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Using zai pit (planting pit) technology to boost productivity and allow intercropping cassava with other crops

1. Introduction

Cassava (ManihotesculentaCrantz) is a stapple food crop and ranked number three amongst national ten crops under Crop Intensification Program (CIP). Cassava does well in most parts of the country. Cassava is an important staple food in Rwanda, even being promoted as a cash crop through the establishment of cassava processing plants. In addition to its tuberous root, its leaves are treated as a vegetable called Isombe. Cassava is consumed in various forms (raw, paste/bread or ugali, boiled for breakfast, or mixed with beans. Cassava is a food security cropand source of income in many tropical African countries, includingRwanda. Tolerance to extreme stress makes cassava adapt todifferent agro-ecological zones of Rwanda (MINAGRI, 2002).Cassava plays a major role in efforts to alleviate the African foodcrisis because of its efficient production of cheap food energy, year-round availability, tolerance to unsuitable ecological and soilconditions in comparison with other crops, and suitability to presentfarming and food systems in Africa (Cock, 1985). Nutritionally, thestarchy root of cassava is poor in nutrients, but leaves are a goodsource of proteins and micronutrients (Ayodeji, 2005).Cassava is among key staple food crops for approximately 500–800 million people living in developing countries (Howeler et al. 2013 in Athanase 2014). Cassava plays a key role as a food security and income-generating crop for many smallholder farmers in developing countries including Rwanda (Tumuhimbise et al. 2013). Worldwide cassava is second after maize (Zea mays L) for production of starch (Howeler et al. 2013). Despite the resilience of cassava under adverse environmental conditions, its production remains constrained by several abiotic and biotic factors. The former includes infertile soils, planting unimproved traditional varieties, and inadequate farming practices, postharvest deterioration, whereas the latter includes green mites, mealy bug, cassava bacterial blight, and viral diseases (Kombate et al., 2017). In five districts; Kamonyi, Muhanga, Ruhango, Nyanza in Southern Province and Bugesera district in Eastern Province, INGABO Syndicate in partnership with AGRITERRA (Nertherland NGO), has tested this technology and good results have been achieved which led farmers to highly appreciate its performance.

Under the well managed conditions in developing countries, productivity of cassava is estimated at 90 t ha−1 of fresh roots (El-Sharkawy 2004). The current obtained cassava yield in Ruhango, Muhanga, and Kamonyi districts is 21,308(Kg/Ha); 13,415(Kg/Ha); and 14,537(Kg/Ha) respectively (NISR-SAS, 2021). However, the new cassava cropping technology of increasing spacing (at 2m by 2m vis-avis the current spacing of 1m by 1m) has been appreciated by farmers where **one cassava plant** can give the production of roots weighing between 40 to 60Kgs vis-à-vis 4 to 10kgs while using the normal spacing of 1m by 1m. Using this new technology of increasing the spacing, only 900 cuttings will be needed to plant one hectare. Planting 900 cuttings per hectare while each plant giving the average production of 40kg, the yield per hectare will be 900*40Kg equivalent to 36 tones/ha. It is not only this 50% increment in cassava roots productivity but also a good yield of beans approximately 1.2 t/ha. This highly productive technology has been gradually adopted by farmers especially in Amayaga region though not at a required level thus a reason to scale it up all over all areas where cassava is being cultivated. Findings done by NISR, 2021 showed that small scale farmer got the average yield of 14,220 Kgs/ha while larger scale farmers got the average yield of 17,543 Kgs/ha.

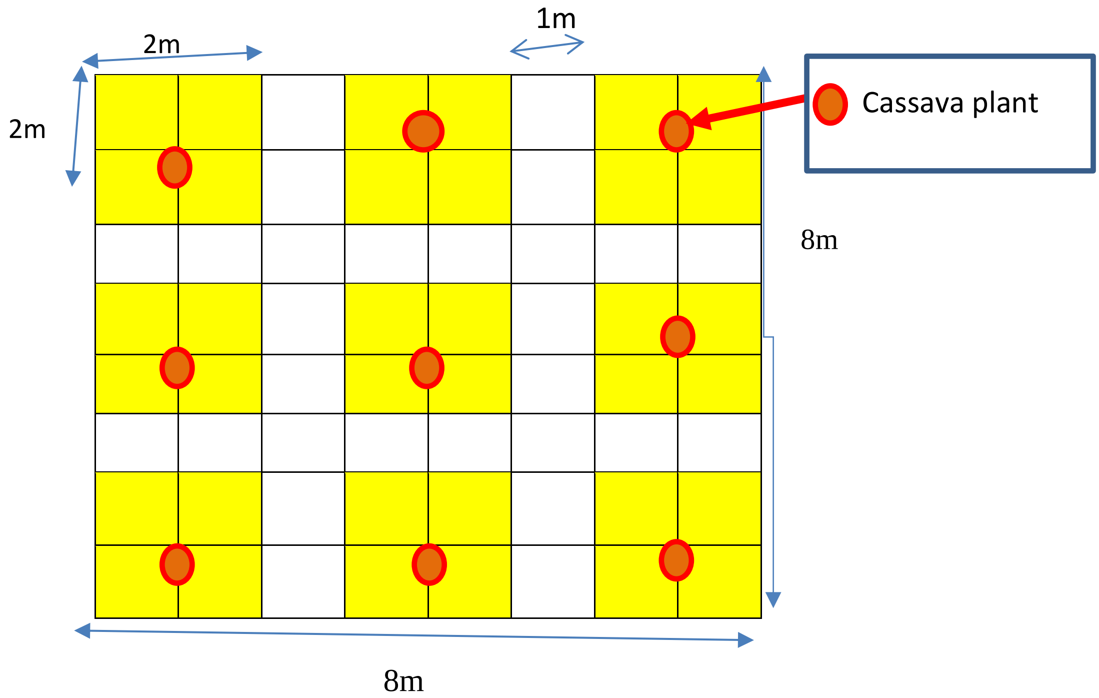
2. Objective of technique adoption

To increase cassava productivity while allowing intercrops of leguminous crops (mainly beans and soybean) to contribute to a balanced nutrition in our farming communities.

3.Methodology

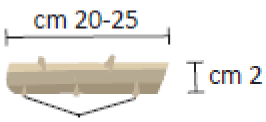
One demonstration plot is installed per each Cell where farmers learn from about the technique. Skilled FFS facilitators, farmer promoters and trained farmers are deployed to support farmers in installation of these demo plots. Each demo plot should be at least One Are (10m*10m).

<u>Demo plot size (8m by 8m)</u>



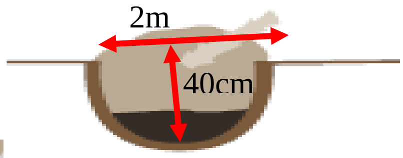
5. Key agronomic practices to implement this technology

- ✓ Hole size = 2m*2m
- ✓ Hole depth = 40cm deep
- ✓ Cutting size= 20-25cm with 5 nodes. Three nodes are placed in the soil and 2 nodes above the ground.
- ✓ After digging the hole, halfway filled with compostable organic matter of dry leaves, maize straws, to the bottom of the hole, then fill the hole with soil mixed with enough well decomposed manure.

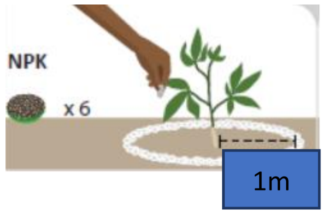


Quality cutting size should be having 5 eyes

A farmer preparing the planting materials



Hole size



6. Functions of a Zai Pit

1. **Harvest rain water**: The small pits acts as micro catchments that collect water and sediment, the soil placed downhill from each pit enhances their water harvesting function. The added organic material improves the infiltration and retention of water in the soil. The micro catchments help to mitigate against periods of drought that occurs frequently in ASAL regions (Zougmore et al 2004)

2. **Concentrate fertility**: Zai pits concentrate fertility near the crop root zone, wind or runoff driven debris, including leaf litter from nearby vegetation is caught in the holes. Fertility gained from these sediments is mixed with organic or mineral fertilizer making them highly fertile. According to Sewadogo (2008) this also increases carbon, nitrogen, phosphorus and soil pH.

3. **Accelerated decomposition**: In the semi arid tropics, termites are abundant, their activities contribute significantly to decomposition of organic matter and nutrient cycling in the soil (Mando and Brussaard 1999). In the process of decomposition added to the

favourable zai pits environment that accelerates the decomposition making the zai pits to remain productive for longer period compared to areas without zai pits.

4. **Reduced competition**: zai pits ensures that competition for moisture, manure and pesticides by weeds are highly reduced. This is because the crop is developed on “artificial environment” which is controlled and thus weeds and pesticides are disadvantaged. However, in case of growth of weeds, weeding should be done paying attention to the downhill side of each pit not to destroy the mounds of soil and reduce their water catchment function.

7. Target stakeholders and partners

The main partners of INGABO farmers ‘syndicate in cassava value chain as well as in encouraging the adoption of this technique are Rwanda agriculture and animal resource development board (RAB), Local government, IITA, Agriterra, Kinazi Cassava Processing Plant, farmer cooperatives, big individual farmers and other interested actors in the cassava value chain.

8. Benefits associated to planting cassava on increased spacing and increased rate of manure usage and intercropping cassava with leguminous crops

Farmers in Rwanda are dominated by smallholder farmers who do not have enough land to grow various crops for their diversified food needs. Once the adoption zai pit by planting cassava on increased spacing and increased rate of manure usage is well implemented, numerous benefits will be achieved on increasing cassava productivity and production as well, again good production of other crops like beans and soybean. Besides expected good cassava and leguminous crops’ production, environmental conservation benefits are achieved thus contributing a lot on food security, poverty and malnutrition reduction. The following are key benefits:

- Proper exploitation of land
- Increasing cassava and beans productivity and production contributing to food security,
- Good income generation,
- Reduction of cassava production cost due to a small number of cuttings needed, making access to clean planting material affordable (only 900 cuttings/ha)
- Environmental conservation and climate change resilience due to less soil disturbance,
- Erosion control
- Quick adoption of best agronomic practices especially use of clean planting materials, enough manure, and mineral fertilizer.