. Overall the NARI released variety *Kona* scored worst. *Hagaz* scored well for its Injera, fodder and thatch. The general picture is that the women prefer the local land races over the newly introduced varieties.

Men and women ranking in comparison

Women did not rank factors such as pest avoidance, drought tolerance, soil suitability, threshing, fodder, and *striga* as highly as their male counterparts, as these items generally fall outside their roles and responsibilities. Women were clearly more interested in the food values and storage attributes of pearl millet.

The overall picture on preferences shows a wide disparity between men and women. Whilst men chose the newly released varieties as their favorites, women preferred the local landraces. This score is undoubtedly a reflection of the priorities that gender places for the different pearl millet attributes. Distinct differences in opinion exist between men and women with regards to certain common attributes. For example, with regard to threshability, men scored *Hagaz* and *Kona* as the best, whilst women scored *Zibedi* and *Tokroray* as being better. Women felt that *Tokroray* and *Hagaz* were best for thatch, whilst men chose *Zibedi* and *Hagaz*. They both agree that *Kona* was poor for thatch.

Male participants were pleased with the new released varieties as they addressed *their* priority needs. However, as a lesson learned, the study shows that more emphasis needs to be placed on the needs of the women with regards to developing new pearl millet varieties.

Shebek Village

Crop production in Shebek is dominated by pearl millet. Farmers informed the study team that in 2005, they intend to plant approximately 50% of their land with pearl millet, 25% with groundnuts, and 15% with sorghum. The remaining 10% will remain fallow. The new varieties were introduced very recently here, i.e. *Kona* in 2003, and *Hagaz* in 2004. The local landrace considered for this study was *Bultug*.



Photo 1 Ploughing operations in Shebek

Men's ranking

Figure 4 shows the priorities that men identified for pearl millet. The question asked was: *'What are the attributes that you look for in pearl millet?'* The figure also shows the rankings that the men gave for each pearl millet variety grown in *Shebek* village. The first variety, *Bultug*⁴, is a local landrace, while the others are the same newly released varieties as in Libana village (*Kona* and *Hagaz* varieties).

⁴ Bultug simply means pearl millet in Tigrigna and Tigre languages

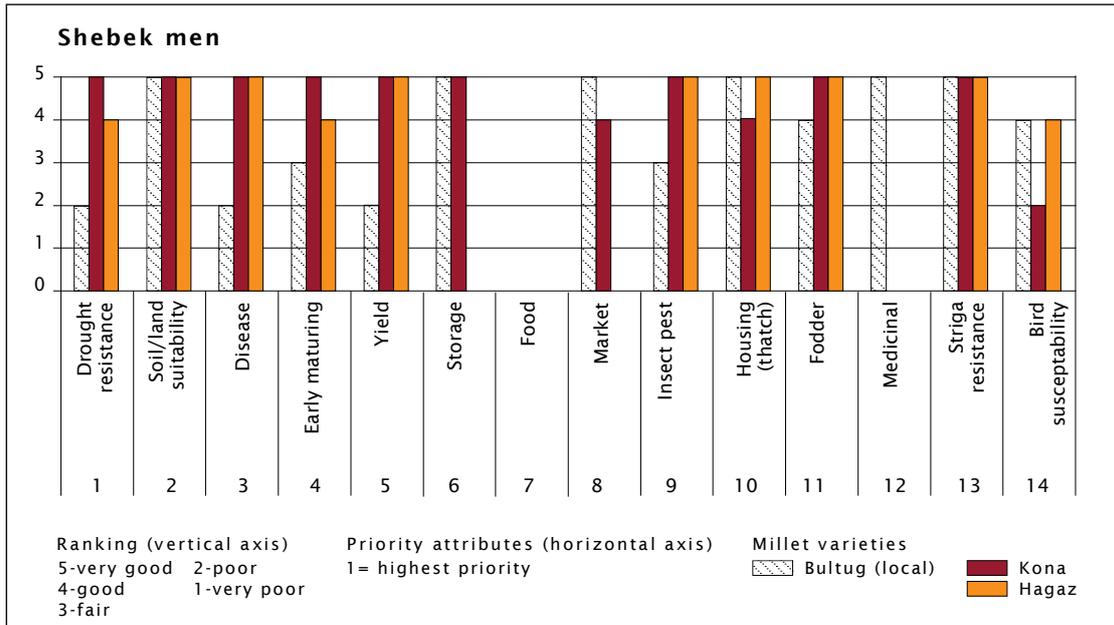


Figure 4 Shebek: men's ranking

The men identified drought resistance as being the most important attribute of pearl millet. This is indicative of the extremely poor and erratic rainfall in this area. Interestingly, their local variety scored as poor, whilst *Kona* scored as very good and *Hagaz* as good.

