Cassava Technology and messaging brief for Northern Tanzania

The brief is in 2 parts: firstly the **core brief** – the ‘must have’ technologies for farmers to make the best of improved seeds + fertilizer + good agricultural and land management practices; secondly **tips** - additional information that will improve a farmer’s ability to make decisions and to illustrate the points made. The core material for this brief was drawn from the ASHC Cassava Systems Cropping Guide (2015) available from the ISFM materials library on the ASHC website.

 Current FAO data for Tanzania estimate that cassava is grown on 950,000 hectares producing 5.4 million tones of fresh roots (FAOSTAT, data for 2013).

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| **Communication issues for the campaign:** Cassava has an image problem amongst some smallholders who regard it as a poor man’s crop – and yet cassava is an important crop that can offer smallholders improved food security and cash incomes, even on poor soils and in drought-prone areas: with climate change it will become even more important.Also, many farmers have experienced devastating viral diseases over the past few decades that have wiped out their cassava crops and led them to grow alternative crops, such as sorghum, millet and sweet potato.At a national and regional level, cassava has the potential to form the basis for large-scale industries in the human food and livestock feed sectors and food and non-food products based on starch. The focus of the campaign should be on the importance of using of disease-free planting material of improved varieties that are disease and drought resistant; correct spacing; weeding until the canopy closes; and the potential benefits of intercropping and use of fertilizer. A major public health issue is the danger posed to consumers from the cyanide that naturally occurs in cassava; peeling and cooking, such as by boiling in water for 15 minutes, allows the cyanide to be removed.  |

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| **Introduction** | **Why grow cassava?** |
| **Core**  | **Nutrition & food security:** Cassava is a starchy root. It is an important staple or co-staple crop and produces significantly more calories per hectare per year than rice or cereals. It is relatively drought-proof and can be stored in the ground until needed. It therefore plays an important role in enhancing food security – it can provide a harvest even in years when maize and other cereals fail and it can be harvested early in the rainy season, when other crops are not ready and stored cereals are running out, thereby helping to plug the hunger gap. The leaves of cassava can be eaten as a leafy green vegetable which is high in protein as well as important micronutrients including iron, calcium and vitamins A and C.Cassava contains potentially dangerous cyanide. The amount varies with varieties grown. Simple processing, such as peeling and cooking in boiling water, eliminates the problem. |
| **Core**  | **Livestock:** Across Africa, cassava has until now played a minor role as a source of livestock feed. It is fed to sheep, goats, pigs and poultry on a small-scale around homesteads where it is processed into food for people. There is, however, huge potential to use commercially processed cassava or, by-products from cassava processed into food for people by agri-food industry, as a substitute for maize or other cereals in feeds produced for intensively reared pigs and poultry.  |
| **Core**  | **Livelihood:** Cassava is cheaper and easier to grow than maize and it does well on poor soils and low rainfall. It requires relatively little labour compared to maize. It is therefore a good smallholder crop. The work that is required, such as planting and harvesting, is hard to mechanize; smallholder farmers may therefore be at a comparative advantage over large-scale commercial producers – while smallholders can use family labour, large-scale producers would need large numbers of paid labourers.With an upsurge in cassava production facilities, cassava is also an increasingly important cash crop that can provide smallholder families with income to buy food and meet other household needs. Smallholders need to ensure there is a accessible and dependable market for surplus production . At the national level, cassava flour can be used as a wheat flour substitute, thereby saving on wheat flour imports. Starch derived from cassava can be used in a wide range of food and non-food industrial uses.There is also an opportunity for smallholders to become specialized producers of high-quality planting material for sale to other farmers. Such farmers can also be effective means to introduce new and improved varieties to local farmers. |
| **Core**  | **Soil fertility benefits:** Cassava is usually produced in low-input systems; mineral fertilizers are rarely used and organic materials such as manure or compost is more likely to be applied to other crops. Under these systems cassava tends to deplete soils of nutrients. Growing cassava intercropped with maize, legumes or vegetables can be advantageous: fertilizer is more likely to be applied to crops such as maize, which the intercropped cassava can also benefit from; crop residues from intercrops such as maize or legumes, if left in the field, can help maintain soil fertility. |
| **Core**  | **Yields:** Average yields across Africa are low, around 10 tonnes fresh roots per hectare, which is a fraction of the yield potential of up to 80 tonnes. Using a range of improved agronomic practices, smallholder farmers can sustainably increase yields to 16 tonnes per hectare or more. |

