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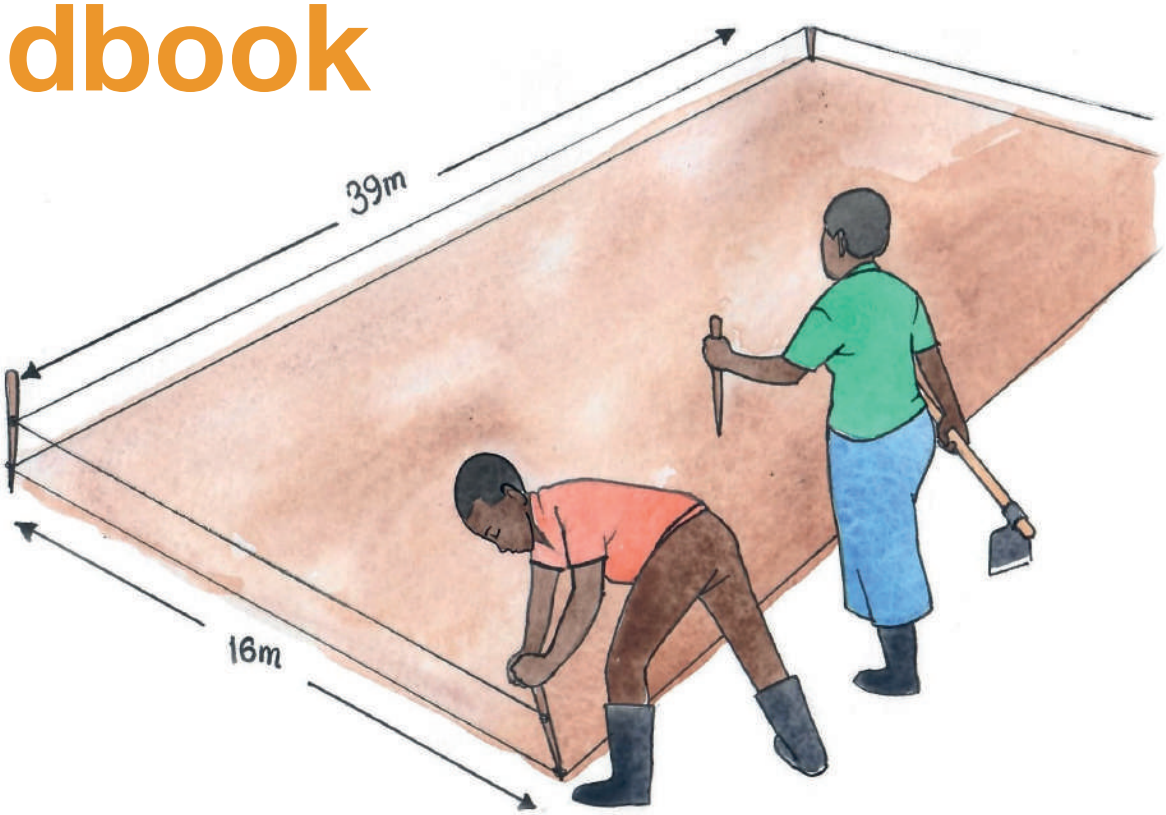
Pfumvudza handbook



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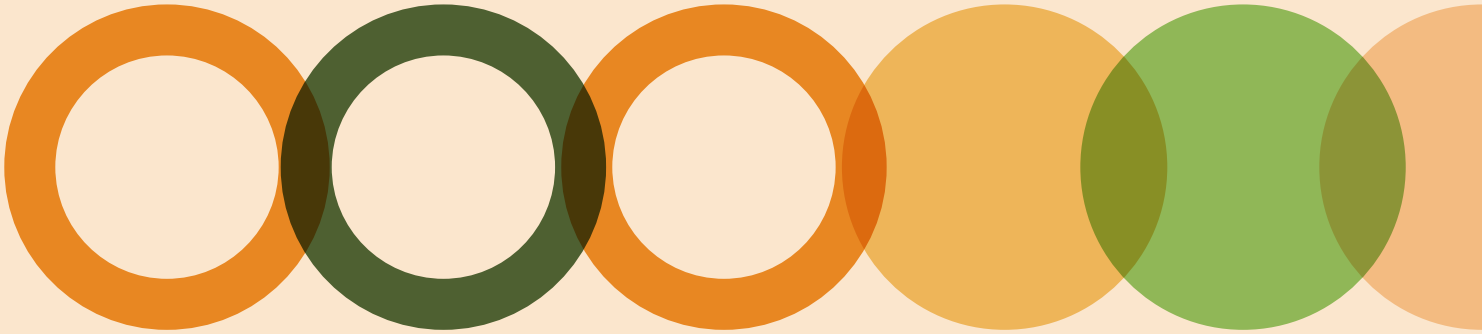


Acknowledgement

This handbook is built upon the foundational principles of Conservation Agriculture (CA) applied to the proven Pfumvudza methodology developed by Foundations for Farming (FfF) in Zimbabwe. The technical specifications detailed throughout this handbook draw from various FfF sources including field research, publications, training manuals, and demonstrations. Users of this manual are encouraged to visit FfF and CSJ's video resources to see this information being applied across different contexts. We gratefully acknowledge FfF for their commitment to providing simple, effective, and sustainable farming solutions for smallholder families across Africa.

www.foundationsforfarming.org

1 Background: The Urgency for a New Season

Most rural families across Africa have about 2 hectares of land. They try to farm all of it but still cannot harvest enough to take them through to the next harvest. They are mostly constrained by a lack of capital to afford improved inputs, labour, and technology. Facing a changing climate which is making rainfall unpredictable, heat from the sun more intense, and seasons varied with unusual extremes, most consistently fail to feed their families and are left desperate for aid[1].

Figure 1 - Climate change affects all of us and especially our crops!

[1]See article: An Assessment of the Contribution of The Pfumvudza Concept Towards Climate Smart Agriculture in Zimbabwe: A Review here

1 Background: The Urgency for a New Season

Pfumvudza – a solution for smallholders

Pfumvudza (meaning “New Season”) is a smallholder farming method, developed by Foundations for Farming (FfF) in Zimbabwe with the vision to ‘do farming God’s way’. It is derived from the key principles of Conservation Agriculture (CA). By concentrating resources on a small plot (16m x 39 m), a family of six is able to produce sufficient food to last throughout a year[2]. The primary objective is food self-sufficiency, achieved by removing the burden of excessive labour and capital investment. Although some smallholders initially feel the strain of digging Pfumvudza holes (known as ‘basins’, or ‘planting stations’), this is more than made up for by the ease of management after planting, and especially the high yield.