The participants agreed that the soils in their area were suited to growing pearl millet, and they scored all the three varieties as being very good with regard to the local soils, which they described as mostly sandy, with good drainage properties; hence typical pearl millet growing conditions.

Downy mildew is an important problem in their area. It scored third in their ranking of priorities. The *Bultug* variety has a poor resistance to this disease. Both *Kona* and *Hagaz* were ranked as being very good against *downy mildew*.

Early maturity was a priority that the men scored in fourth place. They prefer early maturity as a drought escape mechanism and as an early source of much needed food at a critical time when food is scarce (green millet is even roasted and fed to the family). With regard to early maturity, *Kona* was identified as very good, followed by *Hagaz* as good, and lastly by *Bultug*, as fair.

Yield and storage ability follow fifth in importance. Both *Hagaz* and *Kona* were rated as very good for yield, while *Bultug* was seen as poor. With regards to storage both *Bultug* and *Kona* scored as very good. There has been no experience with *Hagaz* yet as it was released during the same year as the study was carried out (2004).

Other priority factors identified by the men include food properties (participants could not identify any real difference between the different varieties), marketability, insect pests, thatch, fodder, *striga* resistance, and bird susceptibility. *Bultug* fetched a better price at market than *Kona*. In 2003, though, farmers were obliged to sell their *Kona* harvest to the Zoba Ministry of Agriculture. They considered the price as fair, yet fixed (35%

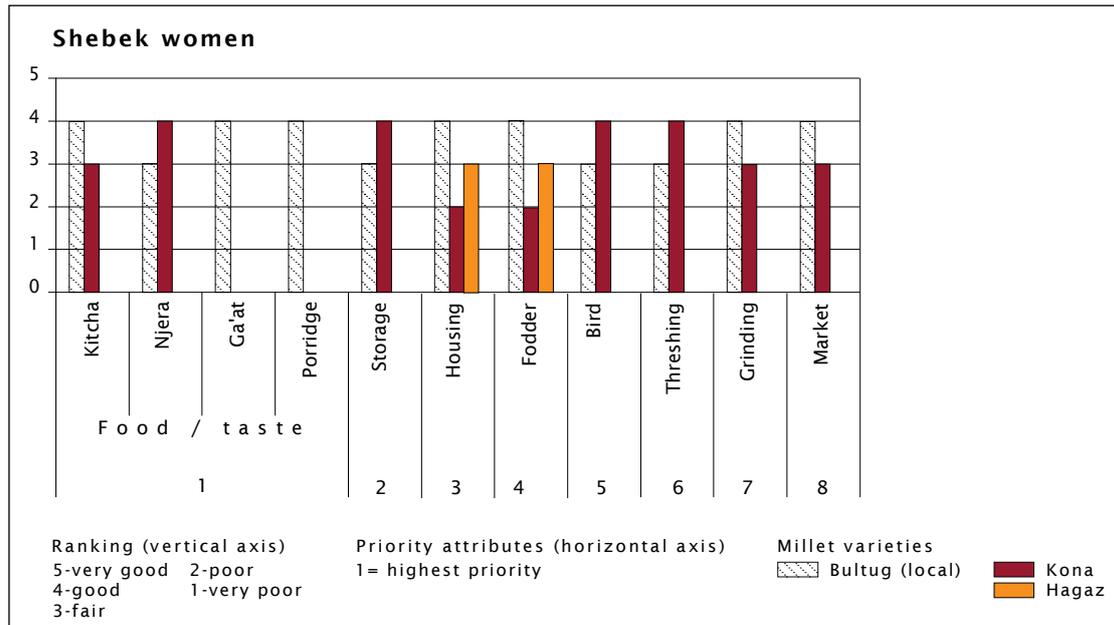


Figure 5 Shebek: women's ranking

more than the local market price, as agreed prior to planting following their agreement for seed multiplication with the Zoba). They had preferred, however, to store their grain for harder times. *Kona* scored as poor for bird susceptibility. This is due to its early maturity that exposes it to a concentrated attack by birds.