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| **Challenges**  |
| **Agronomic practices:** A key challenge with cassava is to use disease-free cuttings for planting. Farmers need to check with extension workers which disease-resistant varieties are available and most suited to their circumstances – agro-ecological zone and household and/or market demand. Other important agronomic practices are: good land preparation, correct planting at the right spacing, weeding until the canopy closes, and the potential benefits of intercrops and application of mineral fertilizer.**Diseases and insect pests:** Viral diseases, such as cassava mosaic disease and cassava brown streak disease have devastated cassava crops in Tanzania during recent decades. Disease-resistant varieties have been developed and are now available. **Adverse weather:** Once the cuttings are established, cassava does well under poor rainfall conditions and can produce a harvest under condition in which maize would totally fail. Cassava does well if annual rainfall is 1000 mm or more; a minimum of 6 months of rain a year with at least 50 mm rainfall per month is needed.**Poor soil fertility:** Cassava does well on poor soils but continuous cropping without application of mineral fertilizer or large amounts of organic matter will deplete the soil. Like all root crops, cassava removes large amounts of potassium (K) from the soil.**Input market problems:** Access to disease-free cuttings of improved varieties may be a problem locally. Otherwise inputs are minimal.**Output market problems:** Smallholders should only produce surpluses for sale if they have access to dependable and profitable markets. Outgrower schemes exist in some areas whereby smallholders receive inputs and technical assistance as well as an assured market for their produce.**Policies:**  |
| 1 | **Land selection and preparation** |
| **Core**  | Cassava is not amenable to zero-tillage. Land for cassava should be cleared of woody vegetation, any cover crops or weeds ploughed in or slashed and left as mulch. Soils need to be well drained: if soil prone to water-logging, mounds or ridges need to be made.  |
| **Tips** | Cassava cutting should be planted at an angle of 45$°$ with two-thirds of the cutting below soil level. On mounds or ridges, the cutting should be planted near the centre. |

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| 2 | **Cassava variety selection** |
| **Core**  | Farmers should seek advice locally about which disease-resistant varieties are available locally. They then need to ensure these varieties are suited to their agro-ecological conditions and production needs. Whichever variety is chosen, the need for disease-free planting material is vital.Drought-tolerant varieties should be used in areas with rainfall below 1000 mm a year. |

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| 3 | **Quality planting material** |
| **Core**  | Disease-free planting material is key. If producing their own planting material this should only be collected from healthy looking plants. Cutting should be freshly harvested, at least 2 cm diameter and 20-25 cm long, ideally taken from the bottom-end of the stem and not with green bark or still bearing leaves. They should be clean-cut, not splintered and bark not chipped off: cut with a sharp implement and handle the cuttings with care to avoid damage.  |
| **Tip**  | If there is need to store planting material for a longer time, long stems can be stored upright under a tree, with the bases buried in moist soil. At planting, the top and bottom ends of the stem should be cut off and discarded, the rest of the stem should be cut to the right size for planting.  |

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| 4 | **Fertilizer application**  |
| **Core** | One example of a fertilizer regime using NPK fertilizer to increase yields from 10 to 16 tonnes fresh roots per hectare:

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| Fertilizer | kg per hectare | g per cassava plant |
| NPK 15-15-15 | 800 (16 bags) | 80 |
| NPK 17-17-17 | 700 (14 bags) | 70 |

