# Ministry of Agriculture and Food Security

## Directorate of Research and Development

# Farmers' Assessment of Improved Coffee Hybrids in Northern Tanzania*


## By

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# FARMERS' ASSSESSMENT OF IMPROVED COFFEE HYBRIDS IN NORTHERN TANZANIA IN 2003/2004 CROP SEASON

## 1.0 Background Information and Justification

With participatory research methods coming to the forefront, farmer assessment is now being used by several of the research teams in many countries including Tanzania to systematically gather farmer opinions in a more detailed manner. There is now greater appreciation of farmers' own knowledge or Indigenous Knowledge (IK) and judgement within the content of their own circumstances. Researchers are now more appreciative of the fact that farmers are able to integrate a number of site-specific factors, which are virtually invisible to researchers. Farmer opinions are therefore being given more weight than before, particularly when new varieties are concerned. Researchers are now moving towards a "consultative "and" collaborative" type of working arrangements with farmers (Stroud, 1996). Since resource - poor farmers technologies are site/location - specific, farmers play a key role in technology development. The experiences with technology development have made clear that new technologies have to be imbedded in the local society, its ecological and physical environment, its cultural experiences and its socio-economic structures.

Coffee is the number one cash crop in Tanzania grown by more than 400,000 households on acreage of 250,000 ha. The crop contributes about 15% of the foreign exchange in the country. The major growing areas are Kilimanjaro, Arusha, Mbeya, Ruvuma, Tanga, Morogoro, Kagera, Kigoma, Iringa, Rukwa, Mara and Manyara regions. The commercial varieties grown in the country are Bourbon (N.39) and Kents (KP 423). N.39 was selected in the 1920s whereas KP 423 was selected in the 1930s. The estimated yields of N. 39 and K423 are 1 – 1.5 ton/ha if well managed. The main production constraints for the commercial varieties are however, high susceptibility to major coffee diseases like Coffee Berry Disease (CBD) - *Colletotrichum kahawae* (Waller & Bridge and Coffee Leaf Rust (CLR) - *Hemileia vastatrix* Ber) et. Br. The varieties are also susceptible to major insect pests like Mealy bugs, Leaf minor, Antestia, Berry moth, Berry borer, white stem and yellow headed borers.

Due to the above problems some crossings of coffee hybrid varieties started in the 50s and 60s for CLR and CBD respectively. Intensive selection and multi-locational trials was done in all coffee growing areas since 1993. In 2000 some on-farm farmer managed trials were conducted in the sites. The main objectives of the on-farm trials were to develop varieties that are high yielding, resistant to CBD & CLR diseases, with good/high cup quality, well adapted to our coffee growing conditions and also preferred by our farmers especially the resource poor ones.

Most coffee growers in the country are confronted by low coffee production due to lack of improved varieties that are potentially high yielding and resistant to diseases and insect pests infestation, high production costs due to application of pesticides to control diseases and pests, low cup quality, low prices of the produce in the world markets and consequently low household incomes for the farming communities.

Since the selection of the two commercial varieties research and development institutions have not released or recommended any coffee varieties to the coffee growing communities that would address their above concerns. Some of the coffee lines tested on-station and on-farm since early 90s have however, shown very good characteristics such as high yields, high resistance to diseases and insect pests, good cup quality, drought tolerance and even faster growth compared to the current commercial varieties.

Based on the superior performance of those lines the Tanzania Coffee Research Institute (TaCRI) decided to conduct a farmers' assessment of the lines so that the farmers can select the ones that are more preferred by them than the current commercial varieties for official release and commercial use.

## 2.0 Objectives

- Identify farmers' criteria for coffee preference
- Identify coffee lines/varieties preferred by farmers
- Release improved coffee varieties for the coffee growing communities
- Increase coffee production in Tanzania
- Improve household income

## 3.0 Methodology

Two farmers' assessments were done in Arumeru and Moshi Districts on the 16$^{th}$ and 17$^{th}$ February 2004 respectively. The one in Arumeru was conducted at a coffee estate farm where the management was optimal with regular irrigation and fertilizer use at planting and during growth stages. The one in Moshi Rural district was conducted at a small scale farmer who used correct spacing but did not use fertilizer at planting time. He occasionally used farm yard manure and inorganic fertilizers after planting. The estate crop was monocropped whereas the one at the small scale farmer was intercropped with bananas (Appendix 6).