It can be concluded from the above discussion that the men were positive with the newly released *Kona* variety. They have not yet had the opportunity to make a conclusive decision on the performance of the other released variety, *Hagaz*. However, in the first five most important attributes, also *Hagaz* scored better than the local variety. When comparing the results between the new varieties, it is clear that *Kona* has a better performance than *Hagaz*. Its only shortcoming, according to the men, was that it has a short plant height and low biomass, and as a result is considered poor for thatch. Male farmers ranked housing thatch as tenth in their list of priority attributes, though. In the course of conclusive discussions farmers said that they observed a double advantage with *Hagaz* over *Kona*, this being that *Hagaz* has the same high yields, coupled with added biomass.

Women's ranking

Figure 5 presents the women's view of millets in Shebek. Their most important reason for growing pearl millet is its value as a food. The women had most experience with their local variety – *Bultug*. As the village is largely Tigringna, *Injera* is their most important food. Interestingly, the new variety (*Kona*) got the better score than the local landrace (*Bultug*) relating to their value as a food.

Storage was the women's second most important attribute. The participants agreed that *Kona* could be stored better than *Bultug*. Thatch for housing scored third as a priority. *Bultug* was better than both *Kona* and *Hagaz*. *Kona* was the worst and thus presented the usual weakness as to this attribute owing to its short size.

The remaining priority attributes that the women identified were fodder, bird susceptibility, threshability, grinding, and market.

The overall picture shows that the women have a slight preference for Bultug over *Kona* or *Hagaz*. However, *Kona* was released in 2002 and 2003, and *Hagaz* in 2004, and therefore participants said they need more time before a comprehensive result could be obtained.

Comparisons between men and women

In Shebek, as in Libana, women gave higher scores to the local variety than to the newly released varieties, whilst for men it was the opposite. Again, this reflects the shared, and gendered, responsibilities relating to millet production and the uses of the crop. Men and women have points in common relating to the different millets. These are concern storage, thatch, and fodder. Both groups agree that *Kona* as a newly released variety has better storage properties and that it was poor for thatch. However, for women, this is important, while for men it is a low priority attribute. For all the other attributes, women felt that the local landrace *Bultug* was better, whilst the men agreed that the introduced varieties were preferable.



Photo 2 A woman's look at millet

Angulet Village

In Angulet, sorghum is the main crop, but is heavily affected by *striga*. Farmers devote about 50% of their crop land to sorghum. Pearl millet and sesame follow with 25% each. The local millet landraces considered for this study are *Hudubay*, *Samro*, *Tokroray* and *Gondoran*.

Men's ranking

Figure 6 shows the overall priorities that the men in Angulet identified for pearl millet in response to the question: '*What are the attributes that you look for in pearl millet?*' Comparisons are then made between the different pearl millet varieties grown in the area. The first four varieties, which are *Hudubay*, *Samro*, *Tokroray* and *Gondoran* are local landraces. The fifth, *Hagaz*, is a newly released variety. Seven tons of it were distributed to Angulet village for the first time in July 2004, i.e. in the year when this study was done. This was late for normal planting. The objective of the distribution was to observe the crop's agronomic performance and popularize the variety.

Results show that farmers were, first and foremost, concerned about good *striga* resistance characteristic of pearl millets. Angulet is located in an area within Gash Barka which is primarily sorghum growing, and which is particularly affected by *striga*. Currently, all pearl millet varieties grown here are *striga* resistant.

Chaffer infestation and *downy mildew* disease resistance were scored as being of equal importance after *striga* resistance. All the varieties grown in Angulet were ranked as having good resistance against this insect pest. Downy mildew is a small problem in this area, but farmers were nevertheless concerned about its ability to destroy crops. Farmers said that of the local varieties they grow *Hudubay* and *Samro* were performing best against downy mildew, and rated these as good. *Tokroray* and *Gondoran* were rated as poor. *Hagaz* was ranked as the most resistant of all the varieties and rated as very good despite its very short history in the area.