One-third of the total quantity required should be applied 4-6 weeks after planting; one-third at 10–12 weeks after planting; one-third at 16–20 weeks after planting. However, this depends on the rainy season: it should not be applied just before the rain stops.To apply fertilizer:1. Using a small weeding hoe (10–15 cm across) or similar tool, scrape a half-moon shaped furrow 20 cm from the base of the cassava plant.2. Apply the correct measure of fertilizer into the furrow. 3. Cover the applied fertilizer with soil.If the second rainy season is short and unreliable then the three dressings should be scheduled in closer intervals so as to supply all fertilizer in the first season. If second season rains are reliable then the last dressing could be applied once the second season rains have established. For later dressings the use of a hoe may not be appropriate as cassava roots near the surface could be damaged. In this case the fertilizer should be applied in a circle or semi-circle around the cassava at 10–20 cm distance. If the cassava is planted in wider rows and closer distances within the rows, the fertilizer may also be banded along the cassava row at 10-15 cm from the cassava row. |
| **Tip** | 3 people working together in a well-organised system should be able to apply fertilizer to 10,000 plants, i.e. 1 hectare, in 1-2 days. |
| **Tip** | If the quantity of fertilizer is not enough for the entire plot, the farmer should apply the recommended amount to the portion of the farm for which the available quantity is enough, and to leave the remaining section of the farm without any fertilizer. This enables farmers to see for themselves the benefit of fertilizer application in terms of yield increases – the farmers are actually doing a mini with/without trial on their own farms. |

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| 5 | **Planting and spacing**  |
| **Core**  | The currently recommended spacing is a square arrangement, 1 m x 1 m, or one cassava plant per metre square. This gives 10,000 plants per hectare. For varieties that grow upright without branching (as opposed to low and profusely branching varieties), a higher density of 1 m x 0.5 m or 1 m x 0.75 m may be used.For multiplication of stems, rather than production of roots, a closer spacing of 0.5 m x 0.5 m can be used.The recommended optimal planting density in a cassava-maize intercrop is 10,000 cassava plants per hectare (1m x 1m spacing) and 40,000–50,000 maize plants (20 cm linear spacing at 1 plant per stand – avoid clusters of several maize plants in the same place). This arrangement is most likely to have little or no detrimental effect on the cassava yield. The maize is sown in a single row between the cassava rows.Irrespective of the type of legume intercropped with cassava, the plant density of cassava should remain at 10,000 per hectare. The spacing for the legumes varies with the type of legume used as intercrop. For groundnuts, the recommended planting arrangement is to broadcast at 25 plants per square metre. For soybean and cowpea, two rows can be planted between the rows of cassava, while for pigeon peas, which grow taller, a single row can be sown.  |
| **Tip** | Replace cuttings that fail to grow after about 3 weeks – at the same time as the first weeding. Plant new cutting in a new hole to avoid same problem affecting new cutting. If failure was due to drought, wait until rains resume before replacing failures.  |
| **Tip** | Cassava does not thrive well in extremely sandy, salt affected, clayey or water-logged soils. |

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| **6** | **Weeding**  |
| **Core**  | It is important to start weed control 3–4 weeks after planting. This can be done at the same time as the replacement of the failed cuttings (in week 3) in order to maximize the use of labour.Weeding should be repeated in weeks 8 and 12, while the final weeding should be done between 20 and 24 weeks after planting, depending on the rainfall. Once the canopy of the cassava and of the intercrops (if any) has closed the shading will effectively control most weed growth. Weeding can be done manually (hoe and cutlass), mechanically (using a tractor) or chemically (although there are no specifically prescribed herbicides for cassava). Mechanical weeding beyond the first 4 weeks after planting can damage the roots. Therefore, manual or chemical weed control is preferred after this period.Generally, small broad-leaved weeds can be left on the field because they will die from the heat of the sun and become mulch. Bulky weeds, weeds with rhizomes and weed species with the capacity to form roots from stem pieces tend to re-sprout if cut and left on the soil surface, so the farmer should uproot and dispose of these types of weeds away from the field.Tall grasses should be uprooted and removed from the field before they flower in order to prevent seed formation and germination, which will further propagate the weed species.  |
| **Tip**  | If land is severely infested with Imperata (spear grass), apply herbicides before soil preparation to eliminate the grass, for example glyphosate. The roots of spear grass can penetrate cassava roots and cause rots.  |