Contextualizing Pfumvudza in Uganda

- **Climate Challenges:** Uganda faces increasing climate variability, including unpredictable rainfall and intense, localized drought, particularly in the northern and eastern regions. These conditions make traditional, extensive farming methods unreliable.
- **Food Insecurity:** While the nation is affectionately known as the “Breadbasket of East Africa,” household-level food insecurity persists, particularly in the drought-prone cattle corridor. Recent statistics[3] confirm the urgency of adopting localized, resilient farming solutions like Pfumvudza.

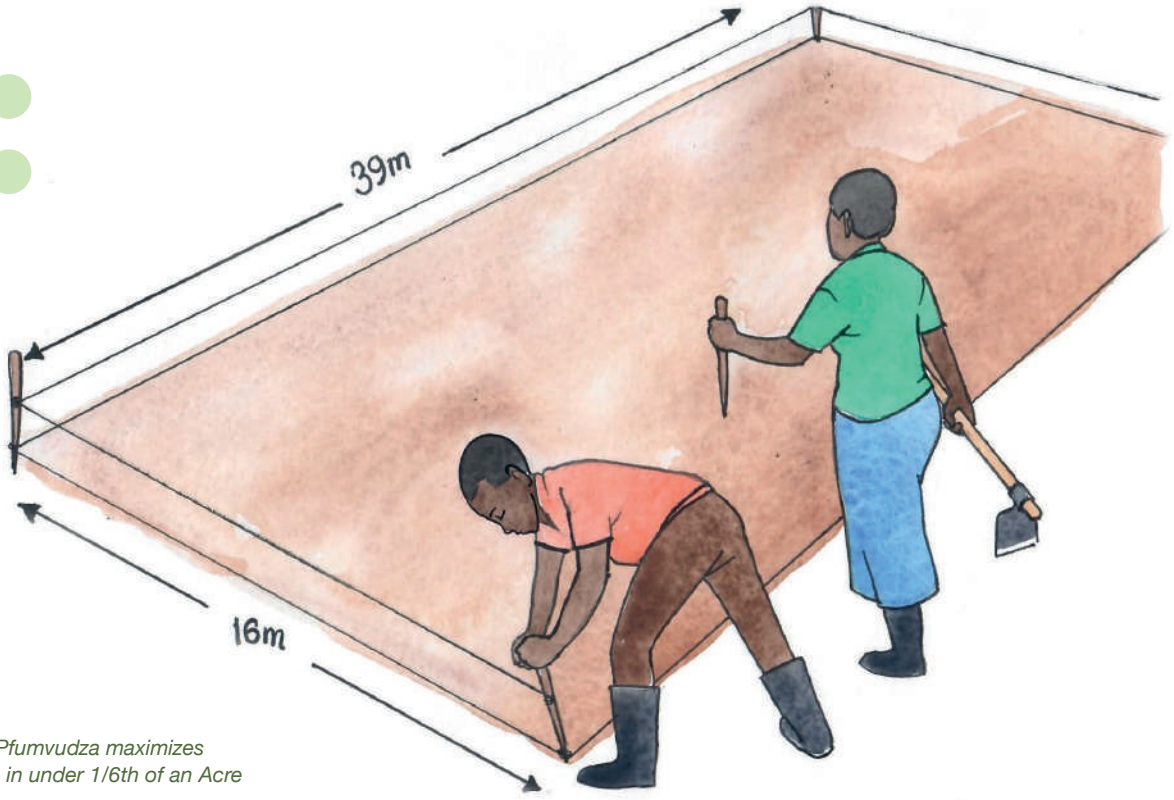


Figure 2 - Pfumvudza maximizes production in under 1/6th of an Acre

[2] See Concept Note: Methodology to make Conservation Agriculture a Practical Reality for the Small-Scale Farmer here.
[3] See Report: Enhancing Agricultural Resilience and Sustainability in Eastern and Southern Africa: Recommendations for Uganda here.

2 Key Principles of Pfumvudza: Innovations and Best Practice

Pfumvudza is successful because it diligently follows four key, synergistic principles of Conservation Agriculture: Minimum Soil Disturbance, Mulching, Precision Farming, and Crop Rotation. It is crucial to understand that mulching is just one component of this holistic approach; all the above must be implemented with equal diligence to achieve the best results.

2.1. Minimum Soil Disturbance

The principle of Minimum Soil Disturbance (or minimum tillage) is about maintaining the soil's natural structure, which is vital for long-term health and productivity. This practice moves beyond the simple benefits of water infiltration and directly impacts the soil's ecosystem and weed dynamics[4].

Expand Benefits and Established Best Practices

Soil Stability, Air, and Water

The main advantage of avoiding the plough or hoe (tillage) is the preservation of soil aggregates – the small, natural clumps of soil particles bound together by organic matter and biological activity[5].

- **Enhance Porosity:** When the soil remains undisturbed, these aggregates are stable. This stability creates a natural network of macropores (channels left by old roots, earthworms, and insects), which act as highways for air and water movement. This allows water to infiltrate rapidly and be retained deeper in the soil profile, ensuring plants have access to both oxygen and moisture.

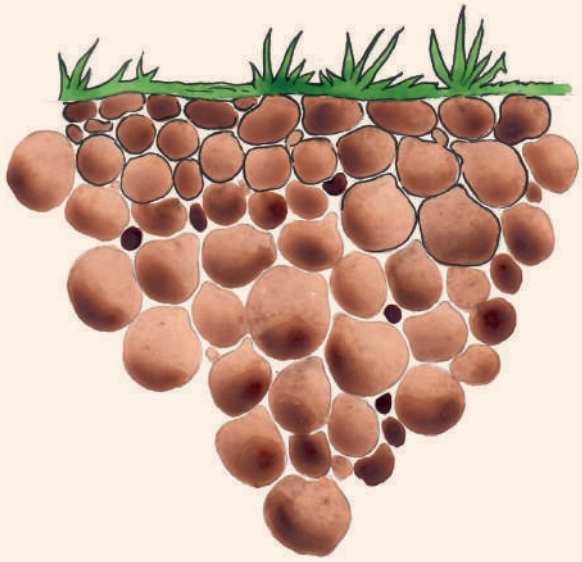


Figure 3 - Undisturbed soil creates a network of macropores, ideal for air and water movement.

- **Tillage Destroys Structure:** Conversely, frequent disturbance (tillage) shatters these aggregates. This initially loosens the soil but, within a short time, the fine particles settle back down, creating a dense, compacted layer beneath the tilled zone (a plow pan). This pan prevents air and water from moving freely, leading to the hard, tight particles that cause runoff and poor water retention, exactly as described.