Yield was ranked as the fourth most important attribute. Both *Samro* and *Hagaz* were rated as very good. Despite late planting, *Hagaz* managed to produce a higher yield than most of the local varieties. *Hudubay* and *Gondoran* were rated as good, whilst *Tokroray* was rated as fair.

Soils in Angulet are deep black fertile soils that have a high water holding capacity, and are prone to water logging in some sites. Pearl millet is highly adaptable to a wide range of soils, except waterlogged conditions; the crop prefers well drained light soils. In spite of this, the men of Angulet prefer to grow pearl millet to the more suitable sorghum. This might be an indication of a cultural preference, or of the pervasive *striga* infestation problem that affects sorghum in the area. Both *Tokroray* and *Hagaz* were rated as being very good and therefore highly suitable to the soils here.

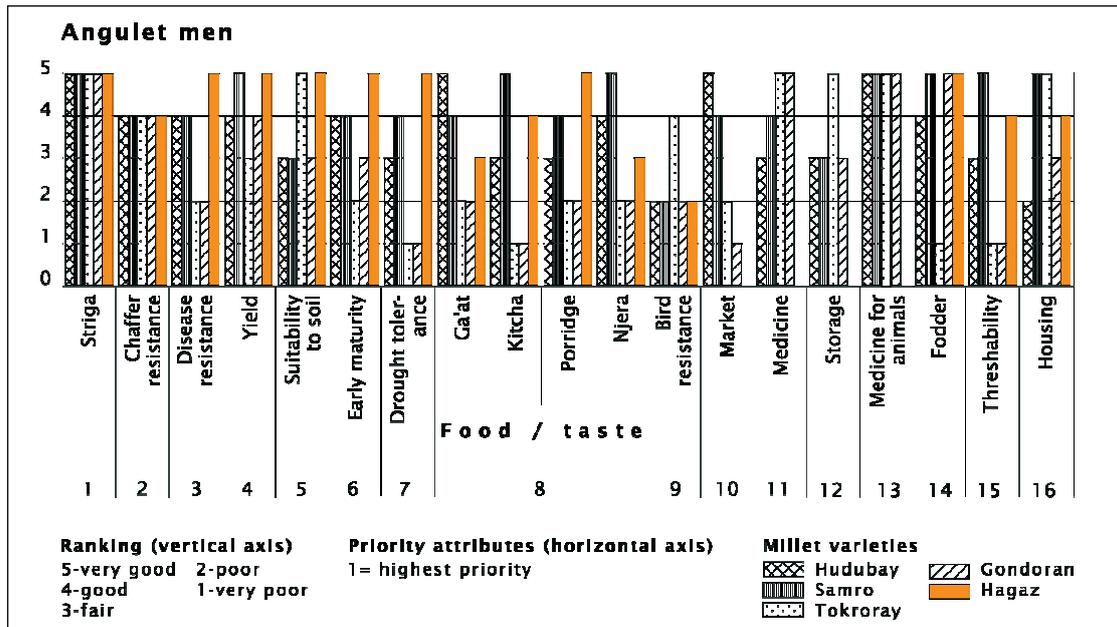


Figure 6 Angulet: men's ranking

Early maturity of a crop allows farmers to receive an early harvest when food stocks are at their lowest and the critical hunger period is about to start. It also allows the crop to escape the feeding stage of the chaffer beetle whilst also escaping late drought periods. The Guluj area, to which Angulet belongs, is fortunate in receiving relatively high rainfall compared to other pearl millet growing areas in Eritrea (Table 1). This explains why farmers ranked early maturity as fifth in importance only. They identified *Hagaz* as the best crop in this respect and scored it as very good. The local landraces all follow with lower scores. Drought tolerance was scored as being as equally important as early maturity. Again, *Hagaz* was ranked as the best crop.

Both food value and bird resistance aspects were ranked as being of equal importance. The main food prepared from pearl millet for the Nara ethnic group which is living in Angulet is *Ga'at* (a stiff porridge). The men rated the local landrace *Hudubay* as the best variety for this dish, the newly introduced *Hagaz* was rated as fair and ranked third. When it comes to an overall assessment of food value, *Hagaz* comes in second place after a local landrace (*Samro*).

The high density of bird pests in the area affects all millet varieties. This indicates a need to develop bird resistant genotypes i.e. with a higher density of bristles.