All coffee varieties were planted in 2001 crop season. Nineteen (19) male and female farmers from fourteen (14) villages in the two districts participated in the assessment (Appendix 7). Majority of the participating farmers have grown the new coffee varieties/lines (TSC 4, TSC 5, TSC 8, TSC 10, and TSC 12) for 2-3 years along with their old commercial varieties namely KP 423 and N39.

Other farmers who have not grown the new lines were also invited to participate in the evaluation.
The tools which were used in the evaluation were absolute evaluation, matrix ranking and pair-wise comparison.

## 4.0 Results and Discussion

Farmers mentioned the importance and main uses of coffee in Tanzania as shown in Table 1.

Table 1: Importance and main uses of coffee in Tanzania

| **Uses** | **Rank** |
|---|---|
| Cash crop | 1 |
| Beverage | 3 |
| Soil fertility improver | 4 |
| Controls soil erosion from the canopy cover | 5 |
| Source of employment | 2 |
| Attract useful insects for pollination | 6 |
| Fuel wood | 7 |

Coffee is mainly grown for commercial purposes in Tanzania. It is also a source of employment in the coffee growing areas particularly where there are coffee estates. Other important uses are beverages, soil fertility improver from the husks and also control soil erosion. It is also an important source of fuel wood from the pruning, stumping or replacement.

### Varieties characteristics

Farmers commented the following on the tested varieties' characteristics (Table 2)

**Table 2: Characteristics of the Coffee varieties**

| Variety | Characteristics |
|---|---|
| TSC 4 | - Very good CBD and CLR tolerance.<br>- Fast growth rate<br>- High yielder<br>- Good drought tolerance.<br>- Few suckers ( minimal pruning)<br>- Few nodes compared to TSC5 & TSC10 varieties<br>- Good cup taste |
| TSC5 | - Very good CBD and CLR tolerance<br>- High yielder with big bean size<br>- Few branches<br>- Bears from lower branches<br>- Faster growth and early bearing of berries compared to other varieties.<br>- Good cup taste. |
| TSC8 | - Very good CBD and CLR tolerance<br>- Good branch spreading with large leaves<br>- Taller plants compared to other varieties<br>- High yielder with big bean size<br>- Faster growth<br>- Good cup taste |
| TSC10 | - High yielder<br>- Faster growth<br>- Good drought tolerance.<br>- Many branches with large leaves<br>- Very good CBD and CLR tolerance<br>- Good cup taste |
| TSC 12 | - Very good CBD and CLR tolerance<br>- Good drought tolerance<br>- Average number of branches and leaves<br>- Average suckers<br>- Average plant height.<br>- Bigger bean size compared to other varieties.<br>- Many nodes<br>- Good cup taste |
| KP 423 | - Good drought tolerance<br>- High yielder<br>- Susceptible to CBD and CLR diseases and insect pests<br>- Fast growth<br>- Nodes have many berries.<br>- Good cup taste |
| N 39 | - Highly susceptible to CBD and CLR diseases and insect pests<br>- High yielder<br>- Many branches and leaves.<br>- Good drought tolerance.<br>- Average bean size compared to other varieties<br>- Good cup taste. |

Farmers were asked to rank the tested lines/varieties using absolute ranking tool. The exercise was done in both assessments (Table 3)

**Table 3: Absolute ranking of coffee varieties in Northern Tanzania in 2003/2004 crop season**

| **COFFEE VARIETY** | Ranking under optimal management | Ranking under sub-optimal management |
|---|---|---|
| KP 423 | 6 | 6 |
| N 39 | 7 | 7 |
| TSC 4 | 3 | 5 |
| TSC 5 | 1 | 2 |
| TSC 8 | 4 | 3 |
| TSC 10 | 2 | 1 |
| TSC 12 | 5 | 4 |

The absolute ranking showed that TSC 5 and TSC 10 were the most preferred varieties followed by TSC 8, TSC 4 and TSC 12. The least preferred variety was N39.

Farmers were then asked to mention the criteria they use to select coffee varieties. The most important ones are shown in Table 4.

**Table 4: Farmers' criteria for selecting coffee varieties in Northern Tanzania in 2003/04 crop season**

| **Farmers' criteria** | **Rank** |
|---|---|
| High Yield | 3 |
| Spreading of coffee branches | 9 |
| Leafiness | 7 |
| Disease tolerance | 1 |
| Big bean size | 5 |
| Drought tolerance | 6 |
| Good cup taste | 4 |
| Fast Growth | 8 |
| Minimal Pruning | 10 |
| Insect pest tolerance | 2 |

The farmers used the 8 most important criteria to rank the varieties under optimum and sub-optimum management conditions as shown in Tables 5 and 6.