[4] See Article: Long-Term Conservation Tillage Increases Soil Organic Carbon Stability by Modulating Microbial Nutrient Limitations and Aggregate Protection here.
[5] See Article: Soil Organic Matter, Biota and Aggregation in Temperate and Tropical Soils – Effects of no-tillage here.

2 Key Principles of Pfumvudza: Innovations and Best Practice

Weed Management and Biological Activity:

Minimum tillage provides a crucial advantage in managing weeds and supporting soil life:

- **Weed Seed Stratification:** One of the most significant benefits is weed suppression. Tillage brings weed seeds from deeper, dormant layers of the soil to the surface where they can germinate. By keeping the soil undisturbed, most weed seeds remain buried and inactive, leading to less weeds throughout the growing season and lower farming costs for weeding labour or herbicides.
- **Protected Soil Life:** Tillage is physically destructive to the soil's ecosystem – the earthworms, fungi (like mycorrhizae that help roots absorb nutrients), and beneficial bacteria. Minimum disturbance keeps these organisms safe, allowing them to continuously improve soil fertility, cycle nutrients, and contribute to the formation of stable soil structure, ultimately leading to more efficient roots and healthier plants.

Innovations and Research Validation

- **The Holing-Out Technique:** Pfumvudza's manual holing out (digging small 15cm basins) is a precise act that confines disturbance to less than 10% of the field's surface
- **Mycrorrhizal Conservation:** Research strongly supports that minimum tillage preserves the delicate networks of Arbuscular Mycorrhizal Fungi (AMF). These fungi are essential partners, acting as massive extensions of the plant's root system to forage for scarce nutrients (especially Phosphorus) and water[6].

BOX 1. PRESERVE THE ECOSYSTEM: MINIMUM TILLAGE

Put the plough away! Pfumvudza's holing-out technique is targeted precision, not destruction. By disturbing only 10% of your plot, you protect natural macropores, preserve your soil's biological networks (Mycorrhizae), and keep dormant weed seeds buried. Result: Healthier soil, less erosion, and drastically reduced weeding labour.

Figure 4 - Holing-Out minimizes soil disturbance to under 10% of the field's surface

[6] See article: Plant and soil responses to tillage practices change arbuscular mycorrhizal fungi populations during crop growth here.

2.2. Mulch: Maximum Soil Cover

Maximum soil cover, or mulching, is the practice of covering the soil with crop residues (stover) or other dry organic material. This is a fundamental shift in managing the soil-water-plant relationship. The benefits extend far beyond simple water conservation, touching every aspect of soil health and crop productivity, strongly supported by both traditional wisdom and modern soil science[7].

Expanded Benefits and Established Best Practice

Water and Thermal Regulation: Stopping the Triple Loss

- **100% Infiltration:** Mulch acts as a buffer, preventing the impact of rain droplets from breaking down soil aggregates and causing crusting. This ensures nearly 100% infiltration of rainfall, eliminating the triple loss of water (runoff), topsoil (erosion), and nutrients.
- **High Drought Tolerance:** Mulch drastically reduces evaporation from the soil surface, sometimes by up to 70%. This keeps the soil moist for day or weeks longer, translating directly to high drought tolerance and minimal plant stress.
- **Temperature Stabilization:** Mulch buffers the soil against thermal extremes. It keeps the soil cooler during the day and warmer at night, maintaining the optimal range (20°C to 25°C range), which is critical for efficient root growth and nutrient uptake.

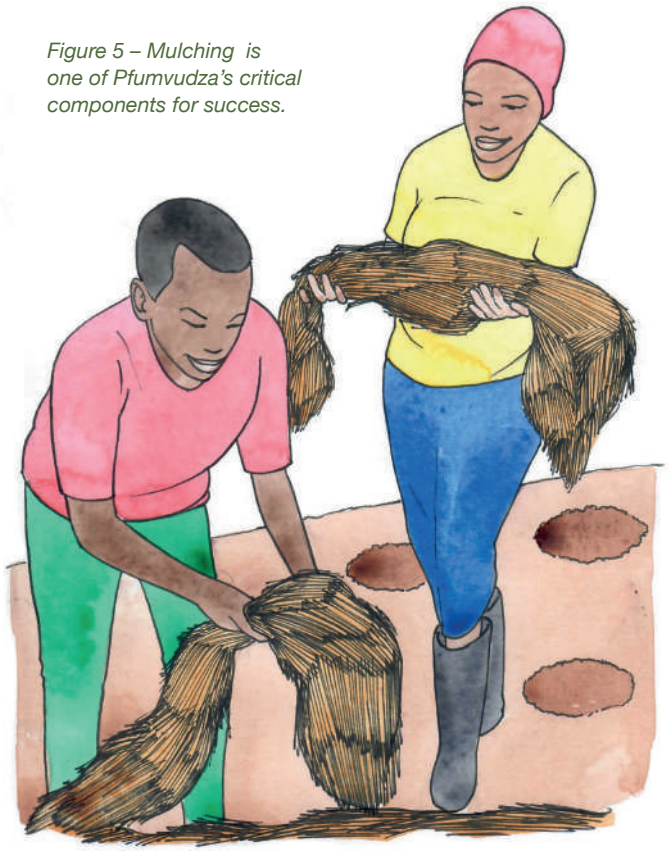


Figure 5 – Mulching is one of Pfumvudza's critical components for success.

BOX 2. THE CLIMATE SHIELD: MULCH

Don't let your soil stand bare! Mulch is the 100% soil cover that acts as nature's thermal regulator and water sponge. It stops runoff, slashes evaporation by up to 70%, and keeps your roots cool during the harshest heat. Result: Dramatically higher drought survival and less heat stress for your crops.

[7] See Article: Does maize and legume crop residue mulch matter in soil organic carbon sequestration? here.

Soil Health and Fertility: The Biological Engine

- **Enhanced Soil Microbial Activity:** Decomposing mulch is the food source for earthworms, microorganisms, and beneficial fungi. This helps build high soil biodiversity and boost the formation of stable soil aggregates.
- **Carbon Sequestration:** The continuous addition of crop residues builds up Soil Organic Matter (SOM). Every 1% increase in SOM significantly boosts the soil's water-holding capacity, making the farm a long-term carbon sink. This means that the farm takes in and stores carbon from the air instead of letting it stay as carbon dioxide in the air, which contributes to climate change.
- **Disease Barrier:** Mulch physically separates rain splash from the soil surface, minimizing the spread of soil-borne fungal diseases[8] such as Early Blight (which affects tomatoes and potatoes), Septoria leaf spot (common in tomatoes), and Leaf Spot Disease (found in leafy greens) to lower leaves[9].