Marketability, medicinal use, storage ability, medicine for animals, fodder, threshability, and thatching / housing were ranked in order of importance as above. The participants had no experience with *Hagaz* for the first four attributes. Participants said they did not generally sell pearl millet, but prefer to store them till the next harvest. Yields generally do not last much into the next year. Rainfall in this agro-ecological zone is higher than in most other millet growing areas of Eritrea, which means that there is also more biomass from other plants available in this area. Participants were therefore not particularly concerned with the fodder and thatch attributes of pearl millet.

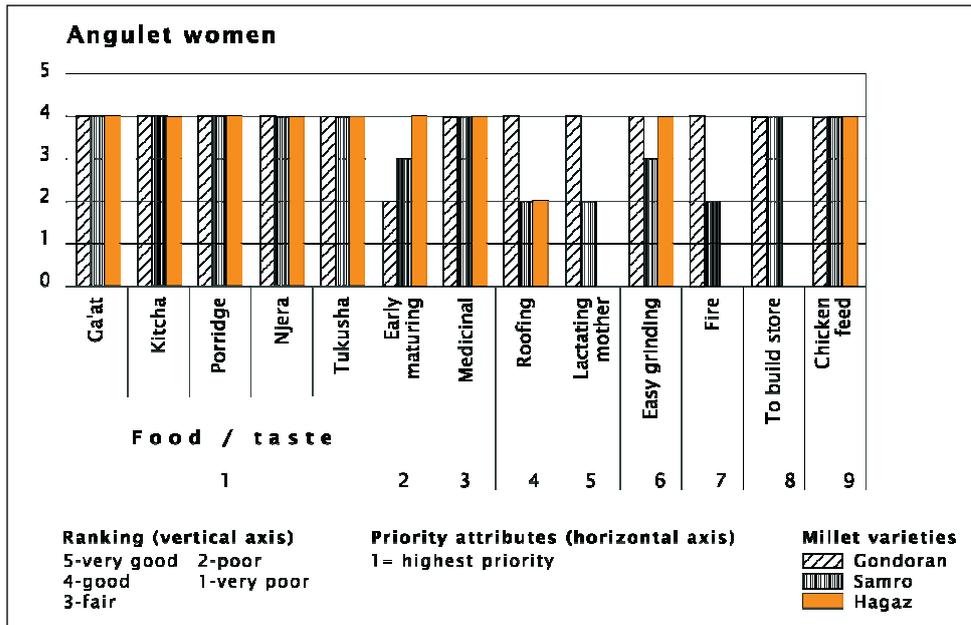


Figure 7 Angulet: women's ranking

An overall analysis of the data based on the first eight highly ranked attributes indicates that the newly released *Hagaz* was the variety of first choice for the men, closely followed by the local landraces *Samro*, *Hudubay*, *Tokroray* and *Gondoran*.

Women's ranking

Figure 7 shows the preferences of the women. Interestingly, they identified only two local landraces as compared to the four identified by the men. Moreover, they re-grouped *Tokroray* and *Hudubay* to *Gondoran*.

The women explained that pearl millet has an important role to play in their community as the main source of food for their families, and as a result they do not sell it. To them, pearl millet is primarily a source of food. It proved difficult to find a consensus among the women as to what varieties they preferred for their different dishes. Generally speaking, but based on extensive discussions, they ranked *Gondoran* and *Hagaz* as good, followed by *Samro* as fair.

Early maturity was their second most important priority attribute after food. Despite the late planting of *Hagaz* women identified it as being the earliest maturing of all the varieties that they planted this year.

All pearl millet varieties were ranked as being of equal quality as rainy season food. In the women's words, they all provide a lot of warmth. They went on saying that millet was the best source of food for children to remain healthy. The health benefits of pearl millet were stressed with the importance that participants placed on its medicinal properties. The women stressed that it was a curative for coughs and colds, and that it could be used as a binding agent for broken bones.

Overall, the women identified sixteen different attributes, covering a wide range of use. Based in order of importance after those mentioned above are the following ones: roofing, women's preference, easy to prepare the land (camel), traditional knowledge, benefits to lactating mothers, grinding, use as a fuel, use as a fodder, building material for store, and chicken feed.