**Table 5: Matrix ranking of coffee varieties under optimum management conditions in Arumeru District, Northern Tanzania in 2003/04 cropping season**

| CRITERIA | COFFEE VARIETIES | | | | | | | TOTAL | RANK |
|---|---|---|---|---|---|---|---|---|---|
| | TSC4 | TSC5 | TSC8 | TSC10 | KP423 | N39 | TSC12 | | |
| Disease Tolerance | 5 | 5 | 5 | 5 | 2 | 1 | 5 | 28 | 5 |
| High Yield | 5 | 5 | 5 | 5 | 4* | 3 | 5 | 32 | 3 |
| Good cup taste | 5 | 5 | 5 | 5 | 5** | 5 | 5 | 35 | 1 |
| Big bean size | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 34 | 2 |
| Drought Tolerance | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 34 | 2 |
| Leafiness | 4 | 4 | 5 | 5 | 4 | 5 | 5 | 32 | 3 |
| Fast Growth | 5 | 5 | 5 | 5 | 3 | 3 | 5 | 31 | 4 |
| Insect pest tolerance | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 21 | 6 |
| **Total** | **37** | **37** | **38** | **38** | **29** | **27** | **38** | | |
| **Rank** | **2** | **2** | **1** | **1** | **3** | **4** | **1** | | |

**Key: 1- Poor; 2 – Satisfactory; 3 – Average; 4 – Good; and 5 - Excellent**

* - If not attacked by CBD before harvesting
** - If not contaminated by an infected grain/kernel

The most preferred criteria in the varieties/lines under optimum management practices were good cup taste, big bean size, and tolerance to drought. Other criteria scored high in the lines were high yields, leafiness, and fast growth. The least scored characteristics were disease and insect pests' tolerance.

Based on the criteria used, TSC 10, TSC 8 and TSC 12 were the most preferred varieties/lines because they scored excellent in all criteria with the exception of tolerance to insect pests where they scored average. The other preferred lines were TSC 4 and TSC 5 which were scored the same as TSC 8, 10, and 12 but scored good in the leafiness criterion. The least preferred varieties were KP 423 and N39, which scored poor to average in some criteria like disease/insect pests tolerance and fast growth.

**Table 6: Matrix ranking of coffee varieties under sub optimal management conditions in Moshi Rural District, Northern Tanzania in 2003/04 cropping season**

| CRITERIA | COFFEE VARIETIES | | | | | | | TOTAL | RANK |
|---|---|---|---|---|---|---|---|---|---|
| | TSC4 | TSC5 | TSC8 | TSC 10 | KP423 | N39 | TSC 12 | | |
| Disease Tolerance | 5 | 5 | 5 | 5 | 3 | 1 | 5 | 29 | 4 |
| High Yield | 5 | 5 | 5 | 5 | 4 | 2 | 5 | 31 | 3 |
| Good cup taste | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 35 | 1 |
| Big bean size | 5 | 5 | 5 | 5 | 5 | 3 | 5 | 33 | 2 |
| Drought Tolerance | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 35 | 1 |
| Leafiness | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 35 | 1 |
| Fast Growth | 5 | 5 | 5 | 5 | 5 | 3 | 5 | 33 | 2 |
| Insect/pest tolerance | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 18 | 5 |
| **Total** | **38** | **38** | **38** | **38** | **34** | **25** | **38** | | |
| **Rank** | **1** | **1** | **1** | **1** | **2** | **3** | **1** | | |

Key: 1- Poor; 2 – Satisfactory; 3 – Average; 4 – Good; and 5 - Excellent

All varieties were highly scored for good cup taste, drought tolerance and leafiness under small holder management practices. Other criteria that were highly scored in the lines/varieties were fast growth, big bean size and high yields. All the improved lines were scored excellent in all criteria with the exception of tolerance to insects' pests where they were scored average. The least preferred criterion was tolerance to insect pests where all the improved lines were scored average while the commercial varieties were scored poor to satisfactory.

Based on the criteria used all improved lines were equally preferred by the farmers and were most preferred compared to the commercial varieties. The least preferred variety was N39. The performance of KP 423 was better under sub optimal management conditions than under optimal management practices indicating that the variety is more suitable for small holder low input production conditions than high inputs production conditions.