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| **7** | **Field diseases** |
| **Core** | **Cassava mosaic disease (CMD)** **Key signs: -** The main symptoms of CMD are patches of discoloured (chlorotic) areas on leaves, which vary from light green to yellow, accompanied by distortion of leaves, often severe. Mosaic symptoms vary greatly in overall pattern and intensity: yellow mosaic shows a strong contrast between the discoloured areas and healthy tissue; in green mosaic the colour changes in leaves are less intense and the border with healthy leaf areas less distinct. In severe infections leaves fall off while tubers continue to show no obvious symptoms. **Prevention and control:** The main ways of controlling the major disease affecting cassava are to grow disease resistant or tolerant varieties; use disease-free planting materials; and early detection and prompt removal of plants that show signs of disease in the field. Dispose of infected plants by burning.**Control:** There are no treatments for CMD.**Cassava brown streak disease (CBSD)****Key signs: -** In CBSD leaf symptoms occur only on older or mature leaves, not on young expanding leaves, as in CMD. There is no leaf distortion with CBSD. Both virus diseases cause a patchy yellowing of leaves but in CBSD this is less intense. In CBSD yellowing occurs along the thin secondary veins that branch off from the main central vein. This can spread and form bigger patches, with a ‘feathery’ or ‘blotchy’ appearance. The most distinctive symptom of CBSD is a dry rot of the tubers: tuber rots begin with localised dead areas that are yellow-brown, with a cork-like appearance. **Prevention and control:** The main ways of controlling the major disease affecting cassava are to grow disease resistant or tolerant varieties; use disease-free planting materials; and early detection and prompt removal of plants that show signs of disease in the field. Dispose of infected plants by burning.**Control:** There are no treatments for CBCD. |

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| 8 | **Harvesting**  |
| **Core** | **Ti**ming: Harvest early maturing varieties between 9-12 months after planting; and late season varieties between 12-18 months after planting.To harvest cassava manually:* Cut the stem at knee to waist heigt
* Use a hoe or cutlass to free the roots
* Avoid damaging the cassava roots
* Pull out the roots by hand
* Check the base of the cassava for any broken-off roots and dig for them out of the soil

Cassava leaves can also be harvested periodically and used as a leafy green vegetable. There is varietal variation, but root yield reductions of up to 40% have been recorded where leaves are harvested. The farmer should be aware that harvesting the cassava leaves may reduce the root yield. |
| **Tip** | When harvesting roots, leave as much cassava crop residue in the field as possible and incorporate the residues into the soil. |

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| 9 | **Post harvest** |
| **Core**  | Once harvested, cassava roots are perishable and will last only for up to a few days to a few weeks before rotting. Traditionally, smallholders tend to leave their crop in the ground and harvest only as much as needed for the next few days. Although this can be a useful and simple method, left for too long the roots can become fibrous and woody. They are also vulnerable to attack by insects and rodents, and theft. Leaving cassava in the ground also means that area cannot be used for other crops. Alternative storage methods are storing fresh roots in trenches or pits and covering them with soil; a simple thatched roof is needed to protect from heavy rain.Roots can also be peeled and cut into thin slices, they may then be soaked and or parboiled (to eliminate potentially dangerous naturally occurring cyanide) before being sun-dried and stored as cassava chips. Chips are often dried on canvases laid on the floor; if raised tables can be used the end product is cleaner and less contaminated by sand or by animals. The dried chips can be stored for several months. Storage needs to protect from moisture and pests, such as insects and rodents – storage systems used for cereals and legumes can also be used for cassava chips. Producing cassava chips is labour intensive. A hand-operated machine to chip cassava has been developed which reduced the time taken by about three-quarters, but they are likely to be too expensive for most smallholders. |
| **Core**  | Chemicals are not usually used in storage. |