The women in Angulet have articulated a special affinity to pearl millet. Pearl millet appears to play a central role in their social and cultural life and livelihood. This is expressed particularly by their ability to discriminate when pearl millet should be eaten, and when it should not be eaten. They said, for example, that mothers should not be given pearl millet during the first two weeks of breast-feeding their babies. They went on saying that pearl millet was a woman's crop of preference. In contrast to the two other villages included in this study, the women of Angulet said that they had the authority to grow their own pearl millet. They were able to distinguish the soils which are easier to plough by camel, and soils which were suitable for pearl millet to be grown. In short, women in Angulet appear to be the custodians of pearl millet.

Unfortunately our tight schedule, and the fact that the *Hagaz* variety was released only in the same year as this study was carried out, prevented us from making valid conclusions on women's preference of millet varieties. Quite apart from this, there is further scope for investigation with regard to the attributes and preferences women place on pearl millet in its different varieties in this community.

Comparisons between men and women

As for the other two communities described in this study, men place special emphasis on the production attributes whilst women focused more on the food attributes. In the case of Angulet, a great number of other attributes document the wide range of use of pearl millet by local communities. While the research team was initially mainly interested in evaluating the newly released *Hagaz* variety, it came to realize the values attached to local landraces, and the reasons for this attachment. As in the other two villages, the men selected *Hagaz* as their preferred variety, based on all the attributes that they mentioned. Women showed a more differentiated ranking.

Conclusions

The three villages presented in this study had been selected by the National Agricultural Research Institute as release sites for the newly developed millet varieties (Kona and Hagaz) based on the compatibility of these varieties with the agro-ecological conditions found in these locations. The different agro-ecological and cultural background of these locations reflects the great diversity found in the millet growing areas of Eritrea.

1. As the previous chapter has shown, **millet is a key element of local livelihoods and culture in the study areas**. In the perception of farmers, millet has **many different functions**, and while the provision of food in sufficient quantity and quality for the household is their main concern, there are many other attributes or qualities that millet is expected to have (Figure 8). However, many of these attributes are rated differently by men and women.
2. The **male farmers** in all three villages rated early maturity and drought resistance, disease (downy mildew) resistance and pest (chaffer beetle) avoidance, adaptation to land and soil conditions, as well as grain yield, as their most important priority attributes. These qualities all relate to **millet production** – and most of them were present in the newly introduced varieties. Farmers were not so concerned with biomass production of pearl millet, but they recognized that *Hagaz* had a higher biomass than *Kona*. They recognized, too, that *Kona* was susceptible to wind damage. Food quality was also mentioned as a desirable attribute, but came second after those mentioned above. On the whole, the results show quite clearly that male farmers were pleased with the results shown by the released varieties.