Innovations and Best Practice

Recent innovations emphasize not just having mulch, but managing its quality and quantity:

- **Targeted Residue Management:** Best practices now focus on using crop residues from high-residue crops (like sorghum and sunflower stover) and placing them strategically. In Pfumvudza, the mulch is placed around the planting station, maximizing localized benefits.
- **Biochar Integration (Research):** Some newer CA models integrate biochar (charred organic material) into the mulch layer. Biochar can further stabilize soil carbon, dramatically increase the soil's ability to hold nutrients (Cation Exchange Capacity), and permanently improve soil structure[10].
- **Soil Life Focus:** The focus has shifted from seeing mulch as just a cover to viewing it as a habitat. By providing continuous cover, farmers are intentionally cultivating a healthier rhizosphere (the zone around the plant roots), which improves the plant's natural defence mechanisms and ability to scavenge scarce nutrients[11].

2.3. Precision Farming

Precision Farming in Pfumvudza is about optimal resource allocation—getting the maximum yield from the least investment by being very careful about every detail to avoid any waste or loss.

Expanded Benefits and Established Best Practices

Higher Productivity from Lower Investment

The core benefit of Pfumvudza's precision lies in its shift from extensive, low-yield farming to intensive, high-yield micro-production:

- **Financial Efficiency:** By concentrating inputs (like fertilizer, lime, and manure) onto small, highly managed basins, farmers significantly reduce the total quantity of costly resources needed compared to broadcasting them across a large field.

  This lowers the total investment (cost of production) while achieving high yields, directly leading to a higher profit margin.

[8] See Article: Effect of Different Mulching Materials on Leaf Spot Disease of Groundnut here.
[9] See Article: Role of Soil Health in Plant Disease Management: A Review here.
[10] See Article: Biochar Amendments for Soil Restoration: Impacts on Nutrient Dynamics and Microbial Activity here.
[11] See Article: Mulching Influences Pear Yield and Quality by changing Rhizosphere Microbial Community Structure in the Arid Region of Northwest China here.

2 Key Principles of Pfumvudza: Innovations and Best Practice

- **Labour Efficiency:** The initial minimum soil disturbance (holing out) and the subsequent use of mulch drastically reduce the most expensive traditional input: labour. Farmers spend far less time on weeding and ploughing, allowing them to manage their limited resources more effectively and focus labour on critical, high-impact tasks like timely planting and pest control.

Targeted Best Practices: Achieving 100% Plant Population

Precision in Pfumvudza ensures that every plant has the best chance to contribute to the final yield, establishing the optimal crop density.

- **100% Plant Population:** Following the exact hole spacing (e.g., 75cm x 60cm) and the plants per hole (e.g., 3 for maize before 'thinning' to just 2 per hole), as specified by the Pfumvudza standard, guarantees the targeted population density (e.g., 133,333 plants/ha). Research confirms that failure to hit the target density is one of the biggest causes of yield loss. Precision ensures that the available land and resources are used to grow the precise number of plants needed for the calculated food security goal.

- **Optimal Root Environment:** The required hole depth (the 15cm basin) is not arbitrary; it's a precise measure that defines the volume for root growth and nutrient saturation. This consistency ensures that every plant starts with an equal, optimal environment, promoting uniform germination and strong early growth.

Figure 6 - Pfumvudza plot with ideal plant population after thinning.

Innovations and Research Validation

Recent innovations in precision agriculture affirm the foundational principles of Pfumvudza:

- **Nutrient Use Efficiency (NUE):** Modern agricultural research highly values NUE, which measures how much yield is produced per unit of fertilizer applied. Pfumvudza achieves extremely high NUE because the practice of placing measured fertilizer doses (e.g., the coke bottle-top or Cup 8 measure) directly into the 15cm planting hole minimizes volatilization, leaching, and runoff. This precision placement is the non-mechanized equivalent of modern variable rate technology (VRT).
- **Climate-Smart Targeting:** Pfumvudza is an established best practice for Climate-Smart Agriculture (CSA). The precision in both input and management ensures that when drought stress hits, the plant has already benefited from the maximized moisture and concentrated nutrients in its small, safe zone, leading to significantly better survival and yield retention compared to conventionally farmed crops.
- **Micro-Scale Management:** The entire system is an innovation in micro-scale management. By treating the farm as a collection of numerous tiny, intensively managed units (the planting basins), the farmer can achieve a level of control and resource efficiency usually reserved for sophisticated greenhouse operations or large, technology-intensive farms.

BOX 3. ZERO WASTE, MAXIMUM GAIN: PRECISION FARMING

Every input counts! Pfumvudza is a commitment to optimal resource allocation. By precisely measuring and placing lime and fertilizer into the small basins, you ensure 100% of your investment benefits the plant. This targeted approach achieves very high Nutrient Use Efficiency (NUE). Result: Lower costs, higher yields, and better profit margins.

2.4. Crop Rotation

Crop Rotation involves varying the plant families grown on the same piece of land each each season, transforming the soil into a self-regulating ecosystem.

Expanded Benefits and Established Best Practices

Disease and Pest Break Cycles

The primary mechanism of crop rotation is the disruption of pest and disease cycles, directly addressing “family associated diseases” i.e., diseases that often affect related species within the same plant family due to similar genetic weaknesses:

- **Pest Starvation:** Most insects, nematodes (microscopic worms), and pathogens (fungi, bacteria) are host-specific. When a susceptible crop (e.g., maize) is followed immediately by an unrelated, non-host crop (e.g., soya bean), the pathogen’s food source is removed. Since many pathogens cannot survive long without their host, their population rapidly decreases, effectively “starving” the disease out of the field.

Figure 7 - Crop rotation enhances fertility, maximizing returns

- **Fungal/Viral Isolation:** Fungal spores and viral particles often survive in infected plant residues left in the soil. By rotating families, the new, genetically different crop is not vulnerable to the residues of the previous crop, providing the necessary disease break (or sanitation effect). Research has shown that rotation is often more effective and cheaper than chemical treatments for managing soil-borne diseases like Fusarium wilt or nematodes.

Soil Health and Biological Innovation

The greatest long-term benefit of rotation is the dynamic improvement of soil health, which naturally produces healthy crops that are inherently more resistant to disease.

- **Nutrient Cycling and Legumes:** The best practice of incorporating legumes (like soya bean or cowpea) into the rotation is critical. Legumes partner with Rhizobium bacteria to perform biological nitrogen fixation, converting atmospheric nitrogen into a form usable by the plant. This leaves a significant residual amount of free, slow-release nitrogen for the next crop (like maize or sorghum), reducing the need for expensive synthetic fertilizers and ensuring the soil is enriched.
- **Root Structure Diversity:** Different plant families have different rooting patterns (e.g., maize has a fibrous root system; sunflower has a deep taproot). Rotating these crops naturally loosens different soil layers, improving soil structure and water infiltration throughout the soil profile. This creates a healthier, more diverse environment for beneficial soil microbes.
- **Bio-Fumigation (Research):** Recent innovations include using specific cover crops, often brassicas (like certain mustards or radishes), in the rotation. These crops release natural chemical compounds into the soil as they decompose, a process called bio-fumigation. This natural process acts as a non-chemical method to suppress soil-borne pathogens and nematodes, enhancing the soil's self-defence capabilities.