A pair-wise ranking was done for the lines/varieties under optimal management practices and sub-optimal conditions as shown in Tables 7 and 8

**Table 7: Pair wise ranking of Coffee varieties under optimum management practices in Arumeru District Northern Tanzania in 2003/04 season**

| | TSC 4 | TSC 5 | TSC 8 | TSC 10 | KP423 | N 39 | TSC12 | TOTAL | RANK |
|---|---|---|---|---|---|---|---|---|---|
| **TSC 4** | | 5 | 8 | 10 | 4 | 4 | 12 | 2 | 5 |
| **TSC5** | | | 5 | 10 | 5 | 5 | 5 | 5 | 2 |
| **TSC8** | | | | 10 | 8 | 8 | 12 | 3 | 4 |
| **TSC10** | | | | | 10 | 10 | 10 | 6 | 1 |
| **KP423** | | | | | | 423 | 12 | 1 | 6 |
| **N39** | | | | | | | 12 | 0 | 7 |
| **TSC 12** | | | | | | | | 4 | 3 |

The pair wise ranking of the varieties under optimal production conditions indicated that TSC 10 and TSC 5 were the most preferred varieties by the farmers followed by TSC 12 and TSC 8. TSC 4 was least preferred among the introduced lines due to slightly less number of nodes compared to the others. The least preferred variety was N39.

**Table 8: Pair wise ranking of Coffee varieties under small holder management practices in Moshi District Northern Tanzania in 2003/04 cropping season**

| | TSC 4 | TSC 5 | TSC8 | TSC 10 | KP423 | N 39 | TSC 12 | TOTAL | RANK |
|---|---|---|---|---|---|---|---|---|---|
| **TSC 4** | | 5 | 8 | 10 | 4 | 4 | 12 | 2 | 5 |
| **TSC5** | | | 5 | 10 | 5 | 5 | 5 | 5 | 2 |
| **TSC8** | | | | 10 | 8 | 8 | 12 | 3 | 4 |
| **TSC10** | | | | | 10 | 10 | 10 | 6 | 1 |
| **KP423** | | | | | | 423 | 12 | 1 | 6 |
| **N39** | | | | | | | 12 | 0 | 7 |
| **TSC 12** | | | | | | | | 4 | 3 |

Similar results were obtained when the lines/varieties were grown under small holder management practices whereby the most preferred lines were TSC 10, TSC 5 followed by TSC 12 and TSC 8. The least preferred variety was again N39.

## 5.0 Conclusions

The most important farmers' criteria for selecting coffee varieties were tolerance to diseases especially CBD and CLR, tolerance to insect pests, high yields, good cup taste and big bean size. All introduced improved lines were highly scored and preferred for disease tolerance, good cup taste, big bean size, drought tolerance, high yielding, fast growth and leafiness regardless of type and level of management practices. The commercial varieties KP423 and N39 were scored low in tolerance to diseases and insect pests. Matrix ranking of the lines under optimum management conditions showed that the

most preferred varieties were TSC 8, TSC 10 and TSC 12 followed by TSC 4 and TSC 5. All introduced lines were equally preferred by the farmers under sub-optimal conditions or small-holder management practices. The commercial variety N39 was the least preferred line/variety in both matrix rankings. The pair-wise ranking of the lines/varieties under both optimal and sub-optimal conditions indicated that the farmers preferred the introduced varieties in the order of TSC 10, TSC 5, TSC 12, TSC 8, and TSC 4. TSC 4 had fewer number of nodes (14-15) compared to the other introduced lines which had an average of 16-17 nodes per branch. N39 was the least preferred variety in both pair-wise rankings.

## 6.0 Recommendation

Since all the introduced lines have performed better than the two commercial varieties under both optimal and sub-optimal conditions in terms of tolerance to CBD and CLR diseases and insect pests, yield, fast growth and big bean size they could be considered for release so that farmers have access to these improved varieties and consequently reduce costs of production from less use of pesticides, increase production and household income.

## 7.0 References


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## 8.0 Appendices

### Appendix 1: Farmers' disliked characteristics in coffee in order of importance

1. Coffee Berry Disease
2. Leaf Rust
3. Susceptible to insects attack e.g stem borer, mealy bugs, leaf miner, Antestia and scales)
4. Lack of cholophyl (less chlorosis)
5. Bearing fruits/berries from top branches
6. Many suckers
7. Over bearing - cause dieback
8. Small beans