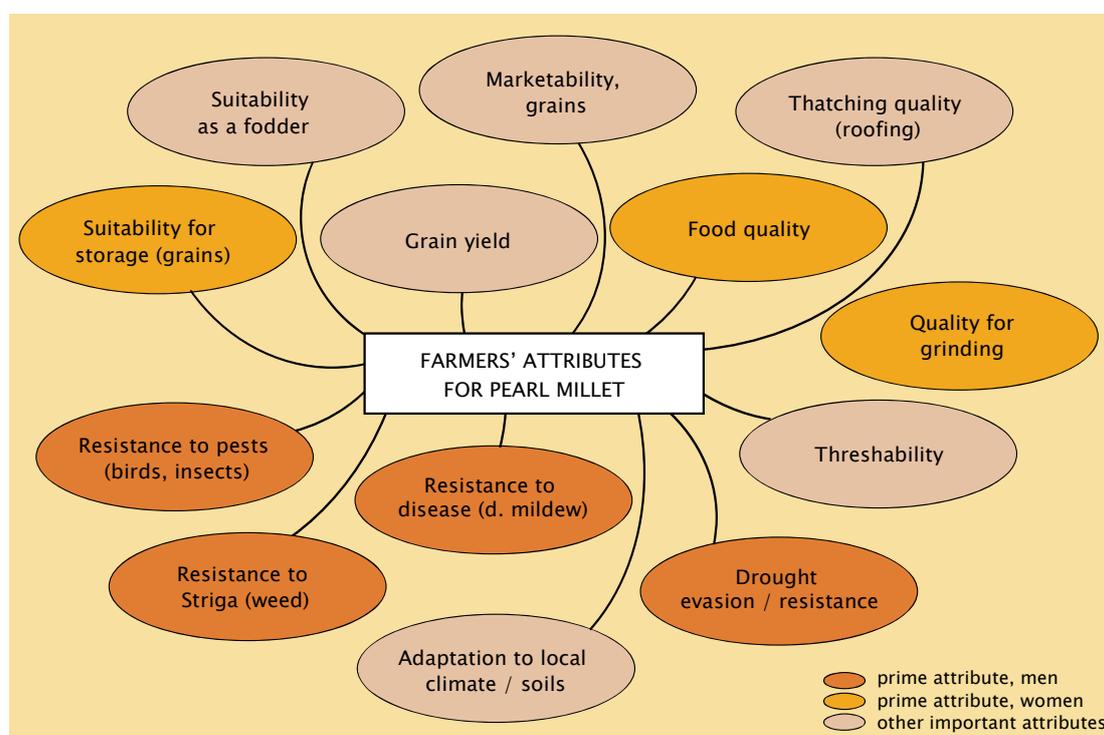


Figure 8 Farmers' priority attributes for pearl millet

3. **Women** tended to have a rich knowledge of the palatability and culinary characteristics of the different varieties. They were less concerned with the production aspects than with those related to **use and consumption of millet** – a clear reflection of local labour division relating to millet economy. Suitability for preparing the various local dishes was their top priority for ranking the different varieties. Storage quality and suitability for grinding and thatching were other important attributes mentioned by women. Yield appeared to be less important. Overall, women chose the local varieties over the new released varieties in all three villages. This information is important as it allows for more balanced decision-making relating to future millet breeding activities.
4. It is suggested to **follow up this appraisal on a regular basis**, if possible annually in the first years of release and on-farm trial of new varieties. Such appraisals should always include the newly developed and released varieties, including *Kona* and *Hagaz*, as well as local landraces. It will be important in future appraisals to schedule meetings in **mixed groups of women and men**, in order to discuss the important differences that have appeared in the course of their separate appraisals in each of the villages covered by this study.
5. 2004 was the first time that **Angulet village** had received an improved pearl millet variety. The positive feedback that the study team obtained from the men here, and the fact that this area has relatively fertile soils, good rainfall, and sufficient land availability, coupled with the prevalence of serious *striga* infestation in sorghum fields, leads the study team to recommend that the release of improved pearl millet varieties (*Hagaz* variety) should be continued and expanded. This recommendation is also justified by the results obtained from on-station trials in Gulij, located next to Angulet, in 2004, where the *Hagaz* variety performed well (see 'Pearl Millet Annual Technical Report, 2004').
6. Future follow-up appraisals should also **monitor the use of traditional landraces**, in order to make sure that these are still grown locally or at least regionally, and are not completely lost and replaced by new varieties.
7. Farmers in one of the selected villages, Shebek, are already selling seeds of the new varieties to neighboring villages, at a higher price than seeds of landraces. There is thus a market for these seeds. This market could be further promoted by supporting initiatives for **village-based seed enterprises**. Such a project would also have to consider seed quality management, probably through certification.

References

- Agricultural Sector Policy and Strategy Framework. 2002. *The State of Eritrea*. Ministry of Agriculture.
- Bantilan, M.C.S., and Joshi, P.K. (eds.) 1998. *Assessing joint research impacts: proceedings of an International Workshop on Joint Impact Assessment of NARS/ICRISAT Technologies for the Semi-Arid Tropics*. ICRISAT
- CFC and ICRISAT. 2004. *Alternative Uses of Sorghum and Pearl Millet in Asia*.
- Eyob Berhane. 2000. *Pearl Millet Landraces in Eritrea*. DARHRD, MoA, Eritrea
- Faujdar Singh, R.N.Rai, Belum, Reddy and Bdiwakar. 1997. *Development of Cultural and Seed Production Techniques in Sorghum and pearl Millet*. ICRISAT.
- Ishward S. Kharwal, Changdgi Rana, Ashok K. Chhabra. 1990. *Pearl Millet Seed Production and Technology*. Mandhar Academic Press, India
- Kenneth O. Rachie, J.V. Majmudar. 1980. *Pearl Millet*. Pennsylvania State University. USA
- Khairwal I.S., K.N. Rai, D.J. Andrews, G. Harinarayana. 1999. *Pearl Millet Breeding*. Oxford and IBH. New Delhi. India
- Khem Singh Gill. 1991. *Pearl Millet and its Improvement*. Indian Council of Agricultural Research. New Delhi. India
- Pearl Millet Improvement Programme. *MoA NARI*. Annual Report For 2003
- Pearl Millet Improvement Programme. *MoA NARI*. Annual Report For 2004
- Pearl Millet Improvement Programme. *MoA NARI*. Annual Report For 2005
- Ramasamy, C., Bantilan, M.C.S., Elangovan, S., and Asokan, M. 2000. *Improved cultivars of pearl millet in Tamil Nadu: Adoption, impact, and returns to research investment*. ICRISAT
- Singh S.D., King S.B., Werder J. 1993. *Downy Mildew Diseases of Pearl Millet*. ICRISAT. Patancheru, India
- Somesh Kumar. 2002. *Methods for Community Participation: A Complete Guide for Practitioners*. ITDG