Effective Crop Rotation Sequence for Uganda

Year 1	Year 2	Year 3
Maize (Cereal)	Soya Bean (Legume)	Sunflower (Oilseed)
Sorghum (Cereal)	Cowpea (Legume)	Traditional Cereal (e.g., Millet)

BOX 4. THE BIOLOGICAL BREAK: CROP ROTATION

Rotate to Innovate! Breaking the cycle of host-specific pests and diseases is your strongest defence against crop failure. Following a sequence that includes legumes (like Soya Bean) naturally enriches your soil, providing free nitrogen for the next crop. Result: Healthier soil, resilient yields, and reduced reliance on synthetic fertilizers.

3 Site Selection and Plot Setup

Careful selection and setup are critical to the success of the small, intensive Pfumvudza plot:

3.1. Site Selection Guidance

- **Proximity to Homestead and Water:** Plots must be as near as possible to the home for easy management, and a readily accessible water source is crucial for supplementary irrigation during mid-season dry spells.
- **Soil Quality Assessment:** While Pfumvudza improves all soils, soil samples can be sent for testing to accurately determine lime requirements (to raise pH) and phosphorous deficiency.
- **Slope:** The Plot should be laid out so that the longer side runs down the slope to minimize lateral water movement and erosion.

Figure 8 - Proximity to the home is ideal for monitoring and securing Pfumvudza plots

3.2. Plot Setup and Protection

- **Demarcation and Holing Out:** Mark a rectangular block, measuring 16m x 39m. Dig 15cm x 15cm x 15cm planting basins along precise measurements.
- **Security (Fencing):** It is essential to enclose the plot to protect your crop from livestock and wildlife.
  - **Practical Option:** Live Fencing – use live fencing – a border created with living, thorn, or densely growing trees and shrubs (e,g., Euphorbia tirucalli)
- **Fire Guards:** Due to Pfumvudza's reliance on a thick layer of mulch, Fireguards must be dug around the plot to create a clear, bare-earth barrier at least 1m wide.

Figure 10 - Fireguards must be constructed following guidance

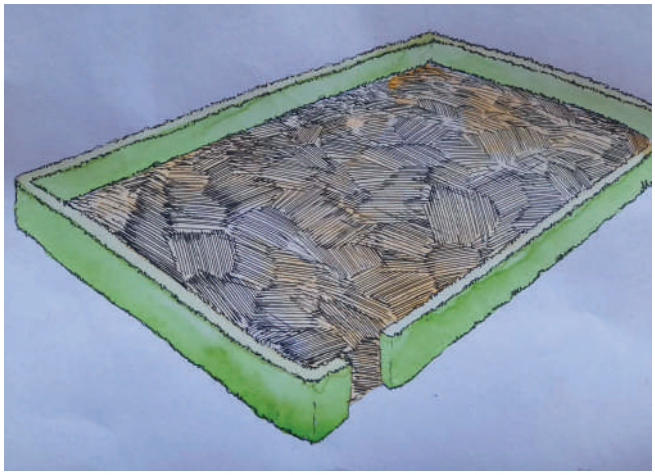


Figure 9 - Pfumvudza Plot with 'live fencing'

BOX 5. THE RIGHT START: CAREFUL SETUP

Success begins before planting. Locate your plot close to your home and your water source to enable timely management and supplementary watering during dry spells. Ensure your plot is secured with a live fence or robust barrier to protect your valuable, fertilized crop from livestock. Result: A secure, manageable plot with high survival rates.

4 Crop-Specific Guidance

4.1. MAIZE

Maize remains the cornerstone of food security for smallholder farmers across most of sub-Saharan Africa. Its suitability and value are rooted in its established role as the primary staple food (e.g., Posho / Ugali), making its reliable production non-negotiable for family survival. While maize is less drought-tolerant than sorghum, high-yielding, drought-tolerant hybrid varieties are now widely available, making it a viable and profitable option. For the smallholder, maize offers the highest potential grain yield per unit of land when managed correctly, directly translating to household food self-sufficiency for the year.

Figure 11 - Pfumvudza plot with mature maize

4.1.1. Pfumvudza Input Pack for Maize

When you use the Pfumvudza input pack, it is possible for you to feed a family for a year from a relatively modest investment. An average Pfumvudza maize plot requires the following inputs:

- 2kg seed.
- 12kg lime.
- 16kg DAP basal fertilizer.
- 16kg Urea top dressing fertilizer.
- Insecticide for stalk borer and Fall Armyworm.

4.1.2. Variety Selection, Pest Management, and Post-Harvest Handling

Crop	Variety Selection & Integrated Pest Management (IPM)	Post-Harvest Handling & Economic Considerations
Maize	**Variety:** Use high-yielding, drought-tolerant hybrid varieties like the DroughtTEGO® series of Longe varieties, Hybrid Maize Magoba, UH Hybrids, and PAN Hybrids. **IPM:** Monitor for Stalk Borer and Fall Armyworm (FAW) early. Use targeted spot application of insecticide.	**Post-Harvest:** Dry the grain to 12% moisture content to prevent storage pests. **Economics:** Highest potential grain yield; primary driver of food self-sufficiency.

4.1.3. Plot size and specifications for Maize under Pfumvudza:

Step 1

- Mark the field at the standard 16m x 39m.
- Measure inter-row spacing of 75cm.
- Measure in-row spacing of 60cm.