### Appendix 2: Coffee pests and farmers' ranking

| **Type** | **Rank** |
|---|---|
| Mealy bugs | 1 |
| Antestia (Kimatira) | 3 |
| Leaf minor (Kidomozi) | 2 |
| Berry moth (Uwiwi) | 4 |
| Berry Borer | 5 |
| Scales (green and Black) | 7 |
| Aphids | 10 |
| Stem borer (Bungua mweupe) | 6 |
| Shoot Borer (Bungua wa njano) | 8 |
| Moles (Fuko) | 9 |

### Appendix 3: Swahili names of some pests

| **Pest** | **Swahili name** | **Part of plant attacked** |
|---|---|---|
| 1. Berry Borer | Ruhuka | (Berries) |
| 2. White stem borer | Bungua mweupe | (Stem) |
| 3. Yellow headed borer | Bungua wa njano | ( Shoots) |
| 4. Leaf Miner | Kidomozi | (Leaves) |
| 5. Antestia bug | Kimatira | (Berries, young shoots) |
| 6. Berry moth | Uwivi | (Berries) |
| 7. Mealy bug | Vidung'ata | (Young succulent shoots) |
| 8. Scales | Vidugamba | (Young shoots) |

## Appendix 4: Swahili names of some diseases

CBD – Chule Buni (Fruits/Berries)
CLR – Kutu ya majani (Leaves)

## Appendix 5: Yield potential and liquor quality of the assessed coffee lines/varieties

| Yield potential | | | Quality | |
|---|---|---|---|---|
| KP 423 | 2.0 | Tons/ha | 6 | FAQ |
| N 39 | 2.0 | Tons/ha | 5 | FAIR |
| TSC 4 | 3.0 | Tons/ha | 6 | FAQ |
| TSC 5 | 3.0 | Tons/ha | 6 | FAQ |
| TSC 8 | 3.0 | Tons/ha | 6 | FAQ |
| TSC 10 | 3.0 | Tons/ha | 6 | FAQ |
| TSC 12 | 3.0 | Tons/ha | 5 | FAIR |

FAQ – Fair Average Quality
Liquor quality scale:
1 – 6: Good Commercially
7 – 14: Poor Commercially
NB: The lower the score, the higher the quality

## Appendix 6: Comparison of Levels of Management

| | Activity | Sites for farmers' assessment | |
|---|---|---|---|
| | | Mr..E. Mtei (optimal management) | Mr.A. Kishumbua (small-holder or sub-optimal management) |
| 1. | Standard hole size plus planting fertilizers | Standard as recommended in coffee | Direct planting<br>Not followed recommendation |
| 2. | Application of F. Yard Manure after planting | Regularly | Occasionally |
| 3. | Application of inorganic fertilizers | Standard | Occasionally |
| 4. | Weed control | Optimum | Optimum |
| 5. | Insect pest control | When observed | When observed |
| 6. | Pruning | Only suckers | When observed |
| 7. | Irrigation | Regularly | None |
| 8. | Intercropping | Mono | Intercropped with banana |
| 9. | CBD Control | None | None |
| 10. | CLR Control | None | None |
| 11. | General observation in the field | Regular | Regular |

**Appendix 7: List of participants**

| List of Participants | Village | District | Gender |
|---|---|---|---|
| 1. Augustino Kishumbua | Mkonongo | Moshi(R ) | M |
| 2. Teresia Kishimbua | Mkomongo | Moshi (R ) | F |
| 3. Barakael G Mushi | Kashashi | Hai | M |
| 4. Elihuruma Olotu | Lyamungo Estate | Hai | M |
| 5. Hosea Ng'unda | Nguni | Hai | M |
| 6. Frank Mongi | Mawanjeni | Moshi ( R) | M |
| 7. Joseph Mdeo | Manushi Sinde | Moshi (R ) | M |
| 8. Johara Mtei | Nguruma | Arumeru | F |
| 9. Yananinsia Kimaro | Losaa | Hai | F |
| 10. Tabu . A Muro | Nguni | Hai | F |
| 11. Albert Sanare | Kifuni | Moshi( R ) | M |
| 12. Onesmo Natai | Lukani | Hai | M |
| 13. Edwin Kaale | Kiruweni | Moshi (R ) | M |
| 14. Ebenizeri Godfrey | Modio | Moshi ( R) | M |
| 15. Gervas Vasuri | FINCA Estate | Arumeru | M |
| 16. Amos Shao | Mrimbouo | Moshi ( R) | M |
| 17. Fatima Faraji | FINCA Estate | Arumeru | F |
| 18. Edwin Mtei | Nguruma | Arumeru | M |
| 19. Albert Massawe | Mkonongo | Moshi (R) | M |