ANNEX 1

Selected key information on the newly released pearl millet varieties

KONA variety (ICMV 221)

- Potential grain yield - 20 - 28 qt/ha
- Downy mildew resistance - less than 1% infestation
- Drought tolerance
- Early maturing - 70 - 75 days
- Medium plant height - 160 - 200 cm
- Bold, attractive panicles
- Tillering - 2-5
- Sowing time- Early July -Mid July
- Method of sowing - row planting/broad casting
- Seed rate - Broad casting - 5-8 kg/ha, row planting - 3 kg/ha
- Fertilizer rate - DAP 100 kg/ha, Urea 50-100 kg/ha
- Time of fertilizer application - DAP at time of sowing basal application, Urea 3 weeks after planting as top-dressing
- Weed control - once, after two weeks from planting

Recommended regions for planting: In the drier areas of Zoba Anseba, Gash Barka or when rainfall starts late July

HAGAZ variety (ICMV 221 x Tokroray)

- Potential grain yield - 22.0 - 30 qt/ha
- Downy mildew resistance - less than 5% infestation
- Drought tolerance
- Early maturing - 75 - 85 days
- Medium - tall plant height - 200 - 230 cm
- Bold, attractive panicles
- Tillering - 2-5
- Sowing time- Late June - early July
- Method of sowing - row planting/broad casting
- Seed rate - Broad casting - 5-8 kg/ha, row planting - 3 kg/ha
- Fertilizer rate - DAP 100 kg/ha, Urea 50-100 kg/ha
- Time of fertilizer application - DAP at time of sowing basal application, Urea 3 weeks after planting as top-dressing
- Weed control - once, after two weeks from planting

Recommended Zobas for planting: In the wetter areas of Zoba Anseba, Gash Barka or when rainfall starts late June

Annex 2

Impact diagrams, Libana and Shebek villages

Impact diagram, Libana women



Impact diagram, Shebek men



Impact diagram, Shebek women



Previous SLM Reports

- Report 1 A Baseline Survey for Sustainable Development of the Deki Lefay Community, Eritrea (1998)
- Report 2 Tradition in Transition – Aspects of Rural Livelihoods in the Eritrean Highlands. A survey for sustainable development of the Adi Behnuna community, Eritrea (2001)
- Report 3 Long-term Monitoring of Soil Erosion and Soil and Water Conservation in Afdeyu, Eritrea 1984–1998 (2002)
- Report 4 Small-scale Micro Irrigation in Eritrea. A feasibility study of affordable micro irrigation technology in Eritrea (2003). Available as a CD Rom.
- Report 5 Amadir. Livelihood and Resource Management in an Eritrean Highland Community. A development baseline (2005)
- Report 6 Land Management in the Central Highlands of Eritrea. A participatory appraisal of conservation measures and soils (2006)

Other reports related to SLM

Soil and Water Conservation and Management in Eritrea. Current Status and Trends. Published by AEAS (Association of Eritreans in Agricultural Sciences) jointly with SLM (1999)

Irrigation Development in Eritrea: Potentials and Constraints. Proceedings of the Workshop of the Association of Eritreans in Agricultural Sciences (AEAS) and the Eastern and Southern Africa Partnership Programme (ESAPP) (2005)

ISBN 978-3-906151-89-1