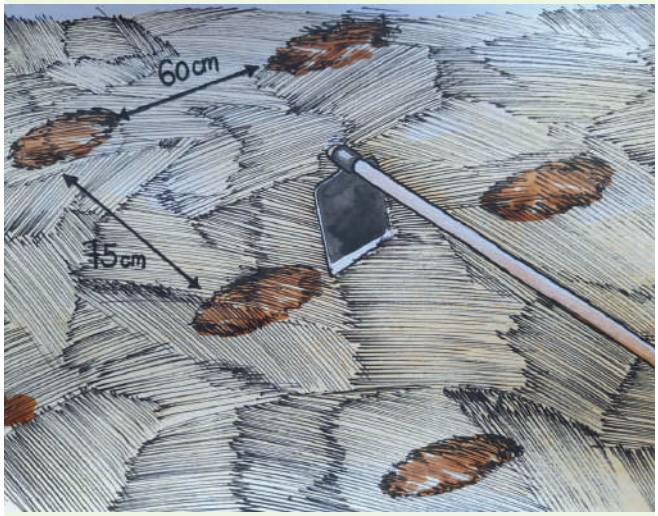


Figure 12 - Careful hole spacing is done to measurement

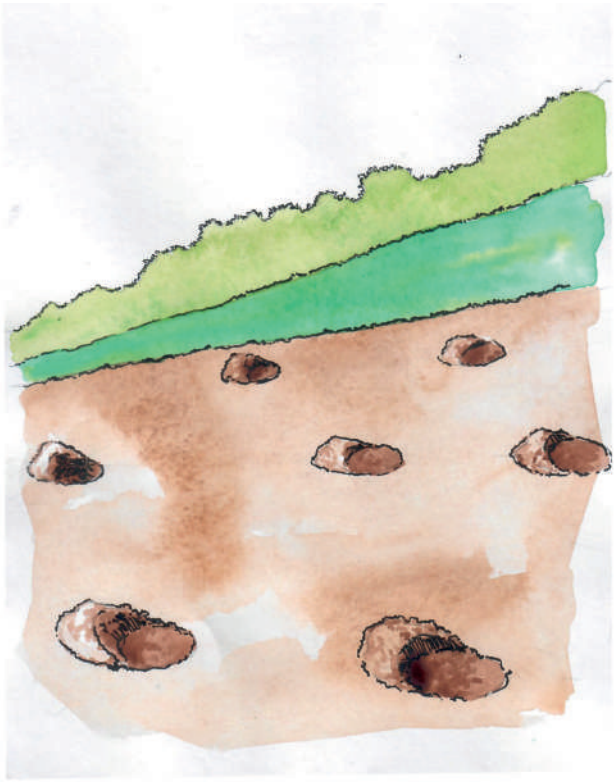
- Dig 52 holes at 28 holes per row.
- This will produce1456 holes per plot.
- Measure each hole dimensions at 15cm x 15cm x 15cm.

When digging the holes, known as ‘holing out’, it is important to heap the soil from each hole down slope to facilitate water capture.

Step 2

- Apply a handful of manure in each hole ahead of the rains starting.
- Cover the holes with a thin layer of soil.
- Leave the holes open and wait for the rains to come.

Figure 13 - Holing-out with the soil heaped downslope



Step 3

- When the first good planting rains come, pour Lime & Basal Fertiliser measuring 1 x Size 8 cup into each hole.
- Apply a handful of manure or compost.

Step 4

- Plant immediately when the first good planting rains come.
- Drop three maize seeds in each hole and then cover the with soil and Mulch to retain moisture.

Figure 14 - Plant three seeds of maize per planting station

Figure 15 - Pfumvudza plots make irrigation easier and more effective.

Step 5

- Keep the plot weeds-free with at least 2 hand-weeding: once at 2 weeks, and again at 6 weeks.

Row spacing and mulch work together to limit growing space for weeds. Due to the carefully planned plot size, Pfumvudza also allows households to irrigate these plots with minimal strain thereby reducing the amount of labour required to do farming.

Adding 1 litre of water to each hole during a dry season is equivalent to 40mm of rain. This can sustain each plant with moisture for at least three weeks. Since each plot has 1456 holes, if you carry 10 x 20L of water per day (200L), it will take 7 days to water the plot. For a committed farmer, this is not hard work – it is necessary precision to produce the desired harvest.

As the maize grows, you must 'thin' your crops (i.e., the practice of removing some crops per hole), so that each hole remains with two plants. The 56 maize plants in each row will give 56 cobs, which produces one 20 litre bucket of shelled grain. Each bucket can provide grain to feed a family of six for one week. The 52 buckets from the 52 rows will feed the family for 52 weeks, which is one full year.

Figure 16 - Thinning is important to retain the best two plants in your basins.

4.2. SORGHUM

For smallholder farmers battling unpredictable weather, sorghum is an excellent insurance policy. This ancient grain is a climate-resilient champion, famous for its drought and heat tolerance. It thrives in marginal lands where maize often fails, guaranteeing a harvest even when the rains disappoint. Sorghum not only provides a reliable staple food rich in essential nutrients but also delivers valuable stover (residue) for animal feed or mulching. Its low water requirements and ability to improve soil structure make it the ideal, risk-reducing cereal for farming in high-stress environments.

Figure 17 - Sorghum under Pfumvudza

4.2.1. Pfumvudza Input Pack for Sorghum

The inputs required for sorghum Pfumvudza are similar in quantity to maize:

- 2kg sorghum seed.
- 12kg lime.
- 16kg DAP basal fertilizer.
- 16kg Urea top dressing fertilizer.
- Insecticide for stalk borer and Fall Armyworm.

4.2.2. Variety Selection, Pest Management, and Post-Harvest Handling

Crop	Variety Selection & Integrated Pest Management (IPM)	Post-Harvest Handling & Economic Considerations
Sorghum	**Variety:** Focus on early maturing and heat-tolerant varieties such as SESO 1 and 3, SC SILA, Seredo, SEKEDO, and NAROSORG 1, 2, and 3 to name a few. **IPM:** Use certified, treated seeds to guard against Head Smut (fungal)	**Post-Harvest:** Excellent storage characteristics. Stover is valuable for animal feed or mulching. **Economics:** Provides a reliable staple food with low water requirements; serves as a crucial risk-reducing cereal.

4.2.3. Plot size and specifications for Sorghum under Pfumvudza:

Step 1

In high potential areas,

- Mark the field at the standard 16m x 39m.
- Prepare planting holes with inter-row spacing of 75cm and in-row spacing of 30cm following the conservation agriculture principles described above.
- Plant 5 seeds per planting hole.
- Thin the plants after 3 weeks of establishment, leaving 3 plants per station (making in-row spacing 10cm).
- The expected plant population creates a density of 75cm x 10cm, and an output of 8, 320 plants in the marked Pfumvudza planting area.

In low potential areas,

- Mark the field at the standard 16m x 39m.
- Prepare planting with inter-row spacing of 75cm and in-row spacing of 45cm following the conservation agriculture principles described above.
- Plant 5 seeds per planting hole.
- Thin the plants after 3 weeks of establishment, leaving 3 plants per station (making in-row spacing 15cm).
- The expected plant population creates a density of 75cm x 15cm, and an output of 5, 547 plants in the marked Pfumvudza planting area.

Step 2

- Apply a handful of manure in each hole ahead of the rains starting.
- Apply 5 grams of lime per planting hole.
- Use a Size 5 cup or any soft-drink bottle top to measure the correct amount.
- Cover the holes with a thin layer of soil.
- Leave the holes open and wait for the rains to come.

Step 3

- When the first good planting rains come, apply 8 grams of DAP as your Basal Fertiliser.
- Use Size 8 cup or a level bottle cap for any soft drink to measure the correct amount.
- Apply a handful of manure or compost.

Step 4

- Plant immediately after receiving good planting rains (following Step 1 above) and then cover the with soil and Mulch to retain moisture.
- Thin the plants following Step 1 above.

Step 5

- Apply 5 grams of top-dressing fertiliser twice in the following way:
  - Apply the first 5 grams at 3-4 weeks after planting.
  - Apply the second 5 grams at 8 weeks after planting.
- Keep the plot weeds-free with at least 2 hand-weeding: once at 2 weeks, and again at 6 weeks.

4.3. SOYA BEAN

Soya beans are the smallholder's secret weapon for both nutrition and soil health. As a legume, soya beans partner with soil bacteria to perform nitrogen fixation, essentially pulling free nitrogen from the air and storing it in the soil. This drastically reduces the need for expensive chemical fertilizers in the next cropping season, directly lowering input costs. Furthermore, soya beans are a high-value cash crop, providing an excellent source of protein and oil for the family and generating crucial income from a rapidly expanding local and regional market.

Figure 18 - Soya Bean under Pfumvudza

4.3.1. Pfumvudza input pack for Soya Bean

The inputs required for Soya under Pfumvudza are the following:

- 5kg Seed.
- 16kg DAP basal fertilizer.
- 16kg Urea top dressing fertilizer.

4.3.2. Variety Selection, Pest Management, and Post-Harvest Handling

Crop	Variety Selection & Integrated Pest Management (IPM)	Post-Harvest Handling & Economic Considerations
Soya Bean	**Variety:** Select varieties appropriate for your region's rainfall, such as Maksoy 1N, 2N, 3N, and 6N suitable to northern Uganda which are able to escape terminal drought. **IPM:** Apply Rhizobium inoculum immediately before planting to ensure effective nitrogen fixing.	**Post-Harvest:** Harvest when 80% of leaves have dropped. **Economics:** High-value cash crop; lowers overall input costs for succeeding crops due to fixation.

4.3.3. Plot size and specifications for Soya Bean under Pfumvudza:

Step 1

- Mark the field at the standard 16m x 39m.
- Prepare planting holes with inter-row spacing of 75cm and in-row spacing of 30cm following the conservation agriculture principles described above.
- Plant 3 seeds per planting hole.
- Thin the plants after 3 weeks of establishment, leaving 2 plants per hole (making in-row spacing 15cm)
- The expected plant population creates a density of 75cm x 15cm, and an output of 5, 547 plants in the marked Pfumvudza planting area.

Step 2

- Apply a handful of manure in each hole ahead of the rains starting and cover it with a thin layer of soil.
- Leave the holes open and wait for the rains to come.

Step 3

- When the first good planting rains come, apply 8 grams of DAP basal fertilizer per planting hole.
- Use a Size 8 cup or any soft-drink bottle top to measure the correct amount.
- Apply a handful of manure or compost.

Step 4

- Plant immediately after receiving good planting rains (following Step 1 above) and then cover the with soil and Mulch to retain moisture.
- Apply rhizobium to seed immediately before planting.
- Thin the plants following Step 1 above.

Step 5

- Apply 8 grams of top-dressing Urea at 7 weeks after planting, using a Size 8 cup.
- Keep the plot weeds-free with at least 2 hand-weeding: once at 2 weeks, and again at 6 weeks.

4.4. SUNFLOWER

Sunflower is an excellent addition to the Pfumvudza system, serving as a vital cash crop and a beneficial soil management tool. Its deep and vigorous taproot system helps to break up compacted soil layers (hardpans), improving water infiltration and soil structure for succeeding crops like maize. As a commercial crop, sunflower seeds command a high market price due to their use in producing cooking oil and animal feed cake, offering smallholder farmers a significant income boost with low input costs. While it benefits from the moisture conservation of the Pfumvudza basins and mulch, its natural drought tolerance further reduces the risk, making it a reliable crop for diversification and income stability alongside staple cereals.

Figure 19 - Sunflower under Pfumvudza

4.4.1. Pfumvudza Input Pack for Sunflower

- 2kg Seed.
- 16kg DAP basal fertilizer.
- 16kg Urea top dressing fertilizer.

4.4.2. Variety Selection, Pest Management, and Post-Harvest Handling

Crop	Variety Selection & Integrated Pest Management (IPM)	Post-Harvest Handling & Economic Considerations
Sunflower	**Variety:** Choose high-oil content varieties such as the PAN 7351, Hysun 33, Agsun 8251, and Aguara 6. **IPM:** Generally hardy; monitor for African bollworm. **Note:** Plant yours seeds only 2cm deep	**Post-Harvest:** Dry the sunflower heads fully before threshing. **Economics:** Provides a significant and stable income boost with low input costs and naturally improves soil structure (taproot).

4.4.3. Plot size and specifications for Sunflower under Pfumvudza:

Step 1

- Mark the field at the standard 16m x 39m.
- Prepare planting holes with inter-row spacing of 75cm and in-row spacing of 30cm following the conservation agriculture principles described above.
- Plant 3 seeds per planting hole.
- Thin the plants after 3 weeks of establishment, leaving 2 plants per hole (making in-row spacing 15cm)
- The expected plant population creates a density of 75cm x 15cm, and an output of 5, 547 plants in the marked Pfumvudza planting area.

Step 2

- Apply a handful of manure in each hole ahead of the rains starting and cover it with a thin layer of soil.
- Leave the holes open and wait for the rains to come.

Step 3

- When the first good planting rains come, apply 8 grams of DAP basal fertilizer per planting hole.
- Use a Size 8 cup or any soft-drink bottle top to measure the correct amount.
- Apply a handful of manure or compost

Step 4

- Plant immediately after receiving good planting rains (following Step 1 above)
- Sow 3 seeds of sunflower at each end of the planting hole
- **Do not plant sunflower seeds deeper than 2cm.** They will not emerge if planted too deep.
- Thin the plants following Step 1 above.

Step 5

- Apply 5 grams of top-dressing Urea at 6 weeks after planting, using a Size 5 cup.
- The sunflower plant will be about knee-high for most people at this stage.
- Keep the plot weeds-free with at least 2 hand-weeding: once at 2 weeks, and again at 6 weeks.

5 Monitoring, Evaluation, and Testimonies

5.1. Simple Monitoring Indicators

Simple tools can help you track progress and carefully follow Pfumvudza's precision standards:

- **Plant Population Counts:** Verify the number of plants per hole (e.g., 2 for maize) at the time of thinning.
- **Weed Pressure:** Record the time (in hours/days) spent weeding the plot. Success is measured by a decreasing time spent weeding over successive seasons.
- **Soil Moisture Check:** Regularly check that the soil under the mulch feels cool and moist.
- **Yield Records:** Accurately measure the final yield (i.e., the number of 20L buckets of shelled grain) against the goal of 52 buckets.

5.2. Testimonies

Smallholder farmers supported by CSJ in Uganda have applied the Pfumvudza concept onto their fields and their experience is encouraging:

> "Pfumvudza was introduced to me last year (2024), and I have tried it this year and it is working. I slashed (i.e., cleared) the land, and then I made holes. After establishing the plant (i.e., planting) I mulched it and followed the rest of the guidance. I encourage others to do what I am doing. Even one of my colleagues, I am the one who introduced him (to the Pfumvudza approach). Right now, he is doing also better. So, I encourage others to do what I am doing"
>
> **Smallholder Vegetable Farmer, Moyo – Northern Uganda, Male**[12]

> "I want to appreciate Kiryandongo Agro-Input Center Limited for the knowledge rendered to us, especially about the Pfumvudza model. From experiments, it is seen that the maize in the Pfumvudza plot is looking very good, green and shiny. In the next season, I am going to plant my whole garden following the conservation principles"
>
> **Benjamin, Kiryandongo Refugee Settlement**

[12] See more about this on CSJ's YouTube page: here.

5.2. Testimonies continued

This experience with the model is also reported by refugees at Kiryandongo Refugee Settlement who share the following[13]:

> "What I have seen is that this model is impressive. The crops stay green, and the yield is much better" **William, Kiryandongo Refugee Settlement.**

Saving money which was previously spent on weeding is now possible for William and Joyce:

> "I have been using the extra money I save to provide nutritious food for my six children and also pay their school fees – something that was very difficult in the past"
>
> **Joyce, Kiryandongo Refugee Settlement.**

> "I used to spend at least UGX120,000.00 on labour for weeding four times each season. Now I only weed once, which has helped me save UGX70,000.00. I use the savings to buy other vegetable seedlings and greens"
>
> **William, Kiryandongo Refugee Settlement.**

Further testimonies confirmed the yield potential of Pfumvudza, committing to apply the approach in every garden going forward:

> "I am making a testament that with the Pfumvudza model, I now harvest up to 20 bags of maize from just half an acre"
>
> **William, Kiryandongo Refugee Settlement.**

> "In every garden I open from next season onwards, I will embrace Pfumvudza because it gives higher yields compared to the traditional way of farming"
>
> **Joyce, Kiryandongo Refugee Settlement).**

Farmers supported by a group of Pentecostal churches in Lango under Rex and Farm Solutions, also attest to Pfumvudza's impact on yields as shown in the following testimonies from Kwania District captured by UBC Television Uganda[14]:

> "I used to farm 10 acres of maize and harvest only 10 bags of maize. With the Pfuvudza model, I harvested 25 bags of maize from three Pfumvudza plots which are less than half an acre"
>
> **Smallholder Farmer, Kwania District, Female.**

[13] See more about these testimonies on the MegaFM website: here.

[14] See the UBC Uganda Television video here.

6 Concluding Remarks

Pfumvudza is a transformative solution that offers food security and profitability to resource-constrained smallholder families. It removes the burden of excessive labour and capital investment, enabling a family to produce sufficient food for a full year from just a fraction of a hectare. The potential is therefore significant for Pfumvudza to deliver bumper harvests in Uganda, particularly in climate affected and resource-constrained areas. With careful attention to detail and following Foundations for Farming's concept, food security for the people of Uganda, and indeed Africa at large, is possible.

The key to long-term success lies in perseverance, high standards, and continuous adaptation to local conditions.

Figure 20 - Pfumvudza guarantees a successful harvest, securing nutrition for families for the whole year.

Glossary of Key Terms

Term	Definition
Pfumvudza	Meaning "New Season," it is a smallholder farming method based on Conservation Agriculture principles that involves concentrating resources on a small plot to produce sufficient food for a full year.
Conservation Agriculture (CA)	A farming philosophy built on three core principles: minimum soil disturbance, permanent soil cover (mulching), and crop rotation.
Mulch / Maximum Soil Cover	The practice of covering the soil with stover (crop residues) or other dry organic material to regulate temperature, conserve moisture, and prevent erosion.
Stover	Crop residues (e.g., maize stalks, sorghum stalks) used as the organic material for mulching.
Minimum Soil Disturbance	The principle of avoiding the plough, limiting intervention to small, specific planting basins to maintain the soil's natural structure and ecosystem.
Holing Out / Planting Basins	The digging of small, precise planting holes (15cm x 15cm x 15cm) instead of broad ploughing.
Precision Farming	The practice of being highly accurate in all farming operations (spacing, input quantity, timing) to maximize Nutrient Use Efficiency and eliminate waste.
Nutrient Use Efficiency (NUE)	A measure of how much yield is produced per unit of fertilizer applied; Pfumvudza aims for extremely high NUE through precise placement.
Crop Rotation	The practice of varying the plant families grown on the same piece of land each season to disrupt pest/disease cycles and improve soil fertility.
Biological Nitrogen Fixation	The process where legumes partner with Rhizobium bacteria to convert atmospheric nitrogen into a form usable by the plant, enriching the soil.

Glossary of Key Terms

Term	Definition
Rhizobium	A genus of soil bacteria that forms a symbiotic relationship with legumes to perform biological nitrogen fixation.
Soil Organic Matter (SOM)	Decomposing plant and animal material in the soil, which acts like a sponge to increase water and nutrient retention and contributes to soil health.
Carbon Sequestration	The process where the farm takes in and stores carbon from the air (as CO2) into the soil, acting as a long-term carbon sink to mitigate climate change.
Plow Pan	A hard, dense, compacted layer of soil that forms beneath the regularly tilled depth, which impedes root growth and water infiltration.
Soil Aggregates	Small, natural clumps of soil particles bound together by organic matter and biological activity, which are essential for good soil structure.
Macropores	Channels left in undisturbed soil by old roots, earthworms, and insects that act as highways for air and water movement.
Mycorrhizae / AMF	Networks of beneficial fungi (Arbuscular Mycorrhizal Fungi) that act as extensions of the plant's root system to help them absorb scarce nutrients (especially Phosphorus) and water.
Triple Loss	The simultaneous loss of water (runoff), topsoil (erosion), and nutrients caused by rain breaking down bare soil.
Bio-Fumigation	A natural process where specific cover crops (e.g., brassicas) release chemical compounds into the soil as they decompose to suppress soil-borne pathogens